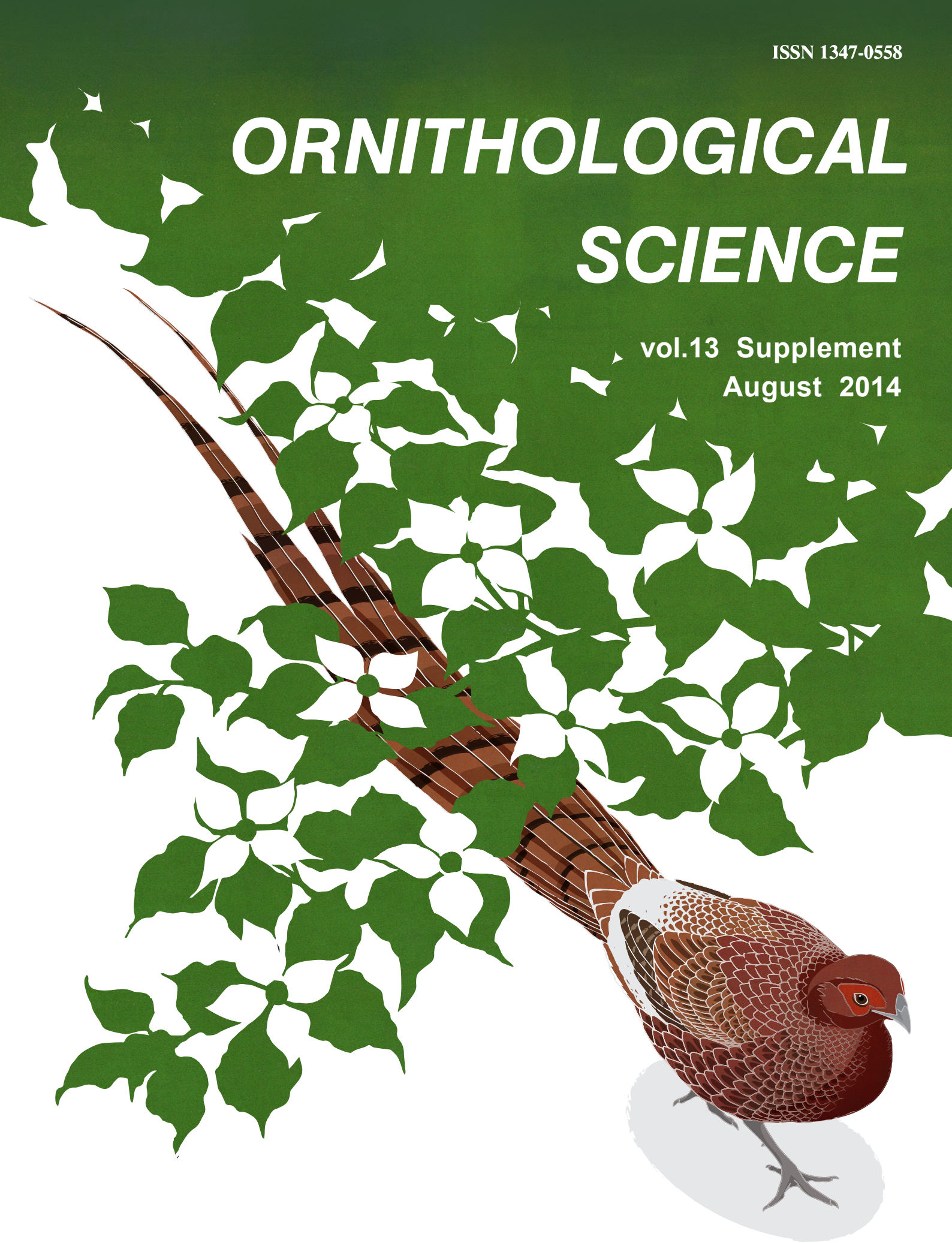
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Presidential Address
&
Plenary Abstracts

Unravelling migration: routes to genes

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Bird migration is one of the most spectacular natural phenomena, fascinates man since very long and is thus one of the most studied subject in zoology. But it is only the last 100 years we are able to unravel its mysteries by marking birds with rings banding and nowadays even various electronic tracking devices, by captive studies understanding the internal mechanisms controlling bird migration, and by sophisticated field studies demonstrating the effects of external factors, such as food availability, weather, competitors, parasites or diseases, on the stopover behavior of migrants and migratory flights. However, integrated approaches to study coherently how the innate migration program interacts with the varying environmental cues and to estimate the contribution of the innate migration program and the environment to realized migration are almost missing. With the Northern Wheatear (*Oenanthe oenanthe*) we started such an integrated approach. The species suits well because of its almost whole Holarctic breeding range and the fact that all breeding populations overwinter in sub-Saharan Africa which makes the Northern Wheatear one of the most long-distant migratory songbirds with extraordinary long non-stop flights across oceans. It is a nocturnal migrant which travels without parental or social aid/guidance. Thus, young birds rely entirely on endogenous mechanisms of timing, route selection and fueling on their first outbound migration. By establishing indoor housing under controlled conditions the endogenous control mechanisms of Northern Wheatear migration could be revealed. At the same time, environmental factors controlling migration could be investigated in the field. On migration wheatears occur in a variety of habitats with sparse vegetation where their stopover behavior could be quantitatively studied in the light of "optimal migration" theory by the use of remote balances, radio-tagging and even experimentally manipulated food availability. By combining field and laboratory studies at various spatial and temporal scales, and linking various sub-disciplines we are aiming a coherent understanding of the control of bird migration.

Evolution of song complexity in Bengalese Finches might mirror the emergence of human language

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Among vocalizations birds make, a class of sounds that consist of more than two types of sound patterns arranged in a certain temporal sequence is called as a 'birdsong', not only because of the organization of sound patterns, but also because our musical aesthetics intuitively allow such an analogy. Scientific investigations of birdsong to date suggest that certain properties of birdsong extend beyond the musical to the developmental analogies. From past 30 years until now, birdsong had been discussed as a useful biological model that might provide clues to the evolutionary origin of human speech. Bengalese Finches (BFs) are domesticated strains of wild white-rumped munias (WRMs) imported from China to Japan 250 years ago. BF songs are composed of multiple chunks and each chunk is a combination of 2-4 song notes. Furthermore, chunks are arranged in a finite-state probabilistic automaton. We studied how and why BFs sing such complex songs. We found the following facts. 1) The ancestral strain sing simpler songs. 2) There is high learning specificity in WRMs but not in BFs. 3) BFs have larger song control nuclei and higher level of glutamate receptor gene expressions than WRMs. 4) Both BF and WRM females prefer complex songs as measured by the nest string assay and males with complex songs are physically fitted than the males with simpler songs. These results promoted sexual selection scenario of song complexity in BFs. We further examined factors related with domestication. We examined songs of WRMs in subpopulations of Taiwan. Where there is a sympatric species to WRMs, songs were simpler. This leads to a hypothesis that in the wild songs needed to be simple to secure species identification, but under domestication this constrains was set free. We also examined socio-emotional indexes. All indexes suggested that WRMs have higher level of stress and social shyness, which should be adaptive under natural environment, but could be limiting opportunities for learning complex songs. Evolution of song complexity involves not only factors related with strengthen of sexual selection and relaxation of species identification, but also socio- emotional factors due to domestication. These results on Bengalese Finches must be useful in discussing possible biological origin of human speech in terms of proximate and ultimate factors.

Beyond the long list, or four things we (should) know about bird invasions

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The most significant event in the study of alien bird invasions to date occurred in 1981, with the publication of John Long's seminal book "Introduced Birds of the World". The significance of this book derives not just from its content, but also from its timing, coincident with the 1982 SCOPE programme on the ecology of biological invasions. It was not long before studies started to appear that exploited the data in Long (1981) to answer questions posed by SCOPE about alien invasions. As a result, we arguably have a more complete understanding of the invasion process for birds than for any other taxon. Nevertheless, there are still some key issues in the study of bird invasions where understanding is not all it should be. I am to highlight four of these issues, by arguing that (1) We don't know half so much about bird invasions as we think, (2) Propagule pressure promotes invasions, (3) Colonization pressure matters, and (4) There is no evidence that escape from parasites promotes alien (bird) invasions. I expect some of the views expressed to be controversial, and others less so, but either way I hope this talk will stimulate others to provide better evidence for or against my positions.

Return to the Malay Archipelago: the biogeography of Bornean birds

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The island of Borneo was central to the studies of Alfred Russel Wallace and, thus, to the development of biogeography as a scientific endeavor. In the 152 years since Wallace's return from "the Malay Archipelago", and particularly in the last 20 years, our knowledge of Southeast Asian birds has improved dramatically. It is a good time, therefore, to take stock of our understanding of Sundaic biogeography and think about where we need to go next in our efforts to reconstruct the evolutionary history of the region. This presentation describes the current state of ornithological understanding--gathered from phylogenetic, population genetic, geologic, and paleogeographic studies--and uses this information to build a framework for future research in the region. The recent production of phylogenetic information on birds, especially on oscine passerines, is spectacular in content and quality, and helps tremendously in reconstructing biogeography. But in addition to this phylogenetic output, we need more population genetic studies in the region. To this end, we desperately require modern specimen material from Indochina, the Malay Peninsula, Sumatra, Java, and south Borneo. As with phylogeny, reconstruction of Sundaland's paleo-environments is also progressing, but uncertainty is rife regarding the disposition of habitats. This is particularly true for the Pliocene and early Pleistocene, when most of the diversification responsible for modern species occurred. We especially need additional paleontological (e.g., palynological) information on plant dispersion. Despite these needs, recent advances make it possible to estimate with moderate confidence when modern birds groups arrived in Sundaland, when and why they differentiated from their relatives in Asia and Australia, and when, how, and why endemism became so high in the Sunda Islands.

Resource selection by parrots: challenges to identifying limiting factors

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The ecological requirements of nest-sites, food, habitat, and area are among the least understood aspects of psittacine ecology. Most psittacines are secondary-cavity nesters and are constrained to select nest-sites from available cavities. However, few studies have determined nest-site selection by parrots or whether this influences reproductive success. We found that the Lilac-crowned Parrot exhibits adaptive nest-site selection that predicts nest success. Mean entrance diameter of nest-sites was also significantly related to body size for 20 Neotropical Psittacidae. This suggests that predation pressure has influenced the evolution of species-specific nest-cavity selection criteria for Psittacidae. Parrots represent a large biomass of canopy granivores in tropical forests, yet their ecological function as pre-dispersal seed-predators is scarcely understood. Nestling diets are also unknown for most parrot species. Seeds form 82% of the diet of Lilac-crowned Parrots, while seeds of 3 tree species comprise 75% of the biomass of nestling diets. Lilac-crowned Parrots are the principal pre-dispersal seed predators of Astronium graveolens, with the foraging activity of parrots resulting in a 56% pre-dispersal seed loss. Hence, the reduction of parrot populations in many tropical forests may have consequences for their functional role as seed predators, influencing recruitment patterns of canopy trees. Habitat and area requirements are poorly known for many species yet parrots have the ability to fly long distances. The Lilac-crowned Parrot has a home-range of >8,000 ha, selectively foraging in semi-deciduous forest, and avoiding disturbed areas. Lilac-crowned Parrots also make long-distance seasonal migrations of 44 km to the Sierra, and juveniles disperse >60 km from their natal area. This makes it imperative to develop ecological connectivity between areas and maintain functional ecosystems. Understanding these ecological requirements of parrots is essential for conservation, and future research needs to determine resource selection by parrots that may indicate characteristics making species vulnerable to human pressures.

Perspectives on the functional design of the avian respiratory system

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It is axiomatic that the energetic lifestyle which birds lead should be supported by an exceptionally efficient gas exchanger. Among the extant air-breathing vertebrates, the avian respiratory system, the lung-air sac system, is distinctively structurally complex and functionally efficient. Separated into two parts, the lungs serve as the gas exchangers and the air sacs as the mechanical ventilators. The lungs are small, compact, and rigid. They are firmly attached to the vertebrae and the ribs. By synchronized bellow-like activity, the cranial- and the caudal groups of air sacs ventilate the lung unidirectionally and continuously in caudocranial direction, creating a highly efficacious gas exchange system. The air sacs are capacious air spaces which disseminate throughout the coelomic cavity, pneumatising adjacent bones. The lungs are morphologically and morphometrically highly specialized: gas exchange occurs through crosscurrent- and countercurrent systems; the blood-gas barrier is very thin; the respiratory surface area is extensive, and; the pulmonary capillary blood volume large. Showing how broadly they have been conserved, the molecular factors which regulate the morphogenesis of the avian lung are the same as those involved in the development of the mammalian one. Although it has paucity of free (surface) macrophages, the avian lung possesses different cellular defences which include phagocytic bronchial epithelial cells, subepithelial macrophages, and intravascular macrophages. In summary, the efficiency of the avian lung can be attributed to many factors of which the foremost are: large tidal volume; continuous and unidirectional ventilation of the lung, and; large pulmonary morphometric diffusing capacity of oxygen.

The Paleontology of Now: Hawaii's birds in the Anthropocene

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At the dawn of the Anthropocene, the Hawaiian Islands hosted an extraordinary array of endemic birds, most of which are now extinct or threatened with extinction. People first arrived in the islands only about eight centuries ago, which means that the young fossil, archaeological, and historical records can be studied to understand how an avifauna was transformed by human influences. Traditional methods in paleontology and paleoecology combined with the study of ancient biomolecules preserved in these relatively young fossils provide surprisingly rich data about the past. To start with, ancient DNA and comparative osteology provide a phylogenetic context for studying extinction, as well as insights into the ecological roles of Hawaii's lost birds. A database of approximately 70,000 identified fossil bones from Hawaii provides information on the prior geographic ranges and habitats of roughly 130 species of birds. A rich fossil avifauna from the mid-Pleistocene is informative about turnover rates before the human era. For endangered species that are abundant in the fossil record, such as the Hawaiian Petrel (*Pterodroma sandwichensis*), ancient DNA and stable isotopes enable us to reconstruct demographic histories and changes in foraging patterns on a millennial timescale. In my talk I review what we have learned about the history of Hawaii's avifauna, with an emphasis on understanding extinction risk in the Anthropocene. For example, we tend to emphasize population size and geographic range size when estimating extinction risk for modern species. Does the record of extinction outcomes in the Hawaiian Islands identify those two factors as important predictors? Additionally, a deadly synergy of forces is often cited as responsible for continental extinctions in the era of modern humans. Does the history of Anthropocene extinctions in Hawaii support synergy as an explanation?

The East Asian Flyway - waterbirds in trouble

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Waterbird species face acute problems in the East Asian Flyway as result of rapid development pressures affecting their habitat, especially in China and particularly amongst long distance migratory waterfowl (Anatidae) and shorebirds (Charadriiformes) which contribute 60% of the populations. Specialist tuber-feeding and grazing wintering Anatidae species suffer particularly from trophic changes in Yangtze River wetland systems, brought about through habitat loss, eutrophication, water abstraction, aquaculture, changes in grazing and many other pressures. Whilst all Anatidae species are threatened by rapid environmental degradation and habitat loss, some, such as Baer's Pochard, lie on the verge of global extinction. Lack of knowledge inhibits our ability to protect some threatened or endangered species, such as the Scaly-sided Merganser. Such changes in waterbird communities are important indicators of ecosystem services and general biological diversity. The most serious problem facing shorebirds in the East Asian Flyway is the massive and rapid habitat loss occurring due to land claim of intertidal areas along the eastern China coast, especially in the Yellow Sea, which are critical staging and refueling areas for a range of species. As intertidal specialists, shorebirds are most vulnerable to loss of such critical feeding areas, which have either concentrated in smaller areas or dramatically declined in numbers. Urgent action is required to identify and protect key shorebird habitats, and to understand the influences of habitat loss on different shorebird species and populations throughout the flyway. The Chinese central government is making a substantial contribution to site safeguard in marine and freshwater systems by incorporating more than three hundred key wetland bird areas into the new plan for defining an 'Ecological Red line' to maintain biodiversity in China.

Speciation in seabirds: why are there so many species....and why aren't there more?

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Speciation (the multiplication of species through the evolution of barriers to reproduction between populations) plays a central role in evolution since it enables two or more populations to adapt and evolve independently. However, mechanisms of speciation are notoriously difficult to study and poorly understood. According to the classical allopatric model ('speciation without gene flow'), populations become reproductively isolated due to gradual genetic divergence during prolonged isolation by an extrinsic (physical) barrier to gene flow. That physical barriers to gene flow can lead to speciation is now well established. However, birds encounter few physical barriers to dispersal, yet have almost twice the species diversity as mammals. What other barriers to gene flow may promote speciation in birds? My students and collaborators are using a variety of approaches to test explicitly the factors that prevent - and promote - gene flow in seabirds. Our work on tropical and subtropical seabirds revealed that populations can diverge genetically on very small geographic scales, even in the absence of physical barriers to dispersal (e.g. within archipelagos). Most interestingly, we found evidence of genetic and ecological divergence of sympatric seasonal populations of Band-rumped Storm-petrels (*Oceanodroma castro*), suggesting that differences in breeding time can disrupt gene flow sufficiently to lead to speciation. Similar effects are being found in other seabirds and non-seabirds. Our meta-analysis of phylogeographic studies of seabirds, as well as targeted studies of boobies (*Sula* spp.), pelicans (*Pelecanus* spp.), auklets (*Ptychoramphus aleuticus*) and murrelets (*Synthliborapmhus* spp.), indicate that differences in non-breeding distributions (e.g. annual residency vs. long-distance migration), foraging ranges or oceanographic regimes also can inhibit gene flow and so promote speciation. In contrast, frequent changes in distribution, as necessitated by glacial cycles, appear to promote gene flow sufficiently to reduce speciation. Large population sizes (e.g. as in auklets, genus *Aethia*) and phenotypic plasticity (e.g. as in murres, genus *Uria*) also may prevent population differentiation and speciation. Recent advances in genome sequencing, especially in combination with ecological tools such as geolocators and new methods for data interpretation (e.g. approximate Bayesian computation, ecological niche modeling) are opening exiting new avenues to test the importance of various behavioural, ecological, demographic and genomic factors in reducing or promoting gene flow and so affecting speciation.

Conservation and monitoring of birds: a decision science approach

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The world's bird diversity is in rapid decline. Conservation research is an applied science dedicated to minimising the loss of species; bird conservation research is no exception. Recently, conservation researchers have realised that to achieve the best conservation outcome with limited resources it is essential that we use decision science tools from economics and mathematics. These tools demand that the users have a clear objective, a suite of possible actions, system models that connect those objectives to action and acknowledgement of constraints. The decision science approach means that we typically need to focus more on the cost and feasibility of conservation actions than ecologists typically do.
I will illustrate the application of decision science thinking to bird conservation through a number of well-worked examples, some of which are being implemented in the real world now. I will consider prioritisation of conservation actions for threatened bird species, seabirds, waders and more. One of the commonest mistakes in bird conservation is to make management and resource allocation recommendations without using decision science tools thereby wasting resources and/or reducing the benefits of conservation dollars. Some common mistakes in conservation prioritisation will be discussed.

Symposium Abstracts

s01-1k

Past, extant and future diversification patterns of Sino-Himalayan passerines

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The evolution of extant species richness in the Sino-Himalayan mountains at the southern and the southeastern margin of the Qinghai-Tibetan Plateau is strongly associated with uplift processes and periods of climatic changes at least from the late Miocene on. These abiotic changes are accompanied by the emergence of extreme elevational gradients of local climate and vegetation which facilitated ecological segregation of close congeners in strong or loose parapatry. Forest passerines most likely have colonized the Sino-Himalayas in a three-fold scenario starting with a late Miocene subtropical radiation and succeeded by a more recent Pliocene boreal radiation and Pleistocene range fragmentation. The alpine habitats of the Plateau region itself are characterized by a much lower species richness, however they harbour a good number of endemics. In fact, some of the latter have turned out to be very old genetic lineages and must have acquired relevant adaptive traits during long time spans of separation. Moreover, not all of the alpine endemics emerged from typical open-habitat breeders but also from forest passerine ancestors during times when the Plateau still harboured forested regions in their areas of origin. Because morphological differentiation among close relatives can remain rather unaffected by genetic divergence in long-term separation (such as in Old World warblers or treecreepers), cryptic differentiation was unveiled by molecular and bioacoustic studies. Consequently, several taxa were recently upgraded from subspecies to species rank and a number of species were described new to science. Many of these are still poorly studied with respect to ecology, behaviour and breeding biology. For some flagship species current breeding and wintering distribution maps are currently compiled on the base of vouchered field records (specimens, samples, recordings). These databases can also be used for a projection of future distributions including range shifts and range losses in a modeling approach.

s01-2k

Phylogeographical patterns of birds in response to the Quaternary environmental changes on the Tibetan Plateau and adjacent regions

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The Tibetan Plateau is well known for the great importance in evolution of montane species because of its unique geological history and landform configuration, climate complexity, and diversified habitats. Population genetic structure and demography under environmental changes since the Quaternary can be detected through a phylogeographic approach. Birds are the best studied taxa of all vertebrates responding to the climatic change through time. Our synthesis focused on summarizing different phylogeographic patterns of birds and interpreting their forming processes on the Tibetan Plateau and its adjacent area. Different patterns have been revealed by the comparative phylogeographic studies on some species: (1) no divergence with a single refugium identified in a restricted semi-continuous area around the eastern margin of the Tibetan Plateau; (2) two divergent lineages with separated refugia located at the south-eastern and north-eastern margins of the Tibetan plateau; (3) multiple divergent lineages with separated refugia located in the south-eastern margins of the Plateau. Glacial sheet movements are considered the key factors in shaping these patterns. Species mainly distributed in the heavily ice covered platform regions of the Plateau experienced population expansion following the retreat of the extensive glaciations, while species distributed on the ice-free edges of the Plateau maintained stable population sizes. Comparing to platform-distributed counterparts, demographic stresses of edge species might have been mitigated by the milder climate. Various behavioral and ecological characteristics, including dispersal capacity, habitat preference, and altitude specificity along with evolutionary history might have helped to shape these different phylogeographic patterns.

The Sino-Himalayan avifauna (S-HA) as a high power species pool for colonizing nearby regions, mainly north/eastwards, in the course of Pleistocene glacial/interglacial alterations

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We tested the hypothesis that the Sino-Himalayan avifauna area (S-HA *s.str.*) has acted as a 'constellation' of isolated populations from which peripheral regions might be colonized. To do this we examined the taxonomic ranks of closely-related species and subspecies (in all senses) in relation to the S-HA, paying particular attention to the following:
- The mutual taxonomic ranks (=genetic distances) and distributions of bird species populations.
- Climate regimes in the past, using, as a well studied "standards", MIS 1 (Holocene interglacial), MIS 2 (LGM – stage of "island" forest refugia in east and inner Asia), and MIS 3 (intermediate cool and wet stage, cool-temperate forests expansion throughout the Region). The MISs 1-3 extent is the last 50 kyr (thousand years).

From palaeoclimatic data for the past 900 kyr (Hao et al., 2012), by analogy to MISs 1-3, we hypothesized chronologies of dispersal events and/or refugial/divergent states in bird populations for four peripheral areas:
1. Northeast Tibet to Altai-Sayan refugium dispersal/divergent events at MISs 3-2 or earlier, followed by long-distant eastward dispersals occurring during MIS 1 (Nazarenko, 1982).
2. Southwest China to Taiwan Island reiterated asynchronous dispersal/divergent events with twin modern taxonomically non-identical isolates (Päckert et al., 2012).
3. The same, along the eastern margin of Asia, from south to north reiterated dispersal/divergent events. Northern twin taxonomically unidentical isolates are within Japanese/Korean refugial area. At MIS 1 some suffered long-distant westward dispersals via Siberia up to Ural Mountains and beyond (Nazarenko, 1990 a, b).
4. In the same area, many species suffered human-induced northward dispersals up to Amur River basin during the late MIS 1 (Nazarenko, 1990 a, b).

The drivers of a mid-elevation peak in bird diversity of the eastern Himalayas, India

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In the eastern Himalayas, a biodiversity hotspot within the world's tallest mountains, we examined species richness patterns, turnover rates, and range size distributions of birds. We also examined the suite of biotic and abiotic factors (primary productivity, habitat variables, climatic factors and geometric constraints) that governs diversity along a 4500 m elevational gradient. We used point count methods for sampling birds and quadrats for estimating vegetation at 22 sites along the elevational gradient. Based on rainfall and temperature data obtained from the study area, we estimated potential evapotranspiration (PET) and actual evapotranspiration (AET) using standard equations. We used a mid-domain effect null model for testing geometric constraints on species ranges. We used regression models (simple and multiple) to identify potential environmental factors that govern bird richness patterns. Finally, we also tested the applicability of Rapoport's rule for birds. Species richness of birds followed a mid-elevation peak in the eastern Himalayas, with the highest diversity at approximately 2000 m. Species richness patterns deviate from the null model predictions, showing no evidence that geometric constraints influence the mid-elevation diversity peak. Among the suite of factors, primary productivity (surrogated by AET) and various habitat variables (plant species richness, shrub density and basal area of trees) account for most of the variation in bird species richness along the elevation gradient. We find that ranges of most bird species were narrow (mostly <500 m) along the elevation gradient with more than 30% of species restricted exclusively to single elevation sites. Our analysis shows little evidence to support Rapoport's rule for the birds of the eastern Himalayas. Turnover rate correlates positively with elevation, and high species turnover occurs at habitat transition zones. Strong correlations of bird richness with productivity and habitat, with a high turnover rate suggest that conservation efforts should consider the entire elevational gradient rather than just peak diversity areas.

Interactions between climate, competition, and habitat in limiting Himalayan bird distributions

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Nearly one thousand bird species breed or winter across the Himalayan range, owing, in part, to the confluence of multiple biogeographic realms, but also to the extreme elevational gradients ranging from sea level to over 8,000 m. Effective conservation of Himalayan bird diversity requires a detailed understanding of the factors that govern species distributions, especially as we try to allocate conservation investments and predict how species ranges may shift with climate change. We aimed to use differences in climate and habitat, as well as the well-documented bird diversity gradient across the Himalayas, to understand the relative importance of these factors in limiting bird distributions along elevational gradients. We conducted community-wide bird surveys along five elevational gradients from two locations in the western Himalayas differing in climate and species richness and featuring altered habitat zonation. Bird surveys were coupled with vegetation surveys at 50 m altitudinal intervals along each of the five gradients. In addition, locally deployed weather stations simultaneously recorded temperature, precipitation, and relative humidity at six locations along each gradient. Many bird species showed displaced elevational distribution patterns both between sites and between slopes within sites. Shifts in distributions were related to both differences in local climate as well as displaced habitat zonation. The presence or absence of congeneric species on some slopes, but not others, led to range contractions, expansions, or shifts, suggesting competition also plays a role in constraining the distributions of some species. While we expect that species ranges may shift with climate change, our results suggest that such shifts may be hindered by “boundaries” enforced by habitat and competition.

s02-1k

A history of ecological studies of birds in rice fields

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Birds have been studied in rice fields for over a century. Early studies focused on species directly linked to crop production, either because they were considered to be crop pests or because they preyed upon undesirable species found in rice fields. Starting in the 1970s, research in Europe began to focus more directly on birds themselves, with studies examining the foraging ecology of herons and egrets in rice fields, and its links to breeding distributions. Around the same time, researchers in the Americas began studying waterfowl in rice fields, focusing especially on questions relating to toxicology and food supply. Research in these regions, in Asia, and more recently elsewhere, has increasingly focused on how changes in rice farming affect the birds that use rice agroecosystems, especially from a conservation perspective. Wading birds and waterfowl have remained a mainstay of much research in rice fields, with a growing body of knowledge from around the world. Studies have become taxonomically more diverse, although most research remains centred on waterbirds despite evidence of rice-field use by a wide diversity of passerines, raptors, and other landbirds. Research to date has been dominated by descriptive studies, usually with an applied focus. Increasingly, however, researchers are recognizing the advantages of rice field systems for studying basic ecological questions. Compared to most natural habitats, rice fields are simple, uniform, systems that are well replicated across a landscape. This simplicity has facilitated more conceptually-driven research in foraging ecology and provides similar potential in other arenas, such as community ecology. Growing collaborations between ecologists and rice growers have also resulted recently in more experimental approaches to studying both the ecology and management of birds in rice fields. Finally, use of radio telemetry and remote sensing has illustrated the potential benefits of taking a landscape-level perspective when studying ricelands.

s02-2k

Avian responses to heterogeneity in rice fields at local, landscape and macro scales

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Rice fields cover approximately 11% of the world's arable land, providing important habitats for birds globally. Rice-producing areas in Asia usually consist of a mosaic of rice fields, fallow fields, forests, ponds and creeks, which provides spatial heterogeneity to agricultural ecosystems from local to nationwide scales. Moreover, typically in rice fields, shallow water is retained during the growing period while fields are usually drained before harvest, creating both dry and wet habitats at different times. Thus, rice fields can serve as an excellent model system for studying avian responses to heterogeneity at various spatial and temporal scales. Focusing on avian responses to habitat heterogeneity created by rice fields, this talk will illustrate an example of how rice fields can be used to address general questions in ecology. I will first focus on behavioural responses by Intermediate Egrets (*Egretta intermedia*) to resource heterogeneity at a field scale. Using detailed information on movement paths and prey captures, I will show that egrets adopt both area-restricted and area-avoided search at different spatial and temporal scales to search for hierarchically-distributed resources. Second, I will explore population-level responses by birds to spatial and temporal landscape heterogeneity in rice paddy areas in Japan. The results obtained showed varying responses to landscape components among species and seasons, indicating the importance of spatial and temporal landscape complementation in supporting bird species in rice paddy areas. Finally, I will address the role of landscape heterogeneity in shaping bird species assemblages at a nationwide scale. Using nationwide monitoring data in Japan, I will show that avian responses to rice-forest mosaics differ greatly between species with broad and narrow geographical ranges, presumably reflecting the historical role of Japanese landscapes in favouring species associated with heterogeneous landscapes. I will conclude my talk by discussing potential future topics.

The recent decline of heron populations in Italy and the changes in rice cultivation practice

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Breeding herons and egrets have been monitored annually since 1972 throughout Northwestern Italy, over an area of 57,591 km^2 with the greatest surface of ric cultivation in Europe (about 2,000 km^2). The total number of heronries increased from 40 in 1972 to 130 in 2013, in pace with an increase in the number of nests that peaked in 2000 to 23 times the initial number for Grey Herons, 4 times for Little Egrets, and a similar increase for the other species. But since 2000, a decresing trend has become evident. In order to check whether this decline could be due to a diminished availability of prey, in turn linked to the rapidly changing rice cultivation practices, we studied the following topics, and compared the 2013 results with those obtained by identical techniques in 1980, 1990, 1995 and 2000 on the same study areas. 1) Changes in chick diet for each of the 7 breeding herons and egrets; a great reduction occurred in some staple prey that use mainly rice fields for reproduction (amphibians) and an increase in new prey of recent colonization (the invasive *Procambarus clarkii*). 2) Changes in the surfaces of rice with little or no submersion, studied using satellite imagery; compared to almost 100% submersion until 1990, and to 70% submersion around 2000, the surfaces of submerged ricefields in 2013 were reduced to <50% at any given time during the breeding season. 3) Foraging success of the adults in rice fields, and their density in agricultural versus seminatural foraging habitats. A modeling is under way of the influence of these changes in prey availability, of the climatic changes, and of other factors, on these declining heron populations. This project was supported by the Italian Ministry of Education, University and Research (PRIN 2010-2011, 20108 TZKHC)"

Rice farming and duck interactions: looking at possible mutual benefits by testing post-harvest practices and duck densities

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Rice paddies provide foraging habitat, safe roosts and nest sites for many waterfowl species during the migration, breeding and wintering seasons. This cereal is cultivated in 114 countries worldwide, with 52 % of the Anatidae (81/155 species) being linked to the presence of paddy rice fields. The literature on wild ducks in rice fields is disproportionately represented by studies from Europe and the USA (though only representing 1% of the world's rice fields), while studies in Asia (90% of the worldwide rice production) are based on the agronomic benefits of breeding ducks in integrated rice-duck farming systems. To better understand the interactions between rice farming and ducks, we first performed a literature review to identify the principal incentives and triggers associated with 1) the management of rice-production areas as waterfowl habitat, 2) the agronomic consequences of attracting wild ducks or rearing farm ducks. Secondly, we carried out two field studies in harvested rice fields in the Camargue (France): we first assessed the influence of post-harvest agricultural practices (burning, crushing, flooding and their combinations) on seed availability and field use by wintering ducks. In a second study, we tested experimentally the effects of foraging wing-clipped mallards at two different densities (300 ducks/ha like in rice farms in Asia, versus 5 birds/ha corresponding to the density of wild ducks in Camargue) on weed seed bank and straw decomposition. This helps in analysing the potentially mutually beneficial solutions that could provide habitat to wintering wild duck populations while simultaneously being accepted by rice farmers.

Does Alternate Wetting and Drying have an impact on birds in rice fields?

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Rice crops are globally important for food security, with over 90% of the world's rice produced in Asia. However, in many Asian rice growing areas, water shortages are a major constraint to rice production. To address this issue, management techniques have been developed to produce rice with less water. One such method is Alternate Wetting and Drying (AWD), whereby water is intermittently supplied throughout the crop cycle, allowing the field to dry out between irrigation events. Using AWD, 15-25% less water is required with no yield implications. Literature suggests that a wide range of avian species are found in rice fields because they act as artificial wetland habitats that are maintained throughout the year. Our objective was to identify whether reducing water input through the practice of AWD decreases bird abundance and diversity in rice fields.

In Bohol, Philippines, timed spot counts, at different stages of crop growth, were taken during the rice cropping seasons of 2013 and 2014. Surveys were taken at sites using AWD and at sites using a traditional community irrigation system (CIS). Sites were chosen at three key locations of the irrigation network; near the source, middle and lower-end of the system.

We will evaluate how the use of AWD affects avian abundance and diversity and how this relates to changes in the dynamics of the rice field habitat. Factors such as crop stage, time of year, field location and weather will be analysed. We will conclude by discussing the possible-effects of AWD on avian richness within the Philippines, as well as possible global conservation implications, were AWD to be adopted nationwide.

s03-1k

Lighting up the forest – what is the impact of artificial light on breeding birds?

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Economic growth and the increase in urbanization has led to an increase of anthropogenic illumination in large parts of the world. Effects of artificial light have been reported in different ecosystems, on many species and species groups. With excellent vision, and – in many species – a dependence on day length information for seasonal timing, birds are potentially strongly affected by disturbances of their natural light environment. However, relatively little is known about the long-term consequences of these disturbances, and even less about the effects of light on different colours. To study this, we set up a large-scale monitoring project in natural habitat in the Netherlands. At eight study sites we experimentally illuminated 100 m long transects at the forest edge with white, green and red light, and left one transect dark. Every year, we assessed the presence, density and activity of many species at these sites according to rigid protocols. In order to have a dark reference for all sites, we started the monitoring routine a year before the artificial illumination was installed. All nest sites and song posts of breeding bird species were located. Birds were frequently netted and banded in order to monitor residence, recruitment and dispersion. We measured timing and reproductive success in birds breeding in nest boxes at and around all transects, as well as daily activity patterns in feeding behaviour. Here we present the effects of light on breeding bird species, including the advance of lay date of great tits (*Parus major*) breeding at the green and white illuminated transects. We show effects on territories, survival, daily and seasonal timing. Experimental, long term studies are essential for the quantification of the impact of artificial light on birds.

s03-2k

The effects of light pollution on daily and seasonal rhythms of songbirds: a mechanistic perspective

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Photoperiod is the most important environmental factor through which birds in temperate environments time their daily and seasonal rhythms. However, light pollution associated with increasing urbanization may challenge and alter the photoperiodic response of avian species. Indeed, avian urbanization has been often associated with an extended daily activity into the night and with an early onset of breeding, and the presence of artificial lights has been suggested as one of the environmental factors responsible of such changes. In recent years, new studies have started to elucidate potential physiological pathways through which light pollution can lead to altered daily and seasonal cycles. For example, exposure to dim light at night (LAN) has been shown to reduce melatonin production, possibly altering photoperiodic time measurement. In addition, LAN can advance the onset of the reproductive physiology and chronic LAN can disrupt regular molting sequence. I will review the evidence about the physiological effects of LAN that may underline changes in daily and seasonal timing of birds, and present the results of an ongoing experiment that aims to elucidate how the expression of key genes involved in the regulation of daily metabolism (clock genes and stress receptor genes) may be altered by light pollution, and the metabolic consequences of such effect.

Waterfowl utilize different habitat at night: implications for conservation.

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Waterbirds serve as key indicators of habitat health and vitality due to their conspicuousness and sensitivity to their natural environment. Accordingly, recent declines in waterbird populations have made conservation of their habitat a high priority in Australia and worldwide. Despite international recognition of the need to classify and conserve water bodies used by these birds (e.g. RAMSAR), less thought has been given to identifying and conserving nocturnal habitats that are important for waterbirds. Even though some waterbirds are known to be most active at night, water bodies identified for conservation of waterbird populations are based almost solely on diurnal observations of behaviour and habitat use. However, the advent of thermal imaging technologies means that night time monitoring can now be achieved. In this study we utilised such technology to observe waterfowl at night. We performed nocturnal population counts and behavioural observations on three species; Grey Teal (*Anas gracilis*), Chestnut Teal (*Anas castanea*) and Australian Wood Duck (*Chenonetta jubata*) at coastal habitats in South Eastern Australia. Our results revealed substantial differences in abundance between night and day across all three species at different sites. The habitats utilised and behaviours displayed were also shown to be different between nocturnal and diurnal hours. Environmental factors also predicted abundance of waterbirds and habitat preferences. Our findings reveal a pressing need to consider nocturnal habitat of waterbirds when assigning land for conservation. Furthermore, given the high level of activity displayed by waterfowl during nocturnal hours, future studies that focus on nocturnal habits and habitats should greatly increase our understanding of waterbird behaviour and ecology.

Effects of artificial night lighting on the timing of dawn and dusk singing in common songbirds

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It is well established that artificial night lighting can influence animal movements, but there is less information about its effects on reproductive behaviour. Previous work suggested that light pollution affects both seasonal and daily patterns of behaviour. We investigated the effects of artificial night lighting and other confounding factors such as anthropogenic noise on the timing of the dawn and dusk song in six common songbirds. In 2012, we recorded singing behaviour in 11 forested plots: 2 plots with artificial light at night, but no daytime traffic noise, 3 with light and noise, 3 with noise, but no light and 3 undisturbed forests. Our results show that artificial night lighting, but not noise, leads to an earlier start of dawn singing in 5 out of 6 songbirds. This effect is strongest for early-singing species. We further show that dusk song is much less affected; only in two species does dusk song continue for longer in artificially lit areas. We also investigated the effects of natural variation in the light environment, and show that this has minimal effects in comparison to artificial night lighting. Furthermore, the effect of the artificial night lighting is directly related to the strength of the light source. We discuss the implications of our findings in the context of sexual selection, i.e. in relation to the function of dawn and dusk song signaling.

Effect of artificial lighting of roosting female Blue Tits on their breeding behavior

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Increased nightly light levels may alter the daily rhythms of individuals. The resulting behavioral changes may have consequences for an individual's fitness especially during the time of reproduction. Here, we investigate changes in the reproductive behavior of Blue Tit females due to artificially increased light levels. In two breeding seasons, we exposed Blue Tit females roosting in nest boxes at the onset of breeding with one hour of additional light every morning until egg laying commenced. We then investigated immediate and long-term effects of the light supplementation, including effects on emergence times from the roosting place, extra-pair paternity, clutch size, and survival. We found no clear evidence for a negative effect of the lighting treatment on the fitness of Blue Tit females.

s04-1k

Identifying areas of high-value for bird conservation and restoration of diversity in the Brazilian Southeastern region

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This study has been carried out at Sorocaba, southeastern Brazil, a 449km^2-municipality, having nearly 600,000 inhabitants. It is located in an eco-region of transition of Atlantic Rain Forest and Savannah biomes. The wooded area currently is composed by 616 forest patches spread along the municipality, corresponding to 28.6% of the total area. Due to the fact of most of forest patches are small and structurally disconnected, there is a huge necessity of identifying the forest fragments critical for conservation and indicate areas for restoration, in order to establish a strategic corridor for biodiversity. In this study a one-year survey of birds was carried out for after supporting the sequential steps of the project. Through fixed point counts carried out from June of 2012 to June of 2013, 1,688 contacts were established in fifteen points and 66 species were registered. The four most common species were *Pitangus sulphuratus* (163 contacts), *Passer domesticus* (144), *Columba livia* (126), and *Patagioenas picazuro* (120). The first and the fourth species are native and the other two are exotic. The number of species per local ranged from 22 to 35 (medium value of 27.1). Whereas first and second patch having highest number of species are in riparian fragments, we may assume that these may play an important role in conserving bird community, The next step of the project is cross databases regarding bird community and tree-plant community, in order to generate a conceptual model capable to show the best regions for restore.

s04-2k

Bird functional diversity and ecosystem services in tropical forests, agroforests and agricultural areas

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Although most bird species avoid agricultural areas, nearly a third of all birds occasionally use such habitats, often providing important ecosystem services like pest control, pollination, and seed dispersal. Combining literature review with meta-analyses of the ecological characteristics of the world's birds, I compared tropical bird species that prefer forests, agricultural areas or both, with respect to body mass, diet, range and population size, frequency, conservation status, habitat and resource specialization. Compared to primary forests, species numbers of large frugivorous and insectivorous birds (especially terrestrial and understory species) often decline in agroforests. In contrast, nectarivores, small-to-medium insectivores (especially migrants and canopy species), omnivores, and sometimes granivores and small frugivores do better, frequently by tracking seasonal resources. However, changes in guild species numbers do not necessarily translate to changes in relative abundance, biomass or function, and more studies are needed to quantify these important measures. These findings indicate that the replacement of forests and agroforests with simplified agricultural systems can result in shifts towards less specialized bird communities with altered proportions of functional groups. These shifts can reduce avian ecosystem function and affect the ecosystem services provided by birds in agroforests and other agricultural landscapes.

s04-3

The conservation importance of agroforests and tree plantations for forest birds in the Malay Archipelago

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A large number of bird species is threatened by the continuing loss of tropical rainforests. However, the proportion of forest birds able to survive in land-use systems such as agroforests and tree plantations remains unclear. The Malay Archipelago, a region characterized by an extremely high number of endemic birds, globally faces the highest rates of forest loss. Based on a comprehensive study of the available literature, a database was generated containing the following information for all forest species of the Malay Archipelago: colonized islands, habitat affiliation, feeding guild affiliation and body size. For individual islands, the database did not consider a bird species as present when it had already gone extinct. Based on this data the following questions were addressed: (1) Do forest birds occupy broader ecological niches on smaller islands, perhaps due to a competitive release caused by a lower species richness? (2) Consequently, do land-use systems such as agroforests and tree plantations have a higher importance for bird conservation on smaller islands? A preliminary analysis considering a total of 586 forest species and 18 islands demonstrates that the niche width of forest birds increases with declining island size. Forest species of smaller islands (e.g. Sangihe, Salayar, Morotai, Obi) are more frequently able to use secondary habitats than forest dependent species of larger islands (e.g. Borneo, Sumatra, Java, Sulawesi). However, further studies are needed to quantify to what extent the reproductive success of these forest birds differs between forest and secondary habitats. For a certain proportion of forest birds these habitats may rather represent *ecological sinks* (e.g. exclusively used by foraging birds), rather than suitable habitats for reproduction.

Bird functional diversity changes in tropical dry forest: comparison among a forest patch, silvopastoral systems and pastures

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Fragmentation and habitat loss are the main threats affecting tropical biodiversity. Those threats imply a richness species decrease, as well as loss of functionality and provisioning of ecosystem services. With the purpose of identifying the impact of Tolima's department cattle systems on birds' conservation and functionality, Functional Diversity (FD) in three different habitats was evaluated (Tropical Dry Forest Patch –TDFP- , Intensive Silvopastoral Systems –ISPS- and low tree density pastures-LTDP-), in order to determine whether there is a change in FD through the structural complexity gradient shown in the three habitat types. As functional traits, five morphological and one ecological variable were measured. A complete community cluster analysis yielded a total of 11 functional groups; all of them present in ISPS and LTDF, but 2 absent from TDFP. FDiversity Software was used to calculate FDp and wFDp indices. Results showed higher values in ISPS and lower in TDFP (FDp: TDFP = 4.7, ISPS = 12.4, LTDF = 10.3: wFDp: TDFP = 3.6, ISPS = 10.0, LTDF = 8.2). Even though this study shows a change in FD, there is no direct relation between structural complexity and FD; habitats with structurally intermediate complexity between forests and pastures, such as silvopastoral systems, had the highest FD indices values. Nevertheless, further studies are necessary to prove the real role of agroecosystems as a source of functional diversity. Additional studies are needed to evaluate if those functional groups are providing real ecosystem services.

s04-5

Potentiality of Indigenous Agroforestry Systems with reference to bird diversity in the Sikkim Himalayas, India

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The Indigenous Agroforestry Systems (IAS) in the Sikkim Himalaya are agro-ecologically diverse (300-2000 m) and have high biodiversity value. We assessed bird community structure covering three agroforestry systems viz., cardamom-based, farm-based and mandarin orange based during 2012-2013 to identify systems of high potential and of high conservation value considering that birds are bio-indicators and are used as surrogate taxon to predict ecosystem health. Further, we investigated the management measures to maximise the community structure of birds in disturbed ecosystems. We followed the open-width point count method along the 18 predetermined transects (six per system) comprising 180 points.

We observed a total of 2026 birds representing 125 species that comprised around 22% of the total avifaunal richness (574 species) of Sikkim. Species richness and abundance of birds were highest in the cardamom-based followed by farm-based and mandarin orange-based systems. The number of species per point was also higher in the cardamom-based systems but the result was not statistically significant ($F_{2,177}$ = 0.149; $p>0.05$). The abundance of birds was significantly higher in cardamom agroforestry systems compared to other two systems ($F_{2,177}$ = 3.125; $p\leq0.05$). We observed that cardamom-based system harbour a unique assemblage of birds compared to other two systems. Only 30% species were shared among farm-based and cardamom agroforestry systems. Similarly, cardamom-based and mandarin orange-based agroforestry system shared only 27% species. The Protected Area Network in the Eastern Himalayas is mostly located above 2000 m elevation while biodiversity occurs below this which is attributed to maximum forest cover and agroforestry systems. Thus, the IAS of Sikkim Himalayas has high potential in conserving biodiversity. Despite the high biodiversity potential, these systems are under tremendous pressure due to land conversion for non-agricultural purposes. While the study is ongoing we still recommend promotion and enhancement of the existing agroforestry systems for their biodiversity value and ecological resilience.

s05-1k

Breeding biology and conservation of old world Psittaciformes

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Psittaciformes has become one of the most endangered orders of birds. However efforts to conserve wild populations of parrots are hampered by the lack of data concerning breeding biology and habitat requirements for most species. Parrots are among the most difficult birds to study in the field, including difficulties in catching the birds, accessing their habitat and nest sites, and following their movements over wide ranges. Even when studies are conducted they often lead to low sample sizes and low publish-ability of the research. The low productivity of such studies may also be a particular deterrent for post-graduate students. In recent years, more studies on the breeding biology of Psittaciformes have been published for both Neotropical and Old World species. Complementary to the review presented on African parrots in this symposium I will summarise and critique the recent research on the breeding biology and habitat requirements of Old World Psittaciformes. I will emphasise a small number of case studies that illustrate how to overcome logistical difficulties to attain high quality data for conservation purposes. These include excellent field studies of the breeding biology of highly endangered parrot species together with analyses of migratory strategies and other evolutionary and ecological aspects of behaviour and life histories relevant to conservation. I will identify gaps in our knowledge of the breeding biology and conservation requirements of Old World parrots, and propose the most productive avenues for future research.

s05-2k

Phylogeography: its development in recent years and relevance to parrots

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Phylogeography has grown from its initial reliance on mitochondrial DNA (mtDNA) diversity in natural populations to increasing use of multilocus sequence data, comparative studies of multiple, co-distributed species, the application of coalescence theory and, most recently, the tools of genomics. Nonetheless, surveys of intraspecific mtDNA sequence diversity remain useful. They define and illuminate questions in current and historical population biology. They help direct where more sophisticated methods might most usefully be applied. Finally, they help in understanding how the Pleistocene shaped the present-day genetic diversity and distribution of regional biotas generally. With these uses in mind, the present paper presents and discusses patterns of mtDNA diversity with an emphasis on examples drawn from available studies from parrots, especially to define where further multilocus work will best be focussed.

s05-3

Impact of invasive species on parrots – case studies in New Caledonia and Wallis & Futuna Archipelago

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As obligate cavity breeders, parrots should be especially vulnerable to predation from introduced mammalian predators. According to the IUCN Red List, however, parrot species reported to be threatened by introduced species mainly occur on the Pacific islands. Most parrot species affected by introduced species occur in New Zealand, French Polynesia, and New Caledonia and are threatened mainly by stoats (*Mustela erminea*), domestic cats (*Felis catus*) and black rats (*Rattus rattus*). However, in most cases where a parrot species is considered to be threatened by predators, this is on the basis of assumption, and while some are supported by limited empirical evidence, very few have been supported by systematic study (e.g. Kakapo *Strigops habroptilus*). Since 2002, we have been studying the impact of introduced mammals on Horned Parakeets *Eunymphicus cornutus* and New Caledonian Parakeets *Cyanoramphus saisseti* to assess predation rates and the relationship between the abundance of parakeets and of introduced predators in New Caledonia (Melanesia). We continuously video-monitored nests during incubation and nestling care and followed fledglings by use of radio-transmitters until their death or transmitter failure. We also assessed the relationship between rat and parakeet density at 40 different sites throughout New Caledonia. On Wallis & Futuna Islands (Western Polynesia), since 2008 we have been studying the impact of recently introduced black rats on the population of Blue-crowned Lorikeets *Vini australis*, a species known to disappear from most islands on which black rats are established. We will present and discuss the results of 12 years of study and present possible alternative ways to manage introduced species.

s05-4

Beak and feather disease virus in a wild parrot species complex (*Platycercus elegans*): host predictors of prevalence and effects on breeding biology

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The order Psittaciformes is one of the most threatened with approximately 30 percent of species at risk of extinction. One widely recognised threat is beak and feather disease virus (BFDV), a highly pathogenic and transmissible virus that only infects the order Psittaciformes. So far BFDV has been implicated in several high mortality events in South Africa and Mauritius, and is considered a key threat factor to biodiversity by the Australian government. Currently, it is not known how BFDV interacts with wild host populations and the factors that influence host BFDV susceptibility, making it difficult for conservationists to prepare for potential BFDV outbreaks. In an 8 year study we tested for BFDV in the *Platycercus elegans* species complex which is an abundant species in south eastern Australia. This system includes two phenotypically distinct subspecies (terminal subspecies) that encircle unsuitable habitat through a series of intermediate populations including a hybrid zone (WS hybrid). We found that the two terminal subspecies in this system had both higher prevalence and viral load than the phenotypic intermediate populations and the WS hybrid. We present microsatellite data that could explain this variation in host susceptibility because more genetically diverse populations may be less susceptible to pathogens, and also discuss how host population divergence can affect viral evolution. Additionally, we show how age variation in prevalence can potentially influence male and female pairing and how parental infection status can influence transmission to offspring, survival and growth.

s05-5

Reproduction in Blue-throated Macaws: factors limiting the recovery of a critically threatened parrot under intense management.

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The Blue-throated Macaw *Ara glaucogularis* is an endemic Bolivian macaw, and one of the two critically endangered_macaw species that still live in the wild. Until now, the only available biological information of Blue-throated Macaw came from studies related to distribution, range, habitat use and population size estimations. Here, we analyse reproductive parameters in an intensively managed wild population of Blue-throated Macaws. During the 2007-2012 period we identified 64 individuals in the study area, of which at least 32 were active breeding birds. The egg-laying season was different for north and south subpopulations. Average clutch size was 2.53 and the incubation period lasted 25 days. Partial losses during incubation were low: two cracked eggs were removed by parents before hatching date. Average clutch size at hatching was 2.10 and hatching success was 72%. In successful nests, the survival of nestlings was 100 %, average clutch size 2.00 and the nestling period lasted 85 days. Between 2007 and 2012, a total of 26 nestlings of Blue-throated Macaw successfully fledged. Given that the average total clutch was 2.5 eggs per nesting attempt, and the average of 0.89 fledglings per nesting attempt, each pair is losing on average 65% of its initial reproductive investment at each nesting attempt. Fifty-seven per cent of 30 monitored nests failed. Most failures occurred during the incubation stage. All monitored breeding pairs showed a high nest site fidelity reusing hardwood-tree cavities and nest boxes. Our research provides the first data on the breeding biology of this critically endangered species. We hope our findings will aid conservation efforts by refining current actions and prompting new approaches towards the conservation and recovery of the Blue-throated Macaw.

s06-1k

Avian translocations to modified habitats: from Reintroduction to Conservation Introduction

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Avian reintroductions, attempts to restore populations in areas from which they have disappeared, have proceeded under the assumption that historical distribution range is a reliable guide to current and future habitat suitability. However, the properties of a habitat that allow species to persist may change over time, and the longer the time since extirpation, the greater the potential for habitat change due to changes in climate, land-use, or community composition. Consequently the new IUCN Guidelines for Reintroductions and other Conservation Translocations (2013) place great emphasis on the evaluation of habitat suitability, so that even a reintroduction within the indigenous range must first assess current habitat suitability in terms of the candidate species' total biotic and abiotic needs. This has two implications for species restorations relying on translocation: (1) even highly modified habitats within the indigenous range could meet a species' needs, and pristine habitat conditions may not be necessary; (2) suitable habitat may lie outside the indigenous range of the candidate species, thus a conservation introduction may be justified. Introductions of organisms outside their indigenous range have had devastating ecological impacts. However, there has been growing recognition of the value of introduction as a valid conservation management tool. Assisted Colonization is the intentional release of an organism outside its indigenous range to avoid extinction of populations of the focal species, and may be justified where protection from threats in the current range is less feasible than at alternative sites. This talk will place these controversial conservation approaches within a translocation spectrum and, with an emphasis on birds, will review the movement of organisms into modified habitats within their indigenous range, and into suitable habitat outside their indigenous range to protect them from current or future threats.

s06-2k

Avian reintroduction into socio-ecological production landscapes: lessons from case studies

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Habitat modification by agricultural and urban expansion is an increasingly important threat to birds globally. So far, almost no reintroductions have taken place in relatively intact habitat, even though a less modified release site might successfully restore populations. All bird species do not require intact habitat. Socio-ecological production landscapes (SEPLs) have been formed and maintained through human activities for long times, which support higher species diversity because they contain moderately disturbed habitats and an ecotone. Some bird species are more adapted for SEPLs than predicted, since they have historically co-existed with humans. But recent rapid civilization and population explosion have degraded natural habitats and have led to overhunting those species, threatening many bird species to extinction. Crested Ibis, *Nipponia nippon,* and Oriental White Stork*, Ciconia boycinia,* were such species in Japan. They were extirpated in 1970s and 1980s, and they have recently been reintroduced into Socio-ecological production landscapes, so-called Satoyama, which is a modified ecosystem by interactions between human and nature for a long time. In order to restore populations of these waterbirds in the Satoyama environment, ecological restoration is primarily necessary before or during reintroduction, which includes creating biotopes, management of nesting sites, and promotion of organic farming. Second, it is also necessary to establish socio-economic consensus between stakeholders and to give environmental education to local people before or during reintroduction. We have learned many lessons from reintroduction programs in socio-ecological production landscapes. This talk will review several case studies of population restoration in SEPLs, which were carried out in Japan and Asian countries, and will discuss required management for reintroduction in Socio-ecological production landscapes.

Reintroduction and ecology of the Oriental white stork *Ciconia boyciana* - Coexistence between humans and birds in Japan

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In Japan, the Oriental white stork (a globally-endangered species) bred commonly up until the first half of 19th century, but was extinct by 1971 due to human persecution and widespread pesticide application. With an increase of the captive population size in 1990s, the first releases of captive-bred birds took place in Tajima in 2005, where the last wild population existed. The first pair was formed in 2006 and the number of birds in the wild increased to 76 in 2013. The annual survival rate of young after fledging is as high as 80%. We monitored an almost fully banded population and found that this species has stable pair-territories throughout the year, and immature birds younger than 4 years form an underworld whose social structure has also been clarified. Additionally, it was found that this species is monogamous with a strong pair-bond. The original habitat of this species is floodplain where intensive rice cultivation has been taking place for a long time in Japan. Thus, wild storks in the past naturally foraged within paddy fields where prey animals, especially fresh-water fish, were abundant due to the high bio-productivity there. Although young birds fly long distances and visit various districts of Japan, they usually return to Tajima after a short stay in each district, possibly suggesting low food availability in rural areas where bio-productivity has declined due to a change in the water-supply system for paddy fields all over Japan. The poor natal dispersal increases the risk of kinship mating that is believed to have contributed much to the extinction 40 years ago. Problems both in natural and social environment that should be overcome in order to achieve harmonious coexistence between humans and storks are discussed.

A lesson for life: is it possible to prepare release candidates in captivity to their post-release environment? A case study in Grey Partridge

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Reintroduction of locally extinct animals into their former range has become an important but controversial tool in conservation biology. Animal reintroductions are complex to conduct and often fail for unknown reasons. Nevertheless, there likely will be an increasing number of reintroduction attempts in the future and hence there is an urgent need to better understand the processes that predict reintroduction success and to actively influence reintroduction outcome. A reintroduction project of Grey Partridge in Switzerland gave us the opportunity to work with two captive strains of partridges that varied in the duration of their isolation from wild-living populations (thereafter called wild and domesticated strain). We subjected parental pairs of the two strains and their offspring to periods of unpredictable food supply or control conditions. We measured behaviour and physiological condition of adolescent offspring coming from the eight strain x prenatal x postnatal treatment combination groups. Finally, we released adult offspring into the wild and determined their post-release survival in relation to strain, prenatal and postnatal treatment and behaviour. Despite physiological advantages, wild strain birds did not survive substantially longer than birds from the domesticated strain. However, encountering a phase of postnatal unpredictability enhanced immunity and post-release survival. Survival was also positively related to bold and independent behaviour. Our results could have implications for reintroduction projects in general. They suggest that the physiology of captive animals can be prepared for the post-release environment and they emphasize the importance of individual behaviour and the social group for post-release survival.

Using Habitat Suitability Models for conservation translocations: empirical investigations within the reinforcement program of Houbara Bustard

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In 2012, the new IUCN Guidelines on conservation translocations reaffirmed the importance of habitat suitability to reintroduction success. Given the increase in anthropogenic pressures, we need also to take into account environmental change which can occur in habitat, and particularly climate change. In this context, Habitat Suitability Models (HSM) have become a widely used tool in conservation to predict current and future species distribution. Predictions of HSM can thus complete the assessment of habitat quality in the field to select priority areas for conservation translocations. However, we have still little hindsight on the benefit of using HSM for translocation success, likely because of the weakness in post-release monitoring. Here we addressed this issue focusing on a reinforced population of the North African Houbara Bustard (*Chlamydotis undulata undulata*) in Morocco. We modelled its potential current and future distribution using the ensemble forecasting framework BIOMOD. Along the whole gradient of habitat suitability, we performed an experimental release of 174 captive-bred houbaras equipped with GPS-transmitters. We tested the benefit of using HSM predictions to select release sites linking survival and movement analyses of released houbaras to the habitat suitability of their release sites. Then, from the thorough knowledge about the spatial distribution of the remnant wild population and the intensive demographic post-release monitoring of captive-bred released individuals, we also tested if released houbaras use the same ecological niche as wild houbaras. Taken together, our empirical approaches which link habitat suitability with demographic processes (survival, dispersal) provide a step towards a better understanding of the relevance of HSM for conservation translocations.

s07-1k

Understanding and Quantifying the Colour Patterns of Birds

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Birds exhibit a stunning variety of colours and patterns, including on their eggs, chicks, and adult plumage. They are also seen against a wide range of backgrounds in many habitat types. Such coloration is used for camouflage against predators, communication with rivals and potential mates, and more. However, analysing animal markings appropriately, and obtaining measurements that are biologically relevant to the information an observer would utilize can be difficult. This is especially true for studies that need to analyse the two-dimensional arrangement of markings, i.e. pattern. In this talk I will discuss new methods to quantify the coloration and pattern of birds and other animals, and the types of metrics that we can obtain to answer a range of questions in camouflage and communication. In particular, I will focus on the need to study avian markings from the perspective of the visual system of the natural observer, and the advantages that digital imaging has over other techniques. I will do so by using examples from work undertaken by my collaborators and I, including on egg mimicry in brood parasites and camouflage in ground nesting birds.

s07-2k

Colour to birds and to humans: why is it so different?

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It is now widely accepted that the colour vision of birds is different from that of ours, and modelling of avian vision has become almost standard, particularly in studies of bird coloration. The ultraviolet sensitivity of birds is often solely highlighted as a key difference with human vision, but the true difference is more than that. Here, I would summarize knowledge of the colour vision system of vertebrates, and review how its evolutionary history influences the colour that animals perceive. A key difference is the number of photoreceptor types present, namely, single-cone cells on the retina. This difference in numbers anatomically underlies the visual performance of animals, and gives rise to different dimensionalities of colour vision. This is because outputs from different photoreceptor types are integrated to compose a single colour, and thus the effect of respective photoreceptor types on perceived colours is indivisible. Most vertebrates are tetrachromatic (with 4 single-cone types), so mammals, which are mostly dichromatic (2 single-cones), are rather exceptional. Among mammals, some primates, including humans, have an improved colour vision through the acquisition of trichromacy (3 single-cones) in their evolution, but this still is unlikely to provide as effective colour discrimination as tetrachromacy. One reason why humans are incapable of seeing UV is probably that the mammalian ancestors were nocturnal, and thus their environment low in UV light. Mammalian ancestors therefore had reduced colour vision in favour of better brightness perception. Overall, the colour vision of birds and humans are divided by the long history of evolution, which yields substantial differences in the perceived colour between them. This is why we need visual models to analyze bird coloration.

s07-3

Using multispectral imaging to study bird coloration

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Contact-type spectrometers and digital cameras, which have been widely used as means of quantifying coloration in studies of birds, have both advantages and disadvantages. Contact-type spectrometers output data of the intensity distribution of reflected wavelengths but provide only point samples. In contrast, digital cameras enable simultaneous colorimetry of the entire body of a bird, but usually provide device-dependent and inexplicable RGB values. There are several excellent methods of transforming RGB values into device-independent and useful color indices. However, wavelength data are not obtained using these methods. Here we report that the use of multispectral imaging developed in the discipline of remote sensing dramatically resolves these flaws of conventionally used colorimetric techniques. Multispectral imaging is a technique that enables simultaneous acquirement of reflected wavelength data from the entire body of a bird. Using this technique to quantify coloration is expected to greatly advance our understanding of birds.

s07-4

Color characteristics of delayed plumage maturation in the male Red-flanked Bluetail *Tarsiger cyanurus*.

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Some avian species show delayed plumage maturation (DPM). DPM is a phenomenon in which individual plumage matures a few years after the first potential breeding season. Plumage coloration is primarily produced from two types of pigment as well as feather microstructure, and is classified into three types: carotenoid-based, melanin-based, and structural-based. Structural coloration commonly reflects short wavelength light (e.g., producing violet and blue colors). Dramatic structural color changes in DPM species may be produced by different plumage structures in individuals of different ages and sexes. We observed the plumage structure of the Red-flanked Bluetail *Tarsiger cyanurus*, a species that shows DPM (i.e., the adult male color is blue and the female/1st year breeding male color is olive-brown). Plumage samples were collected from a breeding population at Mt. Fuji. There was a slight structural difference between blue and olive-brown individuals, although all individuals had similar internal/external plumage structure. Barbs have a sponge-like layer and some melanin-like granules. Our findings suggest that differences in the internal plumage layer produce different colors in the DPM species.

s07-5

A novel method for quantifying egg patterns using HLAC

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Why is there so much variation in egg coloration of birds? This is a simple but difficult question to answer that arose more than a century ago. Today, there are a large number of hypotheses which explain the evolution of egg coloration, and interspecific differences of egg coloration have been discussed well. However, it is still uncertain why intraspecific variation in egg coloration exists, and even more problematic is that some birds show intra-clutch variation in egg coloration. These two variations are less understood than interspecific variation, because ranges of variation are too small and there is the difficulty of quantifying egg coloration, in particular the spotting pattern or maculation of eggs. Old studies often use the man-based methods for quantifying egg patterns, but sometimes these approaches are too subjective and it is hard to compare the numbers between studies. This study aimed to develop a novel analytical framework for quantitatively evaluating egg maculation. For this purpose, I used eggs of the Little Tern as a model subject and tried to apply an image recognition scheme called Higher-order Local Auto Correlation (HLAC). This method extracts high dimensional features from one image and this allows to compare the similarity or difference between images by calculating Euclidean distances. Results were analysed based on the self-organizing mapping algorithm, which allowed to quantify complex patterns of egg markings. This method has a potential to reveal other features of colour patterns of birds, such as feathers, gapes of chicks, and so on.

s08-1k

An overview of ecosystem services provided by birds

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Abstract - Ecosystem services are natural processes that benefit humans. Birds contribute the four types of services recognized by the UN Millennium Ecosystem Assessment: provisioning, cultural, regulating, and supporting services. In this review, we concentrate primarily on supporting and regulating services as these are the ecological functions of birds and are poorly quantified in terms of value to humans. As members of ecosystems, birds play many roles, including as predators, pollinators, scavengers, seed dispersers, seed predators, and ecosystem engineers. These ecosystem services fall into two subcategories: those that arise via behavior (like consumption of agricultural pests) and those that arise via bird products (like nests and guano). Characteristics of most birds make them quite special from the perspective of ecosystem services. Because most birds fly, they can respond to irruptive or pulsed resources in ways generally not possible for other vertebrates. Migratory species link ecosystem processes and fluxes that are separated by great distances and times. Although the values (economic or otherwise) to humans contributed by most, if not all, of the supporting and regulating services have yet to be quantified, they are important to humans. Our goals for this review are 1) to summarize the ecosystem services provided by birds, 2) to outline methods to quantify their value to humans, and 3) to highlight gaps in our knowledge and suggest directions for future research.

s08-2k

Nutrient dynamics and nutrient cycling by birds: Implications from an East Asian perspective

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Large aggregations of birds contribute sizable nutrient fluxes. The impact of birds on nutrient fluxes, represent provisioning services in some cases and supporting services in others. Guano provided by seabirds became extremely valuable in the 19th century because of its rich concentration of nitrates and phosphates used in fertilizer, gunpowder, explosives, and chemical industries. Bird aggregations affect nutrient dynamics and availability in many other situations, from ocean to near-shore islands and coastal marine communities, from lakes to terrestrial ecosystems, and from cities to isolated urban forest fragments. Transportation of nutrients has both direct effects on primary producers and, by bottom-up cascades, indirect effects on primary consumers or detritivores. Such functions sometimes supply positive effects for humans in the form of ecosystem services, but in other cases, produce negative effects such as eutrophication. In order to enjoy ecosystem services from the nutrient dynamics and cycling by birds, various efforts and devices would be needed for decreasing the negative effects, and for the protection of birds from human disturbance. Our goals here are: 1) to highlight the characteristics of birds as contributors to nutrient dynamics, 2) to review the positive and negative effects of birds on ecosystems, including those in East Asia, and 3) to discuss how to maximize the services from an East Asian perspective.

The role of dabbling ducks in the dispersal of plant seeds

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The role of waterfowl in passive dispersal of small (aquatic) organisms is increasingly recognized as an important ecosystem service, contributing to conservation and expansion of plant and invertebrate populations. As waterfowl transport organisms between isolated wetlands, negative effects of habitat fragmentation on local biodiversity are limited in freshwater ecosystems. However, not all organisms are fit for this mode of transportation and little is known about the quantitative scale of waterfowl-mediated dispersal. We addressed the three crucial phases of internal dispersal (endozoochory) of plant seeds: 1) ingestion of seeds by waterfowl, 2) survival of gut passage, and 3) spatial scale of transportation. For phase 1 we summarize results of an extensive literature study on diets of seven dabbling duck species. Seeds of >400 plant species were reported from duck guts, indicating opportunistic foraging and little discrimination between plant species. For phase 2 we performed experimental feeding trials with resting and swimming mallards. Seeds of most fed plant species were able to survive gut passage and seed digestion was less efficient in swimming than resting birds. Most seeds were retained in the digestive tract for 2-4 hours, but maximum retention times exceeded 24 hours. Thus, considering the fast flight of ducks, seeds may be transported over several hundreds of kilometres during migration. For phase 3 we equipped 164 mallards with GPS loggers to reveal high resolution movement patterns. The mallards rarely flew more than 2 kilometres and had a very fixed diurnal movement pattern, returning to the same roosting and foraging sites. To increase our understanding of the functioning of this ecosystem service and the importance of the role of mallards, we will discuss the scales at which dabbling ducks play a role in endozoochorous dispersal in freshwater ecosystems.

Estimation of pest control by Great Tits with application of a nest finder system at artificial nestboxes in Hongneung Experimental Forest, Korea

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Urban forests have a good role in provisioning good habitats for forest birds, however there is little study on the quantification of pest control by forest birds. In urban forests, artificial nestboxes can enhance the number of secondary cavity nesters such as tits and nuthatches due to the presence of a few large-sized trees. We set up the artificial nestboxes at a density of 10/ha in Hongneung Experimental Forest located in Seoul city, Korea. We installed one nestbox with a nest finder system to estimate pest control by Great Tits (*Parus major*) during the breeding season of 2008. We obtained fully recorded videos and analyzed time budgets of prey transfer by the parents. We postulated the number of nestlings as 10 juveniles per nestbox, and we selected a value of 0.15 value as the ratio of pest prey to total preys, and designated controlling time of pests as the pests' density of 200,000/ha. We utilized the costs of pest control reported by Korea Forest Services of 2009. As a result, parents transferred a number of prey ranging from 30,000 to 75,000 to nestlings per year, and we estimated the average monetary value of pest control as 700$ value per nestbox per year. This estimation can be utilized to assess the relative value of nestboxes in urban forests, and can be linked to ecosystem services of urban birds.

Input of ornithogenic nitrogen into paddy fields near a breeding colony of the great cormorants, and its contributions for rice crops

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Terrestrial ecosystems near breeding colonies of piscivorous seabirds can receive a large amount of marine-derived nitrogen in the form of bird feces. It is well demonstrated that nitrogen input from seabirds strongly affects plant productivity in forests or coastal grasslands. However, the effects of nutrient input on plant productivity in agricultural ecosystems near seabird colonies have rarely been evaluated. We examined those effects on rice plant productivity in paddy fields irrigated by a pond system located near a colony of the great cormorants (*Pharacrocorax carbo*) in Aichi, central Japan. Soils and rice plants in the fields closer to the irrigation pond contained larger amount of cormorant-derived nitrogen (higher δ^{15}N‰), indicating that said nitrogen could be inputted into the fields via irrigation waters. Rice yields for the paddy fields enriched only by the cormorants (without any fertilizers) did not differ from those of the fields enriched by synthetic fertilizers. The amounts of nitrogen provided by the cormorants were estimated over tens of kg in dry weight per year per ha of the paddy field. The amount of avian-derived nitrogen present, could save tens of thousands JPY of synthesis fertilizers per year per ha of the paddy field.

s09-1k

Vocal control regions of sub-oscine passerines

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Oscine passerines (songbirds) possess a distinct neural circuit, the song control system that appears to be missing in the closely related sub-oscine passerines. In relation to this neuroanatomical difference, oscines learn their songs during development, while sub-oscines have innate songs. However, only a few species of sub-oscine taxa have been studied neuroanatomically in detail. Here we give an overview of brain areas potentially involved in the song control of a cotinga, a manakin, a flycatcher and an antbird species. Vocal areas were either identified by retrograde tracing from the syrinx muscles or by molecular homology (e.g. singing related ZENK expression, androgen receptor expression) with features of two songbird species, the Zebra Finch (*Taeniopygia* guttata) and the Canary (*Serinus canaria*). Further, we compare the structure of some key genes expressed in forebrain song control regions of songbirds between sub-oscines and oscines, with the focus on hormone regulatory sites. The results so far indicate that the species of the above sub-oscine taxa do not develop forebrain song control regions, but that their brainstem song control regions share similarities with those of songbirds. Thus, it is likely that the forebrain song regions of songbirds evolved after the evolutionary split of the songbird and sub-oscine lineages. Further, since the investigated cotinga (lek based singing, see presentation of T. Aubin) and flycatcher (male-female duetting) show complex vocal communication, such vocal performance does not require forebrain vocal areas typical of songbirds.

s09-2k

Vocal communication in two sub-oscine species from Amazonia, Brazil

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Sub-oscine passerines are widely distributed in the Neotropical region and they are known for presenting stereotyped song and consequently smaller repertoires compared with oscine passerines and hence there appears to be no evidence of vocal learning, except for Bellbirds *Procnias* spp. which show imitations and dialects in their vocal communication. In the present study, we have chosen two very common sub-oscine species in the Amazonian region, Pará State, Brazil to investigate the magnitude of variation of song and calls. We performed playback experiments to define the call repertoire of Rusty-margined Flycatcher *Myiozetetes cayanensis*, a common species in forest edges and secondary forest which has a complex repertoire of 14 different vocalizations, including a complex duet song. We also studied another Amazonian suboscine species, *Lipaugus vociferans*, abundant in the Amazon forest. It has a grey homogenous inconspicuous colour and is a lekking bird, in which males perform conspicuous vocalizations in aggregations. The vocalizations were recorded at the Ecological Park of Gunma (PEG), Santa Bárbara/PA. We analysed songs of individuals from six leks, considering the physical parameters of duration/time of the notes, minimum and maximum frequencies. The results showed that it is possible to differentiate the individuals by song, because there were significant differences in at least one of the physical parameters analysed. These differences may represent an important function in individual recognition inside or between leks. These results provide a basis for more studies on the ecological and behavioural characteristics of lekking birds. The diversity in tropical environments and within suboscine passerines provides an opportunity to study more species for behavioural and neural investigations to define the vocal patterns in this group.

Pattern and neural control of unlearned vocalizations in the Zebra Finch *Taeniopygia guttata*.

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To compare vocalizations of Suboscines and Oscines, it is important to study the unlearned vocalizations of the latter. Bird vocalization research has principally focused on songs, whereas the study of unlearned calls has not been given adequate attention. To understand avian vocal communication a thorough comprehension of call usage is necessary. Zebra Finches emit thousands of calls daily. However, the exact number of call types, their functions and their inter-individual interaction patterns are not fully described and understood. We developed and used miniaturized backpack microphones to record all daily vocalizations of Zebra Finch pairs. We quantified the calling behaviour and, using synchronized video and audio recordings, we correlated the calling patterns and the social behaviours. We described the call repertoire of the Zebra Finch with high precision and found that it is similar among individuals. Through quantitative analysis of the timing of calls of mated pairs we discovered that these are used in bidirectional communication. Pairs established precise patterns of alternated calling: an actual duetting that uses calls. Quantitative description of calling behaviour allows us to describe and further elucidate the role of different regions of the brain involved in vocal communication. We first investigated the role of the telencephalic areas of motor pathway needed for song production in Oscines, HVC and Nucleus Robustus of the Arcopallium (RA). Lesion of this area showed that these are not fundamental for duetting with the partner. We then showed through behavioural experiments and electrophysiological recordings that Zebra Finches are able to recognize the individual vocal signature of unlearned calls. Together these findings shed light on the calling usage and its neural control in Zebra Finches, and open up possibilities for comparative studies.

s09-4

Integrating song and radio telemetry tracking with playback experiments, to infer intra- and inter-sexual relationships in a Neotropical terrestrial insectivore, *Formicarius moniliger*.

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Birds sing as they move through their territories to signal to rivals that their territory is occupied. Typically it is males that sing to defend their territory, but female birds in some species also sing, particularly in the tropics. We recorded songs of Mexican Antthrush (*Formicarius moniliger*), a monomorphic species where female song appears indistinguishable from male song. Because antthrushes are very difficult to see and identify to individuals while vocalizing, we used recordings and song classifications, as well as radio telemetry, to identify individuals and to map territory occupancy. We used playback experiments and radio telemetry to determine the function of song in intra- and inter-sexual interactions. Males sang more than females and responded indiscriminately to male and female song, but females appeared to distinguish between male and female playback and responded accordingly. While females responded more to female song than male song, results show that when females responded to male song, it was females with low frequency song responding to those males with high frequency song. We consider the importance of a negative correlation between song frequency and body mass in this species in explaining this result, compare song responses with movements tracked in response to playback using radio telemetry, and discuss our findings in the context of the hypotheses of mate and territory defence.

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Individual, population, and geographical variation in advertising song of some passerine bird species

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Bird song variation within the species range is often discussed in relation to the concept of vocal dialects. No less intriguing then dialects is the persistence of vocalization elements or even complex vocal constructs (songs) over extensive ranges. We studied geographical and population differentiation of advertising song in birds with discrete and continuous types of song organization, different repertoire size and range configuration. Blyth's Reed Warbler (*Acrocephalus dumetorum*) had a compact range. Individual vocal repertoires include 30 to 104 song types. The similarity of song repertoires between populations was related to the distance between them, but we failed to reveal such relationship for the repertoires of individual males within the same population. Many song types were widespread, almost throughout the species range from the Moscow region to the Ural Mountains. Studying of secondary contact zones of Chiffchaff (*Phylloscopus collybita*) - a species with simple song and huge range - showed that even essential distinctions in its song did not prevent hybridization. Greenish Warbler (*Phylloscopus trochiloides*) is a classical example of an avian ring species, but we revealed that in the zone of sympatry in the West Sayan, convergence of acoustic characteristics of the eastern and western forms takes place. For a sample of Siberian and Sakhalin populations of Dusky (*Phylloscopus fuscatus*), Radde's (*Ph. schwarzi*) and Pallas's (*Ph. proregulus*) Warblers we compared vocalization on opposite (western and eastern) parts of their extensive ranges. Factors and mechanisms that can contribute to the formation of vocal dialects in populations of nightingales (*Luscinia luscinia* and *L. megarhynchos*) are discussed.

s10-1k

The stress of stopping over: oxidative stress associated with long-duration flights and its implications for the ecology of migrants at stopover sites

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During migration, birds primarily use fats to fuel their long-duration flights and this high rate of fat metabolism during exercise substantially increases the bird's oxidative stress. Birds may avoid the cellular damage associated with this oxidative stress during exercise by up-regulating their endogenous antioxidant capacity (e.g. liver antioxidant enzymes) and by consuming more dietary antioxidants in preparation for migration and during stopovers while migrating from wintering to summer sites. I present the results of testing a series of hypotheses related to how the physiology of migratory birds changes during endurance flights to cope with enhanced oxidative stress, and how this relates to the ecology of birds at stopover sites.

s10-2k

Hormonal regulation of the fuel metabolism in migrating birds

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During migratory flight birds rely on endogenous fuel stores. Currently, little is known about the hormonal regulation of energy metabolism during migration, and findings so far were often conflicting. During the last several years, the glucocorticoid hormone corticosterone has been discussed as a candidate that might play a central role in regulating energetic needs during migration. We measured plasma corticosterone levels in free-ranging passerines caught during migratory flight. We compared the plasma corticosterone concentrations of birds with different migration strategies, namely long-distance, short-distance and irruptive migrants. During migratory flight slightly elevated corticosterone concentrations seem to promote the mobilisation of energy stores. We also measured oxidative stress and compare birds caught in flight with resting birds, as well as birds with different migration strategies.

Corticosterone and migratory fueling in Northern Wheatears facing different barrier crossings

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Corticosterone, at baseline and moderately elevated levels, is thought to regulate energy mobilization during the predictable life-history cycle. In birds, corticosterone is known to be moderately elevated during migration, and some experiments on captive, but it was found in migratory active birds that exogenous corticosterone can positively affect fat deposition, i.e. fueling. We present observations that indicate that, in wild birds, endogenous corticosterone does not promote refueling during migratory stopovers. We compared two subspecies of Northern Wheatears (*Oenanthe oenanthe*) during their simultaneous spring stopovers on Helgoland, a small island some 50 km off the German coast. In spring *O.o.oenanthe* travel relatively short distances from Helgoland to their next stopover or breeding sites, whereas *O.o.leucorhoa* face a lengthy overseas journey. Consequently, for their next flight bout *O.o.leucorhoa* deposit more fuel, more rapidly than *O.o.oenanthe*. Corticosterone levels, however, were lower in *O.o.leucorhoa* than *O.o.oenanthe*, contradicting the idea that corticosterone promotes migratory refueling. This finding was solidified by the observation that actual fuel deposition rate was negatively correlated with corticosterone level. We also observed a positive correlation between corticosterone level and fuel stores. In an additional experiment on captive wheatears, we found that the negative relationship between fueling and corticosterone is driven by a reduced food intake with increasing corticosterone levels. Our findings suggest that, rather than promoting migratory refueling, corticosterone may function as a readiness cue, with levels increasing towards departure from the stopover site.

Physiological strategies for stopover in migrating songbirds after barrier crossing in spring

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Knowledge of the physiological mechanisms that regulate migration in songbirds is crucial for understanding evolutionary changes, plasticity, and the ability to cope with climate change and other human induced effects on the ecosystem, yet little attention has been given to these aspects. In spring, songbirds migrating from African wintering grounds need to optimize their speed of migration in order to reach their breeding grounds in Europe, as early arrival is linked to increased reproductive success. In order to achieve faster migration, the routes include high-risk flights over several ecological barriers, such as the Sahara desert and the Mediterranean Sea. Optimal fuel management is therefore a crucial determinant of overall migration time. Here we present the results of a series of studies on the stopover physiology of several species of passerines immediately after the Mediterranean crossing. The studies were conducted on the island of Ponza, off the western coast of central Italy. Work on both long-distance and short-distance migrants showed that their migratory disposition is strongly correlated with the physiological condition, in particular with fat reserves. A telemetry study done on the neighbouring island of Ventotene confirmed these results. In the latter study, lean birds had larger decreases in body temperature at night than those observed in birds in better body condition. Nocturnal hypothermia may therefore reduce metabolic costs and optimize fuel management, e.g. by reducing body mass loss in those individuals that shifted to protein catabolism. This could be regulated by the hormone melatonin, which participates in thermoregulation in birds and has a direct influence on their migratory programme.

s11-1k

The Endemic Amami Jay (*Garrulus lidthi*), invasive Small Indian Mongoose, and other alien organisms : a 21st century investigation of island aliens for improved ecosystem management

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The Amami Islands in southern Japan host many endemic species, including the Amami Jay (*Garrulus lidthi*). These islands are in a major corridor for bird and butterfly migrations, and also for international trade and tourism. These natural and anthropogenic conditions for species introductions have provided many opportunities for organism invasions including the Small Indian mongoose (*Herpestes auropunctatus*), which was introduced to Amamioshima Island in 1979. Following the mongoose invasion, populations of endemic species, including the Amami Rabbit (*Pentalagus furnessi*), the Amami Woodcock (*Scolopax mira*), the Amami Ishikawa's frog (*Odorrana splendida*) and others dramatically decreased in the 1990's, while the Mongoose population expanded. Since 2000 the Japanese government has implemented a Mongoose control project resulting in the Mongoose population being suppressed to a very low density by 2010. This suppression has resulted in the initial recovery of severely affected animal populations. The Amami Jay, which was thought to be less affected by mongoose predation, was removed from Japan's endangered species list in 2008. However the population and range of the Amami Jay is still small (ca. 700 flocks), and other invasive species, such as cats, black rats and goats continue to damage the native ecosystem. Additionally there is also a constant threat of new invasions to the Amami Islands. Our research shows that Amami Jay breeding success currently depends on the super-dominant acorn production of *Castanopsis sieboldii* as much as predation. Therefore conservation plans should consider both short- and long-term effects and potential interaction by both invasive species and other natural factors. We are currently studying Amami Jay genetic diversity, disease ecology, and other factors, together with *ex-situ* conservation efforts. Understanding Amami Jay population dynamics as they relate to invasive species demands sophisticated ecosystem research and management. We discuss this endeavor as a model for maintaining biodiversity under threat from multiple invasive species.

s11-2k

Population Viability Analysis for Swinhoe's Storm Petrels on Chilbal-do Islet, Korea

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Approximately 12,000 breeding pairs of Swinhoe's Storm Petrels (*Oceanodroma monohris*) breed on Chilbal-do Islet, Korea. The population has been probably stable for the past 20 years, but rapid expansion of introduced plants threatens the breeding colony; introduced tall shrubs replace the available nesting areas, and *Achyranthes japonica* entangled the storm petrels to death. To identify the effects of each threat, a population viability analysis was performed by Vortex 9.98 software based on field data in 1987-1988 and in 2008-2009. In 2009, we estimated that 424 adults and 59 fledged juveniles were killed by *A. japonica* and that the total area of native vegetation had decreased by 0.3% annually since 1987. Because the control of introduced plants may affect the mortality (harvest) as well as the nesting area (carrying capacity), we tested four scenarios: 1) no management, 2) tall shrub controls, 3) *A. japonica* controls, and 4) intensive management for both. When the intensive managements are adopted (scenario 4), more than 70% of the current population may survive by 2110. Control of *A. japonica* also may secure 50% of the current population (scenario 3). However, unless urgent control is taken of direct mortality by *A. japonica*, the total population is expected to be extirpated within 60 years according to the worst-case scenarios (scenario 1 and 2). Although most variables were based on rough estimations due to the lack of life history information of this species, this result indicates that control of introduced *A. japonica* is most required on Chilbal-do Islet. Considering the occurrence and rapid expansion of *A. japonica* in all known breeding colonies of the storm petrels in Korea, this study suggests that urgent development of action plans and its implementation to control *A. japonica* in breeding colonies are essential to secure the long-term survival of Swinhoe's Storm Petrel.

Impact of invasive predators on Okinawa and Guam Rails

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Rails on many Pacific islands have lost the ability to fly, possibly to eliminate the unnecessary energetic costs of maintaining flight muscles in an environment lacking natural predators. Of the 130 species in the family *Rallidae*, 17 are flightless island species. Ten of these 17 species are already extinct. The Guam Rail (*Gallirallus owstoni*) has been extirpated from the wild on Guam due to predation by the introduced brown tree snake (*Boiga irregularis*) and extinction has been prevented by captive breeding.
In 1981, the Okinawa Rail (*Gallirallus okinawae*), a close relative of the Guam Rail, was discovered in the northern area of Yambaru on Okinawa, and was described as a new Japanese endemic species. This species has limited flight and nests on the ground. Distribution of the Okinawa Rail was studied using playbacks in 1996-1999, 2000-2001, and almost every year from 2004. Results indicate the distribution area and estimated population size have declined by almost half until 2005.
The Okinawa Prefectural Government and the Ministry of the Environment implemented an eradication program to control the introduced mongoose (*Herpestes auropunctatus*) in the Yambaru area utilizing traps since 2000. As of March 2013, over 5,000 mongooses have been caught. The majority of captured mongooses are from the southernmost range of known Okinawa rail habitat. As Okinawa Rails have disappeared from the southern range in recent years, the high capture rate of mongoose in these areas imply that mongoose are responsible for the loss of the rails.
Strong conservation measures such as habitat preservation, predator control, a captive breeding program and effective re-introduction are required to prevent the extinction of both the Okinawa Rail and Guam Rail.

Behavioural changes in an invasive parasitic fly and its avian hosts, the Darwin's finches.

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The parasitic fly *Philornis downsi* is an obligate parasite of bird nestlings. In its larval stage it lives in birds' nests and sucks blood from the nestlings. This recently introduced parasite has a dramatic impact on the unique bird community of the Galápagos. Observational as well as experimental studies showed that especially the Darwin's finches suffer a high brood loss due to *Philornis* parasitism and this contributes to the dramatic decline of several species. Our data suggest that behavioural changes have evolved in both the host and the parasite in this recently established host-parasite interaction. The parasite has changed its oviposition behaviour: while previously it probably laid its eggs only in nests where chicks had already hatched, its larvae are now found in incubated nests. At least one host species seems to react by abandoning the parasitized nests during the incubating stage and several host species have shown a new form of tool use. They take leaves of an endemic plant species with repellent properties and rub them into their feathers.

The spread of the Spur-winged Plover *(Vanellus miles novaehollandiae)* in New Zealand

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The southern Australian sub-species of Masked Lapwing *(Vanellus miles novaehollandiae)* s elf-introduced to New Zealand as early as 1886. However, the first breeding pair was record ed in the Invercargill area of South Island in the 1932. Known as the Spur-winged Plover in New Zealand, it is classified as 'native', due to its establishment prior to the introduction of t he Wildlife Act 1953. Over the last 90 years, probably due to human modification of the Ne w Zealand environment, the Spur-winged Plover has established and spread rapidly across th e whole of New Zealand. The spread of this species was assessed using presence or absence data on a country wide grid compiled from national surveys conducted from 1930 to 2004. An increase in range was seen over time and shows a high level of agreement with a logistic regression growth curve model for both South and North Islands. This range expansion was found to be similar to the general principle of a lag and exponential growth phase exhibited i n the establishment and spread by many other invasive species. A shorter lag phase was obs erved for the establishment and spread of this species across North Island compared with So uth Island, which is likely to be due to the propagule pressure of introduction to these novel environments. This spread and occupation of a potential 'vacant niche' is expected to continu e until all suitable habitats are occupied at which time the growth curve is expected to level off at its asymptotic value. Potential future areas of study include impacts of ground nesting native bird species in relation to range expansion and abundance and genetic profiling of thi s species from its native range in Australia and New Zealand populations, as an indication of propagule number and contribution to the genetic diversity of the species within New Zeala nd.

s12-1k

Locomotor transitions in birds: the evolution of wing propelled diving as a case study in parsing patterns of character evolution associated with acquisition of a novel locomotor mode

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Fossil data informing the evolution of morphology and mechanics associated with the origin of avian flight have been the subject of intense research. However, changes associated with the co-option of the flight stroke for underwater propulsion have only recently been addressed in light of new data on extinct taxa. Recent discoveries of extinct parts of the lineages containing extant wing propelled divers have both shed key insights into the pattern of morphological change and prompted the identification of new questions. Use of the forelimbs in underwater propulsion is exhibited almost exclusively within two major clades, Charadriiformes and a large waterbird clade that includes the traditional contents of Pelecanifomes, Ciconiiformes, Procellariformes and Sphenisciformes. Of the extant parts of these two clades, puffins and penguins exhibit the most modifications in response to “flight” in a medium ~800 times denser that air. Investigations of the phylogenetic relationships of fossil stem taxa reveal both similarities and marked differences in the pattern and sequence of character acquisition related to the locomotor system in these clades. Combining these analyses with focused new anatomical data collection for extant parts of these lineages, analysis of the evolution of wing propelled diving can provide a case study for considering locomotor transitions more generally. Relevant fossil and dissection data are synthesized, and areas necessitating further nuanced insight from studies of extant locomotor behaviors are proposed.

s12-2k

Comparative analyses of swim speed in marine vertebrates

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Swim speed is an ecologically important parameter for marine vertebrates, as it determines population dispersal, migration pattern, prey capture success, and predator avoidance. The recent advance of bio-logging and bio-telemetry approaches allowed us to record their swim speed in the wild; nevertheless, comparative analyses of those data are lacking, and how swim speed is determined by morphology, physiology, or swimming style is poorly known. In this study, I compiled the mean and maximum swim speed of a range of fishes, reptiles, birds, and mammals (from 0.2-kg herring to a 100-t blue whale) recorded under natural conditions, and examined how these parameters can be explained using phylogenetically-informed statistical methods. I show that (1) swim speed is roughly equal across taxa and body size when temperature-corrected metabolic rate is accounted for, and (2) swim speed per body length is nearly equal across taxa and body size when stroking frequency is accounted for. My analyses show that there are common mechanisms underlying the swimming behaviour (i.e., aerobic metabolic-power production, oscillatory lift-based propulsion) of fishes, penguins, whales, etc.

Is the evolution of avian locomotion driven by biomechanics or physiology?

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Birds have solved the problem of locomotion in air and water in diverse ways, resulting in much of the stunning diversity of bird taxa present today. Moving in either air or water (or both) creates both biomechanical and physiological challenges. Most attempts at quantifying flight and dive costs have focused on biomechanical costs—variation in the cost of flying or swimming based on external morphology, such as body mass and wing area. Nonetheless, only ~20% of available energy is converted into useful work, and alterations in the efficiency at which chemical energy is converted into mechanical energy could be as important as alterations in the variation of biomechanical costs. To examine the relative importance of biomechanics relative to physiology, we collated flight costs for 37 bird species and swimming costs for 19 bird species. Estimates of oxygen consumption during both flying and diving were closely correlated with body mass. After accounting for phylogeny and body mass, 30% of the variation in flight costs was predicted by biomechanical models derived from morphology, whereas 40% was associated with apparent variation in efficiency of converting oxygen into mechanical work. Similarly, after accounting for phylogeny and body mass, biomechanical modeling correctly predicted dive costs in foot-propelled but not wing-propelled diving birds. For both flight and dive costs, physiological efficiency was more conserved among phylogenetically-close groups than morphology. Using a morphological space including 424 extant and extinct birds and modeled flight and dive costs using biomechanics (derived from morphology) and physiology (derived from phylogeny), we demonstrate the adaptive valleys (high energy costs) that were crossed during the evolution of major avian lineages. We argue that the remodeling of physiological systems that convert oxygen into mechanical work was as important as alterations in biomechanics for the higher evolution of birds.

Why do penguins inhale before diving?

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Numerous authors have suggested that marine mammals dive on exhalation. This appears to be true for Phocid seals. For example, Weddell seals dive with a small air volume to facilitate a shallower depth of lung collapse. Exhalation of air decreases lung volume, contributes to the avoidance of decompression sickness (bends) and makes the net buoyancy neutral in the water. On the other hand, penguins inhale before diving. This is an important difference between mammals and birds in regard to diving because birds have rather large volumes of air in the air sacs of their respiratory systems. Air sac oxygen partial pressure was recorded in voluntary dives of Emperor Penguins (*Aptenodytes forsteri*) and the record showed the respiratory oxygen store was depleted during dives, which indicates that pulmonary gas exchange was maintained during dives. This raises two questions: how do penguins avoid the bends and how do they avoid excess buoyancy caused by the air. The first question is not solved yet, but penguins do control the air volume according to dive depth. They reduced air volume inhaled before shallow dives and increased it in deep dives. Flipper movements were substantial during the early descent in dives, especially in deep dives. However, the movements decreased as descending because the air was compressed by water pressure and total buoyancy of the body became nearly neutral. In the case of shallow dives, penguins reduced the inhaled air volume to facilitate a shallower depth of neutral buoyancy. Buoyancy can act as a resistance to downward movement but contribute to energy saving during ascent. Penguins actually stopped flipper movements and glided during the latter part of ascent. A theoretical study first suggested a possibility of energy saving in negatively buoyant fish by prolonged gliding during gradual descent and active swimming upward to the original depth. However, recent theoretical models predicted that saving in the aided direction do not fully offset the increased cost of transport in the opposite direction. And an experiment, in which the body densities of seals were manipulated using detachable weights and floats, indicated that seals had smaller stroke efforts to swim when they were closer to neutral buoyancy. Small body sizes of seabirds including penguins might force them to inhale the air in order to increase oxygen stores for deep dives: they are obliged to swim less efficiently in view of cost of transport between the surface and the depths. On the other hand, in case of larger animals such as marine mammals, they benefit from their large body sizes and have enough oxygen stored in blood and muscle. They can exhale before diving to avoid excess buoyancy, thus reducing the cost of transport.

Functional morphology of wing musculature of extinct flightless Mancalline Auks (Alcidae, Mancallinae)

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Auks were classically viewed as a northern counterpart of penguins, representing a compromise stage between aerial and aquatic flights, although this view has been challenged by some recent studies showing differences in anatomical details and aquatic flight modes between the two. Mancalline Auks are the extinct flightless relatives of modern auks that were once distributed along the North Pacific, whose specialized morphology prompted speculations about their resemblance to penguins. However, little attention has been paid on functional aspects of their wings. Here, based on anatomical observations of modern auks and other birds, the wing musculature of Mancalline Auks was reconstructed from muscular/ligamental attachment scars preserved on fossil materials, and its functional significance were investigated. First, the development of thick, broad articular ligaments of elbow and wrist joints, associated with narrow articular surfaces of bones, indicate that these joints were braced tightly with reduced mobilities. The absence of bony pulleys for some mucles at the wrist suggests that this joint was kept in a straight position. Second, a unique conformation of osteological features of the humerus were likely to support narrow and stiff propatagium that was hardly deformed by external forces. Last, muscular scars indicate increased mechanical advantages of major wing elevators, which enabled powerful wing elevation. In conclusion, wings of Mancalline Auks were powered by powerful actions of both depressors and elevators, and resistant against undesired deformation, thus could act as efficient flippers in aquatic flight. Although anatomical details in mancalline wings suggest that they might act in a different manner than those of penguins, the overall condition shows a clear convergence as a functional unit. These observations illustrate that the two distinct lineages of birds share the evolutionary potential to attain similar functional traits when released from the selection of retaining the ability to fly in the air.

s13-1k

A movement ecology approach for studying avian dispersal processes and patterns and their evolutionary and biogeographical consequences

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Understanding and predicting the dynamics of complex ecological, evolutionary and biogeographical systems are best accomplished through the synthesis and integration of information across relevant spatial, temporal and thematic scales. Recent advances in mechanistic modeling and tracking technology have enriched our capacity to disentangle the key parameters affecting dispersal and other movement processes and to accurately quantify movement patterns. In lieu of this favorable background, movement ecology has recently emerged to facilitate the unification of movement research, by elucidating the links between the internal state, the motion and the navigation capacities of the individual, the external environmental factors affecting its movement, and the resulting movement pattern. As such, movement ecology provides a natural platform for examining the mechanisms underlying dispersal processes and patterns. However, a major challenge remains to link these insights at the individual level to their long-term large-scale consequences for various evolutionary and biogeographical processes. In this talk I will present the basic principles of the movement ecology approach, and will illustrate its application to avian dispersal research, focusing on long-term studies on long-range movements of three vulture species, and lifetime tracks of long-distance migrants such as White Storks. I will aim to highlight the links among dispersal, foraging and migration phenomena, and to propose possible ways to assess the evolutionary and biogeographical consequences of some emerging insights and new discoveries on dispersal and other movements at the individual level.

s13-2k

Individual responses of trans-equatorial migrants to seasonal variation in regional resources across continents

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Studying the underlying drivers of movement has long been hampered by difficulties in following birds over longer distances. This has limited our understanding of how and why birds move, not least on an inter-continental scale, and the possible relationships between dispersal and migration. Furthermore, it restricts our ability to predict how birds will react to global change. Recent technological developments allow us to map the long-distance migratory travels needed to potentially track resource peaks across the rotating earth. The seasonal changes in regional resource abundance across continents, potentially drives movement and dispersal even over larger scales. For smaller land bird species of trans-equatorial migrants, we show that vegetation greenness remains high and relatively constant throughout the year for Cuckoos migrating between the Palearctic and South-central Africa, whereas Thrush Nightingales migrating between the Palearctic and Southern Africa track regional vegetation peaks irrespectively of the greenness of the vegetation. Red-backed Shrikes showed an intermediate strategy. The ability of the complex inherent spatio-temporal travel programme to track the considerable changes in local and regional differences expected from global changes and resulting considerable mismatch is a matter of much uncertainty.

Dynamic migration, drought and drones

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For effective conservation of migratory species we must understand each phase of their annual migration cycle. This is particularly challenging for facultative migrants that use habitats across the landscape in spatially and temporally dynamic ways depending on environmental conditions each year. Information on such habitat use is lacking for most facultative migrants limiting our capacity to effectively understand and manage these species. In this study we investigated spatial and temporal dynamics of winter habitat use by an endangered facultative migrant, the Swift Parrot *Lathamus discolor*. Data on winter habitat use was collected over a broad geographic range by hundreds of volunteers biannually over seven years from 1998-2004. Swift Parrots were detected in 19% of the 4140 surveys and this data was modeled to examine variation in winter habitat use in relation to climate variables. We provide the first demonstration of large-scale drought related movements by a population of small migratory birds throughout their winter range. Variable spatial and temporal patterns of winter habitat use, as well as repeated use of sites, were also demonstrated. In order to better understand the linkages between these wintering areas and subsequent phases of the annual cycle we are currently adapting and testing robotic Unmanned Aerospace Vehicle (UAV or drone) technology for aerial-tracking of small migratory birds. By addressing these significant knowledge gaps we aim to improve conservation management of the endangered Swift Parrot and provide a sound basis for the development of more effective conservation strategies for facultative migrants.

Combining GPS tracking with genotyping techniques to study connectivity of Mediterranean Osprey populations.

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The study of exploration and dispersal behaviour is a key component of conservation-related research on any animal species. This is especially true for populations living in fragmented habitats that are isolated or too small to be self-sustainable. In this framework the case of the Osprey *Pandion haliaetus* in the Mediterranean basin is of notable interest. Despite its favourable conservation status at a global scale, counts indicate fewer than <80 breeding Osprey pairs in the Mediterranean area. Basic information on the spatial ecology of this population is still lacking, limiting the implementation of conservation measures for the species at a regional scale. In this context, we tackled the following three questions: are there (still) exchanges among populations in the Mediterranean basin? What is the genetic distance between individuals and between populations? At this regional level, is there a meta-population system between the four Mediterranean Osprey populations? We studied meta-population connectivity by combining ringing and GPS tracking (as direct methods for tracking movements) and population genetic methods (both mitochondrial DNA and microsatellite analyses, as an indirect method to investigate genetic distance between populations).

Since 2013, >20 Mediterranean Osprey (both adults and juveniles) were tracked with GPS/GSM tags. Data showed that connectivity between populations is potentially possible and can take place via both adult and juvenile dispersal. Individuals from Corsica have been tracked while travelling through Balearics, Spain, Morocco and Sardinia. In order to assess whether populations are also interconnected by gene flow we performed microsatellite analyses at different loci. Combining such direct and indirect methods improves basic knowledge about adult and postnatal osprey dispersal, and will help implementing adequate management actions and planning common and coordinated conservation measures.

s14-1k

Seasonal change in the avian brain: energy, trade-offs, and remodelling

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Birds show recurring seasonal variation in the neural resources committed to cognitive and behavioral functions. Change in the hippocampus of food-storing birds is correlated with seasonal change in food storing. The song control nuclei change seasonally with variation in song production, and the brains of long-distance migrants undergo annual change. Why this occurs is not well understood. Neural structures can be expensive to maintain and operate and so these changes may serve to reduce energy expenditure. Any energetic saving, however, must exceed the cost of restoring the full operation of the structure at a later time. Another possibility is that maintaining the hippocampus or song control nuclei at a high level of performance interferes with the operation of other brain regions. There may thus be trade-offs in the assignment of neural resources to competing cognitive and behavioural functions. Finally, some neural structures may undergo remodelling that improves their operation. Both the hippocampus and the song control nuclei serve memory functions. Reduction in structure size, seasonal neurogenesis, and other changes may improve the functioning of the hippocampus and song control nuclei by discarding neural circuitry that is no longer current or that interferes proactively with the acquisition of new memory. Recent research with food-storing birds, songbirds, and long-distance migrants will be used to critically evaluate these three accounts of recurring seasonal change in the avian brain.

s14-2k

Variation in cognitive ability: causes and confounds

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Perhaps one of the most convincing examples that evolution has shaped cognitive abilities comes from the relationship between variation in food storing, spatial cognition, and hippocampal volume in birds. The success of that work in correlating variation in cognitive abilities with an adaptive context has led to increased effort to understand a greater variety of cognitive abilities and for more species of birds. For example, the spatial and temporal cognition of foraging hummingbirds are being increasingly well characterised. There is, as yet, no evidence, however, that having a better spatial ability (food storers) or better spatial/temporal abilities (hummingbirds) lead to greater fitness. It is, therefore, exciting that there has recently been an upsurge in enthusiasm to investigate and quantify cognitive abilities of animals (especially birds) in the wild and to associate that variation with either fitness and/or variation in brain size. Because some of that effort is being directed at variation in 'problem solving', however, it seems timely to consider how cognition is quantified, how to associate that variation with its underlying neural bases and what alternative explanations for apparent variation might need to be considered. I will use the work on spatial cognition as a model to develop a framework for directing investigations into the causes of variation (within and among) species in cognition.

Transient transcriptomic profiling of pre-singing adult female Canary brain at the onset of testosterone treatment

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Brain neuroplasticity is one of the unique phenotypes of songbirds that provide an excellent opportunity to study hormone modulation in the brain, hence the stimulation of behavior. In the domestic Canary, a sex dimorphic species, mainly male birds sing in nature. Nevertheless, singing behavior can be induced in adult female canaries 3-5 days after subcutaneous testosterone implantation. The key genes and biological pathways that mediate this, however, remain to be elucidated. In order to shed light on the initial phase of this event, we microdissected brain nuclei HVC (center of song control system) and entopallium (visual control region; Ento) from adult female canaries treated with testosterone for 8 hours or 3 days, and from untreated animals, subsequently performed exon-level microarray analyses (Affymetrix). We found a strong and consistent response to testosterone in HVC compared to that in Ento during the course of treatment, which correlates with the androgen receptor expression pattern in the song control system previously demonstrated by in situ hybridization. In addition, the differentially regulated genes in the HVC differed temporally. Thus, we categorized the HVC-specific differential genes according to the transient expressions and followed by functional pathway analyses. From 2076 continuously up-regulated HVC-specific genes, we observed an enrichment of GO-terms related to a number of metabolic processes, as well as processes related to neuroplasticity such as cell differentiation, growth, and survival, synapse development, and angiogenesis. Our results indicate adult female Canary HVC is highly sensitive and specific to testosterone and is tightly controlled in a dynamic fashion.

Changes in preferential response for a mate's call in the budgerigar, a monogamous parrot (*Melopsittacus undulatus*)

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The budgerigar is a monogamous parrot that has been suggested to use acoustic recognition for pair-bond maintenance. Parrots, unlike the majority of birds, learn to produce sounds into adulthood. During pair-bond formation, male budgerigars imitate the calls of females, while females learn to recognize the calls of their mates and show preference to mate calls, responding by calling to their mates' calls more than to those from other males. This preferential response to mate call changes in the same individual: females retain preference to mate calls at one month after separation from their mates but cease to prefer their mates' calls at 6 months after separation, indicating that the preference of females is eventually extinguished (Eda-Fujiwara et al. 2011, Anim. Behav. 82, 971-979). We examined whether the preferential response to mate calls changes in males. Each of 11 males was paired with a female for 5 weeks, and subsequently separated (without auditory/visual stimuli from the mate) for 5 weeks. The male isolated in a test chamber responded to the call of its mate significantly less than to a call from an unfamiliar female at 5 weeks after separation, but did not show any preference upon separation from the mate. Auditory memory is a crucial prerequisite for vocal recognition learning. The male preference for an unfamiliar call suggests that males acquired auditory memory of their mate call during the 5 weeks of pairing period and retained the memory for 5 weeks after separation. This was supported by our additional experiment. The male accompanied by its audience in a chamber (a normal male-female pair in a breeding cage) showed preference to mate call on separation. We discuss the possibility that changes in the preference may be explained by an underlying neural mechanism other than the auditory memory of mate call.

Gonad-dependent and gonad-independent regulation of neural and behavioural plasticity in songbirds

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Most birds exhibit tremendous variation in phenotype over their annual cycle. For example, transitions from breeding, to moult, to migration, to overwintering require coordinated changes in a number of physiological systems, the brain, and behaviour. These changes are orchestrated by endogenous rhythms and entrainment to external cues, primarily photoperiod. In many species photoperiod drives changes in reproductive physiology, and gonadal steroid hormones are often the principal drivers of changes in neural anatomy and behaviour. However, some effects of photoperiod appear to occur independently of gonadal hormones. Here we review recent research demonstrating both gonad-dependent and gonad-independent effects of photoperiod on seasonal neural plasticity and behaviour. In European Starlings (*Sturnus vulgaris*) and White-throated Sparrows (*Zonotrichia albicollis*) photostimulation can drive changes in the size of song control brain regions independent of testosterone and its steroid metabolites. In both species, photostimulation can result in an increase in the size of, and number of neurons within, the song-control brain region HVC even when gonadal steroids are eliminated through castration and treatment with androgen blockers and aromatase inhibitors. However, androgens and estrogens can modulate neuron recruitment to song-control brain regions in region-specific and sex-specific ways. Androgens and estrogens modulate neuron migration (as assessed by the marker doublecortin) in Starlings, but not in White-throated Sparrows. Vernal migratory restlessness can similarly be induced in White-throated Sparrows through photostimulation, even in castrated birds treated with androgen blockers and aromatase inhibitors. These studies build on prior research demonstrating many effects of photostimulation can occur independently of gonadal steroids, and that these steroids may best be thought of as modulators, rather than drivers, of seasonal changes in brain and behaviour.

s15-1k

Learn for life: teaching predator recognition boosts survival of inexperienced individuals in a group-living bird species

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Teaching, where naïve individuals acquire knowledge or skills through the active involvement of a role model, occurs in a range of social species. Given that teaching allows cultural transfer of knowledge between individuals, it has been suggested that teaching is a critical component of human evolution. A shortcoming of all studies investigating teaching is that it has been tacitly assumed, rather than shown, that teaching has long-term fitness consequences. Here I use field experiments to assess the effect of acquired predator recognition on survival in a group-living bird, the Siberian Jay (*Perisoreus infaustus*), where mortality is solely driven by predation. I exposed jay groups to a range of perched predator models varying in their perceived threat level to the jays. In the presence of predator models, some juveniles visited the feeder, but sought safety upon hearing warning calls, and when they observed breeders mobbing the models. Subsequent to the experiments, non-breeders that had observed breeders mobbing the main predator species (Goshawk, *Accipiter gentilis*) had 8.6 higher survival odds than non-breeders exposed to other predator models, or no model ($p = 0.006$). Consequently, these non-breeders had 5.3 higher odds of successfully acquiring a breeding position ($p = 0.003$). These results are the first evidence showing that mobbing facilitates predator recognition, which in turn boosts subsequent survival and thus acquisition of a breeding position, confirming a pivotal, yet hitherto untested assumption of the effect of teaching.

s15-2k

Vocal communication and cooperation in socially-complex species

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A traditional view of avian social behavior is that seemingly-cooperative interactions are motivated only by short-term, selfish rewards. In birds and other non-primate species, furthermore, cognitive skills may also constrain individuals' ability to establish and maintain social relationships and to communicate in complex ways. However, recent evidence suggests that birds have good memory and are indeed capable of acting according to their future, rather than current, needs. The emerging evidence also shows the complexity of an individual's social group can impact the vocal signals used in its interactions with others. As a result, the complexity of social groups may be a driver of the diversity and complexity of vocal signalling systems and cooperative interactions, in both a proximate and ultimate sense. Here we will review work in our labs and other labs in an attempt to use the 'Social Complexity Hypothesis' to explain the evolution of communicative systems and cooperative ability in social birds. The Social Complexity Hypothesis predicts that individuals in more socially complex groups produce a greater diversity of vocal signals and/or express more diverse cooperative behavior compared to individuals in less socially complex groups. We will review and discuss what is known about vocal complexity in birds and make links to different aspects of their sociality, with a focus on two families – parids and corvids. Finally, we aim to discuss the advances in techniques to record and analyze bird calls, and terminology on how to describe the existing knowledge.

Heterospecific responses to mobbing calls

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Passerine mobbing calls are, in part, addressed to conspecific and heterospecific individuals that are potential prey, and may encourage them to join a flock mobbing a predator. Two studies were carried out to investigate these aspects. First we examined whether conspecific and heterospecific individuals differ in their response to natural and manipulated contact and mobbing calls. Chaffinch calls (*Fringilla coelebs*) were manipulated, and contact and mobbing calls, which differ only slightly in structure (start and maximum frequency and frequency bandwidth) were played back at different frequencies (number of pink-elements per minute). This study showed that call rate was the most important aspect – rather than acoustic element structure – to recruit heterospecific individuals, probably based on the simple rule "more calling represents higher urgency". Second, we sought evidence for the possibility that this is a basic, inherited trait in Paride by using playbacks of an allopatric species in Europe (Black-capped Chickadees *Poecile atricapillus*). This species alters the number of D notes of their chick-a-dee call to reflect urgency and threat. These chickadee mobbing calls and songs from North America were broadcast to European great tits (*Parus major*) and compared with conspecific mobbing calls. Great tits responded strongest to conspecific mobbing calls, followed by heterospecific mobbing calls and response to chickadee song was very weak. The number of D notes was inversely related to minimum distance. Thus, the urgency message encoded in the D notes was perceived also by an allopatric but phylogenetically related European species.

Female counter-singing: complex social networks and song learning abilities in New Zealand Bellbirds (*Anthornis melanura*)

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For many Southern Hemisphere passerine species, independent female song is common. However, the vocal learning abilities of females and the social context of female singing are effectively unknown. We looked at female song learning and compare the song learning strategies and social context of song for male and female New Zealand Bellbirds (*Anthornis melanura*); a model species for testing cultural evolution theory. More than 200 male and female Bellbirds were colour banded on Tirirtiri Matangi Island over a 6 year period. We show that both sexes are 'open' learners and that, although song crystallises in juveniles of both sexes at around 4 months of age, they continue to innovate their song throughout their lives. We found that females counter-sing with female neighbours thus forming complex female social networks and that the songs used during these interactions vary over time. We also compared rates of innovation in individual songs of males and females. Understanding song learning flexibility and the social context of song behaviour is important and there are significant ramifications for geographic song dialects when individuals modify their songs throughout their lives, particularly when they disperse. Our genetic analysis confirms that female Bellbirds are the primary dispersers and we hypothesize that dispersal will have less of a homogenising effect on female geographic dialects because females are open learners and that by learning ‘local’ dialects females may be better able to obtain territories and join local female social networks.

s15-5

Mobbing calls of Japanese great tits signal predator type to both parents and offspring

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Individuals of many avian and mammalian species produce anti-predator calls when they encounter a predator. These calls often vary in acoustic structure depending on the type or level of predation risk, thereby conveying information about predators to receivers. Such complexity in communication may also be advantageous in situations in which birds approach and mob predators to defend their offspring, because different risks may sometimes require different anti-predator responses in both parents and nestlings. I tested this idea in Japanese great tits (*Parus major minor*), which produce acoustically distinct mobbing calls for two different nest predators: 'chicka' calls for jungle crows (*Corvus macrorhynchos*) and 'jar' calls for Japanese rat snakes (*Elaphe climacophora*). A playback experiment revealed that adult great tits responded to different mobbing calls with qualitatively different behaviors: they scanned the horizon in response to 'chicka' calls and gazed towards the ground in response to 'jar' calls. These two responses help adults search for and detect the corresponding predators since crows fly to the nest and snakes approach from the ground. Furthermore, older nestlings also responded to the different mobbing calls with different reactions: they crouched down inside the nest cavity in response to 'chicka' calls and jumped out of the nest in response to 'jar' calls. These two responses help nestlings evade the attacks of corresponding predators since crows snatch nestlings from outside of the nest entrances and snakes invade the nests. These results demonstrate that mobbing calls of Japanese great tits transmit referential information about predator types and elicit the appropriate anti-predator behaviors in both adults and nestlings.

s16-1k

Studying ecosystem connectivity with radar – recent findings and future perspectives.

Felix Liechti

There is an enormous, but vaguely known movement of billions of birds, insects, and bats through the free air space, only comparable to animal movements through the open sea. These large scale movements are governed by seasonal climatic fluctuations, dynamics of the atmosphere and the distribution of suitable habitats. Radar is the most common tool to study these movements. This contribution presents specific findings from radar ornithology aimed at reviewing the last few decades of radar ornithology. In the past most studies in radar ornithology used either temporally set up specific radar systems at specific observation points, or re-analysed data from stationary radar systems for case studies. Such studies investigated the timing of migration (diurnal and seasonal), flight behaviour in relation to environmental conditions, and the temporal and spatial pattern of migration by integrating observations from multiple radar sites. Recently, bird data from routinely operating weather radar systems increasingly become available to biologists, which provide almost real-time insight in large scale migratory waves. For applied research studies, dealing with bird collision problems, radar has become an invaluable tool for model validations. Spatially explicit models for bird movements are already in use to forecast risk of bird strikes in aviation and wind farms. Supposedly, general movement patterns of birds across Europe and North-America are freely available in near real time within the next decade. New tools for radar signal analysis e.g. automatic target classification based on wing beat patterns, validating mass movements with ground observations and location of tagged individuals will hopefully improve target classification and thus, the significance of radar monitoring. Forecasts of bird movements similar to the passage of rain fronts will be possible and routinely implemented for measures reducing collision risks. A continuous long term monitoring will allow identifying hot spots and concentration ranges for migratory birds.

s16-2k

Recent and on-going advancements in radar aeroecology: A physicist's perspective

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The aerosphere supports a range of animal life both at the Earth's surface and in the air. While monitoring the movements and activities of terrestrial animals can be demanding, observation of volant organisms are even more challenging because they require novel technologies. Here we focus on the analysis of animal movements using radar. It has long been known that radio waves scattered from flying organisms (bioscatter) can be detected and processed using radar. Depending on the particular design, radar can be used to track individuals, observe the movements of organisms over a variety of spatial and temporal scales, and to some extent discriminate between and identify different taxa. These capabilities are being further enhanced through continuing innovations in radar hardware and signal processing technologies. Moreover, thousands of radar installations are located around the world with many of these already integrated into cohesive networks. In this presentation we explore the fundamental questions: To what extent can radar observations be used to investigate questions about ecology, abundance, and airborne movement of animals over large spatial and temporal domains, and to what extent can they promote the transdisciplinary field of aeroecology? The presentation focuses on fundamentals of radio-wave interactions with flying animals using theory, simulations, and observations to address this question. The on-going development of radar and radar aeroecology (as discussed in the presentation) is particularly timely given the importance of using such technologies to better understand factors that affect movements of animals in the aerosphere relative to regional and global climatic variability. As demonstrated here, weather and biological radar data together with complementary weather observations provide unprecedented opportunities to observe birds, bats, and insects in the aerosphere on both local and large scales.

Continental-scale radar monitoring of the aerial movements of animals

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Different types of radar are in use for ornithological and entomological research worldwide. In recent years, due to improvements in bird detection algorithms, the use of operational weather radar to study aerial movements of animals is increasing, especially in Europe. Operational weather radars provide information on the spatial distribution, the general speed and direction of movement and the aerial density of organisms at different altitudes. We provide a brief overview of recent aero-ecological studies in Europe utilizing operational weather radar, we describe the new EU - COST Action ENRAM (European Network for the Radar surveillance of Animal Movement) initiated in October 2013, and use a small case study to show the added value of working with a large sensor network.

Weather radars in Europe have been used to study flight altitude selection of nocturnal migrants, dawn and dusk ascents of swifts during the breeding season, response of birds to human disturbance, develop predictive models of migration to improve flight safety and provide an early warning of insect pest invasions. Currently five radars (2 in the Netherlands and 3 in Belgium) are being used to continuously monitor migration density and altitude. This is only the beginning of what may be possible in the very near future. ENRAM was initiated with the main objective of merging international and interdisciplinary expertise to establish a coordinated network of radars to monitor the aerial movement of animals on a continental scale and for a broad range of stakeholders. Through this action and other related activities researchers will be improving bird detection algorithms and hence also meteorological products, using knowledge gained from individual tracking of animals to improve interpretation of radar data, and simulation models to help fill gaps between sensors and understand large scale patterns that are observed.

Weather radar observations of bird stopover distributions along the northern Gulf coast of Mexico during spring migration

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We used data from six weather surveillance radars to comprehensively quantify stopover densities of migrating birds during four springs (2009-2012) across the northern coast of the Gulf of Mexico (GOM) from 96° W to 84° W longitude. We temporally-interpolated radar reflectivity measures of birds in the airspace for each suitable sampling night to the onset of nocturnal migratory flight when birds are leaving their stopover sites (sun angle of 5.5° below the horizon). We adjusted reflectivity measures for bias caused by the tilt angle and spreading of the radar beam with increasing distance from the radar out to about 80 km from radars using derived height profiles of bird density and modeled beam heights. Adjusted reflectivity measures are correlated with bird densities on the ground. We summarized data within 1° bins of longitude and within 3 km bins of distance from the coast up to 99 km from the coastline. Median reflectivity values (i.e., relative bird stopover densities) across all years exhibited a bimodal distribution with respect to longitude; with a western peak in Louisiana (93° W) and an eastern peak in Florida (84° W). Bird densities were lowest just east of the Mobile Bay, Alabama (87° W). Patterns of bird densities with proximity from the coastline varied among longitudes such that coastal concentrations of birds were strongest at longitudes where overall densities of birds were also the lowest. At longitudes with high bird densities, peak bird densities were generally much farther inland where the peak of hardwood forest cover also occurred. Our study provides evidence that there may be two main areas where birds make landfall after crossing the GOM within forested areas inland from the coast, and that birds making landfall in-between these two areas are likely constrained to land near the immediate coast.

Convergent Patterns of Long-distance Nocturnal Migration in Passerines and Moths

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Many billions of passerines and insects achieve long-distance seasonal migrations between summer and winter ranges by undertaking high-altitude nocturnal flights. We have carried out the first comparative analyses of the nocturnal flight behaviours and migration strategies of birds and insects, using data collected on thousands of individual passerines and moths by long-term radar studies in north-western Europe. Spring and autumn migrations of small passerines (predominantly Old World warblers such as *Phylloscopus trochilus*, thrushes, chats and flycatchers) were studied with tracking radar situated in southern Sweden between 1999 and 2013. During the same time period, spring and autumn nocturnal migrations of the Silver Y moth (*Autographa gamma*) were recorded by vertically-pointing entomological radars in southern England. Insects such as the Silver Y fly relatively slowly in relation to the airstreams within which they travel, and have airspeeds only one-third of that of the passerines. Thus we expected the moths to have much slower ground speeds and less control over their migratory directions than the passerines. Contrary to expectations, nocturnally migrating Silver Y moths matched passerine migrants for both ground speed and travel direction during their spring and autumn migrations. This surprise result is due to a considerably higher degree of selectivity for the fastest and most favourably directed airstreams among moths compared to passerines in this study. On-going comparative radar studies are examining individual orientation responses of passerines and insects in relation to wind currents to look for similarities and differences in the way the two groups compensate for drift. We will discuss how comparative radar studies of flight in distantly related taxa can shed light on the evolution of animal migration strategies.

s17-1k

Avian phylogeography in East Asia: current status and future directions

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Over the last half-century, systematic study of East Asian birds has lagged behind many other areas of the world. However, this is starting to change, and several recent studies have applied molecular tools to address questions of avian evolution in East Asia. These studies have revealed remarkably deep and complex patterns of diversification that equal or exceed species-level diversification found in other parts of the world. In this talk, I will review past work with a special focus on identifying the phylogeographic discontinuities that are shared by multiple taxa. Two important conclusions emerge. First, increasing molecular and morphological evidence suggests that the East Asian bird fauna is overlumped and that current species-level diversity is underestimated. This will hinder conservation work that depends on an accurate assessment of biological diversity for listing and management. Second, several shared phylogeographic divisions in south China, Taiwan, and the islands of Japan suggest that the region has experienced an unexpectedly complicated biogeographic history that is still poorly understood. Future work should focus on characterizing species-level diversity, inferring the evolutionary history of taxa, and determining the historical factors that contributed to diversification in the region. This will provide a predictive framework for the conservation of both species and areas of endemism as well as contribute to our growing understanding of how Earth history events affect biological diversification.

s17-2k

Japanese islands may have contributed to the rich species diversity of East Asian birds: results of DNA barcoding

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Japanese ornithologists have long been interested in the origins of Japanese populations and Japanese endemic bird species. The origin of Japanese populations is usually assumed to be the adjacent continental area where the phylogenetically closest subspecies or species occurs (e.g., Sakhalin, Korea or Taiwan). However, a recent phylogenetic study of the Eurasian Jay demonstrated that the Japanese taxon was basal to a widespread Palearctic clade, suggesting the possibility that the species originated in Japan. In cooperation with the Yamashina Institute for Ornithology we have almost finished the DNA barcoding of 233 species of Japanese breeding birds. Results indicate that only two genera (*Larus* and *Anas*; i.e. 1.7% of all 233 species) share identical barcodes. Thus, DNA barcoding appears to be an effective tool for identifying bird species in Japan. 32 species (i.e. 14%) contain two or more distinct clades with over 2% nucleotide divergence within species. Some of these show divergence between Japan and the mainland. These genetically distinct populations should be further surveyed for morphological and ecological differences to evaluate their species status. Future DNA barcoding work will make species identification more accurate and stimulate species classifications. These data may also serve in phylogeographical analyses, which may help clarify the origin of the rich East Asian bird diversity. It will be interesting to see whether a pattern of basal divergence, such as for the Eurasian Jay, also holds for other Japanese taxa.

Assessing the biogeographic impact of the 'Tanaka-Kaiyong line' in Southwest China: a comparison of avian community compositions and phylogeographic patterns

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Abstract: Southwest China is widely regarded as a world biodiversity hotspot, but explaining the origins of its high species diversity and endemism is an ongoing challenge. The Tanaka-Kaiyong line (TKL) is one potentially important driver of diversification in the region. Although regarded as a major phytogeographic disjunction in Southwest China, the role of the TKL in promoting avian diversification is poorly understood. We analyzed bird community composition as well as phylogeographic patterns to assess the impact of the TKL on bird diversity. In terms of community composition, we found that, although babblers dominated avian communities on either side of the TKL, bulbuls were more abundant west of the line, whereas thrushes and robins were more abundant east of the line. Avian community composition was significantly more similar on each side of the TKL than it was across the line. Four species complexes, white-tailed robin (*Cinclidium leucurum*), grey-cheeked fulvetta (*Alcippe morrisonia*), rufous-bellied niltava (*Niltava sundara*), and snowy-browed flycatcher (*Ficedula hyperythra*), were further subjected to phylogeographic study. Although all species showed deep and complex patterns of phylogeographic structure, no genetic divisions corresponded to the TKL. Therefore, although the Tanaka-Kaiyong line may be associated with avian community composition differences, it does not seem to have been a major recent barrier to gene flow within species.

Key words: avian community, population genetic, Southwest China, Tanaka-Kaiyong line

The Utility of Microfluidics PCR Libraries and Other Next-generation Sequencing Approaches in Avian Phylogeography: A Case Study for Light-vented (*Pycnonotus sinensis*) and Taiwan Bulbuls (*Pycnonotus taivanus*)

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Emerging sequencing technologies are rapidly changing the field of avian molecular systematics. Although next-generation sequencing provides easy access to large amounts of data from a single individual, scaling this technology to the needs of phylogenetics and phylogeography, which demand homologous markers drawn from an assortment of different individuals or species, is an on-going challenge. We describe a PCR-based method that utilizes next-generation sequencing to target homologous multilocus sequences from multiple individuals. Specifically, our approach couples multilocus PCR amplicon libraries generated on a Fluidigm microfluidics thermal cycler platform with 454 next-generation sequencing. Using this approach we created a library of 48 conserved nuclear intron loci for 48 individual samples from a recently evolved avian species complex in East Asia, the Light-vented (*Pycnonotus sinensis*)/Taiwan Bulbul (*Pycnonotus taivanus*) complex. We generated 134,205 high-quality reads for 2,304 PCR products with an average read length of 563 bases. We built a Python program called Cleaner to identify sequencing errors and utilized the programing pipeline Next Allele to identify haplotypes for individual loci. We discuss the utility and pitfalls of this approach in a study of species delimitation and phylogeographic history of the Light-vented/Taiwan Bulbul complex. The combination of microfluidics PCR libraries and amplicon sequencing is particularly powerful when moderate amounts of very targeted loci are required, but it remains just one approach in an evolving ecosystem of next-generation sequencing tools for phylogenetics. These techniques are opening new possibilities for high-throughput multilocus, and even phylogenomic, analyses in non-model organisms, which should continue to advance our understanding of avian evolution.

Phylogeography and population genomics of a wide-ranging bird in Eurasia, the Common Pheasant *Phasianus colchicus*

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The Common Pheasant, *Phasianus colchicus* is distributed throughout temperate regions in East and Central Asia, and had been widely introduced into Europe and North America as a game bird. This species is well adapted to a wide range of environmental and climate conditions. Thirty-one subspecies have been identified based on substantial variation in male morphological ornaments. We investigated the phylogeography and genetic diversity patterns of Common Pheasant in Asia using two mitochondrial and nine nuclear genes, and male morphological characters. Our analyses revealed six highly divergent evolutionary lineages and the affinity of subspecies to evolutionary lineages corresponds with five pre-defined morphological groups and a previously undescribed group. The distribution of these lineages reflects geographical breaks of mountains, plains and deserts, and the estimates for the divergence times between these lineages probably predate the last glacial maximum. We further found evidence of extensive genetic introgression between contiguous subspecies within lineages. Further, genome-wide patterns of population structure and admixture were assessed by analyzing tens of thousands SNPs derived from RAD-sequencing approach. Taken together, these results suggest that the divergence of Common Pheasant has been shaped by ancient colonization events and isolation during postglacial periods. This study system provides a favorable framework to understand the speciation processes under biogeography, local adaptation and sexual selection.

s20-1k

Nest predation influences on life history strategies

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Nest predation is often the primary source of nesting mortality and, thereby, exerts strong selection on traits that can minimize risk. An inter-connected set of traits that can both respond to selection from predation risk and influence risk are parental care behaviors and development rates. Predation is generally a time-dependent source of mortality such that parental care and developmental changes that allow faster growth and development to shorten the nesting period can directly reduce risk. However, we propose that responses to nest predation risk in both ecological (plasticity) and evolutionary time should be tempered by an interaction of nest predation risk with adult mortality probability. We developed a conceptual framework that predicts that both parental behavior and developmental strategies vary within and among species related to their risk of nest predation, but modulated by adult mortality probability. We test hypotheses with field data collected from a broad diversity of passerine species studied in north temperate (Arizona, USA), tropical (Venezuela, Malaysia), and south temperate (South Africa) sites over the past 22 years. We will show that long-standing theories of relationships between development rates and mortality probability have missed interactions between major sources of natural selection on parental behavior that have caused incorrect interpretations. We will further show that nest predation risk interacts with adult mortality probability to influence parental effort during nestling feeding and post-natal developmental strategies such as differential growth of locomotor modules and immune function. All of these responses to nest predation risk and adult mortality come together to influence clutch size evolution in a set of interactions that were previously unrecognized. The differential evolution of offspring versus adult strategies in response to selection from nest predation highlight evolution, coevolution, and parent-offspring conflict that can exist in life history strategies when considered across diverse species and latitudes.

s20-2k

Acoustic communication, surveillance and eavesdropping by young under the risk of predation

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Nesting birds provide an excellent model for examining the acoustic ecology of predation. In common with many signals, nestling calls are vulnerable to eavesdropping by predators, which means that nestlings face a trade-off between signalling for food and becoming food. Similarly, parents have the dilemma that alarm calls to warn young of danger might also alert predators to the presence of a nest. We consider how nestlings and parents might minimize risks during such communication, and whether nest design or placement could itself reduce the risk posed by eavesdropping predators. In addition to interacting with parents, nestlings can gather information independently through acoustic surveillance of predator cues, and by eavesdropping on other species' alarm calls. We review studies of acoustic ecology and how acoustic communication affects nest predation risk, including our work on White-browed Scrubwrens, and consider avenues for future research.

Adaptive breeding site selection in the face of nest predation: Is it for the birds?

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Understanding the factors determining nest predation probability constitutes a unique problem in predator-prey ecology. Nests are sedentary prey sites usually subject to a wide array of potential enemies that display variation in local abundance, foraging strategies, timing of foraging (e.g., nocturnal versus diurnal), and habitat use. Such complexity renders clear explanations for variation in nest predation difficult, especially in changing environments. Clear demonstration of adaptive nest site selection in birds has also been elusive in the literature. Using the results of a literature review and a wide array of empirical and experimental analyses, in both more pristine and human-altered systems, we will discuss reasons for apparent mismatches in avian nest site selection and nest success in systems where nest predation is the main cause of reproductive failure. In particular, we suggest three categories of explanations for apparent mismatches in habitat preferences and performance, including anthropogenic, methodological, and ecological-evolutionary. For example, HIREC, or human-induced rapid environmental change can tinker with evolved predator-prey relationships and we provide an example from a shrubland system that has changed due to natural gas extraction activities. Methodologically, studies often do not disentangle key habitat variables that may obscure the ones actually related to selection and resulting performance. Finally, we provide alternative explanations to the oft-mentioned idea that the process of nest predation is “random”, and argue that birds are likely behaving optimally in terms of nest site selection in the face of nest predation, given the suite of ambient proximate constraints in their environment.

Nest survival in Arctic-breeding shorebirds in relation to activity of predators and nest site characteristics

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Nest survival in Arctic-breeding shorebirds was studied on south-eastern Taimyr (72°51' N, 106°04' E) in 2011 and 2012 by monitoring the fate of clutches in the nests of the pectoral sandpiper (*Calidris melanotos*) [PSN]. To evaluate the role of nest site selection we deployed quail eggs in artificial nests in random points [ANR] and in the nests used by pectoral sandpipers in the previous year [ANS]. Abundance of alternative prey (lemmings), activity of predators, nesting habitat and overhead concealment of nests were considered factors potentially important for nest survival. Automatic cameras were installed at the nests of all types to aid predator identification. Lemming abundance was low in 2011 and extremely low in 2012; avian predators nested in low numbers both in 2011 and 2012. In 2012, Arctic foxes (*Vulpes lagopus*) were much more active than in 2011 (0.58 encounters per 24 h in 2011 and 2.54 in 2012), and were the only predators recorded by cameras in 2012. Daily survival rates (DSR ± *SE*) differed significantly between 2011 and 2012 and were, respectively, 0.885 ± 0.020 and 0.606 ± 0.051 for PSN, 0.845 ± 0.027 and 0.0 for ANS, and 0.789 ± 0.035 and 0.0 for ANR. DSR of PSN did not differ significantly from that of ANS, but was higher than in ANR, which was consistent with differences in concealment between these categories of nests. When alternative prey were at extremely low abundance, the Arctic fox remained the only confirmed predator of shorebird clutches; whereas when lemmings were more abundant, avian predators may have contributed to shorebird clutch predation. This was supported by differences in survival of clutches with different concealment. Experiments with artificial nests are useful tools for interpreting impacts of certain factors on nest survival, but cannot be used to obtain an unbiased measure of bird nest survival.

Blackbird (*Turdus merula*) nestlings treated with corticosterone or testosterone fail to respond to the risk of nest predation

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Nestlings of altricial bird species can respond to the risk of nest predation through several behavioural and/or developmental changes. However, little is still known about the physiological mechanisms behind predator-prey interactions in general, particularly in relation to the nest environment. Recent evidence suggests that nestlings can show significant changes in hormonal (corticosterone -CORT- and testosterone -T-) levels in relation to the risk of nest predation. Nevertheless, plasma levels of these two steroids can be affected by many other environmental factors such as food availability or anthropogenic activities. Thus, it is particularly interesting to know how nestlings cope with the risk of nest predation when their hormonal plasma levels are impaired. To explore this hypothesis, we simultaneously manipulated both hormonal (CORT and T) plasma levels of BlackbirdCommon Blackbird (*Turdus merula*) nestlings and their perceived risk of nest predation through the presentation of predator or non-predator bird sounds. We found that CORT plasma levels where significantly reduced in the presence of a potential nest predator only when they were provided with oil (control treatment for hormones). In contrast, T-treated chicks maintained their CORT plasma levels independently of the predation risk treatment, while CORT-treated chicks significantly reduce their CORT plasma levels under the two risk situations (with or without nest predator). We will discuss possible adaptive explanations for these results and the role these steroids could play in mediating antipredator behaviour in developing birds.

s21-1k

Biosynthesis and biological action of pineal allopregnanolone in birds

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The pineal gland, an endocrine organ located close to the brain, is known to transduce photoperiodic changes to the neuroendocrine system by rhythmically secreting melatonin. However, the formation of neurosteroids in the pineal gland was, until recently, unknown in birds and other vertebrates. Our recent studies on birds provide evidence that the pineal gland actively produces neurosteroids *de novo* from cholesterol. This is a paradigm shift of neurosteroid formation because it was generally believed that neurosteroids are produced only in neurons and glial cells in the central and peripheral nervous systems. In a series of experiments using molecular and biochemical techniques we have demonstrated that the pineal gland produces a variety of neurosteroids *de novo* from cholesterol in the juvenile quail. Importantly, allopregnanolone was far more actively produced in the pineal gland than the in the brain and only released from the pineal gland. Pinealectomy (Px) decreased allopregnanolone concentration in the cerebellum and induced apoptosis of Purkinje cells, whereas administration of allopregnanolone to Px quail chicks prevented apoptosis of Purkinje cells. Furthermore, Px significantly increased the number of Purkinje cells that expressed active caspase-3, a key protease in apoptotic pathway, and daily injection of allopregnanolone to Px quail chicks decreased the number of Purkinje cells expressing active caspase-3. These results indicate that the neuroprotective effect of pineal allopregnanolone is associated with the decrease in caspase-3 activity during development. We thus provide evidence that the pineal gland is an important neurosteroidogenic organ and pineal allopregnanolone is involved in Purkinje cell survival during development. This is a new function of the pineal gland through the action of pineal neurosteroid.

s21-2k

Biosynthesis and biological action of estrogen at the synapse in birds

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Concentrations of estradiol in the avian brain can fluctuate independently of those in the periphery with studies of songbirds playing a key role for elucidating properties of this localized neuroestrogen signaling. Using in vivo microdialysis, we find that estrogen levels in the auditory processing region NCM (but not elsewhere) change rapidly in response to auditory and visual sensory input as well as to certain behavioral contexts. These neuroestrogens then modulate the firing strength of NCM neural circuits influencing the processing of acoustic signals and the behavioral responses to song stimuli. The estrogen synthetic enzyme aromatase is expressed within synaptic terminals in several regions of the songbird brain, including in the NCM. Rapid regulation of aromatase within synaptic terminals appears to be responsible for at least some local changes in neuroestrogen levels. We refer to this localized neuromodulatory steroidal signaling as synaptocrinology. We have evidence that similar, though not identical, mechanisms are occurring in the hippocampus of songbirds, likely influencing spatial learning and memory capabilities Together with work from other labs on neuroestrogen signaling in hypothalamic regions in the control reproductive behaviors in birds, our results provide evidence for widespread, highly specific and behaviorally important neuroestrogen signaling within the avian brain. Supported by MH061994.

Gonadotropin-inhibitory hormone inhibits socio-sexual behaviors by increasing neuroestrogen synthesis in the male quail

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Gonadotropin-inhibitory hormone (GnIH) is a hypothalamic neuropeptide that inhibits gonadotropin secretion. Previous studies have shown that GnIH inhibits socio-sexual behaviors of birds. In this study, we investigated the inhibitory mechanism of GnIH on socio-sexual behaviors of male Japanese Quail *Coturnix japonica*. Japanese Quail is a commonly used laboratory species for studies of socio-sexual behaviors and its neurophysiological and neuroendocrine bases. Sexually mature male quail frequently display a series of stereotyped socio-sexual behaviors. Socio-sexual behaviors of male quail is reduced by castration and restored by androgen treatment. Although it is generally thought that the action of androgen on male socio-sexual behaviors requires its aromatization into estrogen (neuroestrogen) in the brain (the aromatization hypothesis), the precise mechanism remains unknown. The preoptic area (POA) is thought to be the critical site of aromatization and neuroestrogen action for the activation of socio-sexual behaviors of male birds. Abundant GnIH neuronal fibers were observed in the vicinity of aromatase cells in the POA and almost all aromatase cells expressed GnIH receptor mRNA. GnIH stimulated the activity of aromatase by dephosphorylation and increased neuroestrogen synthesis in the POA *in vitro* and *in vivo*. Aromatase activity and neuroestrogen concentration in the POA were low in the morning when the socio-sexual activities of the birds were high, but aromatase activity and neuroestrogen concentration gradually increased until the evening when the socio-sexual activities of the birds decreased. Centrally administered GnIH in the morning increased aromatase activity and neuroestrogen synthesis in the POA and decreased socio-sexual behaviors. Centrally administered 17beta-estradiol at higher doses also inhibited socio-sexual behaviors in the morning. These results suggest that GnIH inhibits socio-sexual behaviors by increasing neuroestrogen synthesis beyond its optimum concentration for the expression of socio-sexual behaviors in the male quail. This is the first demonstration of any hypothalamic neuropeptide that directly regulates neuroestrogen synthesis in any animal.

Delayed onset and irregular cycles of oviposition in female chicken chimera grafted with male brain

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In chicken, the *DMRT1* gene on chromosome Z is critical for gonadal development. In males having ZZ chromosomes the testis develops, whereas in ZW females the dosage of DMRT1 is not sufficient for the testis differentiation and the ovary develops consequently. Concerning sexually dimorphic development of the brain and related sex-specific features, the mechanism has not yet been fully elucidated. To explore this point, we constructed male/female brain chimeras in which the brain is switched between chick embryos. The brain primordium was grafted in the embryo, before the gonadal development. Therefore, the brain chimeras have the advantage to examine the role of the brain in sexual development independent of the effect of gonadal hormones. We found that the female chimeras with male brain showed delayed onset of egg production as well as irregular estrous cycles. The behavior of chimeras, and concentrations of plasma sex steroids and luteinizing hormone were not affected. We also checked neurosteroid concentrations in the brain. In normal chicks at 21 days of embryonic age (just before hatching) and at 13 months of age, estradiol concentrations in the brain were significantly higher in males than in females. Surprisingly, this difference was maintained in the brains of chimeras: the male brain grafted into females contained a higher amount of estradiol than the female brain. Elevated concentrations of estradiol in the male brain might cause the altered phenotype of female chimera with male brain. These results suggest a new mechanism that controls expression of sex-specific features.

Neural regulation of seasonality in Palaearctic-Indian night-migratory songbirds

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Endogenously generated rhythms control seasonal migration and reproduction in many birds. In close interaction with the environmental day length, these rhythms provide precision in the seasonal timing. Birds, like many vertebrates, distinguish between increasing and decreasing day lengths, and accordingly show summer and winter physiological responses, respectively. The molecular cascades underpinning such photoperiodic mechanisms were unknown until recently when the molecules involved in the induction of responses under long days were shown in the Japanese Quail. We have measured responses at the brain level using a number of proteins and gene markers by immuonohistochemical and qpcr techniques in migratory buntings (*Emberiza* sp.) in and out of the breeding and migratory seasons, respectively. We show the expression of photoperiodic effects in the brain at the protein level, and have identified molecules that may be induced upstream in response to exposure to long days. We suggest that the mediobasal hypothalamus in buntings possibly contains the seasonal clock, which is sensitive to changes in the day length, and regulates photoperiod induced changes at various levels, including metabolism, when buntings adjust from one life history state to the another.

s22-1k

Sensory mechanisms of long-distance navigation in migratory songbirds: a recent advance

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Displacement studies have clearly shown that birds are able to perform true navigation, i.e. they can find the direction of a destination from unfamiliar sites. The sensory mechanisms of navigation remain poorly understood. There are two primary hypotheses explaining the sensory nature of navigation: (1) the *magnetic map hypothesis* proposes that birds use parameters of the geomagnetic field which are more or less predictably distributed on the globe. This hypothesis claims that the magnetic receptor cells used for navigation reside in the upper beak (the so-called '*beak organ*'), and transmit information via the trigeminal nerve to the brain; (2) the *olfactory map hypothesis* assumes that birds can smell their position by taking advantage of odours distributed in the atmosphere. The latter hypothesis has been supported for homing pigeons and tubenose birds (Procellariiformes). We tested the former hypothesis using night-migratory songbirds, Eurasian Reed Warblers (*Acrocephalus scirpaceus*), by the combination of a 1,000 km eastward displacement and microsurgery on the trigeminal nerve to deactivate the beak organ. In addition, we tested whether intact reed warblers kept at a capture site but exposed to the magnetic field of a displacement site would respond similarly to the compensation they showed after a real displacement. Collectively, our results strongly suggest that the trigeminal nerve transmits map-related information at least in the given species (and likely in other songbirds), and this information is derived from the Earth's magnetic field. Our work will be discussed in the context of other relevant studies.

s22-2k

Genomic analyses of a migratory divide between two subspecies of the Willow Warbler *Phylloscopus trochilus*

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Every autumn young passerines migrate to wintering areas without the guidance of experienced adults. This is made possible by the expression of a genetic program encoding information on when, in which direction and how far to migrate. Although it has been established that migratory behaviour has a strong genetic basis, virtually nothing is known about the underlying genes. Knowledge of specific migration genes would allow for a much deeper mechanistic understanding of migration. In addition, comparing the genes in different migratory organisms would shed light on the evolution of these behavioural adaptations.

Our research focuses on two subspecies of the Willow Warbler *Phylloscopus trochilus* in Northern Europe. The subspecies are morphologically and genetically extremely similar, but migrate to different wintering areas in Africa. We used next-generation sequencing to detect genetic differences between the subspecies that could potentially be involved in adaptations to their different migration strategies. The sequence data suggests that a very small proportion of coding genes differ between the subspecies and that these genes are clustered in two regions on different chromosomes. Genetic variation within these chromosome regions is currently being investigated in a hybrid zone between the subspecies. Because of the segregation of genetic variation in hybrids, the chromosome regions could be more independently associated with different migratory strategies and be linked to migration.

s22-3

Hierarchy of compass cues in migrating passerines: what is the role of the stellar compass?

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Migratory birds are generally believed to have at least three independent, and perhaps redundant, compass systems; a sun-related compass, a star compass, and a geomagnetic compass. Apparently, these redundant systems must be integrated following certain rules, that is, they should have some hierarchy. Several recent studies reported either the use of a magnetic compass calibrated from sun-related polarization cues, or simple domination of the magnetic or stellar compass. However, it is apparent that several species of long-distance songbird migrants that seem to need to calibrate their magnetic compass from sunset cues ignore correct stellar information available to them. Garden warblers (*Sylvia borin*) became disoriented if they were prevented from calibrating their magnetic compass at sunset by exposing them to vertical magnetic field. This took place even if they had access to correct stellar information during both twilight and deep night. These and other data strongly suggest that, at least in some cases, stellar patterns are not used for orientation by migrating songbirds, even if this cue is available and potentially useful. It does not rule out, however, that in the same species stellar rotation may play a significant role during ontogenesis of their orientation mechanisms. These findings emphasize the complexity and between-species variation of orientation mechanisms employed by migrating birds.This study was supported by a grant from Russian Foundation of Basic Research 12-04-00296-a.

Disentangling the behavioural and physiological mechanisms of magnetic compass orientation and polarized light sensitivity in birds

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Birds are well known for their impressive migrations and their fascinating, and for us humans almost enigmatic, ability to sense the Earth's magnetic field and see the polarization pattern of the sky, and use this information for orientation and navigation. However, despite decades of intense research aimed at unravelling the behavioural and physiological mechanisms, the question of how birds can perceive geomagnetic field and polarized light information belongs to the big unsolved mysteries in sensory biology. It is well established that skylight polarization patterns at sunset play an important role when nocturnal migrants determine their departure direction. Also, we demonstrated that polarized light cues near the horizon at sunrise and sunset provide primary calibration references for the magnetic compass in some migratory songbirds. However, in spite of convincing evidence that birds are able to perceive polarized light, direct experimental evidence for polarized light sensitivity in birds is still missing. I will present results of a novel behavioural assay that I recently established, where birds are trained to find a food reward in a particular magnetic direction and/or along a polarization axis, allowing us to test the behavioural and physiological properties of magnetic compass orientation and polarized light sensitivity in birds either separately or in combination with each other. Findings from this assay indicate a possible interaction between polarized light and magnetic compass cues, suggesting a closer relationship between the two senses than previously thought. The results support some intriguing parallels between the functional and physiological properties of polarized light reception and light-dependent magnetoreception which could point to a common receptor system. This raises some interesting new questions regarding the functional and physiological mechanisms of the two senses.

Structure and function of the two avian senses for direction and intensity of the geomagnetic field

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Birds are able to perceive different qualities of the geomagnetic field with two different sensory systems: they can use the direction of the field lines as a magnetic compass and the intensity of the field as a component of their navigational map.

The avian magnetic compass is located in the eye. It is assumed to be based on spin-chemical processes in radical pairs, where the equilibrium between singlet and triplet states is affected by the alignment of the molecule relative to the magnetic field. Cryptochromes, blue light absorbing photopigments, have been suggested as receptor molecules (Ritz et al. 2000). We found Cryptochrome 1a to be located in the outer segments of the UV/V cones in the retinae of domestic chickens and European robins (Nießner et al., 2011). These cones are distributed all over the retina and thus could form an activation pattern that indicates directions. We showed *in vivo* that Cry1a is sensitive to short-wavelength light from UV to green-yellow, which is in agreement with the light-sensitivity of the avian magnetic compass demonstrated in behavioral experiments. This strongly supports the role of Cry1a as a key receptor molecule of the magnetic compass

The magnetic component of the navigational map is mediated by the ophthalmic branch of the trigeminal nerve and involves magnetite-based receptors. Candidate receptor structures here are nerve endings in the skin of the upper beak that contain micron-sized clusters of magnetite nanocrystals, which can be stained with Perls' Prussian blue (Fleissner et al. 2003). In contrast, Treiber et al. (2012) identified similar Prussian blue positive structures in macrophages, not in nerve endings. We will report on our efforts to map and identify iron-containing structures in the beak with respect to their neuronal context and analyze whether they are viable as receptors for the avian magnetic map sense.

s23-1k

Geographic morph-ratio cline in a host species with egg color polymorphism: selection gradient versus gene flow

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Coevolutionary arms race between the brood parasite and its host species gives rise to remarkable diversity in avian egg color morphs and often generates polymorphic egg colors within a species. Some *Paradoxornis* species, host species of the Common Cuckoo *Cuculus canorus* in eastern Asia, show clear egg color polymorphism and are becoming a popular model species in the study for the evolution of egg color polymorphism. In Korea, the Vinous-throated Parrotbill *P. webbianus* has polymorphic eggs, in which each female lays either immaculate blue eggs or white eggs in a population. Interestingly, there is a latitudinal cline in egg color ratio, with decreasing frequency of white-egg clutch as the latitude decreases toward the southern part of the Korean peninsula. However, little is known as to whether this gradient is currently at an equilibrium state or in a dynamic state with a potential for change. The observed latitudinal cline may result from either selection gradient such as geographic cline in the strength of cuckoo parasitism or non-adaptive mechanism such as gene flow. In this study, Mitochondrial (mt) DNA was employed in order to investigate phylogeographic relationship among the Korean populations of the parrotbills. The distribution pattern of mtDNA haplotype was then analyzed to infer the direction of gene flow and associated with the observed morph-ratio variation in egg colors. I will also present some preliminary results showing the probable effect of cuckoo selection gradient on the morph-ratio variation. How the morph-ratio cline in egg color ratio occurs, is maintained and changed in the Korean population of the Vinous-throated Parrotbills will be briefly discussed.

s23-2k

The evolvability of mimetic egg patterns: a new perspective

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The Common Cuckoo (*Cuculus canorus*) is renowned for its ability to mimic the complex egg colors and patterns of many of its target hosts. But are there physical, mechanistic limits to the colors and patterns a Cuckoo can evolve? Have some hosts evolved pattern elements, like squiggles or scrolls, that have so far proven to be unmatchable by Cuckoos? What imposes these limits on Cuckoos, and what consequences do they have for the acceptance or rejection of Cuckoo eggs? Surprisingly, few studies have explored the overall possibilities and limits of the Cuckoo's egg-producing abilities, especially from the perspective of physical processes occurring inside a bird's oviduct. Using a computational model of egg pigmentation, I will investigate the physical parameters required for Cuckoos to evolve eggs with certain patterns. I will also analyze the eggs of a wide range of hosts to properly assess the Cuckoo's pattern-mimicking abilities. Is the Cuckoo a perfect or imperfect mimic? If the latter, does imperfect mimicry result from weak selection or from mechanistic limitations in a Cuckoo's oviduct? The eggs laid by Cuckoos provide a model system for understanding the mechanistic processes underlying egg color and pattern evolution. Overall, I argue that future research about egg pattern formation will be illuminating not just in Cuckoos but also in many other brood parasite-host systems in which egg mimicry plays a key role.

Absence of host aggression towards brood parasites in a multiple - cuckoo parasite system, China

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Host aggression towards adult parasites is widespread in different host-brood parasite systems, and the level of aggression may be indicative of the evolutionary stage in the arms race between host and parasite. We experimentally tested host aggression behaviour in nine species towards models of their major brood parasite, the Common Cuckoo (*Cuculus canorus*), a common predator and a control species that is neither a parasite nor a predator. Contrary to our expectation, only two host species (Oriental and Black-browed Reed Warblers) showed aggressive behaviour towards adult cuckoos, and the other seven host species (Ashy-throated Parrotbill, Vinous-throated Parrotbill, Red-billed Leiothrix, Reed Parrotbill, Barn Swallow, Brown Shrike and Azure-winged Magpie) showed no response to cuckoo dummies. We suggest that the anti-parasite strategy adopted by the different host species, in different host-brood parasite systems, could be condition-dependent, and it is too costly for the host to recognize too many parasites in a multiple-cuckoo parasite system. Non-aggressive behaviour towards adult cuckoos might be strategy blocking, or an alternative defense against cuckoo parasitism in this system.

Sex and seasonal differences in cognition in Brown-headed Cowbirds (*Molothrus ater*)

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Brown-headed Cowbirds (*Molothrus ater*) are obligate brood parasites in which only females search for host nests and breeding females have a larger hippocampus than males. As the hippocampus is a region of the brain responsible for spatial memory processing, it is assumed that the larger hippocampus in female cowbirds is required for spatial memory associated with nest-searching. To examine whether female cowbirds did, indeed, have a more accurate spatial memory than males, we investigated sex and seasonal changes in the memory of captive cowbirds as tested using: 1) short-term spatial and colour memory tasks and 2) a spatial navigation task. We predicted that females would outperform males on both types of spatial tasks (touchscreen and navigation) in breeding condition, whereas performance would be similar between the sexes in non-breeding condition. We did not predict any sex or seasonal changes in colour memory performance. As predicted, on the spatial navigation task, females made fewer errors than males in breeding condition, but performance was similar between the sexes in non-breeding condition. However, for the spatial touchscreen test, performance did not vary with sex or season. The spatial touchscreen test likely did not tap into the cognitive mechanisms that cowbirds use in the wild to search for host nests because the cowbirds did not move through their environment during testing. For the colour test, males outperformed females in non-breeding condition, but females improved more than males from non-breeding to breeding conditions. Males, and breeding females, may rely on colour for distinguishing male quality. Female brood parasites have evolved heightened spatial navigational skills (when tested on an ecologically-relevant task) that are enhanced in breeding condition, linking ecology with cognition.

Do Shining Cuckoos mimic the odours of their host?

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The evolution of visual and auditory mimicry of hosts has been well studied in avian brood parasitic systems. In contrast, mimicry of host odours by brood parasites has not previously been investigated. Recent research has revealed that passerines may have well developed senses of olfaction and may use odours to gain spatial and temporal socio-biological information about their environment and about other individuals. One key source of avian body odour is uropygial gland secretions (preen wax). Preen wax has been found to vary among species, populations, and between the sexes. We compared the preen wax composition of the Shining Cuckoo (*Chrysococcyx lucidus*), an avian brood parasite in New Zealand, the Grey Warbler (*Gerygone igata*), its primary host, and seven other potentially suitable but rarely used host species. Assessment of gas-chromatography (GC-FID) traces suggest the preen wax composition of Shining Cuckoos is more similar to the preen wax composition of Grey Warblers than to any of the other seven species examined. This similarity was present in both adult and nestling Shining Cuckoos and Grey Warblers. These results provide the first evidence for olfactory mimicry in any avian brood parasitic system.

s24-1k

Effects of fire regimes on bird populations in foothill forests of the Great Dividing Range in eastern Victoria, Australia.

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The ranges of south-eastern Australia are among the most fire-prone environments in the world, and can serve as a laboratory for understanding some of the changes that may be occurring more broadly. Fires and people have helped shape the native eucalypt forests for millennia but fire regimes are changing in response to climate change and modern human interventions. Occasional severe fires can devastate human communities and severely impact on natural ecosystems. The challenge is to manage fire regimes to minimise severe impacts while maintaining the natural character and ecological values of the forests. The Victorian Government has implemented a range of policies and research projects to meet this challenge, before and after the devastating fires of Black Saturday in 2009.

Studies of bird populations have proved particularly helpful in understanding some of the ecological processes involved in this complex issue. Here we present an overview on responses of birds to severe fires in 2009 and 1983 and compare them with responses to planned burning. We describe a retrospective study that examines effects of fire regimes based on historical records. Spectacular changes in bird abundance and species composition followed severe fires, including an exodus of nectarivores from burnt forests and an influx of aerial insectivores from hundreds of kilometres away. Many birds survived on site and many species recovered rapidly in subsequent years. Responses to planned burns were much more subtle. The retrospective study highlighted the importance of fire frequency while indicating a muted response to time since fire over medium time-frames (5-40 years). Variations in fire intensity and the quality of historical records may have limited the potential of this approach. The studies have numerous implications for policy and management, but much more needs to be learned.

s24-2k

Fire and Mediterranean bird communties: the complex role of global change in novel forest systems.

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The current challenge in a context of major environmental changes that will be exacerbated in the future is to allow a meaningful projection of species distribution to future landscape and climate scenarios. Species distribution modelling may play a fundamental role in this challenge but we need to integrate more ecology in model building and develop more coherent model validation before species distribution modelling may be of use in a dynamic ecological context.

Mediterranean landscapes are highly dynamic systems. Climate changes are one the most powerful driving forces of these dynamics and in the Mediterranean basin its frequency and impact have markedly increased in recent years. However, climate change impacts on biodiversity are often indirect through changes in disturbance regimes. Fire is a critical factor in the Mediterranean and is likely to drive climate change effects over large areas. The description and analysis of landscape patterns associated to fire dynamics have received some attention, but knowledge about how the temporal and spatial arrangement of habitats, arising from wild fires, affects biodiversity in complex, human dominated landscapes is astonishingly poor, with the exceptionn of within habitat succession related recovery of communities after disturbance event.

In this communication, we present recent advancements on habitat and bird modelling responses to fire and climate changes in Catalonia (North-east Iberian peninsula) in which species distribution modelling applications have played a major role. Our study model in dynamic Mediterranean landscapes has stressed the importance of landscape dynamics, population connectivity and model building in the accurate prediction of distribution changes of habitat and biodiversity responses to climate changes, land use changes and fire dynamics during the last 20 years in the region. We argue that a deep insight on the temporal and spatial factors that interact in a complex way to determine current landscape patterns and species responses will be essential if we aim at understanding and managing Mediterranean systems. The generality of these constraints suggest that successful application of species distribution modelling to the prediction of species distribution dynamics in other systems should be developed under a similar integrative, ecological sound framework.

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Pyrodiversity begets biodiversity: the influence of mosaic burning on bird assemblages across multiple spatial scales

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ABSTRACT:

Wildfires and altered fire regimes typically lead to changes in bird diversity and community composition, with evidence of decline under inappropriate fire regimes. Future changes in climate are predicted to increase the scale and intensity of fires across many regions of the world, posing an additional challenge for species conservation. This has stimulated much research into effective means of burning to maintain biodiversity focused on the broadly accepted paradigm that 'pyrodiversity begets biodiversity'. Much work has been carried out at the alpha diversity level in relation to the fire event. Uncertainty, however, remains regarding the relationship between beta diversity and the fire regime mosaic. Controlled burning for conservation outcomes thus remains a controversial topic. We assessed the alpha and beta diversity of birds in the sub-tropical woodlands of Australia. A systematic, nested hierarchical approach to sampling has been adopted in 28 study landscapes, selected to represent gradients in fire history. Preliminary results suggest a significant relationship between species richness of birds and the fire history at the site or alpha diversity level. Species richness at the landscape or beta diversity level was not significantly influenced by fire-mediated heterogeneity. Increasing habitat heterogeneity was associated with landscape level species richness of birds. Further analysis will allow insight into the relationship between fire-mediated heterogeneity and bird community composition. These findings will provide an understanding of the operational minimum level of spatial diversity, at appropriate spatial resolution for effective ecological fire management.

Wildfire, stable unpredictability, and the evolution of cooperative-breeding in the Florida Scrub-Jay

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The Florida Scrub-Jay (*Aphelocoma coerulescens*) defends extremely large territories for its body size, often exceeding 10X the areas defended by larger, closely related scrub-jays of western North America. Its oak scrub habitat is subject to lightning-caused wildfire at irregular 5- to 20-year intervals. Oak shrubs, which are clonal, rapidly re-sprout and return to pre-burn structure within several years after a fire, but do not produce acorns for 2-3 years. Florida Scrub-Jays continue to defend burned habitat within their territory, but also must defend enough unburned scrub to ensure an acorn supply for autumn caching and over-winter recovery and consumption. Paradoxically, juvenile survival is exceptionally high within territories that contain recently burned scrub, probably because of reductions in the natural predator community. Indeed, presumably for this reason, dispersing jays strongly prefer to settle in and defend scrub patches that recently burned. We propose that exceptionally large territories in the Florida Scrub-Jay represent a life-history response amounting to an "insurance policy" hedging two conflicting pressures imposed by a fire-prone habitat. Large, permanently defended territories maximize the probability of retaining unburned oaks (and their all-important acorns) plus significant areas of recently burned habitat following a fire. Jays should defend as large a territory as they possibly can. Such a social milieu favors offspring retention, delayed dispersal, and group defense of territorial boundaries. Therefore, the stable unpredictability imposed by frequent wildfire may help explain not just larger territories, but even the existence of cooperative breeding in this species.

s24-5

How does fire affect bird migration?

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The importance of safe stop-over sites during migration for the survival of bird populations has recently gained more attention, but the impacts of fires on such sites are poorly studied. Most of the ornithological publications connected with wild fires are dealing with the direct impact on breeding bird populations. In the Amur region fires occur annually during the peak times of bird migration. In most cases those fires are caused by humans.

Since 2011 a standardized large-scale bird-ringing project is carried out annually during autumn migration at Muraviovka Park, south-east of the city of Blagoveschchensk at the Amur River in Far-eastern Russia. The importance of the Park as a safe site for re-fuelling was proven for a variety of migratory species. While there was no autumnal fire in two seasons, the area was burned completely in the third season. The differences of bird occurrence and habitat use between the seasons with and without fire were studied. Furthermore, the differences directly before and after the fire were examined.

Many species, which have been common during migration in the years without fire, did not occur after the burning. Some species showed no difference and others were trapped more regularly. Furthermore, many individuals, which have been ringed before the fire, were re-trapped again immediately after it, so the fire itself did not chase them away. It can be assumed that the behaviour depends on the habitat requirements of the species and the intensity of the fire: while most shrubs and the herb layer were completely destroyed, trees survived in the studied case. Habitat loss caused by fires could have a major impact on threatened migratory species.

s25-1k

Adult phenotypes after developmental stress: assessing costs and benefits with fitness metrics

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Animals exposed to developmental stress experience immediate effects with long-term physiological and behavioral consequences. Developmental stress can track through an animal's lifetime affecting its health and performance at multiple life-history stages. In birds, nutritional or hormonal manipulation during the nestling phase can increase stress reactivity in adults. The resulting increase in glucocorticoid secretion is linked to decreased song quality, duller coloration, and reduced attractiveness to females. Developmental stress also programs changes in adult phenotype independently of adult glucocorticoids. The majority of studies assume developmental stress will negatively impact fitness: lower quality secondary sex characters will lead to a decline in reproductive success. However, very few studies have evaluated direct fitness metrics (reproductive success and/or survival). It is possible that lower quality males take alternative reproductive tactics to improve fitness. Recent data from our lab indicate that developmental stress alters parental investment decisions such that these males raise higher quality nestlings. We also have data indicating that adults stressed during development perform better on a novel foraging task. As a result, we suggest a more integrated examination of the fitness effects of developmental stress, accounting for possible benefits in reproductive and survival outcomes.

s25-2k

Understanding developmental stress: integrating brain, physiology and behaviour

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There has been great interest in how stressful conditions experienced during development can program adult phenotypes, and the extent to which such induced changes may be adaptive. However, to date few studies have investigated how different developmental stages interact to influence behavioural traits and the mechanisms that underlie these changes. Exposure to stress causes complex interactions within the hypothalamic-pituitary-adrenal (HPA) axis, resulting ultimately in the release of glucocorticoid hormones, which act on target tissues to maintain homeostasis. This response is tightly regulated through classical negative feedback loops, which include an important role for intracellular receptors (GR/MR) within the HPA axis and hippocampus. Here I describe an experiment using the Japanese quail (*Coturnix japonica*) that aimed to determine the long-term effects of both pre- and post-natal stress on subsequent behavioural traits and the functioning of the HPA axis. Four distinct phenotypes were created: pre-natal stress (*in ovo* elevation of corticosterone); post-natal stress (random food removal for 14 days after hatching), pre- and post-natal stress (both stress treatments applied) and Control. In adulthood the following traits were quantified in all groups: exploration behaviour in a novel environment; physiological response to an acute stressor and GR and MR mRNA expression within the hippocampus, hypothalamus, pituitary and amygdala. Pre-natal stress had significant effects on measured traits at all levels of complexity, with elevated GR expression within the hypothalamus and pituitary, a reduced MR:GR ratio in the hippocampus, an attenuated acute stress response and increased risk taking behaviour the novel environment. Exposure to any stressor, regardless of developmental stage, tended to reduce MR expression within the hippocampus, but increase GR expression within the amygdala. These data facilitate our understanding of developmental programming of behavioural phenotypes and highlight the neuroendocrine mechanism that could underlie the effects of early exposure to stress.

s25-3

Do Telomeres Shorten in Response to Early Life Stress?

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In response to environmental stressors, young vertebrates generally show an increase in glucocorticoid stress hormones (CORT), which alters behavior and physiology to prioritize short-term survival over other traits, including growth. A high level of exposure to CORT in early life can 'program' the development of a phenotype that is generally more stress-responsive, the potential advantages of which come at the expense of longevity. One mechanism that might produce such trade-offs operating across life history stages is the effect of stress exposure on telomere dynamics, which are linked to age related deterioration and lifespan. We experimentally manipulated stress exposure during the early post-natal period (between days 10-22 post-hatching) in a long-lived seabird, the European Shag (*Phalacrocorax aristotelis*) and examined the effect on growth rate, stress-responsiveness at fledging and telomere dynamics. We found clear evidence that early stress exposure results in shorter telomere length at fledging.

The importance of the postnatal context for the study of prenatal effects

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In order to study the importance of processes in the prenatal phase, the embryonic environment is experimentally manipulated and its effects are often assessed after hatching. In most studies, the postnatal condition in which the prenatal manipulations are evaluated is not varied and often consists of standard laboratorial conditions. The postnatal condition is, however, a crucial player in how the effects of the prenatal manipulation come about. Disregarding the interaction between the prenatal and postnatal context may lead to incomplete or wrong interpretations. We illustrate this with our studies of prenatal maternal effects in birds.
First, quail mothers were exposed to either mild heat stress (34 degrees celsius), or moderate housing temperatures (22 degrees) during egg production and their chicks were, in a split brood design, housed under both conditions, creating four groups. Under matched conditions, chicks were housed like their mothers (mothers and chicks both housed under heat stress or control temperatures, respectively). In mismatched conditions, chicks coming from heat stressed mothers were themselves housed under control temperatures and vice versa. There was a clear interaction effect between the prenatal and postnatal condition on both behaviour and physiology of the chicks. Interestingly, some data suggests that the matched condition, even when chicks were housed under heat stress, was advantageous, suggesting that mothers anticipate environmental conditions in which their offspring will be reared and adapt their chicks by maternal effects.
Second, elevation of yolk testosterone within the natural range in eggs of the Rock Pigeon had positive effects under good food conditions during chick rearing, but detrimental effects under poor food conditions.
These results not only have important implications for the study of prenatal development and the evolutionary frame work of maternal effects, but shed new light on existing discrepancies in the literature and generate new questions about physiological mechanisms.

The physio-behavioral phenotype: hypothalmo-pituitary-adrenal axis responsiveness and the timid-to-bold continuum in Florida Scrub-Jays

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Numerous studies have revealed links between endocrine and behavioral phenotypes. In our long-term study of free-living Florida Scrub-Jays (*Aphelocoma coerulescens*), we have examined the relationship between corticosterone (CORT) and behavioral type. Our finding that baseline CORT levels of nestlings were positively correlated with fearfulness eight months later (see Schoech et al. 2009, GCE 163:201-207), prompted follow-up studies. Recently, we found a positive relationship between nestling begging rates and stress-responsiveness (i.e., higher integrated CORT levels) at one year of age. A related study found that individuals from nests that received supplemental food had lower stress-responsiveness at one year old indicating that the early developmental environment is important in determining an individual's physio-behavioral phenotype. In *neophobia* tests in which jays must approach a novel object or cross a ring to access a desired food item (peanuts), more stress-responsive individuals were less likely to complete both tasks. Finally, the physio-behavioral phenotype seems to be fixed within individuals as the magnitude of the CORT response to a stressor and performance in behavioral tests are both repeatable throughout an individual's life. Further, an individual's phenotype has long-term consequences as stress-responsiveness is predictive of lifespan in a sex specific manor. Ongoing and future research will manipulate nestling CORT levels and, when combined with cross-fostering experiments, will allow us to determine the relative roles of environment and genetics in programming individuals' physio-behavioral phenotypes.

s26-1k

Peripheral mechanisms for birdsong diversity

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Acoustic diversity is an important feature of vocal communication. It can increase the variety of vocal signals and optimize their spectral and temporal properties for propagation in different environments. This talk will focus on the peripheral mechanisms underlying important sources of song diversity at three levels: the respiratory system, the syrinx and the supra-syringeal vocal tract. The source-filter model, initially proposed for human speech, also applies to birdsong and provides a useful framework in which to consider mechanisms of vocal diversity. In birds, the vocal source is the syrinx, which is capable of operating in different modes. The lateralized, independent motor control of the bipartite Oscine syrinx has special behavioral significance. Advances are being made toward a better understanding of the respiratory and syringeal control of fundamental frequency and the role of superfast syringeal muscles in determining song tempo. The sound emanating from the syringeal source is modulated by the resonance filter properties of the supra-syringeal vocal tract. The bird controls the resonant frequency by using articulatory movements of the beak, tongue and oro-esophageal chamber to adjust the dimensions of its supra-syringeal vocal tract. The vocal tract filter is an important source of vocal diversity, which can increase the salience of tonal whistle-like song (e.g., Northern Cardinal, *Cardinalis cardinalis*) or concentrate acoustic energy of broad-band vocal signals (e.g., Zebra Finch, *Taeniopygia guttata*) into formants by filtering out some overtones and reinforcing others.
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s26-2k

Neural basis for adaptive adjustment of temporal structure in song of Bengalese Finches

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Song learning and maintenance require precise control of various acoustical properties in aspects of both spectral and temporal structure. It has been previously demonstrated that the anterior forebrain pathway (AFP), which is a homolog of mammalian cortico-basal ganglia circuits, is crucial for juvenile learning and adult maintenance of spectral features of song, such as fundamental frequency and spectral entropy. In this study we examined the capability of adult Bengalese Finches (*Lonchura striata* var. *domestica*) for adaptive adjustment of a local temporal structure, gap duration, and the neural basis for such plasticity. We first developed a real-time signal processing system that can monitor various acoustic features in ongoing song. The system detected specific syllable pairs and measured the duration of gaps between these syllables with 1-ms temporal resolution. Birds were exposed to a brief noise burst immediately after the system detected that a target gap was longer (or shorter) than a threshold level, and were expected to change duration of the target gap in order to avoid the noise stimulus. The result showed that birds could adaptively modify their gap durations to avoid the noise stimuli. Deprivation of an output nucleus of AFP appeared to disable such adaptive regulation of gap duration. The result suggests that the capacity for temporal regulation of singing is at least partially dependant on neural signals from the nucleus, providing a new view to understand the plasticity in song control mechanism. Adaptive adjustments observed in other song features and differences in characteristics of such plasticity at different developmental stages will be also discussed.

Lateralization of song production and implications for song plasticity in Bengalese Finches

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In oscine birds, learned song is produced by a two-voice vocal organ (syrinx) and dual sound production gives rise to rich acoustic diversity. Few laboratories integrate central and peripheral physiology to study song production and plasticity. The Bengalese Finch, a domesticated songbird, is an excellent model for exploring central and peripheral motor control, in part because they show remarkable asymmetry in acoustic production of their learned song. The left sound source produces higher frequency, lower entropy sounds, and the right sound source produces lower frequency, higher entropy notes. The vibratory tissues in each syringeal sound generator are composed of the medial and lateral labia. A Modified Morris pentachrome stain was used to study whether there are anatomic asymmetries in the vocal organ. We found a robust morphologic difference between the left and right lateral labium: the right lateral labium is 2.4x times larger compared to the left. Microstructural analysis of two proteins involved in regulating vocal tissue tension and elastic recoil - collagen and elastin - has revealed a clear pattern of organization along the rostral-caudal extent of the left and right lateral labia. A dense band of collagen lines the superficial edge of the most rostral aspect of the tissue and elastin lines the caudal edge. Bengalese Finches are capable of vocal recovery following disrupted auditory feedback. We then explored whether the morphologic lateralization constrains song plasticity. We specifically targeted the production of left-generated, higher frequency notes in the bird's song through unilateral syringeal denervation or lesion of the left premotor nucleus HVC (proper name). Surprisingly, in some individuals, higher frequency sounds were recovered. This talk will review our ongoing research exploring central and peripheral mechanisms underlying vocal plasticity in adult songbirds, focusing on how peripheral constraints guide, but may not limit, song reorganization.

How vocal plasticity facilitates communication in birds

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Many studies on animal communication investigate what kind of information is encoded in a signal. However, before a signal can be detected and recognized by a receiver, it has to be successfully transmitted. Signal transmission is not a trivial task since signal exchange in any modality is crucially constrained by the environment. Physiological, anatomical, and behavioural studies have revealed how birds change their vocalizations during sound production. We will show that this often stunning vocal plasticity can be used to maintain communication in fluctuating environments. We do this by combining two lines of evidence from various groups of birds including tinamous, galliforms, parrots, and songbirds. One line concerns vocal adjustments in response to different social contexts that impose different demands on signal transmission. The second line of evidence relates to correlational and experimental data showing that birds change their songs and calls to mitigate masking from biotic and abiotic noise. Taken together, the results of these studies show that bird vocalizations are surprisingly flexible on different levels of signal structure and performance, including adjustments of vocal amplitude, signal timing and duration, as well as serial redundancy. The overall picture indicates that birds are sensitive to changes in the biotic and abiotic environment and that they facilitate communication by adjusting the characteristics of their vocalizations in response to different environmental factors.

Involvement of the songbird song system in reproductive behaviour

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Since its discovery over 35 years ago, the song system of songbirds has become an important model system for the neurobiological study of vocal learning and performance. A major function of song in males is to attract a female, and because singing is often correlated with reproduction, singing can be seen as a form of appetitive behaviour that may be consummated by sexual union in which the male's sperm is transferred to the female by the 'cloacal kiss'. Here we ask whether the neural basis of consummatory as well as appetitive aspects of reproductive behaviour can be found in the song system itself. We show that the same medullary nucleus (retroambigualis, or RAm) that projects upon spinal motor neurons innervating expiratory muscles – which provide the pressure head for vocalization - and upon vocal motor neurons for respiratory-vocal coordination, also projects upon cloacal motor neurons. Furthermore, RAm neurons projecting to sacral spinal levels housing cloacal motor neurons receive projections from the same premotor nucleus of the forebrain song system (robustus arcopallialis or RA) that projects upon vocal motor neurons and expiratory premotor neurons in RAm. Thus, by indicating a rather direct form of forebrain control of the reproductive periphery, these results potentially extend the role of the song system to include consummatory as well as appetitive aspects of reproductive behaviour.

s27-1k

Niche changes during biological invasions: prevalence, drivers and consequences

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Numerous examples of rapid adaptation come from the study of non-native species, suggesting that rapid evolution in response to novel selection pressures may be common during invasions. Yet, techniques commonly used to assess invasions risk assume that ecological niches are fixed and immutable, allowing to forecast non-native species distributions in the new range based on native-range niche characteristics. It is thus not surprising that an increasing number of studies detect a mismatch between potential distributions of non-native ranges derived from native-niche characteristics, suggesting a niche shift during the invasion process. However, despite a growing number of studies, it remains difficult to assess the prevalence of niche conservatism during invasions as measures of niche shifts have been shown to vary greatly depending on the underlying statistical and conceptual assumptions. In this contribution, I will review how niche conservatism, i.e. the extent to which niches are conserved across space and time, is currently evaluated. Using birds as a model system, I argue that niche expansion into novel environmental conditions is rare, and that most niche differences between native and non-native populations are due to a partial filling of the native niche in the invaded range. This has important implications for the use of native-range based distribution models, as these techniques may accurately predict non-native distributions when the native and non-native ranges have comparable environments. Also, evaluating native and non-native environmental niches allows identifying those species that exhibit true niche changes. Research efforts can then be focused on these species in order to understand the strategies that have allowed these invaders to expand their niches. Although this contribution focuses on niche conservatism among non-native birds, the degree to which species succeed or fail to adapt to novel environmental conditions is important to a range of topics in ecology and evolution and I will close by discussing some of these issues as well (e.g. predictions of bird distributions following climate change).

s27-2k

Effects of contrasting evolutionary life histories on genetic variation and immune function in birds: a test using populations of endemic and invasive parakeets on Mauritius.

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Endemic island bird species often face an increased risk of extinction when compared to their continental counterparts as a result of small population size and low genetic diversity. The introduction of non-native species to these already fragile ecosystems can further increase extinction rates among endemic species which are unable to adapt quickly to the introduction of novel competitors, predators, parasites and pathogens. The success of introduced non-native avian species on islands is well documented. Often dispersed as a result of human intervention the majority of these species have evolved to adapt to a wide range of environmental conditions on continental systems and therefore have the intrinsic benefits of a greater initial pool of immunological, genetic and phenotypic variation. Consequently, an island endemic species and a phylogenetically similar continental invasive species can sometimes be present on the same island, providing a valuable comparative opportunity to examine genetic and immunological relationships. In this contribution, I will use the apparent contrast in population success between an endangered Mauritian endemic, the Echo Parakeet (*Psittacula echo*), and its highly invasive continental congener, the Ring-necked Parakeet (*Psittacula krameri*), to review the importance of and mechanisms behind the interactions between innate immune function and genetic diversity within and between populations of phylogenetically matched species.

Common Starlings in South Africa: alien, but not invasive?

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Common Starlings (*Sturnus vulgaris*) were introduced to South Africa in 1897, and by 1962 had established themselves in the Eastern Cape region. The relative abundance and distribution of this species has been assessed by 45 point counts on each of two urban and two rural routes since 2007. Four indigenous starling species, and a selection of 15 other species, are counted on each occasion. Common Starlings occur at similar frequencies in the towns of Grahamstown and Port Alfred, where they are the most abundant bird species in the count sample. However point-by-point comparisons show no evidence that Red-winged Starlings (*Onychognathus morio*), the only common indigenous starling species in urban areas, avoid sites frequented by Common Starlings. On the rural routes, Common Starlings are only encountered near farm buildings, which are also the focal point for the occurrence of three indigenous starling species. Here they are the least common species. Current data suggest that in this region Common Starlings are effectively restricted to buildings and heavily modified habitats, avoid natural vegetation, and occur only sporadically on pastures and farmland. Recent studies of the occurrence of the Common Myna (*Acridotheres tristis*) in South Africa have arrived at similar conclusions. Nevertheless the possible role of these alien species in disease transmission and in the spread of invasive alien vegetation remains to be assessed.

Feral Greylag Geese – why do they fare so well?

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Throughout the world, many introduced or "naturalized" bird species thrive in cities. Wildfowl, including ducks, geese and swans, are among the most visible. Throughout Europe, populations of feral geese are increasing, often very quickly. Because they are very visible, tame and in close contact to humans, they receive a lot of attention and often are perceived as a "problem". So to study these rapidly growing populations and what factors may govern their success is not only of scientific interest but may also have management implications.
Since 2002, the State Museum of Natural History organizes ringing and monitoring of feral Greylag Geese (*Anser anser*) in Stuttgart, southwest Germany. Between 2002 and 2012, over 500 Greylag Geese have been ringed, allowing individual identification and thus monitoring of movements, breeding success and behaviour.
Within the city, geese use parks that offer plenty of grazing in direct proximity to lakes for taking refuge. Being an apparently optimal goose grazing habitat, however, birds also face several limiting factors in urban areas that they do not encounter in natural habitats (i.e. close contact to people, dogs causing disturbances and mortality, limited safe nesting sites and overcrowding). What behaviours do geese show in response to these factors?
Unlike wild Greylag Geese, the Stuttgart birds remain in the vicinity most of the year even during harsh winters thus saving the potential cost of migration. Although birds' abdominal profiles decline towards the end of winter, birds develop strategies to cope with ice and snow. Feral geese in urban areas appear to be successful not only because of the good habitat but also because of their behavioural plasticity.

s27-5

Status of an invasive species, the Red-billed Leiothrix and negative impact on native species in Japan

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The Red-billed Leiothrix (*Leiothrix lutea*) has been imported from China to Japan since 1600s, and, recently, its number has been increasing in natural forests in Japan. The analysis of mtDNA control region sequences supports the notion that Japanese populations were derived from introduced individuals from China, and suggests that some local populations have diverged from each other due to multiple introduction events and/or bottleneck effect. Range expansion and gene flow were also detected in some local populations. We also suggested nesting and foraging niche segregation among the Leiothrix and native birds (Amano & Eguchi 2002a, b). The Leiothrix and Japanese Bush Warbler (*Cettia diphone*) placed nests exclusively in bamboo thickets and on bamboo stalks, the latter placing nests in denser vegetation than the former. Segregations in the foraging behavior were also seen mainly in the preference of microhabitat and technique between the Leiothrix and native species, Japanese Bush Warblers and parid species, which may has allowed the Leiothrix to colonize Japan. It is likely that the Leiothrix has successfully established by occupying a vacant niche. However, a negative affect by the Leiothrix on native species through apparent competition was also reported (Eguchi & Amano 2008). The reproductive success of the Japanese Bush Warbler decreased as a consequence of predators being attracted by the presence of numerous nests of the Leiothrix. Control of the Leiothrix is not easy because of its wide distribution in natural forests, but in recent days, the number of Leiothrix is decreasing due to overgrazing by Sika Deer (*Cervus nippon*) on the understorey of forests.

s28-1k

Cognition, ecology, and evolution in wild Great Tits (*Parus major*)

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Cognition is defined as the processes by which animals acquire, retain and use information from their environment to guide their behaviour. While cognitive ability has been most often measured in controlled settings in captivity, the actual costs and benefits experienced by an individual when using information depend not only on its cognitive ability, but also on the prevailing ecological and social context. In the last years, we have been studying the ecology and evolution of innovative problem-solving and associative learning in the monitored population of Great Tits (*Parus major*) in Wytham, Oxford, UK. Individual tits were found to solve new problems more efficiently when part of larger flocks, because more companions reduce the need to invest in anti-predatory vigilance thereby presumably allowing individuals to devote more attention and time to problem-solving. Moreover, larger flocks are generally more diverse and therefore more likely to contain individuals with good problem-solving skills or relevant experience. Individuals who could solve a novel foraging problem in isolation in captivity were not more likely to solve a similar problem in natural settings, suggesting that alternative foraging options (other food sources, scrounging) impact on the expression of problem-solving tendencies in the natural environment. Studying the ecological and social context of information use in the wild is therefore an important step when examining the contribution of cognition to survival and fitness. Recently we have taken the operant learning paradigm to the field by designing portable Skinner boxes and deploying them in Wytham over the winter months. The experiment was fully-automated and returned information on several thousands of colour-based associative learning trials by free-ranging individuals. Great Tits were more likely than other tit species to visit the devices and engage in trials, but there was no sex or personality biases in the sample of Great Tits landing at the devices and registering key pecks. However juveniles were more likely than adults to visit the devices, register trials, and reach the learning criterion. We examine further sources of individual variation in learning speed in link with the natural context of the tests, including the interval at which trials were taken, group size, and the availability of social information. We discuss how this type of approach could contribute to the aim of bridging evolutionary ecology and animal cognition by allowing measurements of cognitive performance in the wild on a large number of individuals.

s28-2k

Do Mexican Jays choose peanuts by listening to the sounds produced by handling the nuts? – field experiments.

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In contrast to extensive research on optimal foraging in birds, the proximate mechanisms by which birds are able to estimate the value of food items have not been well studied. Previous research showed that birds may be able to collect some information about the content of a nut before opening it, and that they may be able to choose nuts of heavier/denser content. In a series of experiments we have previously suggested that Mexican Jays do not seem to use dynamic touch (feeling of heaviness due to perception of inertia while handling the nuts in their beaks) in this situation. We proposed a hypothesis that jays may use the sound produced when they handle peanuts. The handling may consist of simple lifting, or shaking that may be associated with slight opening and closing of the beak. This may produce sounds when the beak hits the nut shell, or when the nuts move inside the shell. In winter 2013 we conducted experiments to evaluate the idea that the birds may pay attention to the subtle differences in sound between peanuts, and whether they also pay attention to the properties of their natural food – acorns. We compared acceptance of peanuts modified in the manner that allows for several types of comparisons, including the following: comparison between peanuts that have equal weight but differ in sound produced when birds close their beaks to hold the nuts, comparison between peanuts that differ in weight but produce similar sounds when handled, comparison of acorns that differ in the sound produced while handled. We used spectrograms to analyze the sounds produced by handling the experimental peanuts. The results will be discussed in the light of proximate mechanisms that allow animals to acquire knowledge useful for optimal foraging.

What determines vehicle avoidance behaviour in birds?

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Among the most widespread forms of anthropogenic modification of the natural landscape is the construction of roads. One effect is road mortality causing major conservation issues affecting amphibians, reptiles, mammals and birds. Why some species are more susceptible to vehicle collision than others however is poorly understood. Here we examine how roadside vegetation patterns, road type, vehicle speed and brain size influence vehicle avoidance behavior using more than 3700 individuals of eleven different species of European birds. We found that on larger roads and at higher vehicle speeds birds were more likely to fly away from the road than to cross it. Moreover, species with a larger relative brain size flew away from the road more often than species with a small brain size whose direction of flight was random. Brain size is generally positively associated with behavioural flexibility in mammals and birds, and our observation of a link between brain size and vehicle avoidance behaviour may in part explain inter-species differences in vehicle collision mortality rates and highlight that brain size can be an important trait for adjusting to anthropogenic changes.

Sibling Communication in barn owls: role of cognition and social interaction

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To resolve the share of limited resources, animals can advertise their motivation and fighting ability, which reduces the cost of physical confrontation. Animals are expected to constantly modulate their investment in signalling according to the payoff. The level of signals of an individual hence often fluctuates to avoid acoustic interferences, to adapt to the presence of an audience or to the resource holding potential and motivation of opponents. These fluctuations raise the question of how individuals adjust at each moment their level of investment in signalling to claim a resource. Using the Barn Owl (*Tyto alba*) as a model species, I will present recent advances in the understanding of the role of cognition (individual recognition, memory, counting ability) and social interactions in the dynamics of a communication process. Nestling Barn Owls adjust their investment according to the number of vocalizing siblings and the temporal variation in their signals, suggesting they use slight changes in siblings' vocalization and signal variability as cues to assess siblings' motivation to compete.

Physical cognition in wild-caught New Caledonian crows

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What do birds understand about their physical worlds? Several avian species are capable of extraordinary behaviours in the wild, such as caching food and manufacturing tools. However, it is unclear how well birds understand the causal properties of the worlds they live in. My research examines the physical cognition of an exceptional bird species, the tool-making New Caledonian crow (*Corvus moneduloides*). These crows use and manufacture several different types of tool in the wild, including hooked stick tools and barbed pandanus tools. They can also solve complex meta-tool problems, and reason about hidden causal agents. I present evidence from recent studies with wild-caught New Caledonian crows showing that these birds have a sophisticated – although incomplete – understanding of the physical properties of weight, solidity and water displacement in a naturalistic situation. I propose that the methods used to investigate cognition in this species can be easily adapted to study other wild populations, to provide a broad picture of avian physical cognition.

s29-1k

Possibilities of long-term monitoring of birds by Rybachy-type funnel traps

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Interest in the data of long-term monitoring of biological events, birds included, is constantly increasing due to the global problem of rapid climate change. On the Courish Spit on the Baltic coast annual monitoring of migrating and breeding birds has been performed since 1957. Large funnel traps are in operation between late March and 1 November. We monitor: (1) timing of spring passage in several dozen avian species, on the basis of first, mean and median capture dates of transients; (2) timing of breeding and postfledging movements in a number of target species based on first and median captures of locally hatched juveniles; (3) timing of post-breeding and post-juvenile moult in local breeders; (4) timing of autumn passage on the basis of mean and median capture dates of transients; (5) numbers of several dozen species of avian migrants on spring passage; (6) numbers of local breeding birds in target species; (7) numbers of several dozen species of autumn transient migrants; (8) numbers of irregular migrants at autumn and spring passage; (9) physiological condition and fuel stores of migrating birds. Long-term monitoring using Rybachy-type funnel traps has shown that over the last 50 years the timing of spring migration and breeding in the Baltic region has significantly fluctuated due to climate change in both short- and long-distance migrants. However, the timing of autumn passage in the same species has not changed much. Numbers of local breeding and transient populations of short- and long-distance migrants has also undergone considerable fluctuation. The numbers of irregular migrants was related both to climatic conditions and to foraging situation. Physiological and energetic condition of spring avian migrants also showed a tendency towards variation in respect to the weather conditions in winter quarters and at stopovers. Long-term monitoring by captures in funnel traps yields much better-quality data on the impact of climate on phenology and numbers of avian populations than visual survey data (Sparks et al. 2013).

s29-2k

The value of long-term ringing data in the light of environmental change

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Ringing and other long-term data sets have contributed considerably to our knowledge of different aspects of avian biology. The mere numbers of caught and ringed birds can be used to describe migration phenology and its changes e.g. due to climate change (namely at stopover sites without or with low numbers of breeding birds). They also reflect long-term changes in population sizes or migration routes. In species that are reliably aged and sexed throughout time, demographic parameters such as the annual reproductive output can be derived from numbers during autumn migration. Data on migration differentiated by age or sex give insight in selection processes during migration. Many environmental data are now easily available at the internet (including remote sensing data from satellites over the last decades) and can be used to interpret the data gained at ringing stations sometimes over more than half a century. In relation to parameters envisaged on route such as temperature, wind conditions, precipitation, changes in vegetation and land use, long-term ringing data can help to understand how climate and land use changes affect birds. Biometric data could reflect associated long-term changes in morphology. They may also be analysed with regard to selective forces (and there long-term changes) during migration on e.g. wing morphology in an inter- or intraspecific comparison. Mainly based on the long-term ringing data from the island of Helgoland (North Sea) the keynote will show how climate and other environmental changes might effect – besides phenology – body condition, morphology and population biology of migrants.

Latitudinal differences in long-term migratory change in the Willow Warbler (*Phylloscopus trochilus)*

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The geographical distribution of populations will make them differentially affected by global warming and Sweden's north to south orientation presents a great framework for studying latitudinal climate change effects. We present a long-term study on the migratory behaviour of two populations of different Willow Warbler subspecies (southern *Phylloscopus trochilus trochilus* and northern *P.t. acredula*). The material covers a 22-31year period and two study sites; the island of Gotland in southern Sweden (ringing data 1990-2012, breeding data 1992-93, 2011-13) and in northern Sweden, Haparanda (autumn ringing data 1982-2012). The Gotland ringing data allow to distinguish between locally hatched and migrating juveniles in autumn and the northern location of Haparanda ensures that only *acredula* is included in the ringing data. The spring passage over Gotland and the arrival of breeding females to the island have advanced,by 3.9 days and 6 days respectively. Male passage over Gotland is 6.5 days earlier than in the 1990s but has only advanced by 1 day in breeding birds, likely due to 2 years of below-average April temperatures. Egg-laying dates are 5 days earlier than in the 1990s. During autumn the median and individual passage of juveniles and adults in the north have remained unchanged or almost delayed, in contrast to Gotland where migrating juveniles pass 8.8 days earlier than in the 1990s. The median passage date of adult birds and appearance of locally hatched male young on Gotland in autumn has also advanced by 4.84 and 4.3 days respectively. The conclusion is that *trochilus* have advanced the breeding period on Gotland but not prolonged it. No spring migration is recorded at Haparanda, but another study at the same latitude found that spring arrival of northern *acredula* was delayed. This suggests that *acredula* is also keeping its time spent at the breeding areas constant, but in contrast to *trochilus*, is slightly delaying its timing.

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An ultra-rich, but homogenized, biodiversity hot-spot: a long-term study using ringing data at Eilat, Israel

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Biotic homogenization is a world-wide process driven by the replacement of rare and specialized species by widespread generalists, which results in increased similarity among neighboring and regional ecosystems over time. We addressed the issue of homogenization on the basis of a 40-years (1970-2009) bird ringing program of a migratory bird community in a renowned biodiversity hot spot and an important stop-over site for migratory bird populations at Eilat, Israel. In general, we recorded a decreasing differentiation of the breeding bird community during this long-term period. With the help of a pair-wise similarity analysis, we found that the mean similarity of the bird community between study years increased significantly during the study period. The main outcome of our study is that biotic homogenization should not necessarily be attributed to urbanization, and that can occur in a place with extraordinary high beta diversity of a migratory animal community over time.

Combining migration counts from several sites – a way to improve population monitoring by ringing stations

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Trapping of birds for ringing is often standardized at bird observatories and used as a surrogate for breeding bird surveys in population monitoring. The method is efficient and cost-effective and large samples can be gathered. This is particularly important for birds that cannot easily be monitored in their breeding ranges (some rare species or populations in distant regions with few human settlements). However, migration counts suffer from biases, mainly due to weather that masks true trends; even when a trend is steep it may take many years before it is accepted as statistically significant. Hence, an attractive thought is to combine data from several bird observatories, hoping that this removes some of the variation. In this paper I use the Pied Flycatcher *Ficedula hypoleuca* to compare migration counts with data from breeding bird surveys in Sweden. At two bird observatories, located in the very south of the country and covering a large part of the migration corridor of the species, trapping effort has been strictly standardized since 1980. The breeding bird surveys sample the whole country with both nestbox studies and representative line transects. First, I look at trapping data from one station and one season and then at the pooled data from the two stations. Both the breeding bird surveys and the ringing totals indicate similar population decline. Whereas the decline estimated by breeding surveys is highly significant, those at the bird observatories are not, or are only weakly significant. However, when data are pooled, the trend becomes statistically significant. Analysing data from several bird ringing sites may therefore be an efficient way to draw improved conclusions about population trends in the recruiting breeding areas.

s30-1k

Multi-year consistency of individual migration timing in Bar-tailed Godwits

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Photoperiod is thought to be an important synchroniser of circannual cycles in migratory birds. We have monitored the departure times on northward migration of individually-marked Bar-tailed Godwits (*Limosa lapponica baueri*) in New Zealand for six years, and tracked birds to their Alaskan breeding grounds via geolocators. This population shows very high intra-individual consistency in migration dates: while departures typically spanned almost 4 weeks, from early March to early April, despite variation in wind conditions between years individuals typically departed within the same week (median range of birds monitored for 4-6 years was 6 days), with one bird leaving on 12 or 13 March for 6 years running. This high level of individual consistency yet large population variation reflects the geographical range of the breeding grounds. Breeding sites span >1000 km north to south (70–60°N) and northern sites thaw on average 3.5 weeks later than southern sites. Southern-breeders generally leave New Zealand in early-mid March whereas northern breeders depart in late March or early April. This gradient in departure timing becomes stronger when birds depart their East Asian staging sites in April/May. Departure "decisions" at both initial fuelling and *en route* staging sites therefore anticipate a subsequent breeding schedule. This level of individual tailoring of migration dates is not explained by photoperiod *per se*, as all birds studied were at the same site so had identical environmental conditions. Instead, it implies that departure dates of individual birds reflect underlying differences in the interpretation of environmental signals, in particular photoperiod length. Current work is directed at using putatively neutral genetic markers (microsatellites) to look for population structuring associated with departure date. In addition we are assembling and annotating a godwit genomic sequence that will be used as the basis for association studies between variation in candidate genes and departure time phenotype.

s30-2k

Ecophysiology of the circannual clock in Spotted Munia, *Lonchura punctulata*

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The role of day length as a proximate cue for timing seasonal reproduction in temperate zone birds is well established. In the tropics, although almost all bird species investigated were found to be photosensitive, considering the small amplitude of the annual photocycle, for a long time it was thought inconceivable that birds here could depend on this cue. Subsequently, the concept of endogenous circannual mechanisms gained acceptance in tropical residents as well as in long distance migrants, but, these are not well understood. Subtropical Spotted Munia, with its clear cut circannual rhythms in 'information free' continuous illumination has emerged as an ideal model and we review our recent researches here. In this bird, circannual reproductive, molt and fattening cycles were shown to be synchronized by daily increments in light hours around the vernal equinox. The process of synchronization involves a phase delay. Experimental evidence was obtained in free running munias held on continuous illumination, that the underlying mechanisms involve gonado-inhibitory rather than the conventional gonado-stimulatory response to increasing day length through a temporary check by thyroid hormones on the photo-neuroendocrine locus. Expression profiles of thyroid hormone receptors are being studied. We also present evidence for a continuum of cue-use, the tropical munia populations, apparently, more photosensitive compared to their temperate conspecifics. The photoperiodic responses of Spotted Munia are distinctly different from that of any 'long-day' birds described thus far and do not conform to the prevalent 'circadian coincidence' model of photoperiodism. Comparisons with other Indian species indicate that birds in tropics have evolved diverse ways of handling the same photoperiodic information, both in degree and kind.

Do earlier birth dates in Pied flycatchers allow for rapid adaptation of laying to climate change?

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Global change imposes a major challenge for animals to adapt sufficiently fast to the high speed of habitat changes. A particular challenge in long-distance migrants is to maintain their annual timing in synchrony with shifts in their food phenology. For example, the timing of laying in pied flycatchers has not adapted to be in synchrony with the advanced food peaks in their seasonal breeding habitats, despite advanced egg laying. The major hypothesis to explain this apparently inadequate response is a rigid mechanism controlling timing of migration: i.e. an endogenous clock informed by environmental cues ("zeitgebers"). It is unknown if environmental cues like food or photoperiod during ontogeny also shape timing schedules. We hypothesised that birth date may causally affect individual timing later in life. In a large-scale field experiment (2009-2011) we delayed hatching of 200 Pied flycatcher (*Ficedula hypoleuca*) clutches by a week, and monitored arrival and laying dates when these birds recruited. We compared recruits born from delayed clutches to those from control clutches (not receiving this delay). Female recruits from delayed clutches started laying eggs later than control females in some, but not all years. This effect was not restricted to first-time breeding females. Variation in the occurrence and magnitude of the effects of timing may be caused by conditions in the year of the experiment or year of recruitment, e.g. conditions en route. Our results imply that earlier laying brings about an advance in the timing of the annual cycle of offspring. This ontogenetic mechanism of quick adjustment could explain observed trends in advanced laying. Whether this is enough to prevent populations to decline is yet unknown. It is important to establish what cue is causing this date effect, and whether limits exist in this type of adjustment to predict the future fate of long-distance migrants.

Avian annual temporal organization in a warming world

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Many birds pass through several life-history stages during a year, such as migration, reproduction and moult. Overlap of these stages may cause reduced fitness, therefore their annual rhythms must be synchronized not only to the environmental cycles, but also to one another. For birds, both photoperiod and temperature are considered important cues to time annual rhythms. However, the relative importance of each cue may vary with the rhythm in question. So, if temperatures increase according to climate change scenarios, what would happen with the timing of different annual stages? Could we expect unequal shifts among life history stages, thereby desynchronizing their seasonal rhythms? To unravel costs and mechanisms of mismatched stages we do field and laboratory studies with two model species: the all-year resident Great Tit (*Parus major*) and a migrant, the Pied Flycatcher (*Ficedula hypoleuca*). The relationship between termination of reproduction and onset of moult of Great Tits is investigated in aviaries using different temperatures treatments with a naturally increasing photoperiod. This is also explored using long term data of breeding and moult collected throughout the years from natural populations. Flycatchers are studied using combined field and laboratory approaches in which manipulations of timing are made to understand the interaction of different stages and flexibility of timing mechanisms. Collectively, our studies suggest that changes in temperature may have different effects on the timing of different stages, but this also differs between males and females. Therefore the costs that birds face in a warming world may not be equal for males and females. Our work points at the importance of studying how various annual stages may be linked when predicting the consequences of environmental change for wild animals.

Role of photoperiod and circannual rhythms in the control of seasonal events in food specialists Cardueline finches (Fringillidae)

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Availability of food on which the young depend is frequently the most important ultimate factor controlling the timing of breeding. The subfamily Carduelinae is remarkable for a wide scope of variability in the extent of specialization on eating seeds. Thus the subfamily is a good model in order to reveal the role of the main proximate and ultimate factors in regulation of seasonal events. Experimental studies of photoperiodic control of breeding, moult and migration have been carried out on 7 model species. They differ from each other in structure of annual cycles, type of territory behaviour and food specialization. Unpredictable crop, features and dates of bearing of the main food plants lead to development of unique features of annual cycles in some studied species such as: migration and sexual activity overlap, breeding and moult overlap, moult and migration overlap; change of breeding areas during the same breeding season; prolongation or recrudescence of sexual activity in moulting birds in response to high seed crop of the main food plants in late summer or early autumn; opportunistic winter breeding. The increasing day-length in spring stimulates development of sexual activity in all studied species and determines the species-specific duration of "conventional reproductive period" but in nature sexual activity is realized in breeding in conformity with dates and features of bearing of the main food plants. Some species developed specific earlier unknown features of photoperiodic reaction. In the only long-distance migrant species of this subfamily, the Common Rosefinch *Carpodacus erythrinus*, photoperiodic control of autumn migration was found. Photoperiodic control of moult has been revealed in all studied species. We will discuss possible ways of interactions of environmental photoperiod, circannual clocks and food supply in unusual situations in the annual cycles of food specialists.

s31-1k

Evolutionary feedback loops: population cycles as both a cause and consequence of individual variation in behavior

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A major problem in evolution is the maintenance of variation within populations, whereas a major problem in ecology is determining the factors that drive population cycles. These problems are brought together by the realization that population cycles, through density-dependent fitness tradeoffs, can maintain distinct behavioral types within a population. In turn, individual variation in behavior is often a major driver of ecological cycles. Here, we show that, in Western Bluebirds, changes in competitive and social environment influenced expression of dispersal behavior in the next generation which drove changes in population density over time. In turn, changes in population density maintained variation in dispersal behavior through density-dependent selection. The interdependence of dispersal, competitive behavior, social environment and density produced cyclical and intercorrelated changes in each of these components over time. Together, these amount to a feedback loop in which changes in population density are simultaneously a causal selective agent in shaping behavior and an ecological consequence of resulting changes in behavior. We suggest that such eco-evolutionary dynamics may be common because the fitness consequences of social and competitive behavior are frequently density-dependent, and ultimately this may account for the evolutionary origin and maintenance of adaptive behavioral strategies.

s31-2k

Spatial behaviour in the Great Tit: exploration, personality and dispersal

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Exploration of unfamiliar environments is an important component of dispersal and habitat selection, yet in many bird species we have only limited knowledge on this process. Somewhat paradoxically, the study of exploration behaviour in free-living populations have received a substantial boost from research on behavioural syndromes (or "personalities") that originated with captive animals. In several species including the Great Tit *Parus major*, activity in a novel environment is now used as a standard score for a behavioural syndrome involving different correlated behaviours. An increasing number of studies, on birds as well as other vertebrates, have shown that exploration scores correlate with individual variation in dispersal. However, the question remains whether these correlations reflect a direct causal link between exploration and dispersal, or are due to associations with other behaviours such as aggressiveness or habitat selection. I will report on our recent and ongoing work on great tits where we addressed this question using two main approaches. On one hand, we used observational and pedigree data to demonstrate that exploration behavior correlates with dispersal at both phenotypic and genotypic level, and that exploration score is associated with other spatial behaviours in the field as well. On the other hand, we are studying how exploration scores in a small, highly artificial environment can be used to predict exploration of larger and more complex environments, both in the lab and in the field. I will discuss results of these tests and their implications for the maintenance of variation in dispersal in natural populations.

Adaptive behavioural variation in social environments

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Over the last decades, it has become evident that between-individual differences in suites of correlated behaviours ("animal personalities" or "behavioural syndromes") characterize a broad range of animal taxa. Various adaptive hypotheses have been suggested, and empirically tested, for why natural selection might favour variation at this level of behavioural organisation. One key hypothesis predicts that personalities are favoured because social interactions lead to a diverse array of social niches. We use aggressiveness data of 12 nest box populations of wild great tits (*Parus major)*, to test whether patterns of between- and within-individual variation are indeed a function of the social environment. We further document the consequences of personality variation by asking whether the social environment affects behavioural phenotypes and how social environments affect fitness, and thereby reveal how the presence of personality structure affects evolutionary processes.

Does immobility in a novel environment predict breeding performance: a study of Great Tits in two different habitats

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Recent studies have shown that animal personality is related to individual fitness. However, individuals with similar personality traits may perform differently in different environments as has been shown in studies where individuals living in urbanized and rural habitats were compared. We hypothesized that immobility in a novel environment as a personality trait is related to birds' reproductive success and that it varies between different habitats. To test environmental effects on individual personalities we captured roosting female Great Tits before the breeding season from nest boxes in coniferous and deciduous habitats and kept them indoors for less than 24 hours. During this time we recorded their behaviour in an aviary in a novel environment experiment in which the immobility time of the bird was measured. Birds were released close to the place where they were captured and later their breeding performance was monitored. Contrary to the conjecture we found no difference in the immobility time between birds captured from coniferous and deciduous habitats. However, females with shorter immobility time were reproductively more successful with larger clutches and more fledglings than birds that tended to stay still in a novel environment for a greater amount of time. We also found that the immobility time in consecutive tests decreased once the bird was more familiar with the environment. Our findings suggest that habitat type does not affect the birds' interest in discovering a novel environment. However, we confirm the variation in reproductive success in birds with different personality traits. Overall, our results suggest that immobility measured in a novel environment may reflect the birds' ability to estimate local conditions and accordingly adapt their breeding effort.

s33-1k

Departure decisions in nocturnally migrating songbirds: when, in which direction, and why?

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During long distance migration, birds alternate relatively short periods of endurance flight with typically much longer periods refueling at stopover sites. The decisions of when to depart from a stopover site, and in which direction to continue migration, are crucial for migrants to arrive safe and in time at their migratory goal. We shall review the status of our knowledge about the daily departure decisions made by songbird migrants. Individual departure direction plays an important role, as it determines the nature of the landscape to be crossed. In all major flyways birds must make the decision whether to migrate across ecological barriers that are devoid of feeding opportunities. To make appropriate decisions birds must jointly incorporate internal information (body condition) and external information (wind support). Current knowledge of individual nocturnal departure times of migratory songbirds will be summarized. To date there is a surprisingly wide scatter of nocturnal departure times in studies from temperate-zone Europe. Though body condition and departure direction might explain some of the variability in the nocturnal departure time, it is possible that the length of the night and remaining migration distance play a part in this variability. Understanding the mechanisms of how birds decide to set off at a certain time of night determines the potential nocturnal flight duration. Early take-off and flight until sunrise should maximize a migrant's nocturnal travel range, thus defining the overall number of stopovers it must make. We argue that nocturnal departure time is a crucial variable shaping strongly the speed of migration that has been sorely neglected in both theory and study of migration.

s33-2k

Nocturnal departure decisions of individuals at ecological barriers

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Many long-distance songbird migrants encounter different types of ecological barriers. At these barriers, individuals must decide whether to stay, move to another site within the same stopover landscape or to resume migration. Upon departure, individuals can either cross or circumnavigate the barrier. Radar studies have revealed that at a broad-scale, there is considerable complexity and variability in behavior among species, locations, time of night and through the season. However, much less is known about individual fine-scale nocturnal decisions and movements prior to departure. We review the current knowledge about these phenomena focusing primarily on VHF telemetry studies of songbird migrants. These studies provide detailed local information about departure, but have also been used to track individuals regionally. Fine-scale departure decisions vary among species, but are related to extrinsic variables such as wind and barometric pressure. For most species, relationships with intrinsic factors (time since arrival, body condition, refueling rates and physiological state) are less well known. Our aim is to use knowledge about fine-scale nocturnal movements and corresponding departure events to develop general models that will help understand how intrinsic and extrinsic factors influence the departure decision in migrant songbirds. However, individuals likely trade-off time and risk when making decisions at ecological barriers, and we know these trade-offs vary considerably among species, time of night and time of year. Thus, the problem is complex, and becomes even more so when we consider migratory departure decisions on landscapes that vary in their ecological suitability for stopover.

Departure and flight behavior of migrants facing a large water crossing

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A large proportion of all migratory birds in the Nearctic-Neotropical migratory system likely encounter the Gulf of Mexico during migration. These birds respond differently to the prospect of a long water crossing, depending on their ability to weigh a variety of proximate intrinsic and extrinsic factors including experience, morphology, energy stores, local food availability, and weather. The objectives of a continuing study of this system include understanding how these factors likely govern departure decisions in a coastal setting and that link stopover sites widely separated by open water. We deployed automated radio telemetry systems along the northern Gulf coast and Yucatan peninsula in Mexico during the fall migration period from 2008 to 2013,to track the movements and activity of Red-eyed Vireos (*Vireo olivaceus*), Swainson's Thrushes (*Catharus ustulatus*), Wood Thrushes (*Hylocichla mustelina*), Gray Catbirds (*Dumetella carolinensis*), Indigo Buntings (*Passerina cyanea*) and Ruby-throated Hummingbirds (*Archilochus colubris*). To date, individuals of all species, except the Ruby-throated Hummingbird, that were radio tagged along the northern Gulf coast, were detected in Mexico, although the proportion detected varied among species. Wood Thrushes and Swainson's Thrushes had the highest detection rates (40% and 30%, respectively). Arrival of Swainson's Thrushes in Mexico was related to departure direction from the northern coast and body condition, but not age or wing length. Young Swainson's Thrushes migrating for the first time had shorter flight times across the gulf than adults. Swainson's Thrushes' body condition and wing length were not related to flight duration, although body condition influenced departure direction. Specifically, lean Swainson's Thrushes moved inland while fat Swainson's Thrushes were more likely to engage in trans-gulf migration. Some individuals of all species made reverse movements inland, although the reasons behind many of these movements remain unclear.

Optimal wind selectivity and flight orientation on departure among avian migrants – dependencies on prevailing wind conditions and flight distances

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Incident wind conditions often exert a strong influence on departure decisions of migrating birds, and on their subsequent orientation, including compensation for wind drift. We estimated optimal wind selectivity after civil dusk and subsequent flight orientation in three migration systems using individual-based models together with dynamic wind data, and compared model results with remote sensing data. Simulated long-distance passerine migration along the western European flyway indicated that both departing in prevailing unsupportive winds and partially compensating for drift on departure are important to maintain fast migration schedules and avoid the ocean barrier. This behaviour matched radar measurements of passerines departing for migration after civil dusk. Simulations of mass migration of songbirds across the North Sea, which were measured by radar, were indicative of selection of supportive winds and flexible and pro-active compensation for upcoming winds. Contrastingly, simulations of endurance flights by Great Snipes departing Sweden revealed that Africa could be reached reliably without compensating for incident wind on departure, with tailwinds on departure reducing required departure fuel loads. We conclude that both departure schedules and orientation strategies can depend strongly on both prevailing winds and flight distances. Finally, we discuss possible trade-offs between departure fuel loads and wind selectivity in light of fitness consequences.

Physiological conditions influence stopover decision in short-distance migrants

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Birds spend more than 80% of migration at stopover sites to rest and refuel. Because stopover has intrinsic costs in terms of energy and time, birds should try to minimize its duration, which depends on both external and internal factors such as endogenous programmes and physiological conditions. In previous studies on free-living long-distance migrant Garden Warblers *Sylvia borin*, whitethroat *Sylvia communis*, and Whinchat *Saxicola rubetra*, we found a strong correlation between indices of condition and migratory disposition, measured as the amount of nocturnal restlessness shown in registration cages overnight. These results were later confirmed by a whole-island telemetry study on garden warblers: birds in good conditions minimized actual stopover duration compared to birds in poor conditions. Here, we present the results of recent studies on the relationship between condition and migratory behaviour in birds that migrate over shorter distances. We focused on three short-distance migratory passerines: Black Redstart *Phoenicurus ochruros,* Robin *Erithacus rubecula* and Stonechat *Saxicola torquata*, which winter North of the Sahara. The study was conducted in the spring of 2011-2013 at our Research Station in Ponza, a major stopover site for trans-Mediterranean migrants. Migratory birds were caught in the morning with mist-nets and hosted overnight in custom-made cages to record the intensity of nocturnal restlessness (Zugunruhe). We found strong correlations between indicators of condition and Zugunruhe, with a pattern that was similar across the three species. In conclusion, our work shows that the physiological signals regulating the decision to prolong stopover or resume migration are similar in short and long-distance migrants.

Chernobyl, Fukushima and other hot places: biological consequences of nuclear accidents for avifauna

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Recent scientific studies of the plants and animals living in Chernobyl, Fukushima and other naturally radioactive regions around the world provide strong evidence that exposure to radionuclides in the environment can lead to elevated mutation rates, reduced fertility and longevity, increased rates of developmental abnormalities, tumors and cataracts, reduced biodiversity and population abundances, and even local extinction. Analysis of these findings indicate that there is no threshold radiation level below which biological consequences are not observed and that even very low levels of exposure can measurably impact natural populations, particularly following multiple generations of chronic exposure. A meta-analysis of published studies for populations in naturally radioactive regions of the world suggests some organisms can evolve resistance to radiation although there is no evidence for hormesis. A comparison of the impacts of radiation in Fukushima versus Chernobyl on identical passerine bird species suggests that 27 years of selection may have reduced population average sensitivity to mutagens. Curiously, historical mtDNA substitution rates within a taxon predict sensitivity and fitness consequences for a species' exposure to radiation. These findings will be discussed in light of recent deliberations concerning acceptable levels of exposure to radioactive materials stemming from nuclear technologies and the long-term ecological and evolutionary consequences of nuclear accidents.

s34-2k

Effects of radiation exposure on species diversity and population density of birds at Fukushima

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Birds are among the most radiosensitive organisms due to their high metabolic rate and hence high rate of ingestion of food, including radionuclides. The abundance and diversity of breeding birds at Fukushima were assessed using standard point counts at 400 sites varying in background radiation from 0.2 to 38.1 mSv/h. Both the abundance and the diversity of birds declined with increasing background radiation independent of confounding variables such as habitat, weather and time of day. Abundance and diversity declined with increasing contamination from 2011 to 2012, and this effect was independent of whether birds were associated with human habitation. Turnover in abundance of birds at census points between years was mainly explained by radiation and population density. The frequency of juvenile birds decreased at higher levels of radiation consistent with reduced reproductive success, and the frequency of singing birds increased at higher levels of radiation suggestive of differential female mortality. Several of these findings parallel the situation in Chernobyl.

Radioactive contamination of nest materials of Eurasian Tree Sparrows due to the Fukushima nuclear accident

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The 2011 Fukushima nuclear accident contaminated large areas of eastern and northeastern Japan, releasing vast amounts of radiation that are likely to have a negative impact on animal life. Cavity nesting birds may be at higher risk of radiation exposure because they build nests from materials that may be coated with radioactive particles. Here we investigated spatial and temporal changes in radioactive contamination of nest materials in the Eurasian Tree Sparrow *Passer montanus* from the breeding season of 2011 directly after the Fukushima nuclear accident to the next breeding season of 2012 in Ibaraki (175 km southwest of the plant) and Tokyo (222 km southwest of the plant). In Tokyo, γ radiation levels in nestboxes were lower than those in Ibaraki, where the levels of 2011 were higher than those of 2012. Further, the amount of radioactive Cs in each nest increased with the increase in nest weight, with a higher increment at Ibaraki than at Tokyo. These are the first data to suggest that γ radiation levels in nests could be higher in the breeding season directly after a nuclear accident than in later seasons, and that nest materials of birds can increase the radiation levels to which parents and their offspring are exposed in higher contaminated areas.

Fukushima radiation exposure & effects in birds

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The effects of acute external gamma-radiations on a wide range of organisms are well known, specifically under controlled conditions. However, the effects of chronic radionuclide exposure on wild organisms, living in their environment, are poorly understood. Such studies were undertaken after the recent Fukushima nuclear catastrophe to assess the effects of ionizing radiations on two wild bird species using nest-boxes (i.e. Varied Tit *Parus varius* and Great Tit *Parus major*). We investigated breeding performance (i.e. laying date, clutch size and fledgling size), phenotypic (i.e. body condition and carotenoid-based traits expression) and physiological (i.e. haematology, circulating carotenoid, oxidative stress, hormonal pattern, genotoxicity) individual variations in relation to external radiation level but also internal individual contamination, which may represent a contribution to total dose rate and thus an important part of the potentiel effects of ionizing radiations on wild organisms.

s35-1k

Causes and consequences of ontogenetic change in birds

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Evidence that avian life-histories are characterised by within-individual change in physiology, behaviour, reproductive performance and survival with age is rapidly increasing. Less is known, however, about the extent to which rates of ageing vary between individuals within species and populations, and about the causes or consequences of such variation. Quantifying these links is important for understanding the constraints and adaptive processes underlying the evolution of ageing and life-histories. In this talk, we (i) present a detailed case study of determinants of variation in rates of ageing in physiology, reproductive performance and survival in the long-lived Common Tern (*Sterna hirundo*), (ii) review studies that have similarly investigated determinants of ageing rates in various traits in birds, (iii) discuss whether current results comply with predictions from life-history theory, and (iv) suggest avenues for future ageing research using birds as model organisms.

s35-2k

Adaptive responses over the lifetime to ecological and social adversity in infancy

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Stressful environments encountered by animals early in development are known to have negative consequences over the long term, prejudicing adult survival and reproduction. However, most support for these effects in birds comes from experimental challenges to captive individuals and we still don't know how general these effects are in wild birds. When we tested for such effects in the Blue-footed Booby (*Sula nebouxii*) in two quite different contexts, we found developmental resilience, life history plasticity and intergenerational effects. (1) Nestlings that grew up submitting to daily aggression from an elder sibling and experiencing elevated circulating corticosterone, as well as reduced food intake and growth (followed by catch-up growth) performed just as well as their dominant siblings in terms of annual survival up to age 20 years, recruitment, annual breeding success up to age 16 years, natal dispersal, aggressive nest defence and immune responsiveness; but in the first few years of adult life they were slightly underweight and fledged offspring with poor prospects of recruiting. (2) Among 11 cohorts, nestlings that grew up in El Niño years, although underweight at fledging, recruited at a younger age and took more sabbaticals and, in the first 10 years at least, showed no deficit in longevity or breeding success; and daughters of females that experienced El Niño as nestlings showed improved breeding success. It may be important that minimization of costs through resilience, plasticity and intergenerational effects was documented in relation to environmental and social challenges of the nature and magnitude that this long-lived species routinely faces in the natural marine environment. Hopefully, we will also be able to present at the symposium our ongoing analysis of a possible Predictive Adaptive Response: superior performance in El Niño years of adults that experienced El Niño early in life.

Differences in the rate of improvement in reproductive performance of long-lived and shorter-lived Tree Swallows in New York, USA

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We report on patterns in reproductive histories of over 2500 Tree Swallow females in a 28-year nest-box study near Ithaca, New York. The reproductive careers of females on our study sites ranged from 1 to 10 years in length. Lay date is the single most important indicator of adult quality in Tree Swallows, and those females that had the longest reproductive careers (6 years or more) tended to start their reproductive careers in their first year with a later breeding attempt. By the second year, they were breeding earlier than average and remained earlier than the population mean throughout the rest of their reproductive histories. Birds with shorter life-spans improved in their laydates over time, but more gradually and not as strongly as did the longer-lived birds. Laydate interacts with many other life history traits, and in this talk we will explore how long-lived and shorter-lived females differed in their life-long trajectories in clutch size, chic growth rates, hatching success and fledging success, as well as how their patterns of movements and those of their offspring varied with age and how birds of different life-spans coped with inclement weather.

How does reproductive effort influence telomere length in the Blue Tit?

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Ageing constitutes a hot topic among researchers in evolutionary biology. This interest is not only due to observed variation between organisms but also due to the fact that this issue can be directly related to humans. There is accumulating evidence that telomeres, protective caps at the ends of chromosomes, shorten with age and this may potentially explain some of the observed variation in longevity. Somatic deterioration reflected in telomere decay in ageing animals may arise from allocation of resources in reproduction at the expense of repair and maintenance. Such presumption is based on the idea of trade-offs, which is essential to understand the evolution of life histories and ageing as a part of it. However, the link between telomere length and reproductive performance received surprisingly little attention.
The main question is whether increased reproductive effort impacts telomere loss. I analysed data gathered throughout a long-term (2003-2013) study of wild Blue Tits (*Cyanistes caeruleus*). An experimental brood size manipulation was applied: some broods were enlarged after clutch completion while others remained unaltered as a control. I sampled adults in the year of manipulation and in the subsequent year after recapturing survivors. This way I investigate the change of telomere length from one year to another. Preliminary findings show that, indeed, experimental birds suffer greater telomere shortening, and the outcome of manipulation on telomeres varies between years. I will discuss possible explanations for these intriguing results. Additionally, I will outline an impact of deteriorated nest conditions (e.g. increased sibling competition in experimentally enlarged broods) on telomere shortening by comparing the young reared in experimental and control nests.

Within-individual approach to sex ratio variation in breeding Common Terns: does experience matter?

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Sex allocation theory in bird species is being increasingly studied with long-term data of sex ratios, which are more robust against sporadic relationships and hint at individual patterns at the population level. However, the study of variance in brood sex ratios has limited potential to explain general trends, and so far consistent evidence of adaptive sex ratio manipulation is lacking. Alternatively, analyses of the variation within individual birds across years is a powerful method to determine the factors that influence brood sex ratio, since parents are expected to bias offspring sex according to their state and particular breeding situation. In the Common Tern (*Sterna hirundo*) previous comparisons at the between-individual level suggest the occurrence of sex ratio adjustment in relation to parental factors. Specifically, the proportion of daughters increased with brood size and maternal breeding experience, suggesting that the reproductive value of sons and daughters may vary and parents benefit from sex-biased investment under specific circumstances. Whether this is due to a decline in breeding performance or related to more experience is analysed based on individual trajectories of female common terns and their partners over an 11-year period. Moreover, analysis of within-individual sex ratio variation across first and replacement broods of the same pair and year also allows investigation of the effect of seasonality while removing effects attributable to individual birds. Thus, this within-individual approach to the relationships between brood sex ratio and parental factors provides valuable insights into individual investment in offspring of different sex, with likely consequences on individual fitness and demography.

s36-1k

The adaptive value of melanin-based color morphs: a role for the melanocortin system.

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The maintenance of genetic variation is a long-standing issue because the adaptive value of life history strategies associated with each genetic variant is usually unknown. Because in several species heritable melanin-based color morphs show different physiological and behavioral norms of reaction, color polymorphism is an appropriate system to investigate the proximate basis of adaptations. A recent genetic model suggests that pleiotropy could account for covariations between pigmentation, behaviour, morphology, physiology and life history traits. I will present recently published and unpublished data from two owl species about the role played by the melanocortin system in covariations between melanin-based color polymorphism and other phenotypic traits. Implications for understanding the adaptive value of color morphs are discussed.#

s36-2k

Redneck wonderland: maintenance of plumage colour diversity in a parrot species complex

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Rare cases of ring species, or circular overlaps, offer excellent opportunities to study speciation because they can reveal how clinal variation across interbreeding populations may lead to reproductive isolation. In an 8+ year study across southern Australia we measured phenotypic traits among multiple subspecies of the species complex *Platycercus elegans*. We focused on breeding pairs in two clinally varying populations/subspecies in order to evaluate the contribution of assortative mating to population divergence. Highly variable yellow-red plumage, based on psittacofulvin pigments unique to parrots, has hitherto been the only trait used to define subspecies, but we found no assortative mating for these pigmentary colours. Instead we found that variation in pigmentary colours was associated with climate (average rainfall) and was discordant with microsatellite variation, indicating a key role for selection in maintaining diversity. By contrast, the ultraviolet-blue structural coloration based on feather nanostructure showed assortative mating in both populations, and varied geographically, but this variation was distinct from the pigmentary coloration. Our results suggest that structural coloration provides more significant sexual signals than pigmentary coloration in this parrot, and in parrots in general. The possible role of disease in maintaining variability in this species complex is also discussed, along with how our findings may suggest refinements to Mayr's ring species hypothesis.

Amount of variation in multiple colouration traits within populations on a large spatial scale in the Pied Flycatcher (*Ficedula hypoleuca*)

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Colour polymorphism with a genetic background provides a visible proxy for genetic differences between populations and for changes in the composition of populations. Colour polymorphism thus presents an excellent opportunity to study evolutionary potential and evolution in action. There are relatively few studies on patterns of colour polymorphism on large geographical scales and even less attention has been paid to differences in the amount of variation of traits within populations across large scales. Variation around the mean within and among populations is nonetheless interesting as it is the raw material for selection. Potential for evolutionary change is largely dependent on the amount of variation present. On the other hand, variation within populations can reflect selection history. We analysed standardised data on male plumage colouration of the Pied Flycatcher from 19 populations across the breeding range. In this species males display multiple apparent ornaments, such as melanin-based dorsal colouration, a white forehead patch, and conspicuous white wing and tail patches. We were particularly interested in analysing the amount of variation in multiple phenotypic traits within populations across the breeding area. We studied the relationships between the coefficients of variation within populations, mean colouration traits and current selection on these traits. In addition, we investigated associations between the amount of variation in multiple colouration traits and variation in environmental conditions. We discuss the role of the amount of variation in plumage colouration reflecting evolutionary potential, the underlying processes leading to geographic variation, and what we can learn from large scale studies on colour polymorphism.

Causes and consequences of plumage polymorphism in the Common Buzzard *Buteo buteo*

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Discovering the mechanisms which maintain genetic polymorphisms in natural populations is a long-standing challenge for evolutionary biologists. In the common buzzard *Buteo buteo*, three plumage morphs exist and individuals with intermediately melanised plumage can have twice higher lifetime reproductive success than dark and light morphs. However, the functional cause of this advantage is not known. We have looked at a number of candidate explanations for these fitness differences. We demonstrate that morphs cannot be distinguished in their heterozygosity, based on 14 microsatellite loci, and thus inbreeding is an improbable reason for the heterozygote advantage. Buzzard juvenile dispersal was estimated from wing-tag resightings and is explained by plumage morph and the allele frequencies of three candidate genes for behavioural timing. Female buzzards of the intermediate morph also breed earlier than extreme morphs, and their nestlings had exceptional allele frequencies for one of the phenological candidate genes. Buzzard ectoparasite loads indicate that infestation is higher in darker plumage morphs. On the contrary, the malaria-like blood parasite *Leucocytozoon* exhibited lowest intensity of infection in dark nestlings. However, dark nestlings had a 15% higher probability of having a *Leucocytozoon* infection. Two immune-stimulation experiments show that differences in parasite infestation may be caused by different immune profiles of nestlings of different morphs. Overall, the results indicate that fitness differences between buzzard plumage morphs may arise mainly due to physiological differences which put extreme morphs at a disadvantage under diverse selection pressures, among which parasites may be particularly important. Such physiological differences may be rooted in the melanin metabolism or in a potentially complex genetic architecture of discrete morphs.

The Niche Expansion Hypothesis: a novel hypothesis to explain the maintenance of polymorphism for species with bi-parental care.

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We propose a novel hypothesis for the maintenance of colour polymorphism for species with bi-parental care. The Niche Expansion Hypothesis postulates that pairs which comprise of contrasting morphs would be better able to exploit a wider range of environmental conditions or prey than pairs containing the same morphs, and thereby have overall greater access to resources and thus higher reproductive output. This hypothesis, therefore, draws on similar theories which have been proposed to explain sexual dimorphism within raptors. Differences in resource use between morphs may occur because morphs may have differential foraging success in different habitats, in different weather conditions, or on different prey types. If so, we predict that over the course of the breeding season the cumulative prey deliveries would be higher or more regular for Mixed than Pure pairs and that reproductive output would also be higher. We test this hypothesis and these predictions using long-term (13 years) monitoring data from a polymorphic black sparrowhawk population on the Cape Peninsula, South Africa. We contrast reproductive output between Mixed than Pure pairs, and use remote cameras at nest sites to examine whether prey delivery rates differ between pairs comprising of contrasting or similar morphs.

s37-1k

Generating a bird genome resource: insights in the avian Tree Of Life, complex traits, and genome evolution.

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Here we will present a summary of an international avian genomes project led by investigators from BGI and other institutions worldwide. The project's core aims are to exploit this data in resolving the avian Tree of Life, characterizing avian genome evolution, exploring the genetic basis of complex traits and diseases, and to provide a public resource for the avian genomics community. In the initial phase of our project, we have collected or assembled the genomes of 48 avian species representing all Neognathae (Neoaves and Galloanseres) and several Palaeognathae orders. We inferred a resolved avian phylogeny that supports some previous controversial relationships, and reveals new ones. This includes identification of the initial Neoavian divergences, which was followed by a rapid radiation of species around the Cretaceous-Paleogene mass extinction event for other species 66 million years ago. We infer that the common ancestor of core (higher) landbirds was a predator, and this behavior was independently lost in parallel derived lineages. Other Neoavian traits that underwent parallel evolution in different lineages, two independent gains each of adaptation to aquatic environments and complex vocal learning. We found convergent sequence and gene regulation changes in the associated brain circuits of vocal learning bird species and humans, and they were enriched for genes involved in neural connectivity. Even though bird genomes have all the necessary genetics for these and other complex traits, they have a massive genome size reduction relative to other vertebrates, and this was explained by a massive erosion of repetitive elements, large segmental deletions, and some protein coding gene loss particularly for those that already had a sister paralogue in the genome. Currently we are in the second phase of the project, in which we are sequencing the genomes of at least one species of all avian families. With this data we aim to further resolve outstanding questions, and present a public resource. Overall, we hope that this project will help scientists make more rapid advances using avian genomes.

s37-2k

Conserved non-exonic elements: a new class of marker in avian phylogenomics

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Genome-wide markers in birds have the potential not only to resolve phylogenetic relationships but also to reveal molecular signatures underlying major adaptive innovations. Conserved non-exonic elements (CNEEs) are similar to ultraconserved elements (UCEs), but, unlike UCEs, they are identified and delimited by a specific statistical (Hidden Markov) model, rather than by BLAST searches, and are found entirely in non-coding regions of the genome. CNEEs are discovered using computational tools involving whole-genome alignments and a Hidden Markov model to measure patterns of constraint relative to a neutral baseline, suggesting they may contain considerable phylogenetic and functional genomic information. We used a 19-way vertebrate alignment, including new draft genomes from Emu (*Dromaius novaehollandiae*) and Chilean Tinamou (*Nothoprocta perdicaria*) to describe the evolutionary dynamics of CNEEs in birds and relatives. We identified over 600,000 CNEEs across vertebrates. Using 3,948 long (> 400 bp) CNEEs and species-tree methods such as MP-EST, we found that CNEEs gave good resolution of avian phylogeny and compared favorably to UCEs and introns analyzed across the same genomes. We then focused on CNEEs as markers for evolutionary innovation, using the evolution of feathers as a test case. To better understand the molecular basis of feather evolution, we surveyed the literature and found over 200 genes that have been implicated in feather development (feather-related genes or FRGs). We identified 10,983 CNEEs falling in the genomic vicinity of FRGs and used these to monitor the changes in regulatory innovation associated with these genes in various vertebrate clades. Our analysis suggests that CNEEs of FRGs have evolved dynamically throughout vertebrate evolution and experienced a spike in origination rates in the common ancestor of birds and also of amniotes. Our results suggest that, quantitatively, genomic innovations associated with feather evolution have been largely noncoding, and that CNEEs will be useful as phylogenomic markers.

Retroposon insertions are genome-wide witnesses of incomplete lineage sorting during the radiation of Neoaves

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Adaptive radiations in birds, such as the rapid diversifications of Darwin's finches or early Neoaves, are unique circumstances for the occurrence of incomplete lineage sorting (ILS). ILS is the persistence of a genetic polymorphism during multiple speciation events and the subsequent fixation of one allele per descending species. This results in hemiplasy, which is a distribution of homologous alleles violating the species tree. Insertions of retroposons, transposable elements that copy and paste via an RNA intermediate, have been previously used to detect ILS in the deep phylogenies of rodents as well as placental mammals. This is because presence/absence patterns of retroposon insertions exhibit very low levels of homoplasy and their discordances are restricted to very short internodes in phylogenetic trees, thus reflecting hemiplasy. Here, as part of the efforts in analyzing the first 48 bird genomes of the B10K project, we studied retroposon insertions on a genome-wide scale and across the breadth of the diversity of Neoaves. Our comprehensive data set of hundreds of retroposon markers located ILS-affected loci in bird genomes and provide evidence for a high degree of ILS in those parts of the neoavian tree that are most difficult to resolve in whole-genome sequence analyses, such as the position of owls. Simultaneously, we show that many nodes of the neoavian tree are either not or only marginally affected by ILS, which substantiates the topological findings of sequence-based analyses. Apart from being the hitherto largest retroposon-based phylogenomic analysis, our study provides unprecedented insights into the temporal and genomic extent of incomplete lineage sorting during early neoavian diversification, and promises to permit the reconstruction of the demography of the neoavian ancestor during diversification.

Regulatory mechanisms of the singing-related genome of songbirds

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The evolution of vocal learning among birds is not well understood. It seems that this trait evolved independently in three avian taxa, the hummingbirds, the parrots and the songbirds. The appearance of new technologies allows the sequencing of bird genomes which facilitates the understanding of molecular processes involved in development and activity of neural circuits controlling learned vocalizations. We compared genomic regulatory sequences of songbirds and non-songbirds based on genes differentially expressed in the song control area (HVC), by means of RNAseq- and microarray-data. These analyses show so far that vocal learning of songbirds is not simply explained by winning or loosing of protein coding genes since most of such genes that are up/down-regulated in HVC are found in genomes of vocal non-learning species. However, the appearance of new transcription binding sites of genes expressed in HVC and the appearance and loss of exons in songbird genomes compared to non-songbird genomes as well as molecules that are not conserved between species such as lncRNAs suggest taxa differences in the regulatory mechanisms that might lead to area-specific expression profiles, which characterize the HVC of songbirds.

s37-5

Avian Genomics: Current Status and Future Opportunities

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Our knowledge of avian genomes has increased rapidly over the past few years, culminating in the publication of the chicken genome in 2004, a milestone in avian genetics and evolutionary biology. This was followed by the Zebra Finch genome, an animal model for studies in neurobiology. Recent advances in DNA sequencing now make it possible to produce draft sequences of any vertebrate genome, quickly and cheaply. Using these technologies we have seen the completion of the genome sequences of the Turkey, Mallard Duck and many other avian species, 57 species completed so far. The annotation of the chicken genome has also been under continuous improvement, the latest revision (Ensembl build 71) has taken advantage of huge volumes of transcriptome data generated by RNA sequencing, in addition to the conventional comparative approaches. This combined approach provides improved gene models, which were validated by experimental information on expression. So far this has worked well for the coding genes and further improvements are expected for the non-coding RNA genes in next few months. Currently access to these genomes and annotations is through a number of international genome databases. However these advances in genome sequencing, genome assembly and annotation also bring problems associated with scalability. How do we assemble so many genomes? Should we continue to annotate each genome separately using RNA sequencing and comparative data? How should we access these data? Should we maintain separate genome databases for each species? I will review the current status of avian genome annotation and discuss some of these questions.

s38-1k

The interdependent evolution of the flight, feeding, respiratory and vocalization apparatus in birds: advances in 3D visualization and animation

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The capacity for flight imposes strict mechanical demands on the body construction of birds and, therefore, also influences the structure and function of all organs. This structural interdependence needs to be analyzed by studying the functional morphology of the various organs simultaneously in order to discover emergent properties and multiple roles of individual elements. This analytical approach has been significantly facilitated by recent advances in 3D imaging and animation to supplement functional morphological data. A virtual 3D model of the skeleton of a bird can be created from an x-ray CT scan with visualization computer programs and can subsequently be mobilized with animation computer programs. The configuration of such a mobilized 3D model can be matched to that of individual frames of an x-ray video taken of particular behaviors. The emerging animated 3D model allows the exact analysis of the movements by individual structural elements relative to each other. By adding the attachments points of muscles and ligaments to the skeletal elements of such a model, the muscle contraction pattern can be studied. Furthermore, recordings of various behavioral aspects, such as sound, EMG, pressure, etc., can be synchronized with the animated 3D model. The analysis of a 3D model combined with functional morphological data of songbirds and parrots revealed that (1) the integument of the neck not only ensures fusiform body contours needed during flight but also tunes the resonance of vocalizations; (2) the evolution of tonal vocalizations may be dependent of the configuration of the pterylosis of the neck; (3) the movements of the tongue and larynx are instrumental in adjusting the dimensions of the oro-pharyngo-esophageal cavity to tune the sounds generated by the syrinx; and (4) the evolution of complex vocalizations is dependent on certain configurations of the feeding apparatus.

s38-2k

Analysis of morphology and functions of jaw apparatus of Vietnamese Passerine birds (Passeriformes; Aves) helps us to specify their trophic adaptations and systematic position

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The biology of many forest birds of Southeast Asia is still poorly known, requiring extensive field study. Field data on the trophic features of Vietnamese forest Passerine birds were collated during ecological investigations of the Russian-Vietnamese Tropical Research Centre between 1989–2013. In this endeavour we applied an original method of morpho-functional analysis of the jaw apparatus that has proven to be extremely useful in interpreting our field data and hypothesize certain features of a bird's feeding biology in case direct observations were lacking. Our method includes a detailed description of the morphology of the jaw apparatus, with a subsequent biomechanical analysis of its mechanical properties allowing the investigation of the possible evolution of trophic adaptations in selected species and groups. A comparison of several congeneric species provides insight into the feeding adaptations within several genera of pycnonotid (bulbuls) and timaliid species and – on an even broader scale – between several families of Vietnamese Passerine birds. Besides data on pycnonotid (16 species) and timaliid (11 species) birds, data on selected representatives of "former families" (i.e. Corvidae, Rhipiduridae, Oriolidae, Campephagidae, Dicruridae, Chloropseidae, Irenidae, Monarchidae, Aegithinidae, Dicaeidae, Nectarinidae, Sturnidae, Muscicapidae and Zosteropidae) were selected to specify their trophical adaptations. Our data are used for the prediction of the ecological niches of species and their preferred habitat types, as well as their reactions to changes in the habitat. The results also show the degree of species or group specialization to the different trophic strategies, i.e. insectivory, frugivory, nectarivory, carnivory, granivory and herbivory. These recently collated data allow tracing the main routes of historical modifications of the basic trophical status of Passerines birds ,which is an adaptation to collecting small but abundant animal food. Based on these data several conclusions on the systematics of Old World Passerines are also presented

The songbird syrinx morphome: a three-dimensional, high-resolution, interactive morphological map of the Zebra Finch vocal organ

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Like human infants, songbirds learn their species-specific vocalizations through imitation learning. The birdsong system has emerged as a widely used experimental animal model for understanding the underlying neural mechanisms responsible for vocal production learning. However, how neural impulses are translated into precise motor behavior of the complex vocal organ (syrinx) to create song is poorly understood. First and foremost, we lack a detailed understanding of syringeal morphology. To fill this gap we combined non-invasive (high-field magnetic resonance imaging and micro-computed tomography) and invasive techniques (histology and micro-dissection) to construct the annotated high-resolution three-dimensional (3D) dataset, or morphome, of the Zebra Finch (*Taeniopygia guttata*) syrinx. We identified and annotated syringeal cartilage, bone, and musculature in situ in unprecedented detail. We provide interactive 3D models that greatly improve the communication of complex morphological data and of our understanding of syringeal function in general. Our results show that the syringeal skeleton is optimized for low weight driven by physiological constraints on song production. The present refinement of muscle organization and identity elucidates how apposed muscles actuate different syringeal elements. Our dataset allows for more precise predictions about muscle co-activation and synergies and has important implications for muscle activity and stimulation experiments. We also demonstrate how the syrinx can be stabilized during song to reduce mechanical noise and, as such, enhance repetitive execution of stereotypic motor patterns. In addition, we identify a cartilaginous structure suited to play a crucial role in the uncoupling of sound frequency and amplitude control, which permits a novel explanation to the evolutionary success of songbirds.

Peculiarities of deep dorsal thigh muscles in moa (Aves, Dinornithiformes)

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The so-called deep dorsal thigh muscles of birds underwent a number of modifications over the course of evolution from an archosaurian ancestor. Of five muscles, comprising the group, only *m. iliotrochantericus caudalis* is generally well developed. Other weaker muscles either assist the caudal iliotrochanteric muscle in inward rotation of the femur (*m. iliotrochantericus cranialis* and *m. i. medius*), or have stronger synergists in abduction (*m. iliofemoralis externus*) and outward rotation (*m. iliofemoralis internus*) of femur. The trend to better development of the last four muscles is displayed by large cursorial flightless birds, such as ratites. *M. iliotrochantericus caudalis* in Ostrich, Emu, Cassowary and Rhea is bulky and multipinnate. Moa have surpassed modern ratites in the development of deep dorsal thigh muscles. *M. iliofemoralis externus* of these birds was multipinnate at the origin; *mm. iliotrochanterici cranialis et medius*, although parallel-fibered, had larger bodies. Generally vestigial or altogether absent in modern birds, *m. iliotrochantericus internus* of the Moa was not only considerably larger; its point of insertion shifted from the medial surface of the femoral shaft to its cranial surface between the greater trochanter and *caput femoris*. None of the recent or extinct birds (including *Aepyornis*), to my knowledge, show a similar shift.

The pelvic system of birds and the origin of flight

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The acquisition of flight is an important step in the evolution of dinosaurs. Two classical hypotheses are invoked to explain its origin, the "arboreal" theory and the "cursorial" theory. In the cursorial theory, propulsion during take-off is fundamental, whereas in the arboreal theory, dampening the impact during landing is the main constraint. The integration of global kinematic data on the birds' center of mass, ground reaction forces, and aerodynamic data, allowed the quantification of the relative contribution of wings and legs during take-off and landing in two species of birds (*Taeniopygia guttata* and *Geopelia cuneata*). Our data demonstrated the prominent role of the legs in the propulsion during take-off and the force absorption during landing. A more detailed kinematic analysis, using X-ray methods (XROMM) revealed the importance of not only the legs but also of the trunk during these phases. The trunk is associated with the femur, highlighting the existence of two functional systems, the trunk and the femur on the one hand, and the distal part of the hindlimbs on the other hand. These functional links prompted us to analyze the relative proportions of the different trunk parts, and the correlations between the trunk and hindlimb segments proportions, among theropods. Morphological measurements were obtained on mounted-skeletons of modern birds and on paleontological reconstructions of fossils. The comparison of these two data sets provides new elements on the evolution of flight and of the morphological requirements for the origin of flight.

s39-1k

Ethno-ornithology and environmental ethics in the southernmost forests of the world

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I recorded bird calls, indigenous names and stories of these birds in the southernmost forests of world. In the *Multi-Ethnic Bird Guide of the sub-Antarctic forests of South America* (2010) a synthesis of these recordings, illustrations, and texts about the Mapuche and the Fuegian-Yahgan ethno-ornithological knowledge is presented. Based on these texts and audio-visual materials, I analyze here the ethical implications of these bird stories, from the perspective of biological conservation and environmental philosophy. To allow comparisons between indigenous and scientific ecological knowledge, I focus on two well-known metaphors: the *tree of life* and the *web of life*. The analysis of the *tree of life* metaphor allows us to conclude that both modern sciences and the indigenous cosmogonies affirm a common origin for birds and humans. This notion supports the *intrinsic value* of the avifauna, because birds are regarded as our evolutionary relatives. This implies that, to a certain degree, the life of birds should be subject to moral considerations based on ontological and ethical judgments commensurable with those involved in assessing the value of human life. The analysis of the *web of life* metaphor also reveals essential correspondences between scientific knowledge and indigenous Yahgan and Mapuche traditional ecological knowledge: both highlight the relevance of interactions among birds, humans, and the whole community of co-inhabitants. The ethical imperatives implicit in this metaphor are consistent with the notion of *instrumental value*. According to it, the conservation of birds can be regarded as an indispensable "instrument" for human well-being. Ancestral Amerindian ornithological knowledge and contemporary ecological sciences provide support for both the instrumental value and the intrinsic value of biodiversity. At the beginning of the 21st century, South America represents a reserve of biological and cultural diversity that offers unique opportunities to reorient global society toward more sustainable and integral lifestyles.

s39-2k

Ornithophilia, ornithophobia: encounters and dialogues in the human landscape

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This presentation examines the manifold meanings of encounters between people and avifauna within human landscapes of significance for conservation. Bird-human relationships ranging from the purely observational to the purely exploitative, specific to individuals and communities as well as cultures, present opportunities as well as risks for conservation science and praxis. The talk draws from ethno-ornithological examples in Honduras, the US, and elsewhere to make a case for adequate, inclusive, but realistic 'conservation dialogues.'

The bird people: Jívaro traditional beliefs, ecological knowledge, and conservation of birds in the Peruvian Amazon

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The Jívaro people, an Amazonian indigenous group in northern Peru and eastern Ecuador, are perhaps historically best known to outsiders for their traditional practice of shrinking human heads, but their cultural inheritance also includes extraordinarily rich knowledge of bird ecology, taxonomy, and behavior that is highly conducive to bird conservation. Birds and bird-human interactions are prominently featured in Jívaro traditional mythology and spirituality, as we will demonstrate through a brief presentation of selected Jívaro legends and stories from the published literature. This tradition is significant, as cultural attitudes towards birds may have a far greater effect on the success or failure of bird conservation than official protection, especially in low-income countries where there is a lack of funding or political will to educate people about the need for conservation or enforce protection. We will also present and discuss recent collaborative ecological research from the Cordillera de Colán, northern Peru, an area nationally and internationally recognized for its high bird diversity, which is inhabited and managed by Aguaruna-Jívaro communities. These communities effectively protect their titled land from colonization by immigrants and associated large-scale deforestation and land-conversion, and they also tightly control commercial hunting and logging. Community leaders have expressed interest in supporting formal forest and bird conservation efforts, in part by banning the harvest of birds whose populations are perceived to be in decline, and supporting the establishment of a formal protected area, the Santuario Nacional Cordillera de Colán, adjacent to their titled communities. The success of these efforts in protecting indigenous land tenure and rights as well as birds and habitat in a region of high biological importance appears to provide a model of joint cultural and ecological conservation, as Aguaruna-Jívaro residents perceive the persistence of healthy forest and forest bird communities and populations as critical to their own well-being.

The bird trade in Taiwan: an analysis of an Eastern pathway to biological invasions

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Most comparative studies in avian invasion biology have been carried out in the context of European introductions. However, the invasion processes in Eastern societies may be different from the Western context in terms of the composition, time and motivation for species translocation and introduction, for example prayer animal release, bird contests and caged birds culture. Our research aims to help address this bias by exploring the composition and characteristics of bird species in the exotic bird trade in Taiwan.
The invasion pathway is composed of a series of stages, each of which must be passed for an invasion to be successful, and each of which should be studied separately. Features of the early stages of invasion are key to understanding the whole invasion process. We therefore investigated the species composition, numbers of birds and their prices in pet markets in Taiwan. We identified 247 bird species (within 34 families) for sale in pet markets across the country. We used randomization and mixed-modeling techniques to assess non-randomness in the composition and characteristics of these species relative to the global avifauna. We also explored determinants of the prices of birds in the market. I will present the findings of these analyses, and discuss their implications in the context of the interaction of species availability and the unique societal demands.

Tiritiri Matangi Island, New Zealand: inspiring environmental stewardship though interactions with birds

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Tiritiri Matangi Island, New Zealand, has an international profile as a successful ecological restoration project. Following a long history of anthropogenic degradation, ecological restoration of the island commenced in 1984. Restoration actions have included a revegetation programme, the successful translocation of 11 native bird species to the island and the eradication of the Pacific rat (*Rattus exulans*). The restoration of the island had a specific aim of enhancing the habitat for indigenous bird species. Many New Zealand birds have threatened status, and the establishment of additional populations has been a critical conservation action for many species. The restoration of Tiritiri Matangi has resulted in the natural recovery of local species of indigenous birds, and allowed the translocation of others into the enhanced environment. Threatened bird species are often confined to remote or generally inaccessible reserves, and in such low numbers that sightings are improbable. On Tiritiri Matangi, birds are generally numerous and very conspicuous. This has allowed another restoration aim to be met – the provision for the New Zealand public to view indigenous bird species. The island has more than 30,000 visitors a year, many of whom experience close encounters with birds for the first time, or see rare and iconic bird species they have never seen before. Many visitors return regularly to the island, such is the significance of their experience. Feedback during guided walks attest to this experience providing ornithological enlightenment. A community group of island supporters allows those inspired by their experience to maintain an enduring relationship with the island and to extend their involvement into ornithological research. For visitors to Tiritiri Matangi, the up-close interaction with indigenous birds gives an appreciation of the importance of birds to the New Zealand environment, and facilitates environmental stewardship through application of conservation philosophies elsewhere.

s40-1k

Conserving migratory shorebirds in a rapidly changing world

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Millions of migratory shorebirds from Arctic Russia and Alaska winter in Australia and New Zealand. We have discovered population declines of staggering severity and rapidity, with some migratory shorebird populations crashing by up to 80% in 20 years. In Australia, migratory shorebirds are declining while resident species are not, suggesting that the causes for these declines may lie outside the country. Using satellite data we have documented startlingly rapid loss of intertidal wetlands in eastern Asia, a region known to be of critical importance as stopover habitat for many migratory shorebirds. Two-thirds of the habitat has disappeared in 50 years. Moreover, our modeling work suggests that future habitat loss through sea-level rise could have profound implications for shorebird populations at a flyway level. Finally, we briefly discuss some of the possible solutions to this difficult conservation problem, focusing specifically on the need for collaboration throughout the flyway and the possibility of creating or restoring lost habitat.

s40-2k

Migratory shorebirds in the Yellow Sea: status, threats, and conservation

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Linking breeding and nonbreeding grounds, stopping (stopover and staging) sites provide temporary rest or refuelling habitats for birds along their migratory routes, thus play important roles in the success of migration. The coastal wetlands in the Yellow Sea regions are critical stopping sites for over three million migratory shorebirds in more than 30 species along the East Asia-Australasian Flyway. Here we review the status, threats, and conservation of migratory shorebirds in the Yellow Sea region. Recent studies have indicated an obvious decline of migratory shorebirds along the Flyway and have linked the decline with the loss of stopping sites in the Yellow Sea. Field surveys on marked individuals have indicated that the survival rates of shorebirds decreased during migration while kept stable in the nonbreeding grounds over the past years, providing evidences of threats to shorebirds en routes. Currently, shorebirds are faced with multiple threats in the Yellow Sea region, including habitat loss by enclose of coastal wetlands for agricultural and industrial purpose, rapid spread of non-native *Spartina alterniflora* on the tidal flats, concentration of pollutants from adjacent regions and delivered by river flow, conflicts of use of tidal flats between human and shorebirds, and shrinkage of tidal flats caused by sea level rise and coastal erosion. Although governments and NGOs have recognized the threats to coastal wetlands and have taken actions to reduce or reverse the disadvantageous effects, more actions are required for conserving the irreplaceable stopping sites for shorebirds along the flyway.

Simultaneous decreases in shorebird summer survival suggest a flyway at risk

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We investigate how industrial developments along the Chinese coast coincided with changes in seasonal survival of three species of shorebirds (the Red Knot, Great Knot and Bar-tailed Godwit) that depend on sites along the Chinese coast to refuel during their migrations between the Siberian breeding grounds and the nonbreeding grounds in northwest Australia. Analysis of eight years of observations on colour-banded individuals shows that, whereas the survival in northwest Australia in late winter has been constantly high, the survival during the time away from Australia severely declined in all three species, with carry-overs after the return to the nonbreeding grounds. In combination with estimates of changes in stopover duration and refuelling rates of red knots staging in Bohai Bay, this strongly suggests that shorebirds are currently facing severe constraints when migrating through China.

Conserving Southeast Asian shorebirds in natural and anthropogenic habitats: an ecological and economic analysis

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The Inner Gulf of Thailand hosts tens of thousands of migrant and overwintering shorebirds, including the endangered Nordmann's Greenshank (*Tringa guttifer*) and the critically endangered Spoon-billed Sandpiper (*Eurynorhynchus pygmeus*). It also hosts globally important numbers of 19 shorebird species. These birds feed on extensive mudflats found in the Gulf and, at high tide, move inland to roost sites. It is generally believed that the birds once roosted in saltmarshes above the mangroves. Very little of these marshes remain, however, as much of the supratidal coastal fringe is now used for salt production and, in more recent years, aquaculture. While saltpans have long been recognised for their value to shorebirds, little is known about how the birds actually use this anthropogenic habitat and, more importantly, whether the increased rates of conversion of saltpans to aquaculture pose a serious threat to the shorebird populations that pass through or overwinter here. To address these issues, we undertook over 200 shorebird surveys in saltpans and aquaculture ponds to assess which species use these habitats. We compared behaviour and foraging success between saltpans, aquaculture, and natural mashes. We also administered questionnaires to landowners in order to elucidate the economic incentives and motives behind conversion of saltpans to aquaculture. We show that aquaculture is indeed bad for some shorebirds, but not all, and that the financial incentives to convert to aquaculture are high. We also show that there are also important differences in the distribution of benefits among land uses, and we discuss the policy options available to conservationists, including ways in which the aquaculture can be managed to minimise its negative impacts on shorebird populations.

International Cooperation in Migratory Waterbird Research and Conservation in the East-Asian Australasian Flyway

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The East Asian-Australasian Flyway (EAAF) embraces 22 countries, from Alaska and Arctic Far East Russia through East and South-east Asia to Australia and New Zealand and supports over 250 populations of migratory waterbirds, including cranes, ducks, shorebirds and seabirds. It contains the highest number of threatened and declining populations of any Flyway and these face a variety of pressures and threats as they migrate through the Flyway. Among the long-distance migrants, several species have declined precipitously in recent years, with some, such as Spoon-billed Sandpiper and Baer's Pochard on the verge of extinction. If present trends continue, this migration, which has existed for millennia, will be abruptly halted for many species within a generation. Migratory waterbirds are truly a shared biodiversity resource. Actions are needed to identify migratory patterns of different species and populations, critical sites for conservation and the variety, intensity and type of threats along the Flyway. Since this is a trans-boundary issue, it requires an international response. The East Asian – Australasian Flyway Partnership (EAAFP) brings together representatives of national governments along the Flyway, with international non-governmental organizations to address migratory waterbird conservation and combines a spatial approach to identifying a critical site network with working groups of specialists on individual waterbird groups and species. Critical to the development and implementation of effective conservation actions is timely and accessible science-based information. Yet data and research vary widely in their availability and accessibility across the countries of the Flyway. Capacity for data collection, targeted research and interpretation is similarly variable, as is the sharing of such information.

Mechanisms are urgently needed to encourage data-sharing, a prioritized, cooperative research agenda, capacity building and more effective linkages between research, monitoring and conservation policy and action throughout the countries of the Flyway

s41-1k

The Black Stork – a New "Kid on the (Contamination) Stage" – New and / or Previously Unnoticed Aspects of DDE Impact

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The contamination with DDT and its breakdown products as a potential cause of population decline of Black Stork have been studied in Europe since 2008. We have collected failed eggs from nests in Latvia, Estonia, Belarus, Poland, Czech Republic, Germany and Belgium. DDT or its breakdown products were found in all analyzed eggs. The ratio of DDT as a proportion of all DDT products increased the first three years of our research and then levelled out. Since the Black stork has not been mentioned as the species which was affected by DDT earlier we do not have information about critical contamination effects levels for this species. There are data however, suggesting that DDT contamination might have affected Black Stork historically. Our data suggest that the eggshell thickness reduction has not (yet) reached the levels described as critical for other affected species. However, we found significant DDE concentration was related to reduction of egg volumes which in turn negatively affect hatching probability – eggs smaller than certain size fail to hatch. The ratio of small eggs versus normal eggs has increased recently. For example, in 2013 for the first time a few entire clutches were below the volume-related hatching threshold. Another DDE-related impact is delay in egg laying. In DDE-contaminated females, the 1st egg is laid significantly later and the intervals between the subsequent eggs increase too. The data suggest that the negative impact of DDE is more completely expressed if the food supply is insufficient. This may affect survival of (young) females, which in turn result could result in a skewed population sex ratio.

s41-2k

Monitoring of contaminants and their effects in the Common Guillemot and the White-tailed Sea Eagle

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A main purpose in marine contaminant monitoring in Europe is to evaluate chemical status and environmental quality under the Marine Strategy Framework Directive, with the goal to monitor and achieve Good Environmental Status (GES). An important characteristic of a good matrix for monitoring purposes is its potential to detect temporal trends or differences between sites or levels in relation to a specified target value indicating GES. In Sweden we use muscle of Baltic herring (*Clupea harengus*) and eggs of Common Guillemot (*Uria aalge*) and White-tailed Sea Eagle (*Haliaeetus albicilla*) to study temporal changes in contaminant exposure and their effects. Herring is important in fisheries and has target levels set for contaminants in relation to GES. Adult Sea Eagle and Guillemot in the Baltic Sea are mainly stationary. Guillemot feeds largely on herring and Sea Eagle on fish and other fish-eaters such as cormorants, mergansers, gulls and seals. A higher trophic level may imply bio-magnification and e.g. DDE shows about 50 times higher concentrations in Guillemot compared to Herring, and about 400 times higher in Sea Eagle compared to Herring and 10 times higher to Guillemot. Eggs from Guillemot, stored frozen in the Swedish Environmental Specimen Bank, have been extensively used for retrospective temporal trend analyses for a large number of chemicals. Ideally, the matrix should also be possible to use for biological effect monitoring. Eggshell thickness, desiccation of eggs, productivity, fledgling weights are examples of effect parameters monitored in the Sea Eagle and Guillemot. Strong relationships between reproduction and residue concentrations of DDE and PCBs in the egg have been observed in the Sea Eagle. Currently, we see reproductive problems and egg desiccation locally among Sea Eagles, indicating an influence of contaminants on the northern Baltic coast and again highlighting the importance of apex predators as sentinels in environmental monitoring.

Fifty years after *Silent spring*: temporal and latitudinal trends of DDE in North American birds over the last three decades

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DDT was banned in the United States and Canada in the early 1970's, but continued to be used in agriculture in Mexico until the 1980s, and for malaria control until 2000. After 40 years since the DDT ban, it is of great interest to examine the fate and persistence of DDT and metabolites (i.e. p,p'-DDE) on birds. To assess how DDE impacted bird populations in North America since the DDT ban, we analyzed the results of nearly 300 studies published in the peer reviewed literature from 1980-2009. The objectives of this study were to determine if DDE concentrations had decreased in North American birds over a 30 year period, to examine if there were any longitudinal or latitudinal patterns in the distributions of DDE, and to determine if DDE concentrations in birds could be linked to global distillation of POPs or to the grasshopper effect. Our analysis suggests no strong overall linear trends of decreasing or increasing DDE concentrations with latitude. However, DDE concentrations were the highest in the central United States, and lower near northern Canada and southern Mexico. The test of a linear year effect was significant ($p < 0.0001$) indicating that as year increased, DDE concentrations decreased. When the data were divided by region, tests for a difference in both longitudinal and latitudinal trends were significant ($p < 0.001$), suggesting that concentration of DDE was decreasing at the same rate in all regions of North America. As expected, our results suggested that DDE residues are decreasing over time in birds from the low to mid-latitude regions. Most supported models suggest that DDE concentrations in birds were highest in the upper mid-latitudes (40°- 50°) than in other portions of North America.

Effects of contaminants on reproduction in the White-tailed Sea Eagle

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Poor breeding success was observed in coastal White-tailed Sea Eagles (WTSE) in Sweden already in the 1950s and eagle reproduction has been monitored annually since 1965. Feeding on fish and other fish-eaters such as mergansers, gulls and cormorants, WTSE become strongly exposed to persistent contaminants; e.g. DDE shows about 400 times higher concentrations in WTSE eggs compared to herring and near 10 times higher compared to eggs from guillemot. From 1989 the sea eagle has been included in the national Swedish environment monitoring program as a sentinel for effects from contaminants. Adult WTSE on the Baltic Sea coast are mainly stationary and thus reflect the regional contamination. Strong negative relationships between residue concentrations of DDE and PCBs in eagle egg and reproductive parameters have been observed. Over the 20-year period 1965-1985, the productivity of the population on the Baltic Sea coast was reduced by 80 %. Some 10 years after the bans of DDT and PCB in the 1970s WTSE reproduction began to improve and since the late 1990s productivity has almost reached historical background levels. However, a significantly higher occurrence of dead eggs in the nests in one region indicates that there were still effects remaining beyond year 2000. Currently, we again see reproductive problems and egg desiccation locally among sea eagles, indicating an influence of contaminants on the northern Baltic coast and again highlighting the importance of apex predators as sentinels in environmental monitoring.

Eggshell thickness, desiccation of eggs, breeding success, nestling brood size, productivity, fledgeling weights are examples of effect parameters monitored in this species. Eggshell thickness is an excellent indicator since it is affected at lower concentrations compared to the estimated threshold for effects on reproduction. WTSE productivity and shell thickness have been adopted as indicators in the implementation of the Marine Strategy Framework Directive (EU), and productivity within the HELCOM Coreset.

s41-5

Focal bird species in neotropical soybean and rice fields for pesticide registration purposes

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An overview of the methodology currently used to assess the acute and chronic (i.e. reproductive) risk posed by plant protection products to birds in Europe is provided. The procedure follows guidance published by the European Food Safety Authority-(EFSA 2009). The first step is the definition of so-called crop-specific focal species. The recommended methodology for collecting such data has been applied in neotropical arable habitats such as soybean fields and rice paddies in Brazil. It appeared to be suitable to derive focal species (i.e. species exposed to pesticides) also for this part of the world. However, the presence of different feeding guilds of birds in the neotropics compared to Europe (i.e. different exposure routes via contaminated diet)-will require some adaptation of the pesticide risk assessment procedure used in the EU for use in South America.

s42-1k

Nutritional wisdom: How do birds balance their food choices with the dynamics of fluctuating nutrient needs?

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The nutrient needs of birds changes dramatically across life history stages such as migration, molt or reproduction, and episodically due to stresses like challenges by pathogens. The ability of birds to change their food choices in order to match these changing requirements is well supported by studies using behavioral, physical (gut contents) and stable isotope approaches. The physiological mechanisms by which birds accomplish this balance depends on cellular sensors of nutrient status (e.g. mTOR) and transmission of information (hormonal, neuro) to fine tune the peripheral chemosensory system (taste, olfactory) and brain reward centers. This system permits regulation of the amount and balance of energy relative to select nutrients (e.g. amino acids, sodium, calcium). The dynamics of nutritional satisfaction are readily apparent following a pathogen challenge, which triggers an acute realignment of nutrient needs, food choices, and metabolic priorities. Although these changes undermine competing processes such as growth or reproduction, they contribute to protection of the host.

s42-2k

Biofilm grazing: missing link in shorebird ecology (satisfaction from "snot")

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Invertebrates, such as polychaetes and arthropods, were long considered principal prey of shorebirds. However, a new chapter in avian foraging and intertidal ecology opened with the discovery of a novel method of feeding by shorebirds on an unsuspected food (surficial biofilms, comprised of microalgae, bacteria and detritus enveloped in a mucus matrix). Evidence from a synthesis of ecological (stable isotopes), physiological (energy budgets), behavioral (foraging observations), morphological (feeding apparatus) and phylogenetic analyses demonstrate that a range of small (<50 g) shorebird species can obtain over 50% of their energy and nutrients from biofilm. Advantages of biofilm grazing include access to rich, rapidly replenished and ubiquitous food sources over an extensive geographical range. Further, this "missing trophic link" between biofilm and shorebirds could stabilize food web structures and enhance the stability of some shorebird populations. However, conservation concerns arise given that "mud" habitat supporting biofilm has not been regarded as essential.

The importance of salt-tolerance in the energetic trade-offs of migratory Dark-bellied Brent Geese

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Determining where and when density-dependent population regulation takes place is particularly challenging for populations of long-distance migrants. These animals live in what can be defined as a meta-ecosystem, a collection of spatially distinct habitats connected by the birds' flyway. We studied the migratory system of the Dark-bellied Brent goose (*Branta bernicla bernicla*) at the meta-ecosystem level. Brent are highly salt tolerant. More than any other goose species they are specialist grazers of intertidal and marine ecosystems, particularly eelgrass beds. The intertidal ecosystems that Brent traditionally rely on are in world-wide decline, and in recent years Brent have made increasing use of intensively managed agricultural land. A good understanding of the respective benefits and costs for foraging on marine and terrestrial habitats is essential to unravel the cause of these shifts in habitat use, as well as the implications of further degradation of intertidal habitat for this species.

In spring 2012, we equipped 30 Dark-bellied Brent geese staging in agricultural and saltmarsh habitats with novel high-duty cycle GPS and accelerometer loggers, by which we quantified year-round foraging activity. We find a strong preference of Brent for eelgrass habitats after returning from the arctic breeding grounds. GPS-data was complemented with detailed observational studies on intake rates and a monitoring program of plant quality. We determined energy budgets for individual birds by integrating information on time budgets, diet and microclimate, thereby testing the hypothesis that the high tolerance for salt provides energetic benefits for Brent. We find Brent regulate their body reserves mainly by adjusting their time spent foraging. Not only nutritional value, but also the temporal availability of resources determines habitat preferences of Brent. An important benefit of intertidal habitat is likely a high availability of resources during both day and night, as opposed to terrestrial habitat which can be safely visited only during the day.

Geese surfing the green wave: a comparison of three flyways differing in predictability

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Herbivorous birds are hypothesized to migrate along a gradient of plant profitability with the shift in the onset of spring towards their breeding grounds (*green wave hypothesis*). We used a comparative approach to see whether flyways differed in the predictability of spring conditions at stopovers along the route, and whether this was reflected in the degree to which birds were able to follow the green wave. We successfully tracked Barnacle Geese (*Branta leucopsis*) with solar Argos/GPS PTTs from their wintering grounds to Greenland ($N = 7$), Svalbard ($N = 21$) and Russia ($N = 12$). In all three flyways, we found the same pattern that the geese were not actually surfing but overtaking the green wave. The birds are thought to profit from fresh plant growth to build-up body stores along the way, enabling them to commence breeding soon after arrival on the breeding grounds (*capital breeding*). By doing so, they can time the hatching of young to coincide with the northernmost food peak, which they would otherwise miss. The predictability of climatic conditions along the flyways differed, mainly because of the presence or absence of ecological barriers, and the goose arrival at the breeding grounds was closer to the local onset of spring when this predictability was higher. This result suggests that a chain of correlations between climatic conditions at subsequent stopovers is enabling geese to closely track the green wave. Because climate is warming more rapidly in the Arctic than in the temperate region (*Arctic amplification*), the question arises whether this will affect the precision of avian migratory timing.

Interference competition in a sexually dimorphic shorebird: prey behaviour explains why the dominant sex suffers and the subordinate does not

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In social foragers, intake rates at increasing densities tend to become reduced by the direct and indirect effects of interference competition. During spring migration of a sexually dimorphic long distant migrant, field intake rates of female Bar-Tailed Godwits (*Limosa lapponica*), were lowered at increasing densities, but not so in the smaller subordinate males. Both sexes suffered from an increase in agonistic interactions as a function of density, but females suffered more than males. Consequently, females lost more foraging time from agonistic interactions than males, but this alone could not explain the density-dependent decrease in intake rate. Lugworms (*Arenicola marina*) contributed 71% energy to the diet of females; males foraged on smaller worms. As these worms are large, mobile and deeply buried prey, we tested whether prey behaviour contributed to the sex differences in interference. Both in field, and during laboratory experiments, lugworms indeed responded to the presence of probing predators by retreating deeper into their burrows. In the field we found that in experimentally-probed plots they produced fewer casts per unit time, indicating a decrease in the surface activity of the worms. In the laboratory, increased experimental probing intensity resulted in deeper burying. In captivity we then determined the functional response of females, with burying depth as a factor. Burying depth decreased intake rate due to increased searching time rather than handling time. We argue that resource depression is responsible for the reduced intake rates for females at high densities. The search for undisturbed lugworms would explain why females forage especially along the moving waterline. In a species as sexually dimorphic as bar-tailed godwits, intraspecific competition mainly occurs within the sexes.

s43-1k

Antimicrobial functions of avian eggshells in an ecological context.

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Avian eggs are at risk of infection by microbes that colonize nests and parents. A large number of parental defense mechanisms has evolved in response to the severe costs and decreased fitness imposed by microbial infection. The eggshell's cuticle is an important component of the natural defenses against microbes, and its role in preventing contamination by microorganisms has been long known in domestic chickens. However, the exact mechanisms whereby the cuticle prevents bacterial attachment and/or penetration have not been clearly identified. Moreover, whether variation in cuticular structure and/or antimicrobial efficacy varies with nesting habitat is unknown. We predict that eggs of birds nesting where microbial growth may be higher (e.g. wet habitats), should have stronger antimicrobial defenses than those in less risky habitats. Here we use scanning electron microscopy and experimental tests to compare cuticular structure and antimicrobial efficacy of eggshells from birds with diverse nesting ecologies. We have identified nanometer-scale cuticular spheres that reduce microbial attachment and penetration in eggs of some birds with high risks of infection. These appear to have convergently evolved in diverse clades that nest in wet or otherwise risky habitats.

s43-2k

Linking gut microbiota composition to life-history and individual quality of arctic-breeding shorebirds

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Arctic-breeding shorebirds use different portions of the world to breed, stage and winter, and migrate long distances over a large variety of habitats. These life history traits expose them to a wide variety of microorganisms through diet, flocking and other trophic interactions. Gut microbiota can affect organism health by facilitating nutrient uptake or by interactions with the immune system. Changes in gut microbial community lead to a variety of diseases in mammals, but little is known about how changes in environmental microbial communities influence bird health. Health is a challenging parameter to measure in free-living birds. A first step in assessing how changes in gut microbiota impact arctic-breeding shorebirds on a population level is to relate variation in shorebird gut microbial communities to key life-history characteristics including migration route, mating system, age and sex. To investigate how gut microbiota influences birds on an individual level, we can relate gut microbiota variation to demographic parameters reflecting individual quality, such as breeding success and body condition. In 2011, collaborators of the Arctic Shorebird Demographics Network collected 624 fecal samples from 11 shorebird species at 11 arctic sites in northern Alaska and Canada. In addition, we collected data on breeding parameters (e.g. initiation date, incubation time, nest success), body mass and biometrics of each individual bird. The bacterial communities of a subset of 540 fecal samples were sequenced using the Illumina high-throughput sequencing platform, resulting in a total of over 40 million sequences. We will discuss similarities and differences of gut microbiota within and among individuals and species and relate these patterns to individual qualities and life-history characteristics. Lastly we will discuss the implications of our results for shorebird and human health in the Western Hemisphere by describing prevalence and relative abundance of several bacterial pathogens.

Body condition and immune status as potential risk factors for avian influenza virus infection in migratory birds

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Similar to some other infectious diseases, the prevalence of low pathogenic avian influenza viruses (LPAIV) in wild birds exhibits marked seasonal variation. Understanding these dynamics and variations in individuals' susceptibility to infection is fundamental to the study of avian epidemiology. By comprehensively sampling Mallard Ducks *Anas platyrhynchos* through a complete annual cycle and at a relatively small spatial scale, we found a large peak in autumn. The autumn peak was likely driven by the arrival of migratory birds, which had a higher LPAIV infection risk and tended to show lower prevalence of antibodies to AIV than resident birds. During this peak of infection, we collected a range of samples to assess whether body condition, immunity or both could potentially explain increased susceptibility to LPAIV infection in migratory birds. We collected serum samples and blood smears, biometric measurements and determined the age and sex of at least 50 individuals per month. Serum samples were tested for concentrations of non-subtype specific AIV antibodies, natural antibodies and haptoglobin. H:L ratios were assessed using the blood smears. Body mass was corrected for structural size to serve as an index of condition.

We found that LPAIV infection risk was higher in lighter birds, with migrants being on average lighter than residents. Otherwise, no profound differences between infected and non-infected birds emerged, general immune status seemingly not impacting LPAIV infection risk.

However, migrants may potentially be naïve to specific LPAIV subtypes circulating on the wintering grounds. Indeed subtype H3N8, to which migrants might have been naïve, was notably present at the wintering grounds before the migrants' arrival. Assessment of (pending) subtype specific AIV antibodies will provide further insight into the factors that make migratory birds more susceptible to LPAIV infections relative to resident birds when arriving at the wintering grounds.

Decision to breed in tropical Red-capped Lark (*calandrella cinerea*) is a balance between reproduction and adequate immune defense against disease

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A trade-off is thought to exist between two life history components: immune defense and reproduction. Birds have to allocate limited resources between these two important processes. When birds increase their reproductive output, they are hypothesised to decrease investment in immune defense, thereby increasing susceptibility to infectious organisms. Disease risk - and thereby the cost of maintaining an adequate immune defense against disease and parasitic infections - are thought to vary with environmental conditions. Measures of immunity in birds have been shown to have a positive association with precipitation and negative association with aridity. We examined the existence of trade-off between reproduction and immune defense within the same and across different tropical environmental conditions. We measured haptoglobin levels in blood samples from non-breeding, incubating and chick-feeding red-capped larks (*Calandrella cinerea*) occuring in three Kenyan environments, characterised by different pattern of rainfall and temperature: warm and dry, warm and wet, and cool and wet. The more messic cool and wet environment is expected to have an increased risk of disease compared to the other two environments. A comparison of different breeding stages within the cool and wet environment showed that non-breeding birds had significantly higher haptoglobin concentrations than chick-feeding birds. This pattern was, however, not observed in the other two environments. Across environments, there was a location effect on breeding stage: non-breeding birds from the cool and wet environment had significantly higher haptoglobin concentration than their corresponding group in the warm and wet environment. There was no location effect between the warm and dry and the warm and wet environments. This results demonstrate, 1) resources allocated to reproduction are unavailable to the maintenance of immune defense, and 2) that birds, in the case of the cool and wet environment, can adjust their immune response based on the pathogenic pressures prevailing in their environment.

s44-1k

Early evolution of birds: perspectives from new fossil discoveries in China

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New discoveries of fossil birds belonging to the Jehol Biota, uncovered from Lower Cretaceous lacustrine deposits in northeastern China, continue to greatly enrich our understanding of the first major avian radiation, providing further information on the evolution of early bird cranial morphology, wing and tail plumage, flight capability, diet, locomotion, habitat, and development. The exceptional preservation of some fossils also provides a rare chance to discuss many biological issues that are usually impossible to address in paleontological studies: the color of feathers in early birds can now be partially reconstructed due to the recognition of preserved melanosomes; the development of the sternum in the extinct group Enantiornithes has been reconstructed, revealing a unique pattern unlike that of modern birds and all other archosaurs; the discovery of preserved crop contents in several Early Cretaceous birds suggests that a near modern digestive tract including specialized crop morphologies evolved early during avian evolution; the rare preservation of ovarian follicles provides evidence concerning the evolution of reproductive behaviour across the dinosaur-avian transition supporting hypotheses that the right ovary was lost in Aves due to the limitations of flight, and together with histological evidence, the gender of some fossil birds can now be accurately determined, providing new insights regarding sexual differentiation in early birds.

s44-2k

Fossils, molecular calibrations, and the divergence of crown group birds

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There still exists much uncertainty about the timing of the initial divergences amongst crown group birds, and the exact extent of this diversification before the Cretaceous/Tertiary boundary. Based on calibrations of molecular phylogenies and on biogeographic considerations, it has been argued that a substantial diversification occurred in the late Cretaceous. Interpretations of the fossil record, by contrast, rather indicate a Cenozoic diversification of most higher-level crown group taxa. I will address some aspects of the avian fossil record that bear on the divergence time of crown group birds. I shall show that a diversification of extant higher-level clades almost certainly did already occur in the latest Cretaceous. However, there exists no convincing evidence for a Cretaceous diversification of morphologically homogenous lower-rank taxa, such as Passeriformes, and the results of recent sequenced-based hypotheses that suggest otherwise are due to the choice of inappropriate calibration points.

Mid-Cenozoic avifaunas and their bearing on the evolution of extant lineages: an example from the Miocene of Europe

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Since the 19th century the fossil localities grouped under the name "Saint-Gérand-le-Puy" in the Allier Basin of central France have yielded a remarkable terrestrial fauna including a diverse range of avian remains. Recent research on these Late Oligocene–Early Miocene (ca. 24–20 mya) faunas has revealed that many of these birds occupy early diverging positions within their respective taxonomic groups. The less derived morphology of these birds has procured a framework for unravelling character evolution and ancestral morphologies in family-level crown group taxa. The "Saint-Gérand-le-Puy" avifauna has also been crucial in assessing European faunal turnovers over the mid-Cenozoic. The gradual replacement of this primitive bird fauna by that now found in Europe seems to have been already underway in the Middle Miocene. The unusual biogeographic occurrences of several tropical taxa such as mousebirds and trogons attest to the relictual distribution of many birds. These findings indicate that the distribution of birds today does not reflect ancient patterns, a phenomenon that has been found at other Early Miocene localities worldwide – a Hoatzin from sub-Saharan Africa being a notable example. This overview of recent assessments of the avifauna of "Saint-Gérand-le-Puy" aims at integrating phylogenetic, biological, and biogeographical hypotheses, which bear directly on the evolution of extant lineages.

Demise of the giants: the role of the biological drivers for the flightless, wing-propelled divers

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Four clades of flightless, wing-propelled diving birds (Sphenisciformes, Plotopteridae, Mancallinae, and *Pinguinus*) evolved during the Cenozoic. The demise of "giant" forms is one of the unresolved questions in their evolutionary histories. Plotopteridae and Sphenisciformes include giant forms that reached lengths and masses much larger than the living *Aptenodytes forsteri* (Emperor Penguin). Their large body sizes must be suited to long-distance swimming and to deep-diving, giving them better chance of survival. Contrary to Cope's Rule, the largest species of these diving birds had disappeared from the lineages after having thrived from the late Eocene to late Oligocene. The coincidental parallel demise of giant forms in the Northern and Southern Hemispheres induced a common competition hypothesis, which suggested that the evolution of marine mammals might explain extinction through competitive displacement. Such an idea is here assessed via taxonomic diversity (i.e., richness) trends from the fossil record reported in the Paleobiology Database. From the late Oligocene to early Miocene (28.4-20.43 Ma), flightless divers and marine mammals show contrasting diversity patterns at global to basin scales; diving birds decreased in diversity with increase in marine mammal diversity, especially Odontoceti. These patterns are not compositional and do not result from scaling effects. We propose that these contrasting patterns suggest competitive interactions between flightless divers and Odontoceti from the late Oligocene to early Miocene. The similar diversity patterns among marine mammals in both global and regional trends imply a role for common evolutionary drivers as previously suggested for the crown Cetacea (or Neoceti) evolution. Flightless divers lack a shared diversity pattern, whether with marine mammals or within the flightless diving birds. The extinction of Plotopteridae and stem-Sphenisciformes in the Pacific Ocean was possibly biologically induced, while other patterns amongst flightless, wing-propelled diving birds probably represent both physical and biological drivers.

Fossil evidence for the evolution of the avian hyo-lingual feeding

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Living birds show a broad diversity in hyoid and tongue morphologies associated with specialized feeding in many taxa, e.g., waterfowl, woodpecker, hummingbird, and parrot. Remarkable features regarding the hyo-lingual apparatus of birds include the well-ossified hyoid subcomponents (i.e., paraglossal, basihyal, urohyal, ceratobranchial and epibranchial); the unique way of hyoid suspension from the skull; as well as the derived muscles associated with the bony hyoid in moving the tongue, which is the key for food transportation in birds. When and how these derived features and functions regarding the hyo-lingual apparatus evolved during avian evolution is largely unexplored. Although bony hyoids are known to be preserved in fossil records frequently both in avialans and non-avian dinosaurs, they have never been systematically evaluated regarding the evolution of tongue function in early birds. Here, we examine a large number of Mesozoic fossil birds and non-avian dinosaurs with hyoid preservation, combined with data revealed by high-contrast CT (computed tomography) imaging from living birds to explore the origin of avian tongue function. Our results clearly indicate a progressive cranial shift of tongue bone relative to the skull in avialans relative to non-avian dinosaurs; two divergent solutions are observed from the different hyoid morphologies between more basal avialans (e.g., enantiornithines) and early ornithurines in hyoid suspension. The further elaboration of bony elements in tongue appears to have occurred well after the origin of flight and close to the crown birds. Body size change, elongation of neck, as well as dietary shifts appear to be associated with the evolution of avian hyo-lingual feeding.

s45-1k

What's a warbler? Phylogeny of the Old World "Sylviidae" complex

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The old world warblers are a large group of passerines formerly grouped together in the family Sylviidae. This group was composed of several hundred species, ranging in all parts of Africa, Eurasia and the Indo- Pacific, and for a long time they were thought to be one of the most diverse groups of passerines in the Old World. This situation changed drastically with the development of molecular phylogenies that demonstrated the non-monophyly of the group, clarified its intricate morphological evolution, and provided some compelling biogeographic hypotheses. As a result, many species are now placed in different families. The case of the name "Sylviidae" is by itself a complex one because of the phylogenetic affinities of the type bearing the genus *Sylvia*. The history of the classification of this group reflects the problems of dealing with morphological similarities and homoplasies. It provides a good example of the challenge of the current phylogenetic classification, favoring nomenclatural stability while ensuring that the names refer to meaningful natural groups.

s45-2k

What can we learn from the molecular systematics, phylogeography, and speciation genetics of Taiwanese birds?

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In the past decade, molecular data have been extensively used to re-evaluate the systematics and evolutionary history of East Asian birds. As a continental island along the coast of East Asia, Taiwan, characterized by heterogeneous topology and ecological environments, hosts more than 163 resident avian species including 78 endemic sub/species. Recent taxonomic studies based on molecular data indicate that all the Taiwanese endemic subspecies examined either form independent clades in phylogenetic trees or have a distinct genetic characterization. This implies that the avian diversity of East Asia could be highly underestimated by traditional taxonomic approaches that are rarely based on strict criteria. In addition, results of phylogeographic analyses have revealed close relationships between Taiwanese taxa and species from diverse regions spreading over East and Southeastern Asia, suggesting that resident birds in Taiwan have multiple origins. Therefore, the dynamics of East Asian birds' historical ranges could be complicated. Recent studies commonly reveal post-divergence gene flow between Taiwanese taxa and their continental counterparts, implying that the strict allopatric speciation might not be the norm for avian speciation and the role of ecological selection in their speciation. In contrast, evidence of strict allopatric speciation is still found in highland species that are disjunctively distributed in Taiwan and the Tibetan Plateau. It denotes the importance of habitat isolation in speciation of high-altitudinal species rendered by climate warming since the Pleistocene glaciation ended approximately 410 thousand years ago. Overall, the advances in molecular systematics and phylogeography, and speciation demography of Taiwanese birds have provided novel insights to the evolution of East Asian avian species. Currently, studies focusing on speciation of Taiwan birds on the basis of genomic data are launched and will improve our understanding about how ecologically divergent selection has molded the diversification of birds in East Asia.

Molecular systematics and diversification of the Asian scimitar babblers (Timaliidae, Aves)

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The Asian scimitar babblers, including the genus *Pomatorhinus* and *Xiphirhynchus*, are a small group of babblers characterized by long down-curved bills and a distribution throughout East and Southeast Asia. To infer the molecular phylogeny of this group and their divergence time, we examined sequences of multiple fragments including two entire mitochondrial genes and four nuclear introns (4352bp in total) from multiple samples of eight of the nine recognized species of Asian scimitar babblers. The phylogeny resulting from the concatenated multi-locus dataset suggests that *Pomatorhinus* is paraphyletic. Due to its paraphyly, we propose dividing the traditional genus *Pomatorhinus* into two morphologically and genetically diagnosable genera: *Pomatorhinus* and *Erythrogenys*. Results of the molecular dating based on the conventional mitochondrial DNA divergence rate indicates that the diversification of these babblers is likely congruent with the historical climatic events. Our findings shed light on the diversification of avian species in southern Asia, a poorly studied biodiversity hotspot.

Speciation in Eurasian Wagtails (Aves:*Motacilla*): inferring phylogeny, delimiting species, and estimating gene flow using RAD-seq data.

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The use of next generation sequencing techniques to answer questions in phylogeography and phylogenetics is relatively new. Here I explore the use of reduced-representation genome sequencing to answer questions about inter- and intra-specific relationships in the passerine genus *Motacilla*. Relationships within this group are unclear, as the current taxonomy does not reflect the mitochondrial gene tree. Of the 11 recognized *Motacilla* species, the Yellow and White Wagtail species are continuously distributed across Eurasia during the breeding season and exhibit high levels of geographic variation in plumage signaling color within species. Eurasia is a range of enormous east-west expanse, but with few current major geographic barriers to migratory birds. Major climate changes caused by cyclical glaciation in the Pleistocene may have resulted in differentiation due to genetic drift and natural selection in isolation. Refugial areas are thought to have existed in western, eastern, and southern regions of Eurasia. To understand what forces are involved in genetic and phenotypic divergence, I constructed a a species tree, conducted species delimitation, and estimated levels of intra- and inter- specific gene flow in *Motacilla*.

s45-5

Diversification and the adaptive radiation of the Parrotbills in Asia

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Since Darwin's era, adaptive radiation has been referred to as remarkable evidence of evolutionary changes in which a lineage has diversified rapidly into multiple new species, particularly when environmental changes gave rise to novel ecological opportunities and new resources. Comprising more than 3500 species, members of the Passerida probably make up a dominant proportion of perching bird communities in the Old World and thus provide many research opportunities to obtain a better understanding of continental radiation. In this study, we investigated the diversification pattern of the parrotbills (family Paradoxornithidae), a monophyletic group of small passerines within the Sylvoidea in Passerida in East Asia. We particularly tested whether the main driver of divergence in parrotbills was adaptive divergence e.g. along niche gradients or allopatric divergence, or whether these two drivers of diversification varied/changed through time. On the basis of a time-calibrated phylogeny, we reconstructed morphological and ecological niche evolution within parrotbills. While we found an early evolution in size followed by a slow-down, differences in elevation occurred rather late within subclades with a peak at 5-7 Ma, which was contemporaneous with increased uplift of Himalayan mountains. Overall this study indicates that both the partitioning of eco-morphological niche and ecological opportunity may play important roles in the diversification of Passerida on a regional scale.

s46-1k

Aesthetic evolution by mate choice: Darwin's *really* dangerous idea

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Darwin proposed an explicitly aesthetic theory of sexual selection in which he described mating preferences as a "taste for the beautiful" and "aesthetic capacity". In his criticism of sexual selection, A. R. Wallace proposed an alternative mechanism of the evolution of mating preference for display traits that are correlated with male vigor or viability, but he called this mechanism natural selection. Modern adaptive sexual selection theory relies on essentially the same Neo-Wallacean theory renamed as sexual selection. The modern version of genuinely Darwinian sexual selection theory is the Lande-Kirkpatrick null model which describes the coevolution of traits and preferences in the absence of natural selection on preference. The LK null model predicts the evolution of arbitrary display traits that are neither honest nor dishonest, indicate nothing other than mating availability, and lack any meaning or design other than their potential to correspond to mating preferences. The current standard for demonstrating an arbitrary trait is impossible to meet because it requires proof of the null hypothesis. Full incorporation of the LK null model into intersexual selection research will lead to the first serious examination of the extent to which natural selection on preferences shapes signal honesty and sensory efficiency in intersexual display traits.

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s46-2k

Are female extra-pair matings sexually selected? Testing non-adaptationist hypotheses in house sparrows

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Before the advent of molecular techniques, sexually selected traits in social monogamous male birds were an evolutionary puzzle. Molecular paternity analysis has revealed that strong inter-sexual selection (i.e. female choice) can potentially act on social monogamous species via extra-pair matings, which are extremely common in birds. Also, it has been generally believed that extra-pair matings are maintained in bird species because not only males, but also females can obtain fitness benefits. In other words, extra-pair matings are a female adaptation to increase their fitness (or adaptationist hypotheses). However, many empirical studies, including our previous study, have failed to demonstrate any female (indirect genetic) benefits of extra-pair mating. Such results indicate that theories based on female choice for indirect benefits (e.g the good-genes hypothesis) are unlikely to explain widespread female extra-pair matings in birds. Alternatively, there is a set of hypotheses in which females gain no benefits directly from extra-pair matings (i.e. non-adaptationist hypotheses). Two of these are the “between-sex” and “within-sex” genetic correlation hypotheses. The between-sex genetic correlation hypothesis explains female extra-pair matings as a by-product of strong selection on male extra-pair mating behaviour, which is genetically linked with female extra-pair mating behaviour. On the other hand, the within-sex genetic correlation hypothesis explains female extra-pair matings as a by-product of strong selection on another female trait, such as fecundity, which is genetically linked with female extra-pair mating behaviour. We test these two genetic correlation hypotheses using an evolutionary quantitative genetic approach on an extensive dataset from a long-term study of the house sparrow (*Passer domesticus*) on Lundy Island, UK.

How does plasticity of sexually selected traits in birds influence their evolution?

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Phenotypic plasticity can produce variation upon which selection can act and it can itself be subject to selection. Although known to be ubiquitous, plasticity has not yet been incorporated into the frameworks of sexual selection and sexual conflict. More recently several studies have began to report phenotypic plasticity in sexually selected traits. I have been studying socially induced phenotypic plasticity of the sexual phenotype in waterfowl and have found evidence that plasticity is under selection and that it can generate incredible variation. But what does this mean for our understanding of potential mechanisms of sexual selection and sexual conflict? The effects of plasticity can mask patterns of heritability, which are considered to be paramount to demonstrating female choice by indirect benefits. If male phenotypes show flexible plasticity and can change between years, can they provide reliable cues of male quality to the female? If the sexes are engaged in sexually antagonistic coevolution, does phenotypic plasticity in one sex necessitate plasticity in the other, and what are the impacts on the overall strength of conflict? This and other questions need to be part of our thinking as we continue to refine theoretical principles in this field.
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Evolution of courtship dance in Estrildid finches

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Bright plumage coloration and complex songs are two classic examples of sexually selected traits in birds. However less attention has been paid to courtship dance, which is often performed with high complexity and inter-individual variability that also suggests that it functions as an ornamental trait in mate choice and is used in intersexual communication. To understand the evolution of multimodal sexual signals in birds, it is also important to study why dance is used in addition to vocal and morphological signals in sexual selection. To fulfil this task, we collected data on courtship dance in 56 species of Estrildid finches that are famous for their dance behaviours, and analyzed them in a phylogenetic comparative study in relation to interspecific variation in life history and ecology. Although males show both song and dance during courtships in each Estrildid species, females of some species do not perform these. We hypothesized that interspecific variance in sexual dimorphism in dance behaviours is caused by the same selection pressures that also generate intersexual differences in coloration and song. Meanwhile, an alternative but non-exclusive hypothesis may posit that dance displays evolved independently of other sexual characters, and particular aspects of the reproductive biology account for interspecific variations in such displays. We found that sexual dimorphism in dance was not considerably correlated with sexual dimorphism in plumage and song, but that dance complexity was associated with the occurrence of intraspecific brood parasitism. These results indicate that when social cost in terms of the risk of cuckoldry increases, it may enhance the importance of behavioural synchronisation between pair members. Therefore, the selection factors affecting courtship dance would tend to be independent from those that shape bright plumages and complex songs.

What do we really know about the role of colour signalling in a model species? Blue Tit plumage research as a case study of impediments to progress in evolutionary biology

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Evolutionary biologists seek to explain the origin and maintenance of phenotypes, and much of this research is accomplished by thorough study of individual species. Thus, progress depends in large part on drawing appropriate inferences in studies of individual species. However, obstacles to sound inferences may be common. I present here a case study of such obstacles to progress in evolutionary biology. I located all published papers examining plumage colour and variables related to sexual selection hypotheses in a well-studied European songbird, the Blue Tit (*Cyanistes caeruleus*). Researchers have found >1200 statistical relationships with plumage colour of Blue Tits in >50 studies. More than 400 of the ~1000 main-effect relationships from the 48 studies that could be included in this meta-analysis were reported without details of strength and direction, and evidence suggests that other effects remain unpublished. These hidden results appear to be a biased sample of all effects, especially for comparisons of plumage colour to age and individual quality, and possibly also to measures of mate choice. Further, type I error was elevated by the large number of statistical comparisons, the frequent use of iterative model building procedures, and a willingness to interpret a wide variety of results as support for a hypothesis. Type I errors were made more problematic because Blue Tit plumage researchers only rarely have attempted to replicate important findings. Last, researchers studying Blue Tit plumage have often developed *ad hoc* explanations for unexpected results. Revising hypotheses in light of data is appropriate, but these revised hypotheses were rarely tested with new data. The only robust biological conclusion supported by my analyses is the relatively trivial observation that male Blue Tits have more colourful plumage patches than do females. Obstacles to progress evident in the Blue Tit plumage literature are likely common in evolutionary biology and beyond.

Environmental, ecological and mechanistic drivers of seasonal metabolic flexibility in birds

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Abstract

Small birds inhabiting regions with cold winter climates show seasonally flexible metabolic phenotypes, with the winter phenotype characterized by increments of summit metabolic rate (M_{sum}) and cold tolerance. We focus here on M_{sum} variation as a metric of metabolic performance because it is positively correlated with cold tolerance in birds, and positively related to overwinter survival in small mammals, although the latter has yet to be demonstrated in birds. Temperature appears to be a prominent driver of seasonal metabolic phenotypes in birds. Evidence supporting this conclusion includes intra-seasonal variation in M_{sum} correlated with temperature variation, recent temperature variables serving as better predictors of M_{sum} variation than long-term climate variables, and inductions of M_{sum} variation by experimental cold exposure. In contrast, photoperiod and social status do not appear to be prominent drivers of metabolic flexibility in birds studied to date. Because skeletal muscle is the primary thermogenic tissue in birds, studies of the mechanistic underpinnings of metabolic flexibility have focused on skeletal muscles, particularly flight muscles. At the level of skeletal muscle, two potential mechanisms exist for increasing thermogenic capacity, muscle hypertrophy and elevated cellular metabolic intensity. Correlative studies suggest consistent winter increments of flight muscle size, with a potential regulatory role for the muscle growth inhibitor myostatin, but variable seasonal trends regarding flight muscle metabolic intensity. Recent experimental studies in small birds, including modifying flight costs, cold and exercise training and manipulation of muscle growth regulators, also suggest that muscle size is an important driver of metabolic flexibility in birds, and that cellular metabolic intensity may also contribute to metabolic flexibility in some species. Future studies should address fitness consequences of M_{sum} variation, relative roles muscle hypertrophy and cellular metabolic intensity in promoting M_{sum} variation across avian taxa, and molecular mechanisms underlying seasonal phenotypes.

s47-2k

Seasonal metabolic adjustments in southern African birds

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Far more is known about seasonal metabolic adjustments in birds resident in north-temperate regions than species inhabiting warmer, subtropical climates. In this presentation, we review our recent work on inter- and intraspecific variation in seasonal changes in basal metabolic rate (BMR) and summit metabolism (M_{sum}) among southern African birds. Mass-specific BMR in five resident species of the summer-rainfall Kalahari Desert was significantly lower (17-35 %) in winter than in summer, with the magnitude of these changes being similar in two nocturnal (pearl-spotted owlet, *Glaucidium perlatum*, and African Scops-owl, *Otus senegalensis*) and three diurnal species (Fork-tailed Drongo, *Dicrurus adsimilis*, Crimson-breasted Shrike, *Laniarius atrococcinneus*, and White-browed Sparrow-weaver, *Plocepasser mahali*). The direction and magnitude of seasonal adjustments in BMR and M_{sum} varied substantially among two populations of southern Red Bishops, *Euplectes orix*. Bishops at a warmer coastal site showed winter reductions in mass-specific BMR and M_{sum}, whereas conspecifics from a colder inland site (1300 m asl) significantly increased mass-specific BMR and whole-animal, but not mass-specific, M_{sum} in winter. We are currently investigating seasonal changes in BMR and M_{sum} in three populations of white-browed sparrow-weavers, at sites that vary considerably in terms of winter minimum and summer maximum temperatures. The data currently available for southern African species reiterate the global variation that exists in the direction and magnitude of seasonal adjustments in BMR, with species from north-temperate climates typically increasing BMR in winter and species from warmer subtropical regions showing the opposite response. This variation may reflect a cold tolerance *vs.* energy conservation continuum, a possibility that can be evaluated by comparing seasonal metabolic variation in conspecific populations from sites that differ considerably in climate. However, substantial variation exists around this global relationship, and the environmental correlates of seasonal metabolic adjustments in birds remain far from clear.

Effects of temperature and photoperiod on energy metabolism and thermoregulation in Chinese Bulbuls *Pycnonotus sinensis*

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Seasonal changes in temperature and photoperiod are important environmental cues for small birds to adjust physiological processes. However, the relative importance of these cues on the seasonal adjustments in body mass and thermogenesis are difficult to distinguish. To determine the contributions of temperature and photoperiod to seasonal changes in energy metabolism and thermoregulation in Chinese Bulbuls *Pycnonotus sinensis*, body mass, energy intake, basal metabolic rate (BMR), organ masses and several physiological and biochemical markers were determined in laboratory acclimated animals. Chinese Bulbuls were acclimated for 4 weeks in the following groups: (1) long photoperiod and warm (LW; 16L:8D, 30˚C), (2) short photoperiod and warm (SW; 8L:16D, 30˚C), (3) long photoperiod and cold (LC; 16L:8D, 10˚C), and (4) short photoperiod and cold (SC; 8L:16D, 10˚C). Experimental data indicated that Chinese Bulbuls exhibited adaptive physiological regulation when exposed to different temperature and photoperiod. Body masses and BMR were higher in SC bulbuls than in LW bulbuls. Gross energy intake (GEI) and digestible energy intake (DEI) were higher in cold acclimated than in warm acclimated birds. The dry mass of several internal organs, state–4 respiration and cytochrome c oxidase (COX) activity in liver and muscle were all heightened in cold-acclimated birds compared with warm-acclimated birds. The plasticity in BMR and energy intake was very important for the regulations in energy balance and thermogenesis in Chinese bulbuls exposed to different temperature and photoperiod. Changes in liver and muscle state–4 respiration and COX activity were the cellular basis for adaptive thermogenesis.

Water availability mitigates the effects of extended fasting in Zebra Finches

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Extended fasting, such as during bird migration, results in considerable changes in individual metabolic flexibility. While much research has been done on changes in the metabolism in response to fasting, much less is known about the contribution of water deprivation to the observed effects. Furthermore, understanding how cell size of tissues contributes to metabolic scaling associated with fasting is virtually unstudied. We investigated this topic in 36 captive Zebra Finches kept in thermoneutral conditions in LD 12:12 schedule. The birds were randomly assigned to three equally-sized groups. Control birds had *ad libitum* access to food and water; one group had access only to water while the last group was deprived of both food and water. The experiment lasted for 24 hours, starting in the evening with overnight physiological fasting followed by daytime extended fasting. We found that the three groups of birds differed significantly from each other in body mass loss at the end of the experiment. Body mass of birds with access only to water was intermediate, significantly higher than that of food and water deprived birds, which were the lightest. The relative mass of most body organs did not differ between the groups. However, birds that had access only to water had the lightest liver; it was significantly lighter also than that of birds which were deprived of food and water. Mass specific RMR was intermediate for the birds that had access to water; the significant difference was found between the highest RMR of control birds and lowest RMR of individuals deprived of food and water. These results will be complemented by analyses of organ-specific fat and water content and measurements of cell size and discussed in the light of state-dependent metabolic scaling. Specifically, attention will be directed to the contribution of sizes of liver cells and red blood cells to RMR.

s47-5

When body temperature is increasing; potential constraints to work rate.

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Birds inhabiting hot and dry environments are faced with a problem to get rid of excess heat produced during work. This is further aggravated when water is in short supply, which puts limits to evaporative cooling. It will be reported that birds in such situations are not defending strict homoeothermy but allow their body temperature to increase in pace with ambient temperature. However, also birds in much less extreme environments invoke above normal body temperatures. By manipulating brood size in Marsh Tits (*Poecile palustris*), breeding at temperate latitudes, we aimed to study the extent to which parental effort might affect their possibility to stay homoeothermic. We found pronounced hyperthermia in response to increased parental effort, thus in our case work rate when feeding nestlings. The extent of hyperthermia was also, like in hot environments, modulated by ambient temperatures. Thus, it seems as when the gradient between body and environment is decreasing and lots of heat is produced in the muscles, these birds have trouble to get rid of this excess heat. We also tested this hypothesis by removing feathers over the breast muscles to facilitate heat dissipation. Parents with increased brood sizes fed their broods equally often but were heavier than control parents also feeding enlarged broods. We speculate to what degree accumulation of heat may put constraints to the work rate of birds.

s48-1k

Individual variation in workload during parental care: can we detect a physiological signature of quality or cost of reproduction?

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Individual variation in breeding productivity should be positively related to individual variation in parental care, i.e. how hard individuals work in rearing chicks. This level of investment should, in turn, be determined by the trade-off between higher productivity and a "cost of reproduction" in terms of decreased future fecundity and survival. These theories are entrenched in the life-history literature, nevertheless some studies suggest that a relatively small proportion of 'high quality' individuals rear large broods, and recruit more offspring, while also having *higher* future fecundity and survival. While "individual quality" remains an elusive concept within ecology (Wilson & Nussey 2010), it is an even more elusive concept from a mechanistic or physiological perspective (Williams 2012). Here I will firstly review studies which have investigated links between workload and productivity; do some individuals work harder at parental care and do they derive clear benefits (more, fitter offspring). If so, how can we measure this? For example, if individuals show 'restraint' during parental care, only working up to some limited energetic ceiling (e.g. long-lived seabirds), should we expect to see any physiological signature of "costs" or relative workload in terms of energy expenditure (BMR, DEE)? Secondly, assuming some high quality individuals are capable of "working hard" or some (low quality?) individuals pay clear costs of working hard how can we measure this physiologically? I suggest that a multivariate physiological approach, while more difficult, is more likely to capture the complexity of individual variation in phenotypic quality.

s48-2k

Mechanisms underlying individual variation in ageing and mortality: the importance of early life

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While within species the broad life history pattern is generally similar, there is often considerable variation amongst individuals in the pattern of investment in key life history traits. Some of this variation is likely to reflect differences in the optimal resolution of life history trade-offs. In this context, the effect of environmental conditions in early life is likely to be very important, since this can have a major effect of the resulting phenotype. In this talk I will discuss the factors that generate variation in ageing and mortality, and the mechanisms that underlie such effects. I will focus in particular on environmentally generated variation, through both direct and indirect (maternal) effects. I will discuss factors that act early in life, such as nutrition, the pattern of growth and stress exposure, and the mechanisms responsible for their late life effects. This will include oxidative damage and telomere attrition. I will discuss the costs and benefits of the phenotypic adjustments that result from early life conditions, using examples from work from my own and other groups.

Mechanisms underlying individual variation in timing of breeding

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Seasonal timing of breeding shows considerable variation both among individuals (within years) and within individuals (among years), despite the large fitness consequences of timing. Understanding the mechanisms that underlie this variation is important when predicting evolutionary or phenotypically plastic responses to climate change. Individual differences can for example be due to 'condition' (either as a result of the environment during development or due to conditions in the months or weeks before egg-laying), or due to genetic differences in sensitivity to predictive cues used in timing of breeding or due. We will explore individual variation in timing using data both from field and captive studies on Great and Blue Tits (*Parus major, Cyanistes caeruleus*). First, we present data from our long-term populations (1955-present) showing that egg-laying date has important fitness consequences. First, we present experimental work on wild birds where we aimed to shift the egg-laying date of individual birds to assess whether the seasonal variation in fitness is due to a causal effect of timing or due to 'high quality' birds that both lay earlier and have a higher fitness. Next, we present data from aviaries on individual variation in the physiological mechanism underlying timing. We show that there is ample variation in hormone concentrations and gonadal development, and that this variation is partly genetic. But we also show that this variation in physiological parameters is not related to variation in actual egg-laying dates. This hints at that the 'fine-tuning' of timing of breeding and the observed phenotypic variation could either be due to variation in unmeasured more 'down-stream' physiological processes or to processes that play a role in the wild but not in captivity, such as energetic constraints. This calls for more physiological work on fitness related traits in the wild, of which we will present preliminary data.

Individual variation in corticosterone responses and the ability of birds to cope with environmental change

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Birds are continuously aware of and responding to their physical and social environment. When stimuli from the external environment are perceived to be a threat or potential threat, a stress response is initiated, with activation of the hypothalamo-pituitary-adrenal axis and secretion of corticosterone. Corticosterone is a glucocorticoid hormone that acts at multiple sites to help birds adjust to and cope with a change in their environment. There is considerable individual variation in corticosterone responses, and a stimulus that initiates a large response in one bird may initiate a small response in another bird. Corticosterone responses and behavioural responses to environmental stimuli are determined by individual characteristics called personality. Birds with low corticosterone responses and proactive personalities are likely to be more successful (have greater fitness) in constant or predictable conditions, whilst birds with reactive personalities and high corticosterone responses will be more successful in changing or unpredictable conditions. The relationship between corticosterone responses and fitness thus depends on the prevailing environmental conditions, so birds with either low or high corticosterone responses can have the greatest fitness and be most successful, but in different situations. It is proposed that birds with reactive personalities and high corticosterone responses will be better able to cope with environmental changes due to climate change than birds with proactive personalities and relatively low corticosterone responses. Phenotypic plasticity in corticosterone responses can be quantified using a reaction norm approach, and reaction norms can be used to determine the degree of plasticity in corticosterone responses of individual birds, and mean levels of plasticity in responses of species of birds. Reaction norms for corticosterone responses can in future be used to help predict the ability of birds to cope with environmental changes due to climate change.

Insulin–like growth factor 1 drives life-history evolution in passerine birds

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Life-histories, as patterns of growth rate, fecundity and lifespan, show broad variance across different species. Such variation among vertebrates is largely mediated through hormones. Insulin–like growth factor 1 (IGF-1) is an evolutionarily conserved nutrition–dependent hepatic peptide, which is shown to be essential in the regulation of pre- and postnatal growth, body size, reproduction and lifespan in laboratory studies. However, we have almost no knowledge regarding how IGF-1 regulates life-history traits in free-living animals. Approaching the question from both an intra–specific angle and an inter-specific phylogenetic comparative angle, we examined for the first time in how IGF-1 impacts key life-history traits like growth rate, body size, clutch size and lifespan in free-living passerines (*Passeriformes*). By manipulating brood size in a free-living songbird, the Great Tit (*Parus major*), to change food availability for nestlings, we revealed that the level of nestling plasma IGF-1 (1) shows adaptive phenotypic plasticity, (2) depends upon resource (i.e. food) availability and (3) plays an important role in regulating the growth of wild songbirds. In phylogenetic comparative studies with 60 species, we showed that IGF-1 is one of the key hormones driving: (1) phylogenetically inert body size regulation, (2) contrastingly different optimal clutch sizes between cavity and open–cup nesting birds and (3) rapid nutrition-dependent lifespan adaptation, which is only minimally constrained by phylogenetic relatedness of the species. These results show that IGF-1 is an important, but to-date largely ignored hormonal mediator of key life-history traits among free-living passerines, and its role should be addressed with further experimental and phylogenetic comparative studies.

Oral Presentation Abstracts

Evolution of wing-propelled diving in the Pan-Alcidae: integration of phylogeny, fossils, bone histology and endocranial anatomy

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Wing-propelled diving is a relatively rare form of locomotion among birds, limited to approximately 50 of ~10,000 species of extant birds and present only in the clades Sphenisciformes, Procellariiformes, Passeriformes, and Charadriiformes. Among Charadriiformes, wing-propelled diving as a method of prey capture is restricted to Pan-Alcidae, which includes 23 extant species and ~35 extinct species. Relatively recent advances in the study of pan-alcid locomotion are complemented by recent increases in knowledge of extinct pan-alcid anatomical variation and species diversity. Furthermore, systematic hypotheses including dense taxonomic sampling of extinct species of Pan-Alcidae provide a phylogenetic framework to evaluate the anatomical, ecological and behavioral evolution of the clade. Despite these many recent advances, morphological variation of neural tissues and microanatomy of osseous tissues, which are putatively associated with locomotor strategies, remain uncharacterized. We present new data on the endocranial anatomy and osteological histology of volant and flightless pan-alcids and charadriiform outgroup taxa, and make inferences regarding the life history of extinct pan-alcids based on knowledge of the ecology and behavior of extant alcids. Endocasts of the brain and inner ear canals of 17 species of Charadriiformes were generated using computed tomography scans and histological thin sections were produced from humeri, ulnae and femora representing 5 species of extant and extinct pan-alcids. Whereas inner ear canal morphology was largely conserved across Charadriiformes, distinct differences between the brains of wing-propelled diving pan-alcids and other charadriiforms, and between volant and flightless pan-alcids were discovered. Similarly, examination of osteological microanatomy revealed distinct differences between the bones of Pan-Alcidae and their sister taxon Stercorariidae, and between volant species (e.g., *Alca torda*) and extinct flightless taxa (Mancallinae and *Pinguinus*). Integration of these neontological and paleontological data provide a more complete picture of the evolution of wing-propelled diving in Pan-Alcidae and facilitate comparisons with other clades of wing-propelled divers.

Exploring moving range edges in parapatric distributed passerines: of climate, genes and biotic interactions

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Dynamic systems like moving contact zones are particularly interesting objects. First, climate and biotic interactions are major factors that shape species distributions, and disentangling their relative effects is a first crucial step to understand those systems. Second, rapid range shift may strongly alter the genetic structure of a species which in turn may affect its dispersal, and the dynamics of the zone itself. Many empirical and theoretical studies have dealt with one part of the problem but rarely have they tried to link the two questions which a moving contact zone offers the opportunity to do. The two parapatric passerines *Hippolais icterina* and *H. polyglotta* form a moving secondary contact zone in Europe. The contact zone has been moving north-eastward for at least 70 years. We used species distribution modelling to assess the relative effects of climate and interspecific interactions on the zone movement. We further analysed the genetic structure of the two species along a transect that crossed both allopatric ranges and the contact zone. Although the zone shift is consistent with a climate-warming scenario, interspecific interactions limit the range edge of each species. Moreover, both species maintained their genetic diversity and structure despite the rapid zone movement, indicating their low susceptibility to current levels of climate change. Although an increasing number of moving zones is being reported, the proximate causes of movement remain unclear in most cases. In the general context of global change, we call for more research on interactions between these processes and the possible genetic consequences.

An overview of the diversity and relationships of the mihirungs (Aves: Dromornithidae), enigmatic giant flightless fowl of Australia

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The mihirung birds (Aves: Dromornithidae) lived in Australia from the Eocene to the late Pleistocene. They were large flightless birds, ranging from *Barawertornis* at the size of an Emu (*Dromaius*), upwards to the most massive bird (*Dromornis stirtoni*) that ever lived. Now generally considered to have been herbivores, little is known about just what they fed on, whether they were browsers or grazers, and even less is known on other aspects of their biology such as breeding. Once thought to be related to ratites, recent work by P. Murray and P. Vickers-Rich has identified features that suggest relationships with fowl and with anseriforms in particular. Currently there are seven named species placed in five genera, but several undescribed taxa are known. However, at most three species in two genera have ever been found together in deposits or even in the same time period and the inter-relationships of taxa are to date poorly resolved. In this paper, I will review the diversity of the dromornithids through time and reassess their generic diversity. Secondly, I will examine the hypothesis that mihirungs are anseriforms in the global context of their relationships to giant fowl of Oceania (*Sylviornis*, New Caledonia; *Megavitiornis*, Fiji), the megapodes, waterfowl and other galloanseres including the Northern Hemisphere giants *Gastornis* & *Diatryma*. It will thus address the question of whether the mihirungs of Australia were a unique endemic radiation, or were they part of a wider radiation of fowl.

Gondwanian relationships of the Early Eocene bird fauna of Australia

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The non-marine, earliest Eocene (54.6 Ma) Tingamarra Local Fauna in Queensland, Australia, yielded avian quadrate bones that have been identified as remains of the early screamers (Anhimidae) and wood hoopoes (Phoeniculidae). Today, the screamers are endemic to South America and the wood hoopoes to sub-Saharan Africa. In the absence of the pre-Oligocene record of anhimids in South America, this raises a possibility that the pananhimid ancestors of extant screamers may have migrated to South America from Australia. Likewise, the wood hoopoes may have originated outside of Africa, possibly in Australia. Transantarctic exchange between Australia and other Gondwanan continents has been suggested before by the relationships of marsupials and snakes from the Tingamarra fauna.

Biogeography of the Neotropical genus *Malacoptila* (Aves: Bucconidae) support the influence of Andean uplift and the reconfiguration of the Amazon basin as primary triggers of speciation

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Neotropical biodiversity has been highly influenced by the Andean uplift and the following reconfiguration of the Amazon Basin. Many studies suggest that the Andes and the main rivers of the Amazon Basin act as barriers to gene flow of several avian lineages, and that events of speciation are intrinsically related to the formation of these barriers. We selected a widespread genus of understory birds to test the possible scenarios behind these events. The genus *Malacoptila* is distributed from southern Mexico to southeastern Brazil, and all the species have a parapatric distribution. Two mitochondrial genes and two nuclear introns were used to reconstruct the phylogenetic relationship among all species. Except for *Malacoptila semicincta*, all species present at least two evolutionary lineages that are geographically structured. We also found that the cis-Andean species are not monophyletic, because the first event of cladogenesis within the genus was the split between the highland *M. fulvogularis* and the lowland ancestors from the other species. The next event of speciation was between the trans-Andean *M. panamensis* and the remaining cis-Andean taxa. For the Atlantic forest we found two lineages within *M. striata*, each corresponding to independent taxa, and an ancient connection with the Amazon forest. The Amazonian taxa were structured within the main interfluves of the basin. We found that *M. fusca* is sister to *M. semicincta*, and both are sister to *M. rufa.* In *M. rufa* we found at least 10 lineages spread along the species distribution, and in *M. fusca,* 5 lineages. In both species the younger lineages are occupying the western portion of the Amazon Basin, which suggests dispersion to these areas after the draining of the Pebas system.

Listening to nature's views

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Promoting the understanding and communication of complex data to the general public is an increasingly important and high profile area of research activity in both the scientific and creative communities. Here we present the results of a project using the process of sonification, which is the representation of data using sound, to develop a novel approach for the analysis and dissemination of ecological data. The human hearing system is highly developed and able to detect small changes in the characteristics of individual sounds, find patterns in compound streams of data and detect higher-level changes in intensity, characteristic and 'feeling'. These attributes make the auditory system potentially ideal for the analysis of complex sets of data, such as those typically produced in modern scientific research. Furthermore, the ability of music to communicate meaning is well documented and, while this is normally restricted to the communication of the artistic intentions of a composer, it can also provide a novel and accessible way to communicate scientific data to the general public. We have sonified long-term land-use and bird abundance data from the UK and Europe, developing soundscapes that describe the dynamics on agricultural systems and associated bird populations. We discuss the opportunities data sonification provides both for alternative statistical analyses, using parameters such as fundamental frequency, amplitude and harmonicity associated with the sounds produced as dependent variables, and the creation of novel compositions driven by patterns in the underlying data.

Relating species traits to extinction risk from the pet bird trade in Southeast Asia

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The pet bird trade involves at least 3,600 bird species and is worth millions of dollars annually. Despite the magnitude of the trade, few studies have investigated which species tend to be threatened with extinction by trade. Here we combine trade records from six Southeast Asian countries with a species traits database to evaluate which traits are associated with (1) being traded, and (2) being threatened with extinction by the trade. Approximately 30% of the 2,231 bird species resident in the countries studied are sold in wildlife markets. Species found in disturbed habitats are heavily targeted. The most intensely exploited families, in proportion to the number of species found in the region, are the Capitonidae, Irenidae, Psittacidae, Sturnidae, and Pycnonotidae. Overexploitation is imperiling 140 IUCN threatened or near-threatened species in our study region. Of those imperiled birds, species found in non-forest habitats and those with small clutch sizes are most vulnerable to the pet trade. These results indicate that trapping threatens different sets of species than those imperiled by habitat loss. Non-forest species appear to be disproportionately sensitive to the trade, probably because these species occur near human habitation.

Antarctic seabirds as indicators of anthropogenic influences

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The Antarctic represents a unique ecosystem and one of the last pristine environments on earth. However, it is not free from anthropogenic influences like global (climate change) and local (human disturbance) changes. These alterations might have substantial impacts on seabird populations. Based on a long-term monitoring of seabirds in the Maritime Antarctic (King George Island, South Shetland Islands) we present data of Southern Giant Petrels (*Macronectes giganteus*) and three sympatrically breeding Pygoscelid penguin species (*Pygoscelis adéliae*, *P. antarctica*, *P. Papua*). While the breeding pair number of Chinstrap and Adélie penguins showed a dramatic decline of ~95 % and ~75 %, respectively (compared to maximum values), Gentoo Penguins almost tripled their numbers. As this is observed in many other colonies along the Western Antarctic Peninsula it seems to reflect the regional climate warming and associated sea ice reduction. Furthermore, a recently recorded breeding colony of the sub-Antarctic Light-mantled Sooty Albatross (*Phoebetria palpebrata*) represents the southernmost known breeding location of any albatross species, indicating more favorable environmental conditions nowadays. Potential further alterations are expected due to glacier retreat and changes in food availability.
Although the worldwide population of Southern Giant Petrel has grown over recent years, Antarctic colonies are continuing to diminish. This decline is mainly attributed to disturbance by station staff and station logistics, as this long-lived seabird is considered to be highly sensitive to disturbance, which easily leads to nest abandonment and egg/chick loss through predation. Our data of breeding pair numbers of Southern Giant Petrels over ~30 years do not show a significant trend, but local changes in several colonies were eminent which are likely attributed to visitations during summer by station staff in their leisure time.
Thus, long-term monitoring of some seabird species reflects direct and/or indirect anthropogenic influences turning them into suitable indicators of future developments.

Understanding attacks by Kea (*Nestor notabilis*), an endemic high country parrot, on sheep in New Zealand

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Human wildlife conflict is a growing global problem with considerable and varied impacts, e.g., on human livelihoods and endangered species, and is especially concentrated in agriculture. A classic unresolved example of such conflict in New Zealand is between Kea (*Nestor notabilis*), a threatened high country parrot endemic to the South Island, and high country sheep farmers. Kea have been observed attacking sheep (a phenomenon known as "kea strike") on high country farms since 1868. However, Kea strike has been inadequately studied and is still poorly understood, with the majority of the literature on the subject being dated and/or anecdotal. Kea strike can cause illness, injury and death in sheep and, although it has declined in incidence, still occurs and is severe on some farms. Several methods are currently used to mitigate Kea strike, including killing Kea. Illegal means of control of Kea are also used, which include inhumane methods such as poisoning. Our objectives are to assess the current prevalence of Kea strike on high country farms, and to assess risk factors and underlying behaviours that are involved. We aim to understand the cognitive drivers of Kea strike and develop mitigation strategies that will benefit Kea, farmers and sheep welfare. We assessed the prevalence of Kea strike injuries on 5 high country sheep farms with histories of Kea strike. Our results show that the farms fell into 3 prevalence categories: very low, moderate, and high, and these findings are consistent with both the frequency and severity of Kea strike reported by the farmers included in this study. Differences in farming management and topography between the 5 farms studied have contributed to the risk of Kea strike. This study provides the first quantitative analysis of Kea strike injuries in sheep, an important step in gaining a scientific understanding of this phenomenon.

o02-5

Factors affecting bycatch of Black-Browed Albatross and Wandering Albatross: relationship between distribution and bycatch probabilities

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Seabird bycatch, in which seabirds are accidentally caught in pelagic longline fisheries, has been one of the causes of declining seabird populations. Understanding the factors affecting seabird bycatch, and also the areas and seasons in which the risk is higher, is essential to identify the priority actions in order to minimize this threat. In our study we analyzed the relationship between bycatch rate (birds caught per 1000 hooks) and several factors, including seabird distribution probability. We estimated the seabird distribution with habitat modeling using tracking data and ecological environment factors. We then selected the best model explaining bycatch rate using zero-inflated models. We used as model species the Black-Browed Albatross (*Thalassarche melanophris*) and the Wandering Albatross (*Diomedea exulans*), both known to be bycaught in pelagic longline fisheries and listed as Endangered and Vulnerable, respectively. The areas with high predicted distribution by the models generally agreed with the areas with high utilization distribution calculated from the tracking data. For colonies in which no tracking data were available, both the Black-Browed and Wandering Albatross models identified areas of predicted foraging distribution. Sea surface temperature and chlorophyll-a were the most important factors explaining the distribution of these species, while bathymetry and slope of bottom were the less relevant. We will discuss the factor affecting bycatch rate and the mechanism of bycatch.

Individual differences in taste perception & dietary wariness in European Starlings: causes and consequences

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Taste, smell, and sight help birds identify and discriminate among foods, and are the important senses involved in behavioural defences against poisoning. One over-riding observation in all studies of behavioural defences is that there is variation in the foraging behaviour of individuals. For instance, some individuals eat large numbers of chemically defended insect larvae, while other individuals are more sensitive, and taste-reject chemically defended prey; some individuals are adventurous foragers, while others are wary. To date, there has been a tendency to view this variation as noise. However, it is known that genetic differences in taste receptors explain individual variation in other vertebrates' responses to bitter tastes, and that stress can decrease glucose and salt detection thresholds in humans, leading to variation in diet choice. In this study we examined how European Starlings (*Sturnus vulgaris*) perceive the tastes of potential poisons (bitter tastes), how much they vary in these responses, and how ecologically relevant stressors might affect behaviour. We measured consumption levels and visitation rates of individual Starlings using a two-bottle choice test, where they received the test solution on one side and water on the other. We also exposed the birds to an ecologically relevant stressor, by creating temporal variation in food availability and measured changes in baseline and stress-induced corticosterone (CORT) concentrations to determine if stress affects taste perception and consumption behaviour. We also tested whether temporal variation in food availability affects Starlings' responses to novel foods. This is the first study, to our knowledge, to measure gustatory thresholds for quinine, and other bitter tasting solutions, and how food restriction and the stress hormone corticosterone affect perception and expression of behavioural defences.

Olfactory signalling in a highly divergent species complex: the Crimson Rosella (*Platycercus elegans*)

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Traditionally, birds were widely regarded as relying primarily on their visual and acoustic senses for communication. Recently though, there has been a growing body of evidence indicating that birds can recognise and respond to chemical cues in their environment. Nevertheless, the role of chemical cues in avian communication is still little known. Within Psittaciformes, only a handful of studies have investigated the role that olfaction might play in signalling. The Crimson Rosella (*Platycercus elegans*) is an ideal candidate for studying olfactory signalling. It is a highly variable species, featuring a series of gradually divergent populations, which differ greatly in plumage colouration. The species also produces a distinct and strong odour, which has never been investigated. In this study, we combined field and lab-based behavioural experiments, along with chemical analyses of the plumage odour. Using experimental odours placed at nestboxes during incubation, we found that females could detect odour differences between species and subspecies. Females arrived to and entered the nestbox significantly quicker when their own subspecies odour was present. They also spent significantly more time on and inside the nestbox when presented with conspecific odour. Furthermore, we found evidence that females could recognise sexes through odour. Females arrived quicker and spent more time in and on the nestbox when a male odour was present. Lab-based behavioural two-choice experiments also revealed that both males and females were able to recognise and showed preference for their own species odour. Using gas chromatography mass spectrometry (GCMS), we found evidence suggesting that *P.elegans* produce chemical labels, which convey information about subspecies, sex and virus infection. These data show that Crimson Rosella individuals vary greatly in odour composition and may use odour as an important cue for species, subspecies, sex and disease status.

Hotshots and Hotspots: local spatial heterogeneity in life-history variation and signal content of UV structural colours in a socially monogamous passerine

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Isotropic or non-iridescent avian structural colours like the ultraviolet (UV) reflective crown of Blue Tits (*Cyanistes caeruleus*, Paridae) form a conspicuous aspect of the phenotype of many birds and are frequently used in social and sexual signalling. Previous research on non-iridescent feather barb structural colours of 230 species from 52 avian families suggests that they are produced by self-assembled, 3D quasi-ordered or amorphous biophotonic nanostructures made up of spongy matrices of beta-keratin and air. Unlike diet-acquired pigmentary colours, however, the precise signal content and evolution of structurally coloured plumage remains difficult to comprehend, perhaps because contemporary studies rarely consider the mechanistic basis of structural colour variation within a bird population, namely the fine-scale properties of barb nanostructures that produce visible structural colours. We address mechanistically how the tight interplay between structural colours and the underlying nanostructure correlates with the life-history characteristics of individuals in two well-studied and adjacent Oxfordshire populations of Blue Tits, by combining field-based ecological data with synchrotron Small Angle X-ray Scattering (SAXS) nanostructural measurements and microspectrophotometric measurements of UV-reflective Blue Tit crown feathers. We also report the first structural data on the comparative development of spongy medullary biophotonic nanostructure in nestling and adult Blue Tits from assays of growing feather germs. We present SAXS as an ideal tool to assay bulk structural properties of complex biomaterials, providing a precise, and high-resolution structural measurements of the scattering nanostructure on a cell-by-cell basis with essentially no sample preparation, allowing for a high throughput hitherto inconceivable.

Effect of a fluctuating environment on multimodal signals

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Many animals communicate using more than one modality (e.g. acoustic, visual), and several hypotheses have arisen to explain the evolution of multiple signals. However, these hypotheses typically assume static selection pressures and fail to acknowledge how environmental fluctuations over time or space can shape variation in signaling systems. Environmental variability, such as food availability and ambient lighting, may affect the costs and benefits of trait development and information content in signalers as well as signal perception and value in receivers. We are studying how the form and function of multiple signals in a tropical songbird change due to spatiotemporal environmental fluctuations. We are testing how variation in light environment and ambient noise influences the transmission, perception, and reliability of song and coloration in the Red-throated Ant-tanager in Panama. We recorded ant-tanager song, plucked feathers to measure color, and recorded the acoustic and light environment from each territory. In addition, we took standard morphometric measurements and collected blood samples to measure circulating levels of carotenoids in each individual. We will present data on the variation and condition-dependence of ant-tanager signals as well as on how light environment and ambient noise correlate with signal production and use. This study should fill an essential gap in our understanding of the evolution of multiple signals, and pave the way for future studies on fluctuating environments.

o03-5

The Colour of an Entire Avifauna: Understanding Chromatic Variability of Australian Birds

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Animal coloration is one of the least well understood components of phenotypic diversity. This lack of understanding stems partly due to the inherent complexity of analysing chromatic information in the eye of the beholder and to the lack of comprehensive theoretical bases to explain it. Currently, our best framework to make sense of this diversity lies with the sensory drive hypothesis which stresses the roles of sensory and environmental variation at shaping colour diversity. Differences in the visual environment – the combination of ambient light and background colours – could determine which colours are conspicuous or cryptic. While there is limited information suggesting that variation in the visual environment may select for different cryptic and conspicuous colours, the generality of these findings is unknown. Here, I employ psychophysical visual models of avian vision together with simple multivariate techniques to make sense of the colour variability of all Australian breeding landbirds. Using this approach I show that sexual differences in selection pressures are responsible for a large part of the chromatic variability of Australian birds: more than a third of the occupied visual space is exclusively male. This chromatic variability is not uniformly distributed in the visual space due to the overrepresentation of "dull" colours. Finally, I explore the role of environmental variability by assessing the match between cryptic and conspicuous colours and their visual environment at the level of a single community. These data highlight the new insights that can be gained from analyses at the level of communities or entire avifauna.

Hierarchical community models for analysing species- and density-area relationships

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Species-area relationships (SARs) are important in ecology, and it is assumed that population densities constituting communities are constant irrespective of area. However, in fragmented landscapes, densities can change with patch area. Previously developed abundance-based SAR models assume that expected species richness is obtained by summing the probability that at least one individual occurs across the species. We showed that density-area relationships (DARs) can affect such probabilities, and their collective behavior can affect the shape of SARs using simulation experiments. Next we developed a hierarchical community model to consider imperfect detection of individuals and imperfect spatial coverage of the patches during the survey. We also developed another model using frequency (number of equal-sized sampling plots in which a species occurs) and occurrence probability-area relationships (OPARs) as surrogates of abundance and DARs, respectively, for plant survey data. We applied the models to bird and plant data collected from young plantation patches with varied area (1.3-10 ha). For birds, we analyzed early-successional species because very few individuals of mature forest species entered the patches. No bird species showed large-patch preferences, and total densities of bird communities did not change with patch area. Plant early-successional and exotic species did not show patch area selectivity, while mature forest species as a group showed small-patch preferences, suggesting that their negative OPARs may have made SARs shallower. The plant community model estimated that about half of the species were encountered during the survey. It was expected that patch-level species richness changed with patch area for birds but not for plants. Population densities are changed by the range of factors including patch area, and complete enumeration of individuals in large patches is difficult. Our modelling approach considers such covariate effects and imperfect sampling problems, and should provide a more precise understanding of biodiversity in fragmented landscapes.

Do long term patterns of bird assemblage dynamics imply interspecific competition? Null model analyses of species associations.

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Interspecific competition has been understood as the main force of nature driving co-existence among species and thus controlling community dynamics for many decades. Competition theory predicts existence and prevalence of so called negative species association (segregation) in spatial or temporal patterns of community dynamics. The main objective of this study is to test this prediction on the sample of breeding bird communities of various habitats (forests, park, meadows) by presence/absence and quantitative null models. Totally, 18 data matrices of studies lasting at least 10 years (10−57 years) from Europe and North America were subjected to analyses. Data matrices were analyzed by null models with the best statistical properties. Descriptions and abbreviations of binary and quantitative null models and indices are in papers of Gotelli (2000: Ecology 81: 2606–2621) and Ulrich & Gotelli (2010: Ecology 91: 3384–3397). We used 10 000 iterations and critical threshold level α=0.05 in all computations. Two binary null models, SIM 2 and SIM 9, in combination with three indices (number of checkerboards (CHECKER), C-score, variance ratio (V-ratio) were run in EcoSim 7.0. Only 18 (20.00 %) of 90 simulations by binary null models showed negative associations (24 (26.67 %) aggregations, 48 (53.33 %) random associations). Two quantitative null model algorithms, IA (aa) and IT (rc), in combination with three indices (number of quantitative checkerboards (CA_{ST}), number of quantitative aggregations (AA_{ST}), and Chao's index of similarity on n communities (MA)) were run in Turnover 1.1. Only 22 (20.37 %) of 108 simulations of the quantitative null models and indices with 18 data matrices showed negative species associations (60 (55.56 %) aggregations, 26 (24.07 %) random associations). The results of simulations do not support hypothesis of interspecific competition as the main driver of bird assemblage dynamics since aggregations and random associations prevailed. The conference presentation was supported from the project Extension of the Centre of Excellence funded by ERDF.

o04-3

Abiotic versus biotic constraints on the elevational distributions of Andean birds.

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Understanding the relative roles of abiotic versus biotic constraints as limits on the distribution of species along elevational gradients is critical for predicting the impacts of changes in climate and land use on hyper-diverse tropical montane areas. We studied species interactions (biotic constraints) and metabolic responses to temperature (abiotic constraints) of more than 300 avian species along an elevational gradient in the Andes of south-eastern Peru where more than 1000 species occur. We found little support for the hypothesis that adults were constrained to specific elevational bands by differences in tolerances of different thermal regimes. Neither did we find support for the hypothesis that interspecific aggression between closely related (usually congeneric) species constrains more than a few species to narrow elevational zones. Nest predation rates, however, varied greatly along the elevational gradient, as did the communities of predators responsible for most nest predation events recorded by cameras at nests. We argue that a suite of life-history adaptations to nesting under different temperature regimes and under contrasting predation pressures may ultimately constrain most species. High-elevation areas, in particular, have severe biotic and abiotic constraints (high nest predation rates, low ecosystem productivity, cold temperatures) that may act as strong filters limiting which species are present.

Population and community-level niche conservatism in antbirds (Thamnophilidae) along a tropical elevational gradient

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Niche conservatism is defined as the tendency for related species to have similar fundamental and realized niches, and as the tendency for the niche of a species to change little over time. Although ecological traits that define the niche have been used to understand the assembly of communities on larger scales, functional traits that determine the niche are fundamental to understanding community assembly on a local scale. Antbirds (Thamnophilidae) constitute one of the most diverse suboscine families and vary substantially in morphology, vocalization and behavior. As many as 40 species may coexist at local scales. As such, antbirds are an excellent system for studying repeated patterns of niche conservatism and divergence under varying environmental conditions. We studied antbird communities along an elevational gradient on the eastern slope of the Andes in and around Manu National Park, Peru. In this area antbird community richness declines from over 40 species in the lowlands to fewer than 10 species in cloud forest 1000 m upslope. Species occurrence data, ecological traits and phylogenetic relatedness of these communities were integrated to determine whether species niches are mediated by interspecific competition or niche conservatism. First, we examined ecological relationships among species to understand whether different species along the gradient exhibit niche shifts of relevant ecological traits, as predicted if their niches evolve in response to the presence or absence of competitors and changing abiotic conditions. Second, we determined whether highly diverse community in the lowlands exhibit nonrandom ecological structure and if more closely related species are more ecologically similar, as predicted with niche conservatism. We discuss different patterns of conservatism and divergence of niche-related ecological traits in antbirds and the implications of these patterns in understanding community assembly and competition in highly diverse tropical avian communities.

Contrasting avian community transitions from lowland to submontane forest on a variety of Bornean mountains

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Species composition of avian communities changes with elevation, and the pattern of elevational change varies depending on landscape and regional characteristics. In Borneo, the elevational distribution of bird species has not been quantitatively assessed, and thus community turnover is poorly understood and its causes unknown. Moreover, the extent to which submontane and hill forests provide habitat for lowland species is also poorly understood. This latter issue is extremely important because of the overwhelming rate of lowland forest loss in Borneo (Montane habitats, while also threatened, are less accessible and more often protected, thus more montane forest remains intact). We examined the elevational characteristics of bird communities on three mountains of similar size: Mt. Topap Oso (1448 m) and Mt. Baring Uning (1464 m) in the continuous mountains of central Borneo, East Kalimantan, Indonesia; and Mt. Pueh (1552 m), an isolated range near the coast in western Sarawak, Malaysia. Point count and mist-net data show significant differences in both species composition and elevation of community transition among the mountains. Montane species occur at lower elevation on the more isolated Mt. Pueh, in keeping with predictions of the mountain mass effect. However, presumably because of its isolation Pueh's overall montane bird community is less rich than Topap Oso and Baring Uning, which are part of an extensive mountain range. Pueh's reduced montane species richness and proximity to the coast likely also contribute to differences in species' elevational ranges through direct and indirect effects of altered competition and moderated climate. We discuss the implications of our results for understanding the biotic and abiotic factors affecting species distributions on elevational gradients, which allow predictions to be made regarding effects of different predicted climate and land use change regimes on Southeast Asian bird communities.

Applications of unmanned vehicle systems to bird studies

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Over the last 6 years, we have used small, "off-the-shelf" Unmanned Aerial Systems (UAS) to conduct population surveys of birds, map and monitor bird habitats, and record the behavioural responses to such machines. First, we flew a fixed-wing UAS over a large Common Tern (*Sterna hirundo*) breeding colony (5,000–7,000 nests) on a dynamic coastal barrier island complex in eastern New Brunswick at low altitudes (<100m). Without flushing the birds and capturing very high resolution (~3cm/pixel) aerial imagery, we carried out an unobtrusive population census and mapped the island habitat in fine detail in order to better inform future management initiatives in the event of rising water levels. Second, we used the same UAS to map a 128-ha wetland impoundment in southern Quebec that contains critical habitat for one of the province's largest Least Bittern (*Ixobrychus exilis*) breeding populations. In conjunction with call-response surveys carried out on the ground, UAS imagery revealing the fine-scale layout of water and vegetation allowed us to determine that bittern abundance is most positively influenced by cattail cover in combination with water-vegetation edge density (interspersion), confirming the findings of several other recent studies. Third, we flew a quad-rotor UAS over the nests of Swainson's Hawks (*Buteo swainsonii*) and Ferruginous Hawks (*B. regalis*) in Saskatchewan in 2012 and over Osprey (*Pandion halieatus*) nests in Montana in 2013, and using an ethogram, we recorded their nest defense behaviour at different stages of the nesting cycle. The strength of the response varied among species and among individual pairs. Other studies with UAS under-way include tracking radio-tagged birds, recording underwater foraging behaviour of diving birds, live-capturing birds, and dispersing nuisance bird species.

At-sea experiment to evaluate the effectiveness of multiple mitigation measures on pelagic longline operations in the western North Pacific

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Incidental mortality (bycatch) of seabirds in tuna longline fisheries is a major concern for population declines of several threatened species. For the conservation of seabirds, experimental research for the effective mitigation measures that reduce the incidental mortality of seabirds in commercial fisheries is essential. Recent research in the Southern Hemisphere revealed that the simultaneous deployment of a combination of tori-lines and weighted branch lines was highly effective at reducing seabird bycatch. In order to address effective bycatch mitigation measures in the North Pacific, we compared the effectiveness of bird-deterring tori-lines with and without weighted branch lines to a control of no mitigation. The weighted branch lines design was based on the Yamazaki double-weight configuration reported to be effective in the Southern Hemisphere. We carried out 62 longline operations in the Western North Pacific. Each operation of 960 hooks was divided into six experimental treatments: single, double or no tori-lines coupled with weighted or unweighted branch lines. Metrics of evaluation were the attack rates of seabirds on baited hooks, sink rate of branch lines and the bycatch rates of the dominant and most vulnerable seabirds to longline mortality in the North Pacific – Laysan and Black-footed Albatrosses (*Phoebastria immutabilis* and *P. nigripes*). Three albatross and five shearwater species attended the vessel during line setting and 107 Laysan and 21 Black-footed Albatrosses were recorded as catch. Both single and double tori-lines eliminated most bird attacks within 75 m of the stern, resulting in a dramatic reduction in seabird mortality rates (96-100%, for single and double tori-lines, respectively) compared to non tori-line treatments, irrespective of branch line weighting. Weighted branch lines without tori-lines also reduced mortality rates, but less effectively than tori-line treatments (60-68% reduction). These results suggest that deployment of well-designed tori-lines dramatically reduces albatross bycatch in the pelagic longline fisheries in the Western North Pacific.

A world review of seabird translocation and social attraction projects

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Active seabird restoration methods such as chick translocation and social attraction (the use of vocalization playbacks and decoys) are now widely used to encourage seabirds to establish new breeding colonies at restoration sites. We present a worldwide review of active seabird restoration projects which found 128 projects that were implemented to protect 47 seabird species in 100 locales spanning 14 countries since 1973 when active restoration methods were pioneered. These methods can achieve conservation goals for threatened and endangered species and for species affected by anthropogenic impacts (e.g., oil spills, invasive species, and fisheries). They are also helpful for relocating populations from undesired breeding locales to more favorable locations, and to establish multiple breeding locations to reduce risks posed by catastrophic events and predicted effects of climate change such as ocean level rise. Active restoration can also help to restore ecological processes, as large seabird colonies function to cycle marine nutrients to terrestrial ecosystems and create habitats for commensal species. Active restoration is especially appropriate where the original causes of decline are no longer working to suppress colony establishment and growth. Successful restoration efforts require careful planning and long-term commitments. As case studies, we review outcomes of 40 years of restoration for Atlantic Puffin and Arctic Terns in Maine, USA.

Use of marine radar to evaluate collision risk of migrants with wind turbines

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The recent development of automated digitization methods and improved software to capture and process information from marine radars has provided new opportunities for quantitative analysis of bird migration patterns including assessing risks of collisions with objects such as wind turbines. However, there are several challenges that must be overcome to make full use of the data. Of particular importance is estimating the probability that a bird flying past the radar will be detected often enough to be identified as a bird based on information such as flight speed, orientation and radar cross section. This detection probability typically varies with distance from the radar: low very near the radar, peaking at intermediate distances, and declining to the radar's maximum range. However, the precise pattern may depend on many factors including size, shape, configuration and angle of the antenna, output power of the radar, the extent and distribution of clutter, the size and movement pattern of the bird, and the digitizing and processing algorithms. As a result, it is necessary to correct for detectability to estimate the density of birds at different altitudes and to compare numbers of birds among sites. In this presentation, we describe several approaches for estimating detectability, including calibration with standardized metal spheres, comparison of reflectance patterns of bird targets among radars and modelling detections of simulated flight tracks of birds moving past the radar. We demonstrate their use with data from several radars in southern Ontario, Canada equipped with tilting parabolic antennas and controlled by the open source software radR (https://radr-project.org). We show that detectability varied considerably with altitude and among radars, and that uncorrected numbers of tracks provide very biased estimates of the numbers of migrants at different altitudes and hence at risk of collision with turbines.

Translocation of Asian houbara bustards (*Chlamydotis macqueenii)*: current knowledge, constraints and future directions

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In 1977, the first Asian houbara (*Chlamydotis macqueenii*) was bred in captivity at the Al Ain Zoo (United Arab Emirates). After four decades of research and conservation effort, the species remains classified as Vulnerable and anthropogenic threats are still growing. Nevertheless, joint efforts of several projects supported by U.A.E brought the number of birds produced in captivity up to 50,000, of which 10,000 have been released into the wild. Translocation of captive-bred Asian houbaras is particularly challenging, given the following constraints: 1) species range (Middle East, Central Asia and Asia), 2) partial-migration behaviour, 3) unclear population genetic structure, 4) increasing direct (hunting) and indirect (habitat depletion) threats in a changing world (climate change). Between 1994 and 2013, more than 1,000 Asian houbaras have been monitored via satellite-tracking offering a unique data set to study the ecology and behaviour of wild and captive bred birds. Here we summarize current knowledge on wild Asian houbaras (migrant and resident), provide original results on translocation of captive-bred houbaras (migrant and resident) and show how the constraints listed above have been addressed in the program of houbara ecology and restoration.

When a male changes his ways: sex differences in feeding behaviour in the Pied Flycatcher

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It is not yet clear how environmental conditions influence sexual dimorphism; especially behavioural traits. In a study of Pied Flycatchers *(Ficedula hypoleuca)* we tested whether there are differences in the composition of food brought to young by the different parents, and whether such sex differences are dependent on the hunger level of nestlings. We found that in normal feeding conditions, female parents provisioned nestlings with relatively more high-quality food collected from the tree canopy (caterpillars), while males brought more food caught in flight. To imitate a temporary worsening of environmental conditions, we experimentally increased the hunger level of nestlings. Male parents responded to this manipulation by increasing the share of caterpillars in their provisioned food, so that the sex difference in provisioning behaviour disappeared. We suggest that in normal feeding conditions males catch more flying prey because they prefer to stay in open locations close to singing and territory guarding posts, to be visible demonstrating their conspicuous sexually selected plumage, or to avoid intra-pair food competition. However, in conditions where their offspring are at risk of starvation, it obviously pays for male parents to switch to bringing high-quality food, so that very hungry nestlings receive a higher quantity of nutritionally valuable caterpillars than they do normally. This result is in accordance with the general pattern previously found for sex differences in animal size – namely that sex differences tend to diminish in harsh environmental conditions. It is possible that a decrease in sex differences in harsh conditions represents a more general pattern than previously assumed. To our best knowledge, the current experimental study is the first to clearly show that parents of a passerine bird species adjust the composition of provisioned food differently in response to an increased food demand among their nestlings.

o06-2

Male Daito white-eyes improve nest positioning skills by learning the threat of two nest predators

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The risk of predation influences many aspects of behavioural and reproductive decision-making. Recent studies suggest breeding birds have a capacity to assess and respond to changes in the risk of predation. However, almost all birds have a number of predators which attack the prey in different circumstances. Can parental birds recognize and respond to several predators? We tried to detect the adaptive change in anti-predation behaviours against two nest predators in the Japanese island bird, the Daito White-eye (*Zosterops japonicas*). Their offspring losses are chiefly due to nest predation by rats and shrikes, which tend to attack nests differentially based on height; rats attack lower nests and shrikes attack higher nests, and both depredate poorly concealed nests more often. We analysed parental age effects on nest predation avoidance in Daito White-eyes by measuring annual nesting success of each individual bird and the percentage of successful breeding attempts during a single breeding season. We found that older males experienced increased reproductive success and lower nest predation, as a result of building better-concealed nests at intermediate heights. Within individuals, we observed age-related improvement of nesting positions and reproductive success, and within breeding seasons, males moved their nests to safer locations following predation events. To determine if the cause of age-related effects on nesting position was due to lack of predator recognition in young males, we conducted a model-presentation experiment. Younger and older males reacted similarly to shrike models, but younger males showed lower level responses to rat models. Shrikes attack adult birds, but rats are no danger for adults. One reason of building the low-positioned nests by first-year males may be because they know shrikes are a threat but have not yet recognized rats as a threat. We conclude that age-dependent improvement of nest positioning by males may be caused by learning from breeding experiences.

Microhabitat selection in ground nesting birds

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Camouflage is one of the most widely used anti-predatory mechanisms in the animal kingdom, preventing detection and/or recognition by the receiver. A wealth of research has investigated concepts and theories of visual camouflage in artificial systems. However, very little work has been applied to real species and natural systems in the wild. Ground nesting birds provide an ideal model system to test visual camouflage theory as they often nest in open environments and rely on camouflage as their primary defence to avoid predation. A key question is whether individual birds behaviourally select specific microhabitats that best optimise the camouflage of their own eggs. We conducted field work in Zambia and South Africa, quantifying the camouflage of eggs from three nightjar, six plover and three courser species. This was done through appropriate models of predator vision, chosen based on our video recordings of these populations' natural predators. We compared the eggs' camouflage properties to the substrate that individuals chose and to substrate patches adjacent to the chosen site. We predicted that individuals' eggs would be better concealed against their chosen patch than against the non-chosen patches. Our results show that plover and courser species select microhabitats that match the patterns of their eggs better than non-chosen patches. To our knowledge this is the first quantitative evidence from the wild that individual birds select microhabitats that optimise the camouflage of their eggs in relation to predator visual systems. Our results demonstrate that camouflage matching in birds is controlled not just by the properties of the egg alone, but also by behavioural choice of individual parent birds whose eggs vary among females of the same species. It also suggests that, like many brood parasite hosts, parents somehow know what their own eggs look like in order to make such decisions effectively.

Solving a paradox: context-dependent effects of maternal testosterone in the Rock Pigeon (*Columba livia*) and its causes and consequences

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In many animal species mothers differentially bestow their eggs with hormones. The increasing pattern of yolk testosterone (T) concentrations over the avian laying sequence is interpreted as mitigating effects of hatching asynchrony by boosting the later hatching chicks. However, why would avian mother first produce hatching asynchrony, classically regarded as an adaptation, and then compensate its effect by maternal T? We hypothesized that maternal T is only beneficial for the chick under good food conditions, when mothers aim to raise the full brood, but detrimental under poor food conditions when brood culling is needed and in the chick benefits do not outweigh the costs of elevated exposure to testosterone. We studied this in the Rock Pigeon, in which first eggs contain much lower T concentrations than last and second eggs, independently of the food situation. We created clutches of two first eggs, one injected with T to the level of the second egg (T chicks), and one injected with vehicle (C chicks). Pairs were then housed under either good or poor food conditions. Only in the good condition T chicks grew faster than C chicks. Only in the poor condition, T chicks had a much higher early mortality than C chicks. These results indicate that higher levels of yolk T functions in concert with hatching asynchrony to optimize the brood size in a changing environment. This not only solves the above paradox, it also explains contradictory results of *in ovo* T injections in the literature. To test whether the food context drives a different cost-benefit balance in the chick we are currently analyzing results of a subsequent experiment testing context dependent effects of egg testosterone on metabolism, immune response, and begging behaviour, all known to be sensitive for yolk androgens.

Provisioning behaviour correlates with the reactive-proactive personality axis among Great Tits in the wild

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Personality is thought to be an important driver of fitness in animal populations but evidence for direct links with functional behaviour in the wild is lacking. We temporarily took wild Great Tits (*Parus major*) into captivity and assayed the continuous personality trait 'exploration behavior of a novel environment' as a measure of the reactive-proactive personality axis. We subsequently located these individuals in the wild and used a combination of radio-frequency identification (RFID) technology, cameras, and radio-telemetry to quantify their foraging behavior during offspring-provisioning. We demonstrate that relatively fast explorers provisioned a higher proportion of good quality prey items to their young than slow explorers during the early nestling phase. During the late nestling phase slow explorers provisioned at a higher rate than fast explorers when food availability was low, indicating that relatively slow explorers may cope better in low-quality environments. Foraging range size did not differ between relatively fast and slow explorers. These findings provide rare field-based evidence that personality measured in captivity reflects foraging performance during a key life history stage in the wild.

Shorter natal dispersal distances at higher population densities in the Great Tit (*Parus Major*) in both time and space

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The population is a basic concept in biology. Yet, in most cases the borders between populations are vague and we know little about the relation between distance and relatedness of individuals at intermediate scales. On the island of Vlieland, Great Tits have been followed since 1955 and about 80 % of the breeding birds were ringed as nestlings, so that their origin is known. Over time, the population size has increased tenfold and the average and median natal dispersal distances have decreased by almost 50 %. A similar decrease has been observed in the population study in Wytham wood near Oxford. However, if there is a causal relationship between population density and natal dispersal, one would also expect to find a similar relationship between dispersal distances and density over space. On the island of Vlieland, the forest is quite heterogeneous with patches of oak and areas with pine that differ substantially in the density of Great Tit pairs. Although there are several methodological pitfalls, a number of indicators for spatial density do indeed show a correlation with distances dispersed. This is consistent with the idea that social interactions play a role in the size and territory covered by winter flocks, and thus lead to smaller winter flock ranges and hence shorter dispersal distances at higher densities. The idea that populations become geographically smaller at higher densities has intriguing consequences that have yet to be explored.

Can population-specific variation in spatio-temporal migration patterns increase our understanding of dispersal in migrants?

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Recent technological advancements enable year-round tracking of even small passerine birds on a global scale. These opportunities call for research in dispersal, an aspect of the avian life cycle remaining poorly understood. The present study aims to understand dispersal patterns and processes by studying the entire migration system of a long-distance migrant, the Red-backed Shrike (*Lanius collurio*), tracked by miniaturized light-level loggers (geolocators) comparing spatio-temporal patterns of migration across several populations. We tracked individuals from geographically distinct breeding populations, hereby enabling us to examine how consistent staging areas and migration routes are being utilized between individuals and populations in time and space. We found that populations show a high degree of migratory connectivity in terms of being strongly separated in different European breeding as well as sub-Saharan wintering areas. Still, the migration tracks showed fundamental spatio-temporal similarities in staging areas utilized en route. These population-specific migration patterns may prove to be an important first step towards understanding the evolution of migration systems and hence, dispersal ability in migratory birds. Also such knowledge is essential for defining future guiding tools for much needed conservation initiatives for Eurasian–African migratory birds.

Discrete choice modeling of natal dispersal: "Choosing" where to breed from a finite set of fragmented areas

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Classic natal dispersal studies focus mainly on the distance traveled by organisms. Although traveled distances are able to capture selective pressures related to dispersal, they ignore the properties of the various possible destinations as well as the individual characteristics. Recently, a number of studies in movement ecology have addressed questions on availability of resources and/or availability of suitable habitats through the use of discrete choice models (DCMs), a widely used class of models within econometrics, which explains observed individual choices as a function of the properties of a finite number of available alternatives. In this contribution, we introduce two types of DCMs, a conditional logit model and a mixed logit model, and discuss their suitability for analyzing natal dispersal data in fragmented landscapes given that the natal and the breeding area of the disperser are observed. We present a case study on a Great Tit (*Parus major*) population in an archipelago of small woodlots in Belgium. Our results do not only confirm those of the classic approach analyzing distance only, but simultaneously, they provide us with additional insights on mechanisms of departure and settlement considering variables that characterize the disperser (e.g. sex, fledging date or personality), the natal area (e.g. size) and the breeding area (e.g. distance to the breeding area from the area of origin). Furthermore, the DCMs allow us to identify interactions between some of these characteristics that are relevant for the trade-offs involved in the decision on whether to leave the birth place and the follow-up decision on where to breed. Finally, we discuss tailor-made modifications of DCMs to extend our approach to other studies involving similar dispersal datasets.

o07-4

Extreme weather events influence reproduction and trigger extraordinary movements of Brown Dipper *Cinclus pallasii* in Taiwan

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The predicted effects of global climate change involve altered patterns of temperature and precipitation, including more extreme weather events such as droughts and floods. The impacts of these predicted changes on a species' ecology are crucial issues. The Brown Dipper (*Cinclus pallasii*) is a habitat specialist which lives along mountain streams and preys on aquatic organisms. Our study area was the Cijiawan Stream at an elevation of 1700 m in central Taiwan. According to daily discharge records beginning in 1967, floods caused by typhoons have become more severe and frequent during the past decade. Our previous work has shown that dipper abundance and aquatic insect biomass were strongly positively correlated, but negatively related to discharge. Moreover, dipper survival was negatively correlated with the degree of discharge. Floods also influenced dipper reproduction. Censuses of dippers along an 8.5 km tract of Cijiawan Stream were conducted every one or two months from 2003-2013. During the breeding season, we counted the number of breeding pairs, the ratio of breeding success and the number of fledglings. The number of breeding pairs decreased after floods, and the number of non-breeding floaters increased in the same season. We also censused the population along the Yousheng Stream, a tributary of Cijiawan Stream, in 2004 and 2012-2013. Unlike at the Cijiawan Stream, the dipper population doubled along the Yousheng Stream after two flooding events. We also confirmed that several banded individuals moved from the Cijiawan Stream to the Yousheng Stream after the floods. These movement distances (3-6 km) were much longer than the average length of their breeding territories (0.4 km). This result illustrated that the animal populations of these two areas were probably connected and formed a meta-population, whereby decreases in one caused increases in the other. Therefore, detecting and protecting multiple refuges for habitat specialists is an important adaptive conservation strategy for climate-change impacted species.

Long-distance dispersal results in a large-scale metapopulation of caspian terns in western North America

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For a comprehensive understanding of certain bird populations, regional evaluations using a metapopulation framework are necessary. We investigated inter-colony movements and demographics of caspian terns (*Hydroprogne caspia*) based on re-sighting of color-banded individuals in western North America, where the population has experienced growth and range expansion. Some individuals prospected for breeding colonies over much of this extensive region. Movement of breeding adults between colonies up to 3,000 km apart (from California to Alaska) in a single breeding season was observed. To our knowledge, this is the longest breeding dispersal documented in seabirds. Apparent annual survival of adult caspian terns at the world's largest breeding colony for the species in the Columbia River estuary was 0.95. Apparent median age at first reproduction at this colony was 6 years post-hatch. The majority of sub-adults visited this and other breeding colonies for several years prior to their first reproductive attempt, and some prospected at multiple colonies prior to nesting. Because the large colony in the estuary is being managed to reduce colony size and thereby reduce the impact on juvenile salmonids listed under the U.S. Endangered Species Act, several artificial colony sites have been constructed outside the estuary as compensation. Terns in the estuary responded quickly to the availability of new colony sites as far as 550 km away and established successful breeding colonies in less than a year. Due to high vagility, delayed onset of reproduction, and high adult annual survival of caspian terns in this metapopulation, individuals can prospect for nest sites over an extensive area and establish a high degree of connectivity among colonies throughout the region. The large caspian tern colony in the Columbia River estuary appears to be an important source-colony for a number of smaller colonies over a vast area with limited and ephemeral nesting opportunities.

The evolution of sweet taste perception in a nectar-feeding bird

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Animals often evolve unique and specific adaptations to thrive in particular environmental niches. The evolution of sweet taste preference in nectar feeding birds provides a powerful model system for understanding molecular mechanisms underlying such phenotypic adaptation. In mammals, sweet taste reception is mediated by a G protein-coupled receptor complex; however, the gene encoding one subunit of the mammalian sweet receptor (T1R2) has not been detected in any bird genome, suggesting loss in the avian common ancestor. Nevertheless, some bird species, such as hummingbirds, display high behavioral affinity for sugars found in nectar. To understand the molecular basis of sugar sensing in hummingbirds, we cloned taste receptor orthologs from oral tissue of hummingbirds, swifts, and chickens. We identified a taste receptor that serves as a functional carbohydrate receptor in hummingbirds but not in swifts and chickens, providing strong evidence for neofunctionalization within the peripheral taste system. Moreover, we pinpointed key mutations that occurred in the hummingbird lineage and enable sugar recognition. Behavioral choice tests and high speed videography in wild and captive hummingbird populations indicated sweet taste preferences that correlated with in vitro functional studies. Thus, we describe a new sweet taste detection mechanism that evolved in hummingbirds since divergence from swifts, and more generally, provide a molecular mechanism for the adaptive evolution of a novel behavior.

Macroevolutionary processes in non-passeriform birds (Aves) at the global scale.

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Vrba's resource-use hypothesis and related habitat-theory suggest that a key to present-day macroecological patterns is found in the past: in the history of turnover of clades (speciation, extinction), and in the paleoclimatic and other geological changes of the areas in which clades evolved. We test several subsidiary predictions of the resource-use hypothesis for non-passeriform bird species (N = 3951) by using the biomic specialization index (BSI), which is based on the geographical range of a species in different climate zones. This index can be used globally, allowing comparisons across continents and taxa. Our results are consistent with the assumptions of the resource-use hypothesis, which predicts that (1) stenobiomic species occur at a high frequency, due to higher speciation and extinction rates than generalists, (2) faunivores are more eurybiomic than herbivore clades, and (3) biomic specialists occur at a higher incidence in the tropical rainforest, desert, steppe and tundra biomes. Deviations from these predictions of the evolutionary hypothesis tested here are related to the incidence of mountainous terrain on ecological specialization, to environmental heterogeneity in some biomes, or to the influence of Neogene continental faunal interchanges, all of which can be explained within the premises of the resource-use hypothesis. This hypothesis was originally based on evidence from fossil and extant mammals; our work represents the first support from assemblages of extant birds.

Tracing the evolution of casque ornamentation in hornbills

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The casque is narrow ridge on the upper bill that has evolved into an ornamental crest in cassowaries (Casuariidae) and hornbills (Bucerotidae and Bucorvidae). In hornbills, the degree of elaboration and function varies with species, from a simple reinforced ridge to a conspicuous brightly coloured elaborate crest that suggest use in mating displays. In some species, the casque is used in aerial jousting or provides resonance to calls, but it is unclear what factors had influenced elaboration in hornbill casques. A recent molecular phylogeny of Bucerotidae was used as the basis for analysis of trait evolution, and tested different models influencing the development in casque ornamentation. Measurements of casque dimensions, bill and wing lengths were taken from study skins to calculate for casque volume and casque index. Elaboration was based on the ratio of casque index with body size (wing length). Comparative analysis of independent contrast was used to test models of casque elaboration against the phylogeny using different variables, such as body mass, diet and territoriality. We used three functions in R, MCMCglmm, Brunch and Crunch and Parsimony in Mesquite to test the trait evolution in hornbills. Analysis of ancestral states using Parsimony indicated that casque elaboration occurred in five of six hornbill clades, but were most prominent in African forest hornbills.

Is density-dependent diversification in North American wood warblers an artifact of species delimitation?

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The temporal pattern of diversification of wood warblers is particularly interesting for the study of adaptive radiations since Rabosky and Lovette (2008), examined the change in diversification rates through time in a group North American *Setophaga* warblers. Their main conclusion was that in this continental radiation, speciation rates decreased as the density of species occupying an adaptive zone increased. Currently, this model of "density dependent diversification" is assumed to be the expected pattern of adaptive radiations. Importantly, methods for detecting shifts in diversification rates are sensitive to taxon sampling. A slowdown towards the present is expected when taxa are randomly pruned from trees with a constant rate of diversification highlighting the limitation of the inferences that can be derived from phylogenies that are incomplete due to practical problems. Additionally, little has been written about the sampling bias that can result from the selection of the terminal taxa that are incorporated in the analyses (i.e. biospecies or phylospecies). Here, we complete the *Setophaga* phylogeny to the subspecies level, and analyze the data with three groups of terminal taxa. The delimitation of the terminal taxa to be used in the analyses had a significant effect on whether there was change in diversification rate, the slope of the Lineage Through Time (LTT) curve and the associated gamma statistic. As expected, when using biospecies, we found a decrease in diversifications rate with time. Conversely, when all named subspecies were used, we found an increase in diversification rate towards the present. Finally, when a revised set of phylospecies was used the pattern approximated a constant rate of diversification. These results show that for diversification analyses, the assumptions used to identify terminal taxa are important, and the outcome of such analyses can be fundamentally different depending on the conceptual framework used to select them.

Forelimb disparity of water birds in a phylogenetic context

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Previous work has shown that the relative proportions of wing components (i.e. humerus, ulna, carpometacarpus) in birds are related to function and ecology, but these have rarely been investigated in a phylogenetic context. Water birds in the orders Pelecaniiformes, Ciconiiformes, Procellariiformes, Sphenisciformes and Gaviiformes form a highly supported clade and have developed a great diversity of wing forms and foraging ecologies. In this study, forelimb disparity in the water bird clade was assessed in a phylogenetic context. We find that different water bird clades are clearly separated based on wing component proportions ($P<0.001$), which are significantly correlated with phylogeny (Pagel's lambda=1, $p=0.033$). Wing proportions differ primarily in relative ulna length and are most similar in relative humerus length. Most of the traditional members of Pelecaniformes (e.g., pelicans, cormorants and boobies) cluster with Ciconiiformes (herons and storks) and occupy a reduced morphospace. These taxa are closely related phylogenetically but exhibit a wide range of ecologies and flight styles. Gaviiformes, Procellariformes and Sphenisciformes occupy a largely distinct morphospace characterized by generally shorter ulnae and longer carpometacarpus. Procellariiformes (petrels, albatross, shearwaters) occupy a wide range of morphospace, showing high variance in relative ulna (variance=6.92) and carpometacarpus (variance=11.37) length. The wing proportions of foot-propelled divers vary markedly, with one large cluster of cormorants broadly overlapping core Pelecaniformes/Ciconiiformes and smaller separate clusters of flightless cormorants, anhingas, and loons. Loons (Gaviiformes) exhibit very low variance (0.46) in wing proportions, and surprisingly they occupy a wing morphospace closest to diving petrels and penguins. Whether this result may reflect wing proportions plesiomorphic for the waterbird clade or a functional signal is unclear.

Temporal partitioning to avoid soundspace overlap by bird communities

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Birds do not always vocalize at random, but may rather divide up soundspace in such a manner that they avoid overlap with the songs of other bird species in order to communicate more efficiently. We describe this phenomenon from several recordings at our principal study location, near Volcano, California. We propose a way to visualize the soundscape partitioning using a circular diagram, and statistically show that less time is vacant or occupied by two or more species, and more time is monopolized, than is expected by chance.

We further focus on the fact that there are asymmetric relationships in the temporal avoidance behaviors among the species. For example, it appears that Black-headed Grosbeak (*Pheucticus melanocephalus*)—what we term a "driver species", with a longer song composed of many phrases—tends to keep its original periodicity regardless of overlaps with other species' songs, while other species such as Chipping Sparrow (*Spizella passerina*), which has a shorter song, tends to vocalize during interstices between the songs of the driver species. We discuss this phenomenon focusing on information flows from one species' behavior to another, and on the asymmetry in overlapping events.

We also consider the evolutionary significance of such a driver species using a computational experiment of the coevolution of the temporal overlap avoidance of singing behaviors, which can be interpreted as a behavioral plasticity, among sympatric species with different species-specific song lengths. We show that the species with the longest songs typically evolve to be driver species, which do not change song timing to avoid overlap with other species, while species with shorter songs adapt to fit into the remaining vacant time segments. This implies that diversity in the behavioral plasticity in bird communities can contribute to more efficient establishment of soundspace partitioning.

o09-2

Quantifying forest vertical structure to determine bird habitat quality in the Greenbelt Corridor, Denton, Texas

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Previous research has sought to quantify bird habitat quality by intensive field work combined with information derived from remote sensing. Yet, their results are limited due to the lack of accuracy in describing the vertical forest structure, which is one of the critical determinants of habitat quality. This study shows that height information derived from three-dimensional remote sensing contributes to produce maps that not only display the known location of target species, but also the potential location of the species based on habitat properties at landscape level. More specifically, this study integrates Light Detection and Range (LiDAR) and hyperspectral remote sensing to examine the relationship between forest stand structure, landscape heterogeneity, and bird community composition by creating a three-dimensional bird habitat map. A total of 5559 birds comprising 91 species were observed during a biannual bird census in 2009 and 2010 conducted in a bottomland hardwood forest in North Texas. Census data combined with the three-dimensional map suggest that local breeding bird abundance, community structure, and spatial distribution patterns are highly influenced by vertical heterogeneity of the vegetation surface. For local breeding birds, vertical heterogeneity of canopy surface within stands, connectivity to adjacent forest patches, largest forest patch index, and habitat (vegetation) types proved to be the most influential factors to determine bird community assemblages. Results also highlight the critical role of secondary forests to increase functional connectivity of forest patches. Overall, three-dimensional habitat descriptions derived from the LiDAR-hyperspectral integrated map serve as a powerful bird conservation tool that shows how the distribution of bird species relates to forest composition and structure at various spatial scales.

Consequences of land use change for breeding birds at the German Coast

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The German North Sea and Baltic Sea coast is threatened by climate change due to sea level rise and changes in precipitation. The collaborative research project COMTESS (Sustainable Coastal Land Management: Trade-offs in Ecosystem Services) studies possible future changes in land management at the German coast. Different scenarios of land use adaptation to climate change are investigated under ecological and socio-economic aspects. The scenarios involve the construction of polders in the hinterland of the dike (currently used as agricultural pastures), which could serve as water reservoirs and prevent salt water intrusion. Depending on the scenario, there could be either development of large reed beds with subsequent peat formation or a mosaic of smaller water bodies and extensively managed grasslands within the polders. These different land use strategies might lead to big changes in the breeding bird community at the German coast. Coastal ecosystems contain significant proportions of several endangered breeding bird species, for example the Black-tailed Godwit, Redshank or Lapwing. They will benefit from an increase in wet and extensively managed grasslands. However, permanently waterlogged meadows could develop into reed beds, leading to a loss of valuable habitat for meadow birds.
I will investigate the impact of the different COMTESS scenarios on breeding bird diversity and the composition of the breeding bird community. A space-for-time approach will be used to estimate future breeding bird communities in the different scenarios.

Shorebirds in a tropical bay: what resources support their food webs?

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Roebuck Bay, in North Western Australia, is one of the main non-breeding and fuelling areas for migratory shorebirds on the East Asia-Australasia fly way. The bay is characterised by high tidal range (+10 m), extensive inter-tidal mud flats, with mangrove systems in some parts of the bay, and seagrass meadows in other parts. It supports high biodiversity and abundance of benthic macrofauna, and can host more than 120,000 shorebirds in the non-breeding season. Between 2009 and 2011, samples of primary producers, primary consumers and blood from three shorebird species; Bar-tailed Godwit *Limosa lapponica*, Great Knot *Calidris tenuirostris* and Red-necked Stint *Calidris ruficollis* were collected from the Bay. Analysis of stable isotopes (SIA) of carbon and nitrogen showed that the primary producers supporting the food webs of the three shorebird species depended on the point of capture within the bay. Microphytobenthos was the dominant carbon source supporting the food web of shorebirds in the section of the bay adjacent to stands of mangroves, whilst in the northern section of the bay, carbon from seagrass, microphytobenthos and particulate organic matter contributed to shorebird food webs. Although relatively abundant, carbon from mangroves did not appear to play a major role. In all the cases, Bar-tailed Godwits held a higher trophic position than Great Knots, with Red-necked Stints in the lowest position. Mixing models indicated that the main prey for Bar-tailed Godwits were suspension and deposit feeders while for Great Knots suspension feeders were the main prey and in the case of Red-necked Stints, suspension feeders and microphytobenthos were the main food source. Since microphytobenthos plays a major role providing carbon to food webs of Roebuck Bay shorebirds, management plans for this Ramsar wetland must consider this trophic link.

Bird community responses to vegetation cover and structural heterogeneity

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Vegetation cover has long been known to be an important predictor of faunal distributions. However, few studies have examined the additional contribution of fine-scale horizontal vegetation heterogeneity for predicting faunal occurrence. Accounting for heterogeneity may provide a more comprehensive picture of the effect of vegetation structure on faunal communities, leading to improved biodiversity management. In this study, we investigated how bird species richness and life-history traits responded to vegetation cover and heterogeneity in different vegetation types. We found that both fine-scale vegetation cover and shrub heterogeneity were important predictors of bird richness, but the direction of the response to shrub heterogeneity differed between vegetation types. We further investigated these patterns by examining the responses of birds grouped by various ecological traits. Our study is the first to show that bird species with particular traits responded not only to the amount of cover, but also had a preference for (or were restricted by) different levels of vegetation heterogeneity. For example, we found that some bird species with particular life history traits, such as aerial feeders, showed a preference for patchy, heterogeneous micro-habitat. In comparison, bird species with traits such as low mobility and ground feeding exhibited a preference for dense, uniform vegetation cover. Our findings suggest that managing for high levels of vegetation cover, or alternatively managing for high levels of vegetation heterogeneity; will have different effects on the faunal community, with some species responding positively and others negatively.

Conservation values of variously managed off-reserve forests for avifaunal communities in lowland Nepal

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Although protected areas are central to global biodiversity conservation, off-reserve forests are increasingly recognized as potentially important for the long term conservation of biota, particularly in less-developed countries where communities rely directly on resources from natural areas. We assessed the conservation value of differently managed forests for avifaunal communities in lowland tropical forests. In particular, we explored whether their conservation value was additional or complementary to those of formal protected areas. Using data collected from 112 sites in protected areas (n=31), state managed forests (n=37) and community managed forests (n=44), we assessed how bird species richness, abundance, diversity and community composition varied among tenures. Although sites in protected areas had the greatest species diversity, community managed forests supported a complementary assemblage. Of 124 species recorded, only 45% were common to all management tenures. Overall, the distinctiveness and richness of species in sites in forests outside of protected areas contributed substantially to regional avifaunal diversity. These results highlight the potentially critical role of appropriately managed community forests. The maintenance of diverse bird assemblages in forest regions depends on complementary management of forests both outside and inside the established protected areas.

Bird community at Gunung Halimun Salak National Park: an important endemic bird area in Java, Indonesia

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Gunung Halimun Salak National Park (ca. 113,357 ha) is the largest remnant rainforest block on Java island, Indonesia. It is located at $6^0$32′– $6^0$55′ South and $106^0$13′ – $106^0$46′ East, at elevation between 500 and 2211 m above sea level. Based on the diversity of associated trees, the areas have been classified into three altitudinal zones: collin (500-1,000 m), submontane (1,000-1,400 m) and montane (> 1,500 m) zones. Exploration and long-term study on birds in some parts of the area have recorded 274 species which is 54% of the total Javan birds (507 species) or 18% of the total Indonesian birds (1603 species). Among those birds, 32 species have a restricted range characteristic of endemic species. It is approximately 94% of total restricted range of endemic species on Java island (34 species). The most important restricted range species include the Javan Hawk-eagle (*Spizaetus bartelsi*), Chestnut-bellied Partridge (*Arborophila javanica*), Javan Scops-owl (*Otus angelinae*), Salvadori's Nightjar (*Caprimulgus pulchellus*), Volcano Swiftlet (*Aerodramus vulcanorum*), Blue-tailed Trogon (*Apalharpactes reinwardtii*), Brown-throated Barbet (*Megalaima corvina*), Orange-fronted Barbet (*Megalaima armillaris*), Javan Cochoa (*Cochoa azurea*), White-breasted Babbler (*Stachyris grammiceps*), White-bibbed Tree-babbler (*Stachyris thoracica*), Crescent-chested Babbler (*Stachyris melanothorax*), Grey-cheeked Tit-babbler (*Macronous flavicollis*), Rufous–fronted Laughingthrush (*Garrulax rufifrons*), Javan Fulvetta (*Alcippe pyrrhoptera*), Spotted Crocias (*Crocias albonotatus*), Javan Tesia (*Tesia superciliaris*), Rufous-tailed Fantail (*Rhipidura phoenicura*), White-bellied Fantail (*Rhipidura euryura*), Pygmy Tit (*Psaltria exilis*), White-flanked Sunbird (*Aethopyga eximia*) and Javan Grey-throated White-eye (*Lophozopterops javanicus*). Details of distribution and habitat types of those species will be discussed.

Large-scale changes in birdlife and landscape - winners and losers in Germany over the past 25 years

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A nationwide mapping of breeding bird species was conducted in Germany between 2005 and 2009. All species observed in 3,000 grid squares measuring 12x12 km were recorded. These surveys resulted in the production of distribution maps for more than 200 less common or rare species based on semi-quantitative data. Additionally, common breeding birds were counted within the framework of the German Common Breeding Bird Survey (CBBS). This comprises 1,000 randomised sample plots and is based on a stratified design using land cover and abiotic characteristics for classification. The data obtained were used to model distribution maps and to estimate population sizes of 46 common and widespread species. In interpreting our results, we also took into account CBBS data from the last two decades, as well as data from a national atlas project conducted in the 1980s. The populations of some species have recently increased, among them the Great Bustard (*Otis tarda*), which has benefited from intensive management. The losers however greatly outnumber the winners. Large declines, either in range or abundance, were observed especially in populations of farmland birds, such as Skylark (*Alauda arvensis*) and Corn Bunting (*Miliaria miliaria*). We attribute this primarily to land use factors. For example, the average size of field lots and farming methods are very different in East and West Germany. These differences - reinforced by market regulating subsidies - apparently account for a significant part of the east-west gradient in the number of farmland bird species per grid square. Other factors must also be considered however, including the significant climatic and biogeophysical disparities between the regions. The aim of our study is to analyse these factors and to present selected results.

Interrelationship of bird species richness and habitat features during breeding and nonbreeding seasons in Indian Himalayas - a conservation approach

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Rapid rate of development in many parts of Indian Himalayas with explosion of human population has led to deforestation, which resulted in decline of bird species in the past. In India, there is a need to monitor Himalayan birds and their requirements at the habitat level in different seasons for conservation. However, the relationship of Himalayan birds with habitat features in different seasons of the area are still not known yet. We compared bird communities living in the Kumaun Himalayas using multivariate explorative techniques of quantitative data. Point count method was used to sample birds during breeding and nonbreeding seasons with 100 monitorings of 50 points in each season. Bird species richness was significantly higher in the breeding season than nonbreeding season. Principal component analysis (PCA) on vegetative physiognomic variables revealed 75.19% variance in breeding season and 79.14% in the nonbreeding season. Floristics axes by Detrended correspondence analyses (DECORANA) showed a gradient of altitude (eigen value: 0.315), plant abundance (0.215) and slope (0.146) in the breeding season while the gradient of plant abundance (0.304), plant cover (0.215) and altitude (0.132) were powerful during the nonbreeding season. Non-metric multidimensional scaling (NMS) revealed a clear pattern in a significant negative relationship in bird species richness and open forest character extracted from physiognomic variables during breeding season. Bird richness was positively correlated with high altitude and high tree richness forest character during the nonbreeding season. This study can be helpful in understanding the habitat need of Himalayan birds and their conservation during different seasons of their life.

The cost-effectiveness of bird conservation in agricultural landscapes

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Habitat restoration provides a key strategy in the conservation of birds in agricultural landscapes, where the degradation and loss of habitat through agricultural development and intensification threatens the long term viability of many species. Billions of dollars are spent globally on restoration in such systems, with bird conservation a major driver, however there are not sufficient funds to address the scale of the problem. Therefore restoration needs to be as cost-effective as possible to maximise the conservation gains from these investments. However, the lack of integration of economic data into restoration evaluation means that we do not know which strategies are the most cost-effective in the conservation of birds.

This study compares the effectiveness and cost-effectiveness of different approaches to the restoration of woodland bird habitat in agricultural landscapes, through an *ex-post* multi-disciplinary evaluation of passive and active restoration sites in agricultural landscapes in south-eastern Australia. The richness and composition of bird communities is measured at paired treatment and control sites across active and passive restoration sites varying in age, size, shape and landscape context, providing a measure of the conservation gain as a result of restoration. Detailed costs are determined for each restoration project, and combined with measures of conservation gain using economic evaluation techniques, to allow comparison of cost-effectiveness across different restoration treatments. Analysis will explore the influence of various ecological and economic factors on the effectiveness and cost-effectiveness of restoration, to allow future bird habitat restoration programs in agricultural landscapes to be designed to maximise the conservation gains per dollar spent.

This presentation explores issues of effectiveness and efficiency in the restoration of birds in agricultural landscapes, and presents preliminary data comparing the cost-effectiveness of different restoration techniques representative of those applied in similar systems around the world.

o11-1

Modeling maintenance of egg polymorphism over a geographic scale

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In avian brood parasitism, egg color morphs are a key fitness component around which co-evolutionary arms race between parasites and their hosts revolves; many hosts have evolved a fine tuned ability to recognize and reject parasitic eggs that look dissimilar to their eggs while some parasites have countered the host defence by mimicking their eggs. Clear polymorphism in egg color, blue and white, has been observed in some interactions between the Common Cuckoo *Cuculus canorus* and parrotbill species of the genus *Paradoxornis* as its host in eastern Asia. The possibility of dynamic maintenance of egg polymorphism with temporal oscillation in the frequency of white and blue eggs has been suggested by a theoretical model. The model, however, assumes a closed system with no gene flow among local populations, and it remains an open question how this dynamic maintenance is realized over a geographical scale where gene flow among local populations is likely occur to greater or lesser extent both in the parasite and its host. In addition, the predicted period of frequency oscillation is in the order of a hundred generations, too long to practically monitor in a local site. To understand the maintenance of egg polymorphism over geographical scale, I present a modeling framework to consider gene flow among local populations over a geographical scale and to extend the previous model to become "spatial". My final goal is to quantify a spatial scale that results in a geographic cline of egg color morphs relative to local dispersal range of the host and the parasite. We will discuss possible explanations for observed color morph frequencies over a continental scale in eastern Asia.

The importance of early-life environmental stress on total phenotypic variation

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Early-life environmental stressors can have marked effects on many behavioural, physiological and morphological traits. However little is known about which traits are most prone to be affected by early-life environmental stressors and what the contribution of early-life environmental stress is relative to other sources of individual variation (i.e. genetic variation and maternal effects). We investigated these questions in the Grey Partridge (*Perdix perdix*). We subjected parents of two genetic strains (wild and domesticated) to either *ad libitum* or unpredictable food availability and raised their offspring either under *ad libitum* or under unpredictable food availability, which resulted in 8 treatment groups (strain x maternal treatment x early postnatal treatment). We measured morphological (size, plumage characters), physiological (glucocorticoid stress response, oxidative stress resistance, several measures of immunity) and behavioural (several behavioural tests) traits, and recorded survival when released into the wild (as a measure of a fitness component). We found that only part of the traits were affected by the early-life stressor (unpredictable food availability during the first 3 weeks), while others were predominantly affected by maternal effects or depended on strain. One trait (immunity) was enhanced when chicks were raised under the mild stressor of unpredictable food availability during early life and these birds survived better when released into the wild. We present a grouping of traits affected predominantly by early-life, maternal or strain effects and also estimated additional individual variability of traits. This informs about the relative contribution of early-life stress on total phenotypic variation for different groups of traits.

Changing phenology when phenotypic plasticity does not suffice: evidence for evolution in action?

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Climate change alters seasonal ecological interactions, and because observed phenotypic responses are often insufficient, evolutionary changes are required. Here I show that *Ficedula* flycatchers are adapting their annual timing through a combined phenotypic flexible and possibly an evolutionary response. Because the individual flexible response was weaker than the mean population response, flycatchers lay at present up to a week earlier with the same temperature than 30 years ago. This effect differed across Europe, being strongest in regions with most spring warming. This possible evolutionary response was predicted by observed heritability and selection on annual timing. I hypothesize that populations in warming regions could evolve because survival selection for early arrival and breeding has weakened as temperatures upon spring arrival have increased and female survival consequently increased over the years. Whereas rapid evolutionary response may allow some species to adapt, our observed rate of adaptation in flycatchers is still less than the advance in timing of a major food source, and as a result major local population declines have been reported.

The spatial scale of selection and the evolution of phenotypic plasticity in seasonal timing

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Variable environments can select for phenotypic plasticity. A key example of this, with relevance for understanding responses to climate change, concerns plasticity in phenology - the timing of events in the annual cycle. Here, I report on analyses of more than five decades of data from a study of phenology and its fitness consequences in the Great Tit *Parus major*. Using a mechanistic model, I explore the extent to which plasticity in phenology of Great Tits is an adaptive response to temporally variable environments, and show that plasticity in this trait is of overwhelming importance for persistence in the face of expected climate change. However, I also extend this work to consider the spatial scaling variation in phenology among birds, as well as the trophic chain on which their offspring rely for food. I present data suggesting that adaptive plasticity is scale-dependent, and I will argue that selection at multiple spatial scales in the Great Tit acts as a constraint on the evolution of adaptive phenological plasticity.

The genomics of a wild passerine bird, the Great Tit *Parus major* and its application for quantitative traits

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Until recently it was impossible to connect variation in ecological relevant traits to genome-wide molecular genetic variation in bird species from natural populations. Such a connection is essential to identify genes responsible for phenotypic variation and to study the way these genes interact with the environment in which they are expressed, in order to describe or predict micro-evolutionary processes. We have sequenced and assembled the Great Tit (*Parus major*) genome and we have developed a genomic toolkit that enables us to study genome-trait associations in this ecological model species. Here I show results of the genomic characterisation of the Great Tit and the use of our genomic toolkit to study associations between polymorphisms in the genome and phenotypic variation in behavioural and life-history traits.

Distinguishing the effects of selection from demographic history in the genetic variation of two Old World flycatchers

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Determining the mechanisms responsible for the distribution of genetic diversity in natural populations has occupied a central role in molecular evolution. Our study was motivated by the unprecedented observation that a widespread Eurasian flycatcher, *Ficedula albicilla*, exhibited no variation at the mitochondrial DNA (mtDNA) ND2 gene in 75 individuals sampled over a 5,000 km distance. In contrast, its sister species, *F. parva*, had low but considerably higher levels of mtDNA variation. We assessed whether natural selection or demographic factors could explain the absence of mtDNA variation in *F. albicilla*. Eighteen nuclear genes were sequenced to estimate the two species' phylogeographic histories, and for comparison with the mtDNA data. Multilocus coalescence analyses suggested that *F. albicilla* experienced a population expansion perhaps following a population bottleneck. Simulations based on this demographic history, however, did not replicate the extremely low level of mtDNA variation. Historical range changes based on ecological niche models also failed to explain the observed mtDNA patterns. Neutrality tests (DHEW and ML-HKA) suggested a non-neutral pattern in the mtDNA of *F. albicilla*. We found a transmembrane-skewed distribution of non-synonymous substitutions between the two species, three of which caused functional change; the results implied that positive selection could have targeted mtDNA. Several lines of evidence support selection rather than demographic history as the main force influencing the patterns of mtDNA variation. Despite the influence of natural selection, many of the phylogeographic inferences derived from mtDNA were robust, including species limits and a high level of gene flow among populations within species.

Hybrid zones and clines as sources of novelty in a parrot species complex: implications for speciation and conservation

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Geographic variation in phenotypic and genetic traits is present in many species, with important implications for speciation, adaptation to new environments, and conservation. However, the evolutionary processes that give rise to geographic variation within species, in the absence to barriers to gene flow, are often poorly understood. Hybridisation may result in the evolution of novel or extreme (transgressive) characters compared to ancestral forms by providing a source of genetic variation (or transgressive segregation), and may consequently play an important creative role in evolution. This in turn may promote speciation, despite the presence of gene flow, and population persistence, by enabling rapid adaptation to novel environments. However, these patterns have rarely been studied in birds. We investigated this in the circular overlapping Crimson Rosella (*Platycercus elegans*) parrot complex of south-eastern Australia. Rare cases of circular overlaps, or ring species, offer a unique opportunity to study how adaptation and population divergence proceeds in the face of gene flow, because they feature clinal variation along a chain of interconnected populations that culminate in taxa which meet but exhibit species-level differences. We compared trait values in the most divergent populations, along with geographically intermediate clinal and hybrid populations. We studied a diverse suite of traits, including colour, odour, and vocal signals, body size, behaviour, and pathogen infection. We found broad evidence for an association between clinal/hybrid populations and novel or extreme traits in this complex. These patterns were present across morphological (plumage signals and calls) and behavioural (laterality) traits, and in pathogen infection. We also found that at least one such trait, structural plumage coloration, was strongly related to assortative mating, suggesting a possible role in speciation. Our results provide evidence that clinal/hybrid populations may provide important sources of evolutionary novelty in birds and may contribute to population divergence.

Admixture as a factor in diversification in Wallacean bird assemblages

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Genetic introgression and concomitant phenotypic admixture are known to occur widely across hybrid zones of closely related species. These phenomena are well-studied in a number of avian model groups known to hybridize, especially across temperate-zone tension zones. However, the effects of introgression and admixture on differentiation and species diversification are generally believed to be marginal. In fact, it has been suggested that introgression and admixture counter-act organismic diversification by wiping away accumulated levels of differentiation across contact zones. The paper presents preliminary morphological, bioacoustic and genetic data from several bird complexes living across a number of poorly-studied islands in the Wallacean Region (eastern Indonesia). It is proposed that genetic introgression and admixture have been vital in generating organismic diversification across these islands. Levels of phenotypic and genetic pairwise differentiation between islands can be carefully predicted by taking earth-historic events into account. These results suggest that admixture and introgression can be important factors in bird diversification.

The origin and trend of the common magpie in Japan: Microsatellite analysis of old and new introduced populations

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The common magpie (*Pica pica*) ranges widely from Europe through Asia, but is not native to Japan. A small population has been established in Kyushu, the southernmost main island of Japan, since the introduction of several pairs from Korea 400 years ago (according to ancient documents). Its range had been very restricted, but has gradually expanded to the entire northern part of Kyushu during recent 40 years. Another population has recently been established in Hokkaido, the northernmost main island of Japan, whose origin is unknown. The number of individuals increased to about 200 in the last 20 years.

To estimate the origin and the reason for this difference in the population trend, we analyzed microsatellite polymorphism in these populations together with native populations in Korea and Russia. We found the origin of the Hokkaido population was not Kyushu, and most individuals were derived from Russia. The genetic diversity in Hokkaido population was not decreased compared to native populations. By contrast, genetic diversity in Kyushu was low, suggesting a strong founder effect. However, recent introduction or immigration across the Korean/Tsushima strait was also suggested. Our results support the general notion that the trend of non-native population depends a lot on founder population size and the number of introduction events.

o12-5

Comparative phylogeography of the entire understorey bird community in a sky island reveals differential impacts of island structure on population structure

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Sky island systems provide an excellent opportunity to study species distributions with the effects of isolation and connectivity, resulting from the interactions between topography and paleo-climate. In such systems, breaks in mountain ranges cause vicariance (isolation), while paleo-climatic changes cause changes in dispersal (connectivity) between populations. We previously studied a montane forest species in the Western Ghats sky islands that revealed deep phylogenetic breaks at ancient geographic divides, and population divergence roughly corresponded to paleo-climatic events. We proposed to examine if this paradigm was consistent for several montane species in this system. We sampled almost the entire understorey bird community from the *Shola* habitat (matrix of natural forests and grasslands) from all six major 'islands' in the Western Ghats sky island complex, covering most of the endemic species' range. Two mitochondrial and two nuclear gene sequences (~3kb, 253 samples, 24 species) using standard primers were assembled. Maximum likelihood and bayesian trees revealed a deep divergence for several endemic species across ancient geographic divides. There is evidence for cryptic speciation and possible delimitation of new species. Phylogeographic signatures were stronger and divergences deeper for montane forest and grassland specialist species. Correspondingly, widespread and migratory birds (both long-distance and elevational) showed less phylogeographic structure. Divergence times across species varied and were not consistent with a break caused by a single event. Our study is the first of its kind in this biodiversity hotspot, and provides evidence that species ecology may interact with processes like vicariance and dispersal to drive evolution across such a landscape.

Do phenotypic and ejaculate quality reflect siring success in the Collared Flycatcher?

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As a consequence of polyandry, sperm of several different males can be in direct concurrence for the fertilization of a given set of eggs, extending sexual selection to postmating mechanisms. Sperm competition describes the competition over paternity occurring between males ejaculates, after the initial mate choice occurred. As a result, selection favours any characteristic of the ejaculate enhancing fertilization success, including sperm number, viability, velocity and longevity. According to the phenotype-linked fertility hypothesis, honest signals in males (secondary sexual characters) reflect male fertility. Females should then use the relative size of male signals when making decisions to engage in extra-pair copulations as an insurance against infertility. Several studies have found links between phenotypic traits and ejaculate quality or between sperm traits and fertilization success, but few studies link all three components. Here we present data linking sexually selected traits, sperm quality and paternity success in a wild population of Collared Flycatchers (*Ficedula albicollis*). Collared Flycatchers have been monitored on the island of Öland, in the Baltic Sea, for over ten years. Extra-pair copulation is fairly common in the population, with over 17% of nestlings being sired by extra-pair males. By comparing sperm traits to the size of known sexually selected characters and the number of offspring sired, we will discuss if phenotypic traits can signal fertility in the Collared Flycatcher.

o13-2

Superior performance of extra-pair offspring may result from genotype-by-environment interactions

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Genetic polyandry is a common reproductive strategy observed in numerous species of passerine birds. However, in spite of three decades of intensive research we still lack convincing explanations of its evolution and maintenance in wild population. Two hypotheses – namely the “good genes” and the “compatible genes” hypotheses are invoked to explain the selective advantage that polyandrous females may have over the monogamous ones. In our study we explore these hypotheses using a wild population of a genetically polyandrous species – the Blue Tit (*Cyanistes caeruleus*). We determined parentage of all clutches in the populations. We also measured a number of offspring traits, Including immunocompetence, plumage colour and morphology. To complement our study we performed an experiment by manipulating the brood size of some of the studied clutches and thus creating an environmental gradient of stressful conditions. We demonstrated, that extra-pair offspring (EPO) were superior compared to the within-pair offspring in terms of immunocompetence but only in enlarged (i.e. stress-affected) broods. We suggest that the superiority of EPO may result from genetic effects interacting with environmental effects.

Flirty females? The role of female song in *Malurus cyaneus*

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Although female songbirds can develop songs as complex as males, little is known about their function and evolution. In fact, female song was for a long time regarded to be useless and or a result of physiological abnormalities, but in some species females produce complex, individual songs. Recent studies suggest that females may use song in similar contexts to males, including territorial defence and mate attraction. The aim of our study is to understand alternative functions of female song in birds, rather than explaining it as an equivalent to male behaviour. We focused on the Superb Fairy Wren (*Malurus cyaneus*), which is known to have a complex social and mating system. Probably in context to that, females of this species evolved a complex song, which they produce independently from their mates and therefore represent an ideal study species. We conducted behavioural observations and playback trials with dummies during three stages of the breeding period namely (i) the pre-fertile (ii) fertile (iii) post-fertile period. We tested female responsiveness towards male and female intruders. Our results show that territorial pairs perform significantly more song bouts when females are fertile. Furthermore, we found that females respond significantly stronger to males than to females during their fertile phase of the breeding cycle. Our results indicate that females appear to use song not exclusively in territorial defence as was previously thought, raising the question whether singing behaviour occurs in context to fertility advertisement and pair commitment. To our knowledge this is one of the first studies investigating female song combining fertility stage and intruder sex, considering alternative functions rather than the classic pathways of sexual selection.

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"Broad-sense" sexual conflict: the evolution of female sexual autonomy and theoretical implications for the evolution of morphology and complex behavior in birds

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Current models of sexual conflict over mating largely conflate mating preference and resistance to forced copulation, and thus have focused narrowly on the direct fitness costs that females incur by mating with males that harm them. Research on antagonistic genital coevolution in waterfowl suggests that "indirect" fitness costs associated with mating with an individual that would not otherwise have been preferred behaviorally may be key to understanding the evolution of traits such as female vaginal complexity that control rates of fertilization but not sexual attack. Using four-locus theoretical population genetic models, we apply this broader view of sexual conflict quantitatively to the evolution of genital morphology in waterfowl, and then extend the concept to the evolution of Bowerbird bowers as structures that protect females from sexual attack. We show that indeed, resistance to forced copulation can evolve in correlation with preference for attractive phenotypes. In this way, females are able to positively reinforce their ability to freely choose mates: females that manage to resist coercion and mate with attractive males pass on those advantages to their offspring. Thus, the evolution of "resistance" traits (vaginal complexity or preferences for protective structures) cannot be fully understood without consideration of their role in promoting sexual autonomy. This concept of sexual conflict in the broad sense may have further previously-overlooked implications for other important questions in avian evolution, including the loss of the avian phallus and the evolution of cooperative display in lekking birds.

o13-5

Females insure against infertility of their mates: an empirical test of the fertility insurance hypothesis in a wild bird population

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Fertility insurance has long been discussed as a plausible hypothesis for the adaptive function of females engaging in extra-pair copulation, but has never been tested experimentally. Although the frequency of azoospermia is reported low, infertility of eggs can be catastrophic to the fitness of females, and it is assumed that females can eliminate the risk of laying an infertile clutch by copulating with extra-pair males. Here, we attempted to test the hypothesis experimentally by deluding females into perceiving that their mates are infertile using a wild population of Japanese great tit, (*Parus major minor*), a socially monogamous passerine with a moderate frequency of extra-pair paternity. During the egg laying period, we replaced the eggs of experimental pairs with artificial eggs so that the females would perceive that the eggs were infertile, and ot induce a replacement clutch. The level of extra-pair paternity was compared between the replacement clutches (n=12) and second clutches of the control pairs (n=18) to determine the effect of the treatment on extra-pair behaviour. We found that the proportion of extra-pair offspring within the brood of a replacement clutch of experimental pairs (28.8%) was significantly higher than second clutches of control pairs (16.4%). The result of this experiment supports the infertility insurance hypothesis of an adaptive function for female engaging in extra-pair copulations. Although separating the hypothesis from other hypotheses is still a challenge, the present study is the first experimental evidence for the potential benefit to females engaging in extra-pair copulations to insure the fertilization of their eggs.

Post-war changes in rice farming and egrets in Japan

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During the 20th century, the loss and degradation of wetlands has occurred around the world, including Japan. Rice fields have played an important role for providing artificial habitats for many wetland species such as aquatic plants, invertebrates, frogs, fishes and birds. However, since the end of the Second World War, the intensification of agriculture has been widespread and has threatened the farmland biodiversity in Japan. In this presentation, I summarize the history of post-war changes in rice farming and their impacts on biodiversity, by reviewing earlier studies in Japan (including my own). A primary focus is egrets and their main prey species, frogs and fishes, which are high trophic-level species in rice-paddy ecosystems. Earlier studies suggest that two types of agricultural intensification are primary causes for the decline of these species. First, the application of chemical pesticides within and around rice fields has threatened egrets through the reduction in prey abundance and chemical agent contamination. Its negative impact seemed to be greatest between 1950 and 1970 before the use of highly toxic agents (e.g. PCP and DDT) was banned. Second, physical changes such as mechanization and habitat drainage have also been a threat to vertebrates. In particular, the development of modern, efficient drainage systems has significantly reduced the abundance of frogs and fishes. As a result, foraging egrets tend to aggregate in remaining “traditional” fields with shallow earthen ditches. I also discuss conservation efforts to halt the loss of farmland biodiversity in Japan: wildlife-friendly farming such as organic farming, the installation of fishways and winter flooding.

o14-2

Responses of the Chinese bulbul in life history traits to urbanization: the role of food and nest predation

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Urbanization is regarded as a major cause of global environmental change and a major contributor to species endangerment. Its impacts on avian life have drawn increased attention in recent years, but little empirical information exists about how the life histories of birds respond to urban habitat characteristics. This added knowledge would be a powerful tool to understanding avian communities and species distribution patterns in urban environments. We explored the responses of the Chinese bulbul (*Pycnonotus sinensis*) in life history traits to urbanization in Hangzhou, East China, during 2012-2013. Percentage of concrete surface within a series of buffer zones was used to measure the urbanization gradient. We compared nesting start-date, clutch size, egg weight, incubation period, fledging period, hatching success and fledging rate of 234 nests from countryside to city center. The results showed that, with urbanization, the Chinese bulbuls tended to nest earlier ($n=114$, $p<0.001$) than their countryside counterparts. Urban nests had larger egg weight per egg ($n=84$, $p=0.003$), higher hatching success ($n=220$, $p=0.021$), and a longer fledging period ($n=96$, $p<0.001$). Furthermore, we compared chick feeding rate and nest predation rate in differing levels of urbanization, using video camera monitoring and artificial eggs at nests. We found that urban nests had higher feeding rates ($n=21$, $p=0.01$) and lower egg predation rates ($n=133$, $p=0.024$). Our results suggested that urban habitats might supply more food to adults but not sufficient to chicks. Countryside nests had higher egg predation, and city center nests had higher chick predation. Different food resources and nest predators along urbanization the gradient might explain the responses of Chinese bulbul in life history traits to urbanization.

Birds, body size and climate change

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Reduction in animal body size has recently been suggested as a third universal response to contemporary climate change, alongside changes in species' phenology and distributions. Body size affects metabolism and fitness, so changing size has implications for resilience, yet temporal patterns of size variation and the ecological and life history traits that underlie it remain poorly understood. We examined inter-annual variation in the body size of 50 Australian passerine species over a period of ca. 50 years using museum specimens collected across the species' geographic ranges, sampling tropical and temperate regions. We tested for relationships between body size shifts and a range of life history and ecological traits, including body mass, diet, mobility and climatic region. We documented considerable variation in temporal size patterns among species, and discuss findings in relation to the relative sensitivities of species to climate change. Our study highlights the complexity and dynamic nature of size responses to environmental change and the significance of body size in determining vulnerability to extinction.

Fynbos endemic birds are vulnerable to extinction due to global warming

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The Fynbos Biome (Fynbos) is the smallest of the six floral kingdoms, contained completely within South Africa. Best known for its high plant species richness and endemism, it also hosts six endemic bird species and is suitable habitat for a further seven of South Africa's endemic passerines. The six Fynbos endemic bird species are currently listed as 'Least Concern' despite a lack of information on population size, ranges or trends. We conducted point counts across the biome to determine densities; used MaxEnt to map bioclimatic space; and South African Bird Atlas Project data to map trends. We identified two species, Cape Rockjumper (*Chaetops frenatus*) and Protea Seedeater (*Crithagra leucoptera*), as species that should be classified as 'Vulnerable' due to decreased reporting rates, small ranges and high levels of fragmentation. These two species showed a bioclimatic range limited by mean annual temperature below 15°C as well as climatic variables typical of the Mediterranean type ecosystem that defines much of the Fynbos. Measurements of evaporative water loss (EWL) and resting metabolic rate confirmed that these two species have the lowest temperature tolerances of 12 species resident in the Fynbos. Temperatures for the Fynbos region have increased by at least 0.5 °C over the last 30 years. Although we cannot confirm that reporting rate decreases from atlas data are due to climate change, we demonstrate that with a temperature increase of 4 °C (a likely IPCC scenario for the end of the century) no bioclimatic space will remain for these two species.

o14-5

Decline of urban House Sparrows in relation to local and landscape factors

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Swedish House Sparrow populations have declined for decades, reflecting similar trends for farmland birds throughout northern Europe. Using a variety of approaches, we investigated the effect of agricultural intensification on the occurrence and abundance of House Sparrows on farms in replicated landscapes. In particular, we tested the hypothesis that agricultural specialization has resulted in loss of landscape complementation, such that resources needed during breeding and winter have become spatially separated, with negative consequences for house sparrow population sizes. Analysis of breeding bird surveys showed declines to be linked with periods of agricultural intensification, but also that House Sparrows suffered from increasing farm specialization towards animal husbandry. Using space-for-time substitution, we found that the probability of finding House Sparrows on farmsteads was lower in landscapes with strong farming specialisation compared to in landscapes with mixed farming and that interactions between local food resource variables (animal husbandry, winter feeding) were stronger in landscapes with specialised farming. Experimental addition of nest-sites resulted in higher occupancy when natural nest-sites were scarce, but there was no detectable effect on population change. Experimental foraging studies demonstrated lower food availability during breeding in intensively farmed crop-production landscapes, whereas experimental addition of winter food demonstrated no effect on population changes irrespective of agricultural landscape type. Our studies demonstrate that not only agricultural intensification, but also specialization resulting from structural rationalization, has consequences for farmland birds. In addition, it demonstrates the importance to consider the multivariate consequences of agricultural intensification at multiple spatial scales.

o15-1

Molecular cloning and seasonal expression of corticosterone receptors in the diencephalon of Eurasian Tree Sparrows (*Passer montanus*)

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Glucocorticoids (GC) mediate various essential biological functions by binding to and activating their specific receptors. In vertebrates, the interaction of the glucocorticoid receptor (GR) and the mineralocorticoid receptor (MR) in the hypothalamus and hippocampus plays an important role in the negative feedback pathway of GC regulation. In free-living birds, a number of studies have demonstrated seasonal regulation of the adrenocortical response to stress, but only a few studies have examined the seasonal expression of the GR and the MR. In this study, the full-length open reading frames (ORF) of the GR (eGR) and the MR (eMR) cDNAs from a passerine species, the Eurasian Tree Sparrow (*Passer montanus*), were successfully cloned, and the seasonal expression patterns of eGR and eMR mRNA in the diencephalon were determined. The ORF eGR contains 2,322 base pairs (bp) encoding 773 amino acids (aa), and the eMR contains 2,952 bp encoding 983 aa. The eGR and eMR are highly conserved in their gene and amino acid sequences and in their secondary and 3D structures when compared with other species of birds and vertebrates. Our results demonstrated that the Eurasian Tree Sparrow exhibits significantly decreased GR and MR:GR mRNA expression in the diencephalon during the wintering stage when compared with the breeding and the pre-basic molt stages, but no differences were observed for MR mRNA expression. The seasonal modulation of eGR and eMR mRNA may reflect the plasticity of adaptive strategies and the diversity of downstream regulating mechanisms of the hypothalamic-pituitary-adrenal (HPA) axis that serve to maintain an optimum balance between survival and reproduction.

Hormonal correlates of photoperiod induced seasonal life history states in the migratory Black-headed Bunting

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Day-light length influences the timing of seasonal migration and reproduction by interacting with endogenous clocks in several birds. The actual physiological correlate of this interaction is, however, unknown. We postulated (i) that migratory behavior in night-migratory songbirds are maintained in day-night environment by changes in the daily pattern of melatonin secretion, and (ii) that thyroid hormones are involved in the regulation of events linked with the migration and reproduction. We examined this by measuring hormones in the blood, and by manipulating endogenous hormone levels with exogenous hormone or with chemicals that alter the effects of hormones in the night-migratory Black-headed Bunting *(Emberiza melanocephala)*. We measured plasma melatonin levels in the Black-headed Bunting during two different migratory states, and during exposure to photoperiods that differed in the light intensity and/or spectrum. Circulating melatonin levels reflected the duration, intensity and wavelength of daily light environment. Melatonin levels were correlated with physiological states linked with seasonal migration, but a causal link between the two was not established. We also examined the effects of iopanoic acid injected over three weeks under short day-length on photoperiodic induction in buntings when they were subsequently exposed to long days. The treatments affected the amplitude of photoperiodic response, measured as body fattening and mass gain, gonadal recrudescence and *Zugunruhe*. We concluded that thyroid hormones are involved in the regulation of seasonal responses in the migratory Black-headed Bunting.

o15-3

Climate-induced environmental variation in yolk hormone levels in Great Tits

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Despite the prominent effects of climate change on bird reproduction, maternal effects in birds have rarely been considered in this context. Maternal effects via egg composition, such as yolk hormones can be a powerful way to influence offspring phenotype and even fitness, and large variation exists in yolk hormone levels among and within clutches. It is not well known, however, how climate-related environmental variation in temperature, food availability, and timing of egg laying may affect allocation of resources and hormone levels to eggs, thereby perhaps facilitating or hampering adaptation to global warming. Variation in environmental conditions before or during laying could act as cues of the maternal/environmental conditions during offspring rearing, to which egg resource allocation is adjusted, or could constrain such allocation. Using the Great Tit (*Parus major*) as our model species, we studied temperature-related variation in yolk androgen hormones among and within clutches in environmentally controlled aviaries. We experimentally manipulated temperature before and during laying, using different temperature regimes over 5 years. We also collected correlative field data on egg composition in relation to ambient temperature and timing of breeding. Furthermore, to study whether egg composition responds rapidly to short-term changes in food availability during laying, we did a supplementary feeding experiment in a field population, by both increasing and decreasing food availability. Our results suggest that (rapid) changes in temperature and food availability can indeed affect egg composition (e.g. egg mass, yolk androgen and thyroid hormones), thus emphasizing how global warming-related changes in the environment may affect resource allocation to eggs and thus the potential of maternal effects interacting with environmental cues to facilitate or hamper adaptation to changing climate.

Geographic variation in clutch size and stress response along a latitudinal gradient in the Thorn-tailed Rayadito (*Aphrastura spinicauda*), a Patagonian furnariid

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Environmental variability represents challenges to avian reproduction possibly by way of affecting mechanisms that could translate into major physiological consequences (i.e., stressors). In order to assess how different ecological conditions affect reproductive and coping strategies, we compared clutch size and the adrenocortical responses to standardized stressors among populations of the Thorn-tailed Rayadito (*Aphrastura spinicauda*), an endemic furnariid from the Patagonian forests of Chile and Argentina. In four different populations from north-central Chile to the extreme south of Chile, encompassing 25 degrees of latitude (Populations: Fray Jorge National Park, Manquehue hill in Santiago area, Chiloe island, and Navarino island), we found significant reproductive differences between populations, with clutch size increasing from north to south, as follows: Fray Jorge (3.04±0.69 eggs), Manquehue (3.46±0.63), Chiloé (4.50±0.78), and Navarino (4.95±0.94). We did not find differences in egg size between populations, nor in adult survival. We also found that baseline corticosterone levels tend to be lower in the southernmost populations. On the other hand, we found that the stress response did not vary among populations in any of the three years of the study. We concluded that low environmental temperatures do not represent a stress situation for rayaditos if food abundance is sufficient to support energetic demands, and possibly larger clutch size in southern populations are the result of greater seasonality.

o15-5

Effects of social status and oxidative stress on antioxidant allocation and sperm quality in a passerine bird

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Reactive oxygen species (ROS) are normal by-products of our metabolism, which cause cell damage and impose physiological constraints to all organisms. Sperm cells are very susceptible to ROS, and oxidatively damaged sperm show reduced fertilizing capacity. Oxidative stress in sperm is expected to have dramatic consequences for male fitness under circumstances of sperm competition. It can thus be predicted that, in species where males have differential access to females and sperm competition is frequent, dominant males enjoying more copulation opportunities should invest more antioxidant resources into their somatic functions vs. their germline in order to increase their attractiveness and hence secure their paternity. In contrast, subordinates who have less mating opportunities and frequently face sperm competition should invest into the antioxidant protection of their germline to enhance their sperm quality and increase their likelihood of paternity. We experimentally tested this hypothesis with House Sparrows *Passer domesticus*. We maintained 54 males and 36 females in 30 outdoor aviaries at the Station for Experimental Ecology in Moulis, France. We dosed half of the males with the pro-oxidant diquat to induce chronic, moderate oxidative stress. The other half was dosed with a saline solution to serve as controls. We recorded agonistic interactions to determine male dominance, and collected sperm samples every second day and blood samples every week for a period 3 weeks. Male redox status in red blood cells and sperm was assessed through oxidative damage to lipids (MDA) and DNA (COMET assay), and through levels of endogenous and exogenous antioxidants such as glutathione, vitamin E and the enzyme SOD. Sperm quality was measured as swimming velocity, percentage of motile sperm, and sperm longevity. Our results provide new insights into how antioxidant resource allocation strategies underlie individual reproductive tactics.

Cumulative delays from pre-breeding stages affect breeding chronology and performance in a migratory seabird

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Considerable progresses in tracking migrating seabirds at sea over prolonged periods provide invaluable insights in population dynamics to understand how successive steps are linked throughout the annual cycle. Here we set out to measure whether the environmental conditions the birds experience at sea between two successive breeding periods affect timing of their return migration, which may in turn impact both timing and success of subsequent breeding. Using miniaturized light and temperature geolocation dataloggers (GLS) over three successive years (2010-2011 to 2012-2013), we collected 33 datasets on Rhinoceros Auklets (*Cerorhinca monocerata*) movement and activity at sea during the inter-breeding period (July to April). Recent 'broken stick' modelling approach enabled us to distinguish wintering from migrating behaviours at sea, and the loggers wet/dry records allowed inference of attendance patterns at the colony. Breeding outputs (egg size) and success were measured through long-term monitoring of the colony. Our results show that while individual post-breeding departure dates at sea and wintering areas were alike between years, the birds started their return migration almost 10 days later on average during years with low productivity (chlorophyll concentration) levels on the wintering sites compared to a 'normal' year. Accordingly, the first night ashore was also 8 days later on average following poor winter conditions compared to the normal year, as we expected. However, the shift in breeding dates continued to increase during the course of the breeding cycle until egg laying, following poorer conditions and delayed return. Eventually, both egg size and breeding success were significantly lower following poorer winter conditions. These results allow assignnent to specific phases at sea the delay in breeding chronology of the birds observed from land, and suggest that the impact of marine conditions experienced during both winter and pre-laying exodus, may be cumulative in affecting breeding readiness and performance in a migrating seabird.

Carry-over effects and individual variations in corticosterone level, at-sea behaviour and reproductive success in a small pelagic seabird, the Manx shearwater

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Individual variation in both quality and reproductive performance offers critical insights into evolutionary ecology. While conventional theories in vertebrates suggest that such variation is mostly due to age or experience, recent work suggests that some individuals perform better regardless of their age. In particular, inter-seasonal or *carry-over* effects have been recognized to play a critical role in influencing individual performances. Although individual variation in sex, foraging patterns, parental care and reproductive performance were well documented, how these traits are associated with reproductive performance and the causes underlying the variations remains elusive. We combine archival light loggers -- to elucidate wintering movement, conditions and the effect on breeding performances of the Manx shearwater (*Puffinus puffinus*) -- with proximate physiological mechanisms underlying individual variation in life-history traits. Specifically, we link individual variation in at-sea behaviour to corticosterone levels (as extracted from feathers, indicating long-term conditions during growth) and reproductive success, which potentially affect fitness, and we examine the extent of carry-over effects. Preening secretions on seabird feathers have an unknown corticosterone concentration and represent a more recent deposition window than feather growth. Sample preparation methods for liquid chromatography/ tandem mass spectrometry of corticosterone in seabird feathers are reported. By combining behavioural and physiological studies, we show how the individual variation in life-history traits is associated with reproductive performance and the mechanisms underlying the variation.

Individual variation in resource allocation strategies in the lesser black-backed gull

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Quantifying spatiotemporal variation in movement patterns at various levels of ecological organization is of paramount importance to improve our understanding of the ecology, life history and behaviour of wild organisms. For migratory species, conditions experienced during winter may impinge upon the reproductive strategies in the forthcoming breeding season (i.e. *carry-over effects*), which has been confirmed in several populations of seabirds. Species are conventionally assigned to one of two opposing strategies to invest resources in future reproduction: "capital" breeders are believed to rely on stored, endogenous, resources while "income" breeders are believed to rely on concurrent exogenous food intake. Yet, most real-world species are located along a continuum of mixed allocation strategies between these two extremes. Recent within-population studies suggest that individuals, sexes, or cohorts might substantially differ in their overwintering strategies and in their tactics to allocate resources to survival and reproduction, which may have important fitness consequences. Here we test a novel, non-invasive approach to determine individual resource allocation strategies. During 2012 and 2013 we analysed isotopic signatures ($\delta^{15}N$, $\delta^{13}C$, $\delta^{34}S$) of breeding female feathers [moulted on winter (capital endpoint) and breeding (income endpoint) grounds], egg-components and down feathers within a breeding population of individually-marked lesser black-backed gulls (*Larus fuscus*) at Zeebrugge (Belgium). We calculated the discrimination factor from eggs to down feathers and Bayesian mixing models revealed substantial individual variation in allocation strategies. In spring 2013, we equipped 20 females with a state-of-the-art GPS device that allow detailed monitoring of movement and feeding behaviour in both breeding and wintering sites. By integrating stable isotope results with data on female physical condition, reproductive performance, and year-round mobility, we here discuss how individual resource allocation strategies result in life-history variation through trade-offs with properties of the reproductive cycle.

o16-4

Timing of moult is regulated by an intrinsic schedule in the Pied Flycatcher (*Ficedula hypoleuca*)

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Many birds undergo a complete post-breeding moult, in which they replace all feathers. The onset of autumn migration can only take place after the moult is completed. Moult starts at the end of the nestling period, while the parents are still feeding chicks. As a consequence, parents may have to trade-off their resources between two demanding tasks: feeding the chicks and moulting. Early departure to autumn migration may have several benefits, and birds may thus be under selection to (initiate and) complete moult as soon as possible. We tested three alternative scenarios that might predict moult initiation in the Pied Flycatcher. Moult could be triggered by: (1) The phase of breeding: parents start to moult relative to a certain late breeding stage (e.g. nestling age), (2) The calendar day: parents initiate moult at a certain photoperiodic time point, or (3) The intrinsic schedule of the individual: set by some previous phase of the yearly cycle, such as timing of migration, arrival to the breeding grounds or egg-laying date. We experimentally studied how timing of breeding affected timing of moult. We delayed the breeding cycle of one group of pairs by delaying the start of incubation by one week. To achieve this, we kept the eggs in a refrigerator for seven days. The experiment caused statistically significant differences between the groups in timing of moult at the same breeding stage. In both sexes, the delayed group moulted earlier relative to calendar date, meaning that the birds had started to moult according to a previously set schedule even though the nestlings were small (hypotheses no. 3 above). This indicates intrinsic links between different phases of the annual cycle within individuals.

The effects of nest predation risk on parental investment and reproductive success.

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Predation on dependent offspring is an important selective force that influences parental investment strategies. In passerine birds, nest predation is the primary cause of reproductive failure, making birds an ideal system to study the effects of offspring predation on parental investment. Parents can assess nest predation risk and modify investment in order to decrease the probability of actual nest predation. For example, in the face of increased nest predation risk, parents may decrease offspring feeding rates to avoid revealing the location of their nest to visually oriented predators. A few studies have looked at how parents adjust parental investment to changes in predation risk, yet even fewer have looked at how these changes influenced reproductive success. These costs to reproductive success associated to changes in predation risk have only been studied on north temperate species, which are characterized by "fast" life history strategies. However, based on traditional life history theory, "slower" species like those in the tropics are expected to respond with greater risk avoidance under increased predation risk which could have comparatively greater consequences for reproductive success. Despite tropical birds potentially responding more strongly to increased risk by decreasing parental investment and bearing greater costs to offspring than their temperate counterparts, this possibility remains unexplored. We experimentally increased nest predation risk for tropical passerine birds and measured responses in parental investment (e.g. changes in egg size, incubation attentiveness, feeding rates) and the consequences for offspring development and survival (i.e. reproductive success). Species responded differentially to an increased perceived nest predation risk. The species that responded most strongly to the treatment decreased incubation attentiveness, feeding rates and had offspring with slower growth rates than those from control nests. Cumulatively, these changes in parental investment negatively affected reproductive success (fewer young fledged per nests in treatment than in control nests).

Ecological correlates of vulnerability to fragmentation in forest birds on inundated subtropical land-bridge islands

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Habitat fragmentation is widely considered to be one of the primary threats to biodiversity throughout the world. Identifying the ecological and life-history traits that render species vulnerable to fragmentation is an important prerequisite for the development of effective conservation strategies. In this study, we determined how species traits influence vulnerability to fragmentation using bird data collected from islands created by the inundation of the Thousand Island Lake, China. We tested *a priori* seven well-defined hypotheses that species with low abundance, small geographical range, high habitat specificity, large body size, high trophic level, low foraging strata, and low fecundity would be more vulnerable to fragmentation. Birds were surveyed with the line-transect method during 2007 and 2010 on 42 islands and the adjacent mainland. We derived the species traits that were associated with fragmentation vulnerability from our survey and from the literature. After phylogenetic correction, these variables were used separately to assess their association with two indices of fragmentation sensitivity (the number of islands occupied and change in abundance). The 46 bird species included in the analyses exhibited considerable variation in sensitivity to fragmentation. The number of islands occupied ranged from 1 to 42. All bird species on islands had declined in population density to some extent, except for the Black Kite (*Milvus migrans*). Model selection based on stepwise multiple regressions identified natural abundance at mainland sites and habitat specificity as the best correlate of the number of islands occupied, and natural abundance at mainland sites as the best correlate of change in abundance. Body size, clutch size, trophic position, foraging strata, and geographical range size were not significantly correlated with fragmentation vulnerability. We suggest that, in order to conserve birds in the region effectively, priority conservation efforts should be paid to rare species and species with high habitat specificity.

Facultative cooperative breeding in Cabanis's greenbul (*Phyllastrephus cabanisi*) in relation to cloud forest fragmentation

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There is a growing consensus that a combination of ecological factors and life-history traits can trigger species to express cooperative breeding behaviour. However, if and how this may affect their sensitivity to ecological stressors or direct evolutionary trajectories is still poorly understood, in particular in tropical forest species that are increasingly exposed to rapid habitat change. Video-recordings at nests of Cabanis's greenbuls (*Phyllastrephus cabanisi*) in a fragmented SE Kenyan cloud forest show that individuals other than the adult breeding pair help care for the offspring and forego the opportunity to breed independently. While the total amount of food delivered to the nestlings does not increase in the presence of helpers, adult breeders appear to compensate for the care of the helpers by reducing their own food provisioning, and hence, their costs of reproduction (*load lightening strategy*). While possible fitness benefits for helpers are currently less evident, marked variation in the presence, age and sex of helpers, and the genetic relatedness among cooperative flock members in relation to forest quality, suggests that helping behavior reflects the plastic outcome of a cost-benefit balance. This is possibly mediated by parent-offspring conflicts over the timing of dispersal. To identify the drivers of post-fledging dispersal, settlement and helping strategies in male and female offspring, we combine the results of a long-term mark-recapture program with radio-telemetry and playback experiments. We discuss the results of this study within the context of novel selection forces acting on natural populations as a result of anthropogenic activities.

Mesopredator release: impacts on previously unaffected components of a seabird population

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Many avian populations on islands are threatened by alien mammalian predators. This is especially true of seabirds where both cats (*Felis silvestris catus*) and rats (*Rattus* spp.) can cause severe declines in population size without remedial actions such as eradication programmes. While effective, the effects of such conservation interventions are poorly monitored and often outcomes are not predicted prior to action. Here, we document a long-term study of Sooty Terns (*Onychoprion fuscatus*) on Ascension Island in the South Atlantic where birds have been subjected to cat and rat predation over two centuries. We show that eradication of cats, the apex predator, has not led to recovery of the seabird population. Instead, it has resulted in a mesopredator release event with increasing numbers of rats now impacting more negatively on seabirds than the previous dual-predator regime. While similar outcomes of interventions have been documented in other study systems, here we explore more widely the effects and conclude that 'release' of mesopredators results in them living longer and growing larger as a result; they then impact on previously unaffected components of the seabird population (i.e. larger chicks) with downstream negative consequences that were not predicted. We conclude by discussing the long-term effects of mesopredator release on this specific seabird population and in so doing suggest ways to manage populations of birds and their predators that minimise the impacts of predation during recovery actions. We hope that our insights are helpful to others who are considering effective conservation interventions to counter alien invasive species.

Variation in the role of tree decay to promote cavity nester biodiversity in the World Wide Cavity Nest Web

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From a biodiversity perspective, much of the world is chronically short of tree decay, especially in human-influenced ecosystems. Yet over 1000 bird species globally depend on decay processes to form tree cavities to provide the critical nesting and roosting sites. Cavities can form slowly over centuries with the presence of tree decay or physical processes or they may form relatively quickly when avian excavators penetrate the outer sapwood and remove the decayed heartwood. We examine the role of tree decay dynamics in structuring cavity-using vertebrate communities in Nest Webs (i.e., interdependent assemblages of cavity consumers and/or producers in structured-nidic guilds) across continents in temperate and tropical systems in the Americas and Africa. In the Nest Webs of North-America, woodpeckers function as keystone species as they excavate over 90% of the holes used by secondary cavity nesting (non-excavating) vertebrates. In South-America, 69-80% of secondary cavity nesters use cavities formed by decay or external damage, even when woodpeckers are present. The abundance and diversity of cavity-using vertebrates is often positively associated with cavity availability that in turn depends on rates of hole formation and persistence. To maintain biodiversity it is critical to understand the role of tree decay and excavators as structuring agents in wildlife communities. In North America, this involves retaining the tree types and conditions (e.g., hard deciduous trees with soft spots of decay) that are suitable for woodpeckers to excavate. In forest ecosystems with decay-based nest webs (South-America, Africa), it is important to retain a supply of large live trees with decayed branches and large and small dead-standing trees to maintain a diversity and abundance of cavity-using birds.

Variable food supplies and introduced predators set a complex ecological trap for a facultative migratory bird.

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Ecological traps arise when habitats are altered by anthropogenic influences and animals make maladaptive decisions about where to settle because the environmental cues they have evolved to use are no longer reliable. Severe demographic effects of ecological traps (e.g. Allee effects) have been best demonstrated for sedentary species probably because 'trapped' populations cannot easily escape local conditions. However, facultative migrants (i.e. species with variable direction, distance and timing of migration driven by food availability) also utilize modified landscapes, but their movements may enable them to escape from ecological traps when conditions change. We present a conceptual model that shows the variable demographic processes regulating populations of facultative migrants in landscapes containing ecological traps. This model predicts that depending on the relative attractiveness of high versus low quality habitat, facultative migrants could be exposed to one of three demographic scenarios: 1) source/sink dynamics; 2) equal preference ecological traps or; 3) severe ecological traps. We tested our conceptual model using the Swift Parrot *Lathamus discolor*, an endangered facultative migrant. Annual variation in the spatial configuration of food led to different settlement decisions by Swift Parrots. When food was equally abundant at predator free (high quality) and predator infested (low quality) sites, Swift Parrot occupancy was similar in both areas, but high mortality and breeding failure only occurred at low quality sites (corresponding to an equal preference ecological trap). However, when low quality sites had more abundant food than high quality sites, Swift Parrots preferentially settled in the former, and paid a severe predation penalty (corresponding to a severe ecological trap). However, our data indicate that the cumulative effects of habitat degradation can complicate the effects of traps, and low forest cover (which exacerbates predation risk) creates a quality gradient within predator infested sites. Our study demonstrates an urgent need to understand how temporary capture/escape from ecological traps impacts long-term population viability of facultative migrants.

Within-song type variation facilitates neighbour-stranger discrimination in a bird with a small repertoire size

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Economically efficient defence of territory requires the ability to distinguish between neighbours and strangers (later NSD). We studied the Ortolan Bunting (Emberiza hortulana), a small migratory passerine species in which males usually have a small song repertoire(2-3 types), which is commonly shared (< 11 different song types per 100 males within a population), but both repertoire sizes and level of sharing may differ between populations. The shared song types are individually distinct because initial song phrases of particular males consistently differ in frequency parameters. Males of this species were found to distinguish between neighbours and strangers regardless of repertoire size and sharing level and differences in song frequency seems to be crucial for NSD. Here we present data from a few different populations from Central and Northern Europe in order to test if the necessity of NSD enforced a trade off between song repertoire size and within song type variation. We recorded full repertoires of representative numbers of males from each population and measured repertoire size, repertoire sharing and frequency parameters of song types. The frequency shift of the same song types was found in all the studied populations. We found that the pattern of frequency shift differentiation among males sharing a particular song type is non-random and depends on song diversity within local population. In populations with a high level of song type sharing, neighbouring males shared song types significantly more different in frequency, while there was no such pattern in population with high song diversity. We suppose that this within-song type variation facilitate NSD.

o18-2

Sharing mates and nestboxes is associated with female "friendship" in European Starlings *Sturnus vulgaris*

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Breeding decisions in birds involve both mate and nest choice, and there is increasing evidence that social influences may modulate individual choices. Female preferences may be affected by other females' preferences and mutual choice cannot always be excluded, which makes the whole pattern more complex than assumed by most sexual selection models. Social transmission may be facilitated by particular social bonds, therefore pre-breeding social networks may influence later mate choices. The other case where females share mates or resources is polygyny, generally viewed to only benefit males. If mutual benefits may arise then mechanisms should evolve to reduce the reproductive cost for females such as to reduce the cost of aggression by sharing their mate with a preferred same sex social partner. We tested the hypothesis that females' mating decisions may be influenced by the pre-breeding social network and that social partner relations established prior to breeding may affect decisions (mate/sites) in a facultative polygynous species, the European Starling. Two experiments were designed to test the relative importance of male or nest by following the whole dynamics of the breeding cycle from the pre-breeding period until mate and nest selection. In both cases socially isolated females tended to be excluded from breeding, while pre-breeding social partners tended to share mates and to nest in close proximity, mate copying leading in some case to polygyny. The final pattern resulted both from female "likes and dislikes" and male preferences for some females. Aggressive interactions between females were rare. Vocal sharing between females may have been a clue for males as to the degree of social integration of these females.

o18-3

Song sharing in neighbouring and non-neighbouring territorial male Pied Bush Chats

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In most oscine bird species, male song is composed of different song types, of which some song types are shared with other males. Song sharing is believed to provide insights into the contexts in which songs were acquired in addition to the role of song repertoires in intra- and intersexual communication. Our aim for this study was to investigate whether song sharing occurs in the Pied Bush Chat (*Saxicola caprata)* (a sedentary tropical species with song repertoires), and if yes, whether neighbouring males share significantly more song types than non-neighbouring males. To assess the song sharing between males, a standard song sharing index was used by comparing all song types of each male with all song types of the other male. Results revealed that males had a mean repertoire of 22.8 ± 4.4 song types ranging from 17 to 30 song types (N=8). In all, 78 song types were identified in the song repertoires of eight males. Of these, four song types (5%) were delivered by all males, while 33 (42%) song types were unique i.e. sung by single males. Results also indicated that neighbouring males shared significantly more song types than did non-neighbouring males. Nevertheless, no two males shared all song types in their repertoires. Repertoire matching was frequently observed among neighbouring males indicating that territorial establishment and maintenance could require males to share songs. Results also support the pattern that has emerged between song sharing among territorial neighbours and sedentary behavior of the bird species possessing song repertoires.

Social organization in the flightless Kagu, a bird endemic to New Caledonia

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The Kagu (*Rhynochetos jubatos*) is a flightless bird endemic to the mainland of New Caledonia (South Pacific). It was thought to be monogamous, living in family groups on exclusive territories in rainforest. We used molecular genetics fingerprinting, radio-tracking, continuous video monitoring of nests, and feeding experiments to study the social organisation of Kagus. From July 2011 to December 2012, we fitted transmitters with proximity sensors on 17 Kagus of 4 neighbouring families that we have already been studying since 2002. In total, we recorded about 40,000 encounters among Kagus during this period. By analysing DNA extracted from feathers, we determined kinship and sex of all individuals. By examining video footage at nest sites, we found that a Kagu breeding unit consisted of one female and 1-2 males that participate in incubation and provisioning of chicks. We confirmed genetically that the breeding system is polyandrous rather than monogamous. A breeding unit is usually assisted by 1-3 subadult and adult offspring, which occasionally help in incubation but do not feed the chicks. The analysis of encounters among Kagus registered with proximity tags revealed that the social interactions of individuals are not limited to the family members but constitute an extended social network of neighbouring families.

Can birds negotiate hatching time via acoustic communication?

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Climate change means that it is more difficult for birds to time their reproductive attempts optimally to coincide with peaks in food abundance. Any mechanisms allowing birds to readjust the time of hatching after egg-laying may therefore be selected for, particularly in less predictable environments. Here, we tested whether acoustic communication between parents and offspring before hatch could play a role in fine-tuning hatching time to current conditions. In an aviary experiment on wild-derived Zebra Finches, we manipulated incubation onset and then recorded parental behaviour and communication during incubation. We found that in the few days preceding hatching, parents emitted a specific call type whilst alone in the nest, which had never been recorded in other contexts. In a follow up experiment, we incubated whole clutches in artificial incubators where either “incubation calls” or control contact calls (tets) were broadcast. We predicted that if “incubation calls” are a proximal mechanism to accelerate or synchronise hatching, clutches exposed to incubation calls should hatch sooner and more synchronously than control clutches. Preliminary analyses confirmed our predictions, which suggests that hatching time –and developmental trajectories– may be more flexible than previously realised. These findings are especially important in the context of climate change, which through effects on reproductive phenology, is predicted to have a strong impact on global bird populations.

Going the distance: Shared duration and destination of overwintering in pairs of Scopoli's shearwaters (*Calonectris diomedea*)

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Recently, due to new capabilities for tracking individual birds' movements over the course of a year or longer, new evidence is emerging for individual consistency in migration schedules and destinations, although it remains unclear whether this individual consistency is due to hard-wired differences in migration programs, or persistent individual differences in condition. Using geolocators, we tracked migration journeys of Scopoli's shearwaters (*Calonectris diomedea diomedea*) breeding in Linosa Island (Italy) across three years, and extracted parameters describing timing and spatial aspects of the birds' movements. Birds showed remarkable variation in final overwintering destinations along the western coast of Africa that ranged from the Canary Islands and Cape Verde, to the Guinea basin and as far south as Namibia. We found significant individual consistency in both temporal and spatial aspects of migration. Furthermore, for the first time, we show significant repeatability among partners in the total distance they travelled, the locations of their overwintering destinations and the southern-most point they reached during migration. Partners were also repeatable in the total time they spent in the overwintering area. However, pairs did not leave the breeding site at similar times in autumn or return at a similar time the following spring, and comparison of the time course of their movements revealed that they did not travel together. In light of recent findings, that reduced parental investment causes migrating shearwaters to travel less far, we suggest that the repeatability in migratory behaviour that we identified within pairs reflects shared carry-over effects of parental investment from the previous season, and might be therefore condition-dependent.

o19-2

The role of endogenous rhythm in movements of facultative migrants

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It is assumed that obligate and facultative migrants use different cues for timing their life-cycle events. During late summer and autumn, obligate migrants predominantly rely on their endogenous programmes, which only to some extent may be corrected by the current photoperiod. Facultative migrants are believed to respond mainly to local current conditions when making the decision to migrate or remain resident at the breeding grounds. However, the relationship between endogenous programme and environmental factors in regulation of facultative migrants is not as well understood as those of obligate ones. We present results from long-term field and experimental studies of small insectivorous birds known in the north-west regions of Europe for their high fluctuations in numbers during autumn migration: the great tit (*Parus major*), long-tailed tit (*Aegithalos caudatus*), coal tit (*Parus ater*) and the tree-creeper (*Certhia familiaris*).

Our data suggest that the role of endogenous rhythm is underestimated in such species. The long-term field data on the great tit showed that the timing of movements of the species depends mainly on the endogenous stimuli rather than on population densities or food abundance. The experimental study of the long-tailed tit revealed the annual cycle of migratory restlessness that is exhibited in captivity and is influenced by photoperiod. The field data of the studied species showed that the pattern of seasonal changes in fattening is similar to obligate migrants. Whatever the migration-triggering mechanism of the individual might be, the migration of studied species may occur in the period of its genetically determined readiness to move.

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To be at the right place at the right time – individual timing of annual life history events by a trans-Sahara migrant

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In general, the time window favourable for reproduction decreases with latitude. Hence, for migratory birds the importance of optimal arrival at the breeding site increases with increasing latitude. In addition, the time needed for migration from Africa also increases the further north birds breed. Therefore, we expect that the schedule of life history events in the course of the annual cycle (breeding, migration, moult) is less flexible in higher than in lower latitudes. In contrast, in lower latitudes there might be less of a time constraint enabling more flexible schedules with more opportunities for the exploitation of unpredictable favourable conditions. A few studies have analysed population specific arrival and departure times within species and have found ample differences in the duration of migration between populations. No study, however, has ever quantified the amount of variation in the entire annual cycle between different populations on an individual level. We equipped 156 Alpine Swifts (*Tachymarptis melba*) of four populations in Europe (Spain, Switzerland, Bulgaria, and Turkey) with light geolocation loggers to compare their annual cycle. The species is an aerial plankton feeder, a long distance migrant, and has high site fidelity to its breeding colonies (recapture rate up to 60%). In southern populations rare cases of second broods have been recorded and therefore we expect increasing variability in the timing of migration towards lower latitudes. We investigate whether or not a possible time constraint has an impact on migration route and non-breeding range, and to what extent the onset of spring at the breeding site affects the arrival dates within a single population. We discuss the implication of constraints in the annual cycle for the evolution of migration and the ability to adapt to environmental changes.

o19-4

Dispersion, route fidelity and within-pair coordination: the mysterious migration of the Atlantic Puffin

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Migratory movements of pelagic seabirds have remained mysterious because traditional study methods provide scant data, but a revolution in miniature tracking technology and novel computational techniques is now making it possible to study the detailed behaviour of individual seabirds all year round. Using archival light loggers, we have established a long-term tracking program to investigate the migratory behaviour of a key species of UK breeding seabirds, the Atlantic Puffin (*Fratercula arctica*). We realise a detailed study of the migration routes of individuals for up to six years, focusing on route fidelity and timing. We also investigate potential sex-specific and pair-specific effects on the puffins' migratory strategy.
The first results are intriguing. Puffin migration is dispersive, with individual birds showing remarkable diversity in overwintering destinations. Yet, individuals are highly conserved in their routes and destinations. Furthermore, we found some evidence that partners follow similar routes, at least during part of the winter, suggesting potential social interactions within pairs during the non-breeding season. These results cannot be explained by genetic or cultural inheritance of the migratory route, the two usual theories about navigational control of migration. Our study should not only be a crucial test of a novel theory of migratory navigation but should also bring invaluable information for conservation planning, since UK puffin populations are in decline.

Time to move: Nomadic Black Swans (*Cygnus atratus*) in arid Australia following La Niña floods

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In contrast to the seasonal, predictable migrations of birds in Europe and North America the nomadic waterbirds of the arid interior of Australia must travel large distances to locate seasonally and spatially unpredictable water resources which are ephemeral. How Australian waterbirds have adapted to this desert environment and are able to locate ephemeral water bodies in this vast landscape is a major unsolved puzzle of bird migration. After years of drought, two recent La Niña years caused heavy rainfalls and an influx of vast numbers of waterbirds into the arid interior of Australia. During this period, we deployed GPS satellite-transmitters on a large number of Black Swans (*Cygnus atratus*).Tracked individuals were successful in locating new ephemeral water across hundreds of kilometres. Individuals usually moved at night and we found several weather variables predicted the timing of their movements. With conditions in the interior deteriorating for waterbirds after the La Niña period ended, birds moved to coastal and inland refugia although these two strategies came at different costs to individuals. Our findings provide new insight into connectedness of waterbird habitat in Australia, the navigation ecology of nomadic individuals and how Australian waterbirds have adapted to an environment which can rapidly change.

The effect of hen flea infestation on the status and intensity of infection with malaria parasites in the Blue Tit

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Because host populations become exposed to novel combinations of parasites, it is important to understand how interactions between parasites may affect disease dynamics. However, to date the majority of studies looked into single parasite systems, and the importance of interactions between parasites in natural populations has been recognized only recently. Different parasites may interact by e.g. modifying each other's transmission efficiencies and virulence. From the perspective of host population dynamics special attention should be paid to parasites with a very wide geographical distribution, such as the hen flea (*Ceratophyllus gallinae*), and parasites with a high potential of expanding their geographic range such as blood parasites from the genus *Plasmodium*. Both parasite types are known to negatively affect host fitness, however, no study looked into the possible interaction between them. We aimed to experimentally disentangle the causal relationship behind the occurrence of co-infection with these two parasite types in a hole nesting passerine – the Blue Tit (*Cyanistes caeruleus*). The study was carried out in a population with high infestation levels of both the hen flea and malaria parasites. We created two types of nests with experimentally reduced and increased infestation with hen fleas and examined how the variation in the flea infestation level at the early stages of the nesting cycle influences the status and intensity of infection with malaria parasites at the end of the nesting cycle. The results of the study are discussed in the light of implications of the distribution of hen fleas for the spread and prevalence of malaria parasites.

Genetic background helps understanding immunocompetence, growth and survival in House Sparrows

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A well-functioning immune defense is crucial for survival and reproduction. To date it remains challenging to judge the quality and function of the entire immune system as common tests can only explain a fraction of it. The major histocompatibility complex (MHC) is important for pathogen resistance by presenting antigens on the cell surface to T-cells. According to the heterozygote advantage theory, individuals heterozygous at MHC loci may be able to elicit more efficient defenses against a greater diversity of pathogens, and their territory size and survival might be influenced by the MHC as well. Our aim was to study if MHC alleles influence immune response, body size and survival. To test this, we used 135 House Sparrows (*Passer domesticus*), which were captured in the wild and housed in large outdoor aviaries. From this parent generation, we obtained 300 offspring of which 128 survived the first winter. With our aviary population we were able to account for several environmental factors, which would otherwise influence our results. To properly mirror the immune response, the following tests were conducted: PHA skin swelling test (first and second response), hemagglutination test, bacterial killing assay, leucocyte counts, hematocrit and erythrocyte sedimentation rate. Furthermore, we collected data about survival and body parameters for over 2 years. To ensure that we only tested MHC heterozygosity, we also assessed neutral heterozygosity at 10 polymorphic microsatellite loci. Results indicate that MHC alleles influenced some areas of the immune defense as well as survival, especially in the early development. However, we found no evidence that the MHC influenced body size.

o20-3

Does environmental microbial community composition drive maternal immune investment in avian eggs?

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An organism's immune system is vital to the defence against infection and disease. Variation in immune function is commonly observed in birds, and previous studies showed that various aspects of avian immunity vary among individuals, populations and species, across environments, and annual cycle stages. Attempts to explain such variation in the context of life history tradeoffs have only partly provided answers. Microbes are principally everywhere, and immune responses are not fixed. As immune defences are key to protecting an organism against infection and disease, we hypothesize that abundance, diversity and structure of environmental microbial communities, as potential agents causing infection and disease, play a substantial role in shaping host immune defences. Because of the multifaceted nature of immune systems, we study immunity in avian eggs as a more simplistic model. Using manipulated microbial communities we study the effects of soil microbial community composition on maternal immune investment in captive Zebra Finches (*Taeniopygia guttata*) eggs. Under different environmental microbial pressures, we will study the development of microbial community composition on the egg surface and their ability to invade egg contents. Contemporaneously, we will analyse maternally transferred antimicrobial proteins and natural antibodies. We will discuss our results and aim to relate immune investment to microbial pressure exerted by the environment hosts live in.

Long antibody persistence and transgenerational transfer of immunity in a long-lived vertebrate

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Although little studied in natural populations, the persistence of immunoglobulins has the potential to dramatically affect the dynamics of immunity and the ecology and evolution of host-pathogen interactions involving vertebrate hosts. By means of a multiple year vaccination design against Newcastle Disease Virus, we experimentally addressed whether levels of specific antibodies can persist over several years in females of a long lived Procellariiform seabird, the Cory's Shearwater, and whether maternal antibodies against that antigen could persist over a long period in offspring several years after the mother was exposed. We found that a single vaccination led to high levels of antibodies for several years in the considered species and that the females transmitted antibodies to their offspring that persisted for several weeks after hatching even 5 years after a single primary vaccination. The temporal persistence of significant levels of maternally transferred antibodies was highly dependent on the level that nestlings had just after hatching, which decreased over the years after a primary vaccination. A second injection of the vaccine boosted efficiently the level of antibodies in females and thus their transfer to offspring. We were not able to detect an effect of chick growth on the speed of decay of the maternal antibodies. Overall, these results stress the need to consider the dynamics of the immune responses at different temporal scales if we are to understand the evolutionary ecology of host-parasite interactions and the trade-off between immunity and other life-history characteristics in long-lived wild species. They also have strong potential implications for conservation in some host-pathogen systems in which vaccination can be used in natural populations.

Dynamics of a plumage ecosystem

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Avian plumage is a poorly understood dynamic ecosystem. Feathers are the habitat. They vary in size, shape, texture, and color on a single bird. Within the plumage live lice, mites, bacteria, fungi, and yeasts. Some of these organisms feed on the feathers and detritus of the plumage. Others feed on the other organisms that live in the forest of feathers. We have been monitoring changes in the microbiota of the plumage of north temperate birds in Ohio, U.S.A. since 1993. The plumage microbiota are most abundant from December-early March, less abundant from May-August, October-November, and least abundant in late March, April, and September. The periods of lowest microbial abundance correspond with molt. Most of the species we sampled molt only the body plumage in the spring, and the abundance of microbes did not decrease as much as in the fall when body, wing and tail feathers are all molted. Feather lice and mites follow a pattern similar to that of the microbes. We have also recorded frequency and type of preening behavior in a flock of captive starlings living in an outdoor aviary. Preening is most frequent and intense during periods of molt, particularly during the fall molt, less so during the summer, and preening is least frequent and performed in short bouts in winter when the bacteria are not active at the cold temperatures in the winter plumage. This pioneering study shows the complex dynamics of a thriving ecosystem in the plumage of birds and how that ecosystem links to the behavior of the birds themselves.

Comparative phylogeography of widespread Palearctic corvid birds

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Comparative phylogeography deals with the evolution of species complexes, co-distributed taxa and ecological communities. Widespread Palearctic species of the family Corvidae represent suitable models for searching common geographic patterns of genotypic diversity and to trace evolutionary scenarios for the species' range formation. In our earlier studies, we found two kinds of phylogeographic patterns in Palearctic corvids. For some species two diverged mitochondrial (mt) haplogroups were discerned, while no subdivision was found in the other corvid species. It was shown that species with a "two-group pattern" prefer open and semi-open habitats (Crow, Magpie, Azure-winged Magpie, Rook and Jackdaw), whereas the others with the "single-group pattern",are predominantly forest-inhabiting territorial birds (Siberian Jay, Nutcracker and Raven). Each of the latter species might have originated from the same forest refuge while those of the former group might have survived glaciations in two or more suitable areas and then diverged. Thus, ecological factors might help to interpret phylogeographic processes. While the distinct mt haplogroups of species with the "two-group pattern" indicates old splits, it would be interesting to infer phylogeographic structuring at lower levels within groups. The intensively studied Carrion Crow *Corvus corone* s.l. shows the "two-group pattern", but its subdivision in mt haplotypes does not correspond with the distinct (grey-black vs. total black) color forms. New data on several secondary contact zones between these haplogroups are presented. Furthermore, we present new results on other corvid species (e.g., *Corvus macrorhynchos*, *Pica pica,* and *Perisoreus infaustus*) allowing the analysis of phylogeographic patterns among Corvidae at smaller geographic scales in more detail.

o21-2

Phylogeography of *Phasianus colchinus* Linnaeus, 1758 inferred from mitochondrial and nuclear genes in Iranian plateau

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Common Pheasant (*Phasianus colchicus*) Linnaeus, 1758 is the most widespread pheasant, with its native range in the Palearctic Regions. Thirty subspecies have been generally recognized subspecies from five groups, which have been occasionally afforded specific status. There is considerable geographic variation in male plumages within and between groups. In particular, variation within each group casts substantial doubt on the validity of many subspecies. Where ranges are contiguous, variation often appears clinal (including presence of white collar, intensity of plumage coloration and body size), but differences can be more abrupt between slightly isolated populations. The present study is the first investigation to disclose phylogeny of the Common Pheasant in Western parts of the Palearctic Regions (Iranian plateau). Using two mitochondrial and three nuclear loci, we constructed phylogenetic relationships between 17 nominal subspecies of the Common Pheasant. Our results suggested that *P.c. principalis* (White-winged Pheasant) is closely related to the *P.c. tarimensis* (Tarim Pheasant) and placed in the *principalis-chrysomelis* group: Whereas *P.c. persicus*, *P.c. talischensis* and *P.c. colchicus,* were clustered together forming the Black-necked Pheasants (the *colchicus group*) clade. Our data also indicated that the origin of Common Pheasant might be Southeast Asia.

Resolving the puzzling evolutionary background of Blue Tits (*Cyanistes spp*.) on the Canary Islands, in Africa, and in Europe

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The origin and status of the Blue Tits on the Canary Islands have been debated, and various suggestions have been made based on morphology and on single or few mitochondrial or nuclear genetic markers. As opposed to traditional assumptions, the island populations have been suggested as the source for mainland populations. The genetic differentiation between different islands is remarkable, with one group comprising the easternmost islands and Northwest Africa, one group on the central islands, and the La Palma population taking an outstanding position. The latter shows sequence and structural affinities to European populations, but was recently grouped with a remnant population of African Blue Tits from Libya. We sequenced 18 nuclear introns and two mitochondrial markers, covering 12,500 bp, for 70 individuals from the island populations, three African populations including Libya, three European populations, and suitable outgroups. Coalescent-based analyses estimates a species tree where La Palma and Libya form a well-supported clade which branches off the remaining African island/mainland populations soon after the initial separation between African and Eurasian taxa (the latter also containing azure tit *C. cyanus*). Furthermore, we performed Restriction site Associated DNA (RAD) sequencing on single representatives for all clades, yielding some 70,000 orthologous loci across the genome. Single nucleotide polymorphism data were used in phylogenetic modelling to confirm the pattern retrieved from sequence based analyses. We present the suggested evolutionary and phylogeographic history for the Blue Tit group, and suggest taxonomic revisions accordingly. We also evaluate the implementation of a RAD as a next generation sequencing based approach compared to coalescent modelling of extensive traditional sequence data.

o21-4

Phylogeography and bioacoustic variation of Southeast Asian bulbuls (Aves: Pycnonotidae)

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Close to the Isthmus of Kra (at about 12 ° North) on the Thai-Malay Peninsula, is a contact zone between many bird taxa found in continental Southeast Asia. Northern and southern range limits of bird species and subspecies have been noted around this area. However, we found phylogenetic divergence at contact zones of three subspecies of bulbuls at a significant northward distance from the Isthmus of Kra. The hypothesis about Neogene marine transgression might explain this genetic divergence. The divergence between North and South corresponded with recent intraspecific lineage separation of *Pycnonotus flaviventris* and *P. finlaysoni*. In contrast, we found a deep genetic break in *P. atriceps*. Ancestral range analysis showed that continental Southeast Asia is the center of origin and the diversification center of *Pycnonotus* bulbuls. Bioacoustic variation in these species also shows a similar pattern to the phylogenetic results. However, the songs of *P. flaviventris* near the Isthmus of Kra are different from the northern and southern group. The divergence in songs of the three bulbul species might be affected by recent habitat changes (plasticity) rather than historic events.

Into and out of the tropics: the generation of the latitudinal gradient among New World passerine birds

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One prominent explanation for the latitudinal gradient proposes that its prime cause is the greater age and/or higher origination rates of tropical clades, and the infrequent/delayed dispersal of their component species into temperate regions. An alternative is that species carrying capacities vary regionally, which influences rates of net diversification via ecological opportunity. We contrast these hypotheses to assess potential historical influences upon the latitudinal gradient of New World passerine birds, comparing patterns among the two suborders present (the oscines and suboscines), which are known to have had alternative routes of dispersal across the region.

Strong latitudinal gradients are present within both oscine and suboscine birds, but their overall shapes differ. Among the oscines, older species are found towards the north, with progressively younger species present in the south. Regional variation in oscine richness is statistically well explained by a combination of productivity and elevation ($R^2 = 0.76$). In contrast, few suboscine groups have colonised the north, and their current diversity is well correlated with temperature seasonality ($R^2 = 0.74$).

Because the oscines colonised the Americas from the north, their latitudinal gradient must reflect regional differences in net diversification rates, and not the time present within a region. Richness patterns derived from phylogenetic data, and the strong predictive power of NDVI, suggest their radiation is consistent with the idea that entry into a new region stimulates a burst of diversification, which is higher and/or continues for longer in areas with greater carrying capacity. Conversely, the suboscine distributions potentially reflect a large historical barrier to dispersal, and niche conservatism in climatic tolerances. While contemporary conditions can explain much of the passerine diversity patterns, history appears to have had an important influence on the taxonomic composition of this gradient.

o22-1

Seasonal changes in responsiveness of the photoperiodic response system to long day length in the subtropical tree sparrow

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In earlier investigations, we reported that the subtropical tree sparrow uses seasonal changes in photoperiod to regulate its reproduction, moult and related events. In the present study we investigated seasonal variations in response to photoperiod by examining the effects of long and short days on stimulation of response and termination of refractoriness, respectively. We also assessed whether photoperiodic effects were sex dependant. In one experiment, wild sparrows were transferred in each month of the year to artificial long days (14L/10D) for 12 weeks. Birds transferred from November to March (female) or April (male) showed gradual gonadal growth and darkening of bill color, while those transferred from April (female) or May (male) to July underwent gradual gonadal regression and lightening of bill colour. Moult in the wing primaries and body feathers progressed with gonadal regression and the birds transferred from April/May to October exhibited a gradual increase followed by a decrease in feather moult. In another study, six weeks of short day (9L/15D) exposure could recover responsiveness to long days in refractory birds. Though male and female birds showed similar pattern of responses, they differed with respect to the extent of gonadal development. Overall, we found a gradual change over seasons in responsiveness of the endogenous response system to stimulatory effects of long day length, suggesting roles of both long and short day lengths in regulation of seasonal cycles in subtropical tree sparrow.

o22-2

Numerical demonstration of inspiratory aerodynamic valving in Japanese Quail

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It is widely accepted that air flows unidirectionally in an avian lung throughout the entire respiratory cycle. To date, two mechanisms, air sacs and aerodynamic valving, are considered to control this flow direction. Past numerical studies with anatomically simplified models suggested that inspired air is directed to the mesobronchi because of flow separation at the ventrobronchial junction of the primary bronchus and ventrobronchi. However, a lack of corroborative research with an anatomically realistic geometry of avian airways still leaves the aerodynamic valving a hypothetical mechanism. The present study was aimed at demonstrating the occurrence of aerodynamic valving in an anatomically realistic geometry model of the avian lung. The lung of an adult Japanese Quail (*Coturnix japonica*) was scanned with micro-computed tomography with a spatial resolution of 66.5 μm. The physical representation of airways, i.e. the primary bronchi including primary bronchus, mesobronchus and its branches of four ventrobronchi, was obtained by image analyses. The results demonstrated that the inflow was accelerated by an abrupt reduction of the cross-sectional area of the primary bronchi at the first ventrobronchial junction, and the flow velocity increased four-fold at the same location. Vortices formed at the root of the branches, preventing the air from going into the ventrobronchi. As a consequence, the inflow was mostly directed towards the mesobronchi throughout the respiratory cycle. These results clearly demonstrate the occurrence of aerodynamic valving in a real avian lung, corroborating results from earlier studies.

o22-3

Winter thermoregulatory strategies of a small, solitary-roosting bird, the Rufous Treecreeper (*Climacteris rufa*)

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Rufous Treecreepers (*Climacteris rufa*) are small (30 g), insectivorous, cooperatively-breeding passerines endemic to southern Australia. In semi-arid Wandoo (*Eucalyptus wandoo*) woodland they are ground-frequenting and despite below-freezing overnight temperatures in winter, they roost singly in tree hollows. We examine the physiological and behavioural adaptations used by treecreepers to meet daily energy requirements during winter. In the laboratory, open-flow respirometry was used to measure metabolic rate, evaporative water loss and body temperature over a range of ambient temperatures (10 °C -30 °C). Treecreepers had typical endothermic responses to low ambient temperature, with no evidence of torpor. Mean body temperature of birds in the laboratory at 10 °C was maintained only 1°C lower than thermoneutral body temperature (39.4 °C, n = 6), achieved by an 37% increase in metabolic rate and an 42% decrease in thermal conductance. In the field, body temperatures of wild, free-living treecreepers, measured under ambient conditions using implanted temperature-sensitive radio transmitters, did not drop below 37 °C even when ambient temperatures were below 0 °C. The thermal and location characteristics of roost hollows varied; some roost sites were similar to ambient conditions, but others created a more favourable microclimate that was 3 °C - 9 °C warmer than ambient overnight temperatures. Behavioural observations suggest that treecreepers do not alter their daily activity patterns to incorporate thermal behaviour, with no evidence of basking during the day or social thermoregulation (huddling) at night. A low energy foraging strategy and low thermal conductance, combined with the thermal benefits of roost hollows are likely essential in helping these small birds meet their energy demands during winter.

o22-4

Circadian rhythm of neurotranmitters and neuromodulators in central and peripheral tissues of a migratory song bird

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Circadian rhythms control a variety of physiological functions, including migration, reproduction, sleep, metabolism and cognition. At the brain level, these functions are mediated by a host of neurotransmitters /neuromodulators. Little is known, however, if they are under the circadian clock control. We therefore aimed to measure daily variation in the transcript levels of arginine vasopressin (AVP), vasoactive intestinal peptide (VIP), neuropeptide Y (NPY), somatostatin (SS), glutaminase, glutamic acid decarboxylase (GAD) and glutamic-oxaloacetic transaminase (GOT) in both the central (hypothalamus and retina) and peripheral tissues (heart, stomach, liver and gut) at six times of the day in the night-migratory Red-headed Bunting *(Emberiza bruniceps),* exposed to 12 h light: 12 h dark. All transcripts were expressed with a circadian rhythm in the hypothalamus and retina, except the SS and glutaminase in the latter. A significant circadian rhythm in many of these transcripts was also seen in the liver, heart and stomach, albeit with minor variations between tissues. We suggest that a circadian clock controls transcription of these neurotransmitters/ neuromodulators in the migratory red-headed bunting, and that there exists a temporal relationship in their expression between central and peripheral tissues.

Population limitation in a migratory songbird with variable recruitment: direct and indirect effects of nest depredation and weather on reproductive success

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Although avian nesting success has been much studied, relatively little is known about the multiple factors and their interactions that contribute to annual reproductive success, let alone their impacts on population dynamics, especially for long-distance migratory, open-cup nesting species. We combined a field experiment limiting access to nests by mammalian predators with modeling of long-term (1983-1995) field data on breeding success of American Redstarts (Parulidae: *Setophaga ruticilla* L.; N = 553 nests) to assess the effects of multiple extrinsic and intrinsic variables. The experimental treatment (baffles placed around tree boles beneath active nests; N = 71) increased nesting success significantly (74% extrapolated from daily nest survival vs. 50% in controls), demonstrating the negative impact of scansorial mammals, primarily red squirrel (*Tamiasciurus hudsonicus* Erxleben*)* and eastern chipmunk (*Tamias striatus* L.) on redstart reproductive success. Based on unbaffled nests (N = 482), daily nest survival varied annually, and was most strongly influenced negatively by sciurid nest predator abundance and positively by May temperature. Daily nest survival was influenced to a lesser extent by June rainfall and declined with nest age, but not with calendar date. Since nearly all nest failures were attributable to predators, these climate and nest age impacts were probably caused by indirect effects involving predator and/or prey behavior. Population density had no effect on nest success, after accounting for these other factors. Important implications of these results for understanding avian population dynamics include the value of identifying nest predators, likely complex future effects of climate and climate-predator interactions on reproductive success in migratory songbirds, and the ecologically decoupled contributions to population dynamics from summer predator-mediated reproduction versus winter food-limited adult survival.

Predicting small-scale variation in Great Tit breeding phenology using remotely-sensed satellite data

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Recent studies suggest that phenotypic plasticity is a key process underpinning how animals respond to environmental change. However, our current understanding of the determinants of plasticity in natural populations is limited by the fact that studies often treat the environment as equivalent for all individuals within a population (e.g. temperature measured at a single location). Many animals use a restricted amount of space within the range of the population, suggesting that selection is likely to favour sensitivity to small-scale environmental variation. Great Tits (*Parus major*) show considerable within-population spatial variation in breeding phenology. Like many woodland passerine birds, a key food resource for their offspring is the flush of lepidopteran larvae (e.g. winter moth *Operophtera brumata)* adapted to feed on the newly emerged foliage of deciduous trees (e.g. oak *Quercus spp.*). We demonstrate that the timing of oak leaf development and the peak in caterpillar abundance also show marked within-population variation, at a spatial scale that is relevant to individual bird reproductive attempts. This variation provides a potential mechanism driving patterns of spatial variation in bird phenology, which is worthy of further exploration. However, collecting large-scale data on vegetation budburst is labour-intensive and cannot be obtained retrospectively. Here we use the novel approach of inferring vegetation phenology from satellite images for a 385ha mixed woodland over a 14-year period. Using nestbox-specific vegetation 'green-up' dates derived from MODIS satellites at 240m resolution, we demonstrate that small-scale variation in Great Tit phenology can be predicted from remotely-sensed satellite data. We also present findings on the extent to which spatial variation in the mis-match between satellite-derived vegetation 'green-up' dates and observed bird phenology predicts individual fledging and recruitment success. We discuss how this approach could greatly broaden the scale and scope of studies exploring phenological matching between organisms and their environment.

o23-3

When early birds do not get the worm: habitat heterogeneity modulates the breeding performance of a raptor under changing climate

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Human-induced global changes, mainly habitat and climate modifications, are known to affect population dynamics and reproductive parameters of birds. Habitat composition and climatic variables could also interact at a local scale, which might have marked consequences on demographic parameters of populations. We investigated long term data of the breeding densities and performance of an open-country raptor, the Eurasian Kestrel (*Falco tinnunculus*), breeding in two adjacent but differently structured habitats: open farmland (OH) and a heterogeneous area composed of small fields and forested patches (HH). We tested for interactive effects of landscape structure (OH vs. HH) and climatic variables (temperature and precipitation) on habitat preference, laying date, clutch size, number of fledglings and breeding success. April temperature was the only climatic variable showing positive temporal trend, an indication of climate warming in this boreal area. Laying date, number of fledglings and breeding success differed significantly between OH and HH, while climatic variables affected three out of four breeding parameters, either alone or in interaction with habitat type. These results illustrate how animals breeding in contrasted habitats can be differentially affected by the very same regional climatic conditions. In addition, early arriving parents, thus expected to be of higher quality, laid three days earlier in the OH than in the HH, but had significantly lower breeding success than birds breeding in the HH (68% vs. 84% respectively). This difference in laying date only held for low April temperatures, suggesting that kestrels were not able to correctly assess the breeding potential of both habitat types during cold springs. This would indicate the existence of an ecological trap emerging solely during cold months of April.

Undermatching swallow distributions at large scales due to perceptual constraints

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Examining whether a target organism follows the input-matching law has proved useful in understanding the mechanisms underlying individual distributions within a population. Previous empirical studies, however, primarily focused on fine scale distributions, and only a limited number of studies have attempted to determine how the number of foragers relates to the availability of food in each patch at large scales. We studied the large-scale distribution of Barn Swallows *Hirundo rustica* as they aggregated in prey patches after the breeding season. In 8 out of 9 combinations of prey patches during a period of high total swallow numbers (early September) and 8 out of 10 combinations of prey patches at low swallow numbers (late September), the observed ratio of swallow numbers to prey availability was less than that predicted based on a stochastic model of prey availability. The slope of the regression line for the relationship between the log ratio of swallow numbers and ratio of prey availabilities increased from less than 1 (0.6 ± 0.13 se) in early September to around 1 (1.1 ± 0.28 se) in late September. Average foraging rate at each patch increased with an increase in prey availability. As far as we know, this is the first line of evidence that supports the predictions of the perceptual constraints hypothesis (Abrams 1986) at large scales. We believe that studies focusing on the perceptual constraints may provide conclusive information to understand the mechanisms governing the large-scale distribution of foragers within a population.

o23-5

Age dependent reproductive success and seasonal change of adult survival of Japanese Rock Ptarmigan

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Rock Ptarmigan *Lagopus muta* have a large distribution in the northern hemisphere. The Japanese Rock Ptarmigan *L. m. japonica* is the southernmost subspecies and occurs in high mountains at elevations > 2,200 m a.s.l in mainland of Japan. Population declines of the Japanese Rock Ptarmigan have been reported for some decades, with the total number of Japanese Rock Ptarmigan estimated at 1,700 in the 2000s. The major threats to its survival are global warming, loss and damage of alpine vegetation by the grazing of Japanese Deer *Cervus nippon* and invasion of predators from low-lying areas such as Red Fox *Vulpes vulpes japonica,* Common Kestrel *Falco tinnunculus*, and Jungle Crow *Corvus macrorhynchos*. To effectively conserve the Japanese Rock Ptarmigan, we need information on demographic parameters. In this study, we report on age dependent reproductive success and seasonal change of adult survival on Mt. Norikura where we conducted a population study from 2001.

We could reveal that yearlings have lower reproductive success than adults, particularly chick survival of yearlings was lower than of adults. Monthly survival of males was lowest in May and June which is the peak period of defending their territories. In the case of females, monthly survival was low in the breeding season, from June to September. On the other hand, survival in winter, from November to March, was extremely high in both sexes. This seasonal change in monthly survival was linked with their life history and seasonal change in presence of predators in the alpine zone.

Finally we compare the characteristics of Japanese Rock Ptarmigans with demographic parameters of other populations.

Postglacial colonization and diversification of the Jungle Crow in its north-eastern frontier as revealed by comparative morphological analysis

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After the last glacial maximum, the Jungle Crow *Corvus macrorhynchos* began to colonise north-eastern Asia from a southern refugium. Two recolonization routes are presumed: via the Korean Peninsula and the Japanese Archipelago, *C. m. mandshuricus* arriving via the former and *C. m. japonensis* via the latter. The settlement process in this area and the mechanisms for intra-species diversification are not well understood. To better understand their patterns of settlement and diversification, I investigated differences in cranial and bill shape among four local populations: those of Hokkaido, Sakhalin Island, the continental seaboard adjacent to the Tatarsky Strait, and the west of the Sikhote-Alin Mountains. Of the three non-morphometric characteristics documented, the supraorbital foramen was rather homogeneously distributed among northeast Asian populations. The septum and a pin-hole in the parasphenoid bone showed discrete distributions between the Hokkaido and Russian populations. There were clear differences in many morphometric characters among the populations, especially between Hokkaido and Sakhalin Island, where crows on Hokkaido have the largest but most slender bills in northeast Asia. Crows on Sakhalin Island have relatively small and robust bills, but the highest body mass. A dimorphism of Jungle Crows on Sakhalin Island could be explained by the dispersion of young crows from mainland populations. In addition, I observed a latitudinal cline among the three populations of the Russian Far East. From the continent to Sakhalin Island, body size increases although the same overall shape is maintained. In the Upper Amur River region I found evidence of recent population expansion. Finally, my results suggest that the two main colonisation movements that occurred during the Holocene were generally divided by the La Perouse Strait rather than the Tatarsky Strait, as had previously been thought.

Ecological and phylogenetic significance of the scleral ring in diving aquatic birds

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Diving birds must accommodate their vision to air and water, two very different optical media. A few species, such as penguins (Sphenisciformes), dive to depths approaching the aphotic zone of the ocean and must accommodate their vision to both the change in media and significant light attenuation. Previous studies show that optical properties of the eye e.g., pupil aperture and focal length, are reflected in the eye's gross morphology and have a strong positive correlation with osteological proxies from the orbit and scleral ring. This study combines qualitative and quantitative measurements utilized in previous studies to create a larger feature space for classification. A total of 170 species were evaluated for distinct classes of eye shape, 90 of which were newly measured species of Charadriiformes, Procellariformes, Pelecaniformes, and Sphenisciformes. Unlike in previous studies of land birds, no pattern was recovered in eye shape based on the light levels where the birds foraged. Aquatic birds are active in a wide range of conditions; foraging both day and night and at varying water depths based on the time of year and available prey. Diverse aquatic bird ecology probably contributes to the lack of distinct eye shape classes based on dive depth. Regression analysis was able to recover prey capture style (i.e., plunge, pursuit, skimming, or wading) based on orbit and scleral ring measurements. Misclassification was most common in taxa that exhibited multiple modes of prey capture such as the albatross (Diomedeidae). The ability to determine foraging style based on osteological eye measurements may have implications for identifying prey capture method in extinct species of aquatic birds.

Walkings, from birds to dinosaurs.

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Birds are the most diversified clade among extant tetrapods and are able to live in various environments. Despite this ecological plasticity, their bauplan is very conservative and corresponds to a specialization for flying. This specialization necessitates the presence of wings and a rigid trunk. Beside the specialization for flying, birds, like all theropods, are fundamentally bipeds. This feature, basic for the clade, allows them to move on most substrates. As such, birds are able to live and move in trees, on the ground, and in water with only adjustments of the limb proportions. Depending on the environment, the physical properties of the substrates are very different and the question we address here is the link between the geometrical features of a bird's bauplan and its efficiency on different substrates. We used Xrays records of birds when moving in different conditions to analyze the motion of the skeleton. The motions of the quail (*Coturnix japonica*) when walking were reconstructed in 3D. Walking and swimming were analyzed in a teal (*Callonetta leucophrys*) and compared with the quail. Xray records of the hopping motion of the Zebra Finch (*Taeniopygia guttata*), when moving on two different substrates, were analyzed. The comparison of the body motions in the different conditions revealed the same kinematics features: the trunk and the thigh are associated in a locomotor module that controls the center of mass trajectory. The distal limb parts, from the tibiotarsus to the toes, are associated in a propulsive module. Those results, together with the data from take-off and landing in the Zebra Finch presented by Pauline Provini, indicate that this association of the body parts may be a key innovation in the avian theropods' evolution. Yet, it allows to move on substrates with different mechanical properties and thus to colonize almost all the environments.

The morphological and developmental evolution of asymmetrical flight feathers

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Asymmetrical flight feathers are an important morphological and functional innovation related to the evolution of flight, yet the role of development in the evolution of vane asymmetry remains largely undescribed. Both theoretical modeling and developmental experiments have found that, due to the tubular development and branched morphology of feathers, simple or small changes in development can have large complex effects on final feather shape. As a result, it is not readily obvious how feather development is modified to produce even simple shapes such as an asymmetry in vane width between the two sides of a flight feather. Using a combination of theoretical morphology and detailed, comparative studies of developing and mature feathers, we provide the first comprehensive description of the developmental and morphological modifications responsible for vane asymmetry in flight feathers. First we developed theoretical models of vane width in terms of barb morphology and then in term of developmental processes to describe how different developmental modifications can cause vane asymmetry. Next we compared developing and mature feathers from target species to determine which modifications occurred in real feathers, and found that there are two main developmental modifications that each controls an independent character of barb morphology. Finally we surveyed barb morphology in flight feathers to determine the relative importance of each barb morphological character in driving vane asymmetry across the diversity of birds, and found that it strongly depends on specific feather function. This research has allowed us to elucidate the developmental processes important in the evolution of asymmetrical flight feathers.

Fossil Insight into the Evolution of Penguins

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Flightless wing-propelled divers have evolved four times within Aves, in the Sphenisciformes, Plotopteridae, and twice within Pan-Alcidae. Among these groups, penguins are not only the sole lineage to have extant representatives, but they also have the most extensive fossil record. Among the more than 50 extinct species are several unexpected morphotypes such as spear-billed penguins, slender penguins and "giant" penguins that greatly exceeded the living Emperor Penguin in size. Fossils from penguins span a 60 million year interval and provide details of the evolutionary changes that occurred as these birds radiated and spread throughout the southern hemisphere.
Among the unique features that can be traced into the early phases of penguin evolution is a plexus of blood vessels along the flipper serving as a counter-current heat exchanger. This plexus appears to have been absent in the most basal penguins but is present in the first species that occur outside Zealandia, the presumed ancestral area of Sphenisciformes. Like other flightless wing-propelled diving bird lineages, penguins converged on an osteosclerotic bone structure which is hypothesized to enhance resistance to bending or torsional loads and reduce buoyancy, thus conserving energy during diving. This adaptation stands in contrast to the osteoporotic structure seen in most vertebrate diving predators such as marine reptiles and cetaceans, and is probably linked to physiological constraints in birds. Many Paleogene penguins display a substantially less dense humerus, which indicates that changes in bone microstructure continued to occur long after the initial loss of flight. Transitions in neuroanatomy and the auditory system likewise can be shown to have continued after the initial loss of flight, as documented by the study of fossil endocasts.

Migratory waterbird research and monitoring in the East-Asian Australasian Flyway – essential for conservation or fiddling while Rome burns?

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The East Asian-Australasian Flyway (EAAF) is one of nine global bird migration pathways. It embraces 22 countries – Arctic Far East Russia and Alaska are the breeding area of many waterbirds that migrate through East and South-east Asia to non-breeding grounds in Australasia. Of over 200 species (cranes, ducks, shorebirds, seabirds and others), 33 are globally threatened and 13 Near Threatened, often facing multiple threats in different countries. Some, like Baer's Pochard *Aythya baeri*, Spoon-billed Sandpiper *Eurynorhynchus pygmeus* and Siberian Crane *Grus leucogeranus* are on the brink of extinction. Among the long-distance migrants, shorebirds, including Nordmann's Greenshank *Tringa guttifer*, Far Eastern Curlew *Numenius madagascariensis*, Great Knot *Calidris tenuirostris* and Black-tailed Godwit *Limosa limosa* have declined steeply in recent years. In this presentation, I discuss the role of research and monitoring in the context of migratory waterbirds in the EAAF. For instance, is there an ethical obligation for scientists to contribute to the effective conservation of threatened species or can we spend research funding studying aspects of their biology not necessarily relevant to conservation? Who decides what science is "useful"? Do we need to be advocates or can we pass that role on to others? Currently, much of the science in the Flyway is on species ecology, which is of lowest rated priority by a sampled group (62) of individuals and organisations in the Flyway. When do we know enough about the ecology (or trends) of a species to make sound management decisions? What kind of evidence do policy makers and managers need and in what format? According to our experience, much of the relevant research does not reach site managers. Without effective communication, science has no practical use. Also, data limitations should not hold back the communication to policy makers, as for many species there is not enough time left.

Shorebird foraging ecology in Australia: anthropogenic vs natural supratidal habitats.

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Many species of shorebird undertake long distance migrations, which impose extremely high energetic demands upon them. During these migrations, the birds depend on a limited number of specific habitats as stop-over sites, which make them extremely vulnerable to the loss or degradation of these locations. The loss or degradation of critical habitats along their flyways is capable of precipitating a decline in populations. The East Asia-Australasia Flyway has experienced ongoing major habitat loss that appears to be related to rapid shorebird population declines. However, some species of shorebird have the capacity to use alternative anthropogenic habitats, such as salt works, as stopover sites with some species selecting these preferentially over intertidal mudflats. Although numerous studies on the use of salt works by shorebirds have occurred in other regions of the world, especially in temperate zones (e.g. Spain and San Francisco, USA), there is a lack of knowledge about shorebird foraging ecology and use of salt works and natural salt lakes in northern Australia. Here we outline the abiotic and biotic parameters determining shorebird use of three supra-tidal sites in Western Australia; Lake MacLeod (a natural salt lake), Port Hedland and Dampier salt works (anthropogenic salt production sites). We discuss the significance of these sites for regional shorebird populations and present the results of foraging ecology studies in order to build a conceptual understanding of why these sites are important for shorebirds. This study is derived from a collaborative research project between Dampier Salt Ltd.-Rio Tinto and Edith Cowan University.

Global patterns in the conservation of migratory birds

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Migratory birds often utilise many different habitats across international borders and depend on the success of conservation efforts in multiple countries. For this reason, such species are granted special protection status under a number of national and international agreements. However, we show that the largest international agreement, the Convention for Migratory Species, fails to cover many of the world's threatened migratory birds, and that very few threatened altitudinal and nomadic migrants are listed. Additionally, the proportion of migrants protected by the CMS is especially low outside the European-African flyway. This is important because our analysis shows that species richness for migratory birds peaks in the boreal zones, northern Africa and the mountainous regions of South America, and that globally threatened migrants occur disproportionately in the southern hemisphere (Australia, southern Africa and Antarctica). Important areas for migrants thus contrast strongly with regions globally recognized as biodiversity hotspots. Moreover, more than half of migratory birds have less than 10% of their migratory distributions overlapping protected areas, in contrast to the much better protection of the portion of their range in which they are present year round (40% of species with less than 10% protected area coverage). Our analyses reveal clear gaps in global protection for migratory species, both from the perspective of legislation and protected areas. We call for expansion of binding international and national agreements to cover all appropriate migratory bird species, and clearer incorporation of the needs of these species into landscape-scale conservation efforts.

Ecology of migratory shorebirds in Australia's ephemeral wetlands

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The conservation of non-breeding habitats for migratory species is critical for the long-term viability of their populations. For highly mobile species that respond to pulses in resource availability opportunistically, the geographic location of important habitats can vary substantially over time. In Australia some migratory shorebirds use highly ephemeral wetlands when available, but these wetlands can be dry for up to a decade. This variation in habitat suitability can cloud conservation efforts, monitoring effectiveness, and our understanding of the costs and benefits of the overall availability of ephemeral wetlands. Existing metrics on the importance of a wetland for shorebirds rely on counts of the number of birds that use the habitat, but high spatial and temporal variation in the availability of these habitats has left no clear understanding of how, where or when to take conservation action sufficient to protect these species. Similarly, the interpretation of monitoring data is highly confounded by these movements. The first step in understanding both the importance and implications of these kinds of resource pulses across the non-breeding ranges of migratory shorebirds in Australia, is to map the suitability of their habitat across both space and time. Here we report on attempts to develop species distribution models that capture the variable habitat suitability in Australia over time for four migratory shorebird species; Sharp-tailed Sandpiper (Calidris acuminata), Curlew Sandpiper (Calidris ferruginea), Red-necked Stint (Calidris ruficollis), and Common Greenshank (Tringa nebularia). We then explore long-term banding data to look for correlations between pulses in resource availability and either average individual condition or demographic rates.

Effects of the Great East Japan Earthquake on the wintering distribution of Brent Geese

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To assess the effects of the Great East Japan Earthquake (2011) on the life of Brent Geese *Branta bernicla*, we investigated their wintering distribution along the southern Sanriku Coast from Hirota Bay (38°59′N, 141°38′E) through Rikuzentakata to the estuary of Kitakami River (38°34′N, 141°27′E), Ishinomaki in the winter of 2011-2012 and 2012-2013. Geese were counted in the study area from late November to early December (291), early January (380), and late February (403) in 2011-2012 and mid-December (495), late January (350), and mid-February to early March (394) in 2012-2013. The number Brent Geese counted was not substantially different from counts prior to the earthquake. From November to January, more geese were observed in the fishery harbors (59% in 2011-12 and 63-67% in 2012-2013) than on the sea (35-41% in 2011-12 and 29-30% in 2012-13). We suggest that the geese began using fishery harbors, where they had only rarely been observed prior to the earthquake, due to: (1) wharfs in harbors thatt had subsided during the earthquake being subsequently washed by sea water and covered with seaweed, providing a new food resource to the geese, (2) reduced fishery activity in the damaged harbors and hence reduced human disturbance, and (3) loss of farming facilities in coastal waters for Wakame (seaweed) *Undaria pinnatifida* and Oysters *Crassostrea gigas* during the tsunami, which had previously provided the geese with seaweed. From February to March, more geese were observed on the sea (63% in 2011-12 and 56% in 2012-13), presumably resulting from the growth of seaweed on the farming facilities resettled after the earthquake. It seems likely that the geese adapted to large-scale environmental changes caused by the earthquake through shifting their foraging habitat and overwintering areas.

Radar studies of flight speed and migration patterns of nocturnal passerine migrants in relation to light and topography

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Radar technology is a very valuable tool to use when studying bird migration in detail. We have used tracking radars at several different sites in Sweden to study individual passerine migrants during their migratory flights. Of special interest was to precisely measure flight speeds during migration and to put these speeds into the context of optimal migration theory. We have been able to show that passerine migrants fly faster (higher air speeds) during spring than during autumn migration at all our different study sites, which is in accordance with optimal migration theory predictions. We have also been able to show that flight speed increment during spring in relation to autumn differs between long and short distance migrants. Passerine migrants migrate mainly during night. At one of our study sites, Abisko, the sun does not set for a large part of the spring migration season (midnight sun). In spite of this, we found that migration continued to be centered around midnight, but with changes in the temporal concentration of the passage of migrants. Another of our study sites, Falsterbo, is a peninsula where many migrants pass. We wanted to know how the coastlines of the peninsula affected the flight paths of passing migrants, but we recorded limited effects of the topography on the flight paths. I will present a summary of all these recent findings of our long term radar tracking program.

Migratory movement of Streaked Shearwaters *Calonectris leucomelas*

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Seabird distributions outside the breeding season have been less documented due to technical and practical difficulties. Although ship-based surveys provide a better understanding of at-sea distribution of seabirds, observational information is often limited given the inability of determining the origin, sex, and breeding status of individuals. Thus, how individual seabirds migrate during the non-breeding period and if such behaviour differs between sexes, among colonies, or within individuals has been elusive. The Streaked shearwater (*Calonectris leucomelas*) is a medium-sized Procellariiform seabird, breeding on islands in east and southeast Asia during the boreal summer. From 2006 to 2010, we recorded migratory movements of Streaked Shearwaters using light-based geolocators at three breeding colonies in Japan (Sangan, Mikura and Awa Islands), and obtained data of 223 migrations, including 47 birds that were tracked over two successive years. Shearwaters migrated to four wintering areas in November-February during the non-breeding period: seas off northern New Guinea, Arafura Sea, South China Sea, and seas off northwestern Australia. Most shearwaters migrated to the seas off northern New Guinea (73.1% of migrations), and others to the Arafura Sea (17.0%) and South China Sea (9.0%), and two birds to seas off northwestern Australia (0.9%). Between sexes, males were more likely to migrate to the South China Sea, while females were more likely to migrate to the Arafura Sea. Females started their southward migration overall earlier than males. Among colonies, shearwaters from Awa Island in the Sea of Japan were less likely to migrate to seas off northern New Guinea, compared to other breeding colonies in the Pacific, possibly due to differences in accessibility between breeding colony and wintering area. We also found individual consistency in their migratory movements, as individuals migrated to the same wintering areas with similar timing as in the previous year. Our study revealed the migratory movement of a pelagic seabird migrating within the western Pacific Ocean.

o26-3

Colonization of migratory Oriental Honey-buzzards in Taiwan reveals fast evolution of migration without a genetic basis

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Genetic variation is known to have an additive effect on the propensity, timing and direction of migration. The variation in migratory traits and genetic boundary between migrants and residents in conspecific populations have been explained by the additive effect of genetics. We examined a recently established breeding population of Oriental Honey-buzzards (*Pernis ptilorhyncus orientalis*, OHB) in Taiwan, a traditional wintering or stop-over site of the species, to explore possible factors regulating the expression of migratory behavior. We captured 49 OHB with bow-nets in Taiwan and obtained both a set of feather samples and a blood sample from each for mtDNA and microsatellite analyses. The stable hydrogen-isotope results of feathers separated our samples into two groups. MtDNA results based on *ctyb* sequences (332-bp) showed that all the birds shared a single haplotype, indicating a common and recent origin. We used the isolation-with-migration model with 10 microsatellite DNA loci to estimate historical gene flow and found it was unidirectional, from migrants to residents. This suggests that the resident population was established by migrants and residency was permanent. Using an assignment test to identify ex-migrants in the resident population revealed that abandonment of migration was a continuous process instead of a single event. Genetic differentiation between migrants and residents was virtually zero. Continued genetic input from migrants into resident population did not heighten migratory propensity among residents. We propose that Taiwan OHB demonstrate the effect of extrinsic factors on their expression of migration, and provide a good example of a change in migratory behavior without genetic basis.

Migration of the Common Cuckoo *Cuculus canorus* and reactions to displacement followed with satellite telemetry

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Solitary, nocturnal migrants constitute the majority of birds migrating between Eurasia and Africa. Yet the migrations of these birds are among the most poorly known. A consequence of the solitary behaviour is that the orientation mechanisms and migratory programme cannot be taught between generations, but only conveyed genetically. How this programme works is yet not known however. We used satellite transmitters to track the migration of eight adult Cuckoos from southern Sweden and eastern Denmark through their annual migration to the winter sites in southwest central Africa and back. Stopover areas were used consistently between individuals and for substantial periods. The spatio-temporal organisation of migration routes was very similar among individuals and all birds migrated to specific *en route* areas of limited spatial extent. A simulated clock-and-compass migratory system could not explain the narrow migratory corridor observed, not even when adding a barrier filter of large water bodies and high mountains, indicating that goal-area navigation was involved to reach the population-specific stopover sites. We displaced 12 adult cuckoos from Denmark to southern Spain prior to normal breeding site departure, and tracked their response. All individuals showed an initial compensatory orientation, but this did not take them back to the normal route. Subsequently, the birds showed quite different responses by either homing in on one of the normal stopovers or the normal winter area. All birds tracked into onset of migration, were able to navigate back to the normal route, but when and where they corrected for the displacement was apparently an individual decision.

Individual consistency in migratory behaviour in Atlantic shearwaters and petrels

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Ascertaining the role of individual consistency in avian migrations and its relationship with environmental variability and specific life-history traits is essential to understand the migratory plasticity of long-lived species. Nonetheless, most biologging investigations often concern individuals sampled sporadically i.e. tracked only once, or twice at the most, mainly due to the difficulty of obtaining repeated journeys of the same individuals. We present here the results of a long-term tracking project including seven seabird species using geolocator devices: Manx Shearwater (*Puffinus puffinus*), Great Shearwater (*P. gravis*), Boyd's Shearwater (*P. boydi*), Cory's Shearwater (*Calonectris borealis*), Scopoli's Shearwater (*C. diomedea*), Cape Verde Shearwater (*C. edwardsii*) and Bulwer's Petrel (*Bulweria bulwerii*). We assessed the consistency in the non-breeding areas used by the same birds tracked from 2 to 5 consecutive years by estimating the annual repeatability in non-breeding grounds of every individual. By decomposing migratory variables into within- and among-individual variability, we found that the relevance of such components varied greatly among species. For example, individual repeatability in non-breeding grounds, as indicated by distances to the wintering area, was high in Bulwer's Petrel (with an intra-class coefficient [ICC] =0.98±0.03, $P<0.001$), and relatively low in Boyd's Shearwater (ICC=0.24±0.16, $P<0.001$), while Great and *Calonectris* Shearwaters showed intermediate values. Our results provide the first interspecific comparison into variation in individual consistency in the migratory strategies among shearwaters and petrels. These results highlight the importance of considering within-individual variability when studying the migratory behaviour of a given species. Future research is needed to understand the links among such individual strategies, environmental variability, population dynamics and the evolution of migratory strategies.

Factors driving rapid changes in virulence of the bacterial pathogen *Mycoplasma gallisepticum* in house finches *Haemorhous mexicanus.*

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Interactions between emerging pathogens and their hosts cause changes in both host and pathogen. A novel strain of the bacterium *Mycoplasma gallisepticum* (MG), a widespread, economically important poultry pathogen, emerged in 1994 in wild passerines in Eastern North America. In House Finches – its primary wild bird host –the pathogen causes severe conjunctivitis resulting in reduced survival in the wild. As the epidemic spread rapidly in the eastern (introduced) part of the finch's range it caused massive declines in host abundance. In 2002 MG successfully spread to the western (native) range of the host. Since its emergence we have collected MG samples, primarily from House Finches. This made it possible to determine that all House Finch MG isolates across North America are derived from a single successful host jump. Nevertheless, different isolates vary strongly in virulence: MG virulence, as measured by severity and duration of eye lesions, is rapidly and independently increasing both in eastern and western House Finches. This provides us with a tractable system to test experimentally the causes of genetic changes in virulence. We will report on experiments that test the hypothesis that increases in virulence are the result of imperfect host immunity selecting for pathogen isolates that are sufficiently virulent to successfully infect and transmit between non-naïve House Finches. The ability of MG to evolve in virulence and persist in House Finch populations could affect population dynamics of House Finch populations for decades to come.

Experimental infectivity trials reveal adaptation by song sparrow hosts to local strains of *Plasmodium*

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Hosts and parasites impose strong selective forces upon one another, often resulting in local arms races of antagonistic coevolution. Selection on parasites is expected to promote increased ability to exploit locally common host genotypes, whereas selection on hosts should promote increased resistance to local common parasite strains. The outcome of these arms races is expected to vary depending on virulence as well as the relative generation times and dispersal abilities of hosts and parasites. To determine whether migratory songbirds or their haematozoan parasites show local adaptation to one another, we conducted a reciprocal infectivity trial. Song Sparrows (*Melospiza melodia*) collected from two breeding sites separated by 400 km were experimentally exposed to the avian malarial parasite *Plasmodium,* cultured either from their site of capture (local parasite) or from the other site (nonlocal parasite). Bloodborne *Plasmodium* loads were measured over 30 days following exposure. We observed differences between host populations in the risk and severity of becoming infected with *Plasmodium*, and differences between parasite populations in their ability to establish an infection. Infection risk, but not the intensity of successful infections, was higher for hosts exposed to nonlocal than to local parasites. We discuss the evolutionary implications of local adaptation by migratory birds to their bloodborne parasites, particularly in light of parasite range shifts associated with a changing climate.

o27-3

The effect of spatially varying seasonality on the epidemiology of Avian Influenza

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Seasonality represents one of the strongest and ubiquitous forces shaping natural systems. The role of seasonality has been well recognised in population dynamics of infectious diseases, including Avian Influenza Viruses (AIV) in wild birds. However, the causal mechanisms underlying seasonal dynamics in AIV remain largely speculative. Waterfowl are considered to be the main vector and reservoir for AIV. Given the global distribution of waterfowl species and AIV their interaction is particularly suitable to investigate the effect and significance of seasonality on host-pathogen dynamics. We analysed AIV infection data from *Anseriformes* species across North America and Europe focussing on variations in climate, seasonality and the position of sampling locations along the various flyways. Surveillance data were derived from the influenza research database (IRD). Bird densities were estimated using the eBird database and seasonality patterns were calculated using remote sensed vegetation data (NDVI). Our results confirm the widely accepted hypothesis that AIV infection dynamics are driven by changes in local population densities. However, we were able to elucidate its relationship with seasonality, where seasonality affects temporal breeding distribution (i.e. the extent of breeding synchronisation), in turn affecting bird densities and ultimately AIV infection dynamics. Furthermore, our analysis indicates that the role of immunological naïve juveniles and temporarily visiting migrants in the infection dynamic differ significantly with respect to the position of the sampling location along the flyway. These findings are important for our understanding of AIV host-pathogen interactions in wild birds and their complex relationship with health issues in man and their livestock. Furthermore, our analysis can serve as a basis to assess potential changes in AIV epidemiology due to climate change effects on seasonality.

Testing the role of migratory birds in the spread of zoonotic disease

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Migratory birds have recently been implicated in the spread of disease over broad geographic distances. However, this implication relies on the assumption that migrants can continue migrating when infected with a pathogen, despite the potentially competing energetic demands of mounting an immune response and migration. We presented three species of migratory songbird (American Redstarts *Setophaga ruticilla*, Hermit Thrushes *Catharus guttatus*, and Yellow-Rumped Warblers *Setophaga coronata*) with an immune challenge (LPS; lipopolysaccharide) during spring stopover at Long Point, Ontario, Canada. Activity, body condition, and skin temperature were measured for 22 Hermit Thrushes (10 treatment, 11 control) and 24 Yellow-rumps (12 treatment, 12 control) over a 48 h period in an aviary at the study site. Yellow-rumped Warblers receiving the LPS challenge showed reduced activity, lost greater amounts of fat, and had lower skin temperatures than controls; however, no effects of the LPS challenge were observed in Hermit Thrushes. Concurrently with the aviary study, we also fitted birds with miniature digital radio transmitters (23 Redstarts, 14 Hermit Thrushes, 16 Yellow-rumps), administered the same LPS challenge to half of the birds (11 Redstarts, 7 Hermit Thrushes, 8 Yellow-rumps), and immediately released all birds back to wild. Stopover duration was then measured with an expansive automated digital telemetry array covering approximately 250 km^2. For each of the three study species, stopover duration did not differ between birds receiving the challenge and controls, suggesting that free-living Yellow-Rumped Warblers were able to mitigate the effects of a mild immune challenge during stopover. Our results highlight potentially important species-specific differences in ability to mount an acute-phase immune response during spring migration, and the need for further research into the mechanisms by which species are able to mitigate the effects of an immune challenge in the wild.

o27-5

Emerging infectious disease selects for darker plumage coloration in Greenfinches

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Outbreaks of emerging infectious disease offer a unique chance to study viability selection in action in short time windows. Finch trichomonosis, caused by a protozoan *Trichomonas gallinae* emerged in Great Britain in 2005 and led to epidemic mortality and a significant population decline of Greenfinches (*Carduelis chloris*) in the UK and Northern European countries in subsequent years. We recorded covariation between plumage characteristics and trichomonosis-induced mortality among wild-caught Greenfinches brought into captivity in Tartu, Estonia. Occurrence of fault bars (markers of stressful conditions experienced during feather growth) on tail feathers was five times higher among the dead birds than among survivors. Black (eumelanotic) compartments of tail feathers of survivors were on average 21 % darker and had 25 % lower reflectance in UV than feathers of dead birds. Standardized linear selection differentials for UV and visual reflectance (1.9 and 1.6, respectively) appear larger than any of the directional selection differentials reported in a previously published meta-analysis involving various organisms. Our findings thus provide probably one of the clearest examples of strong infection-induced viability selection in action. Such pattern is best explained by proposed pleiotropic effects of genes involved in eumelanin production on immune function. These findings suggest that melanin-based colouration can evolve via mechanisms that are independent of visual information provided by the pigment.

Parental food provisioning strategy in relation to brood sex ratio in the Black-billed Magpie: an experimental study

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Theory predicts that parents should differentiate their investment into male and female offspring to maximize their fitness. Recent studies on brood sex ratio adjustment in birds have focused on how parents affect the primary sex ratio at egg laying. However, it is still not clear how crucial sex-biased parental food provisioning can be in shaping the brood sex ratio at fledging. I chose the Black-billed Magpie (*Pica pica*) since earlier studies in our magpie population have suggested that sex-specific mortality of nestlings, and the resulting sex ratio at fledging, may be actively adjusted through sex-biased food provisioning. In this study, we manipulated initial brood sex ratio at hatching by cross-fostering and video-recorded parental feeding behaviour in the Black-billed Magpie (*Pica pica*). We aimed to examine (i) whether parents have sex-biased food provisioning strategy, (ii) whether this depends on the original or the manipulated sex ratio, and (iii) whether the parental provisioning adjusted brood sex ratio by inducing sex-specific mortality of nestlings. Our results showed that parents provided more food to male nestlings in male-biased broods and to female in female-biased, and the brood sex ratio was more biased at fledging. Also, the sex-specific mortality of nestlings was affected by original brood sex ratio. These suggest that magpie parents actively adjusted brood sex ratio by differential feeding, to bias the sex ratio bias which females initially induced at laying stage. We discuss the parental feeding strategy as an adaptive parental behaviour for sex ratio adjustment.

A behavioural correlate of extra-pair paternity in Blue Tits *Cyanistes caeruleus*

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Although extra-pair behaviour and its costs and benefits have received much attention, the behavioural mechanisms underlying patterns of extra-pair paternity are still far from understood. Male and/or female forays to potential extra-pair mates have been proposed to lead to extra-pair copulations and thus extra-pair fertilizations. Such forays have been observed in blue tits as well as in several other species, but could rarely be linked directly to extra-pair paternity. Here we present an extensive dataset on extra-territorial forays of male and female Blue Tits *Cyanistes caeruleus* to 'foreign' nestboxes during the early breeding season. Such behaviour is rare but may allow individuals to assess the breeding stage of the visited pair, or to encounter potential extra-pair mates. To record this behaviour on a population-wide scale, we equipped all nestboxes with RFID readers to detect automatically individual identities of birds visiting a nest other than their own. We combine four years' worth of data to describe daily and seasonal patterns of nestbox visits, and we link these to male age, body size, and extra-pair paternity. Taking into account the spatial context in which extra-pair behaviour occurs in blue tits, we find that male but not female nest visits during the early breeding season predict the occurrence of extra-pair paternity with the visited individual. Furthermore, the nest visiting behaviour tended to be performed more frequently by older males, suggesting a potential behavioural mechanism linked to the wide-spread effect that older males are more successful at siring extra-pair offspring.

Breeding habitats and song structures shed light on evolutionary mechanisms of tinamou (Tinamidae, Tinamiformes) sexual dimorphisms

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Various forms of sexual dimorphism are expressed across avian taxa. Sexual size dimorphism and plumage dichromatism are among the most distinctive forms in birds. The evolutionary mechanism of male-biased versus female-biased sexual dimorphisms is not fully resolved. Hypotheses, such as 1) *sexual selection*, 2) *dimorphic niches* and 3) *intersexual competition*, have been proposed to explain the evolutionary origin and maintenance of sexual dimorphism. These three hypotheses, respectively, argue that the evolution of sexual dimorphisms is driven by 1) mate preference/intra-sexual competition, 2) differential selections on two sexes due to the division of reproductive roles, and 3) selections imposed by inter-sexual resource competitions. While sexual selection hypothesis predicts coevolution of sexual signals and sexual dimorphisms, dimorphic niches and intra-sexual competition hypotheses predict relations between sexual dimorphism and habitat conditions. Different forms of sexual dimorphisms may have been driven by different evolutionary forces within a lineage, and thus may be explained by different evolutionary models. Here I explored the evolutionary mechanism of sexual dichromatism and size dimorphism in a family from the most basal avian clade, Tinamidae, in which female-biased sexual dichromatism and size dimorphism are predominant. I comparatively studied tinamou song structure, breeding habitat condition, along with dichromatism and sexual size dimorphism. I found that sexual size dimorphism coevolved with breeding habitat conditions but not with song structures, indicating support for intra-sexual competition or differential niche hypotheses. On the other hand, tinamou sexual dichromatism coevolved with song structure but not with habitat condition, suggesting a potential role of sexual selection in the evolution of tinamou sexual dichromatism. These different histories of sexual dichromatism and size dimorphism imply divergent evolutionary forces underlying the two forms of dimorphisms.
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How food predictability affects foraging routines of Griffon Vultures

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Supplementary feeding stations are commonly used to sustain conservation programs of scavengers but their impact on behaviour is still debated. They increase the temporal and spatial predictability of food resources while scavengers have supposedly evolved search behaviour for unpredictable resources. In the Grands Causses (France), a reintroduced population of Griffon Vultures *Gyps fulvus* can find carcasses at three types of sites: (1) "heavy feeding stations", where carcasses from nearby farms are concentrated (spatially and temporally predictable), (2) "light feeding stations", where farmers can drop carcasses at their farm (spatially predictable but temporally unpredictable), and (3) "open grasslands", where resources are randomly distributed (both spatially and temporally unpredictable). The impact of feeding stations on vulture's searching behaviour was investigated using 28 GPS-tracked individuals. Unsurprisingly, static habitat selection analysis showed that vultures prefer more predictable feeding sites. Thanks to the high rate with which GPS locations were acquired (interval <5 min), we further investigate habitat selection in a dynamic way through spatial and temporal analyses of prospection patterns. At the temporal level, Fourier and wavelet analyses enable us to detect potential periodicities in the timings of revisits to any particular feeding site. At the spatial level, we focus on the series of feeding sites visited to determine whether vultures tend to repeatedly visit potentially interesting sites in a systematic way. Both temporal and spatial analyses thus make it possible to investigate the extent to which vultures rely on routine behaviour to prospect their environment, which one of the main possible prospection strategies in these birds. We finally investigate the extent to which the behavioural rules used differ across sex and age categories, and also depend on weather conditions (particularly wind speed and direction).

Wintering hotpots of Short-tailed Shearwaters, and their prey distribution, in the Bering and Arctic Seas

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Short-tailed Shearwaters (*Puffinus tenuirostris*) breed in the southern hemisphere, and make a trans-equatorial migration to the Bering and Arctic Seas during the non-breeding period. Recently, sea ice has decreased which might, through prey availability, affect the marine ecosystem including these highly mobile top-predators. Detecting high use areas of top-predators and understanding the links between them and key prey species are crucial to predicting ecosystem changes and designing effective management plans. We investigated the foraging hotspots of Short-tailed Shearwaters using two types of data sets: geolocator tracking data (2009-2011) and ship-based surveys (autumn 2012 and summer 2013). We found seasonal patterns of shearwater distribution and compared related environmental characteristics between these two different data sets by habitat modelling. The distributions of shearwaters by ship-based surveys and tracking showed a similar seasonal pattern, as they were distributed mainly in the Bering Sea and around the Aleutian Islands in summer, but they moved into the Arctic Sea in autumn. However, selected environmental variables differed between these two data sets, probably reflecting intrinsic constraints of the two types of survey. We also conducted acoustic surveys in summer 2013 and net samplings of krill for three years in 2007, 2008 and 2010 to quantify the condition of their prey (mainly krill). We examined occurrence patterns of krill at each growth stage and their favoured water conditions using the habitat modelling. Then, we tested overlap or difference between distributions of Short-tailed Shearwaters (tracking and ship-based data) and krill. Our study addresses the importance of understanding ecologically significant areas used by top-predator and key prey component in the changing high latitude area.

Aeroecology of post-breeding Purple Martins (*Progne subis*): distribution, abundance and trophic impact

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The Purple Martin (*Progne subis*) is a large migratory swallow that nests communally and aggregates at night roosts throughout the non-breeding period of the annual cycle. We have previously shown that this species consumes on the order of 100,000 metric tonnes of insects per year. Understanding the spatiotemporal impact of this consumption on food webs in the aerosphere requires a quantitative description of the distribution and abundance of martins through the annual cycle. During the post breeding period, night roosts of this species can be located and quantified using weather surveillance radars. We used a mosaic of the United States national weather radar data for 2009 through 2012 to determine the number, distribution, timing, and size of post-breeding Purple Martin roosts (June through August). We identified a total of 201 Purple Martin roost locations that were active in the study period. In any single year the number of active post-breeding roosts ranged from 137 to 141; 80 to 90% of roosts persisted from year-to-year. Roosts typically formed in mid to late June and dissipate in mid August; although regional variation in phenology was substantial. Birds emerged from the roosts in the hour before sunrise, although the timing of emergence also varied by region. We also used mosaicked radar data to derive an index of the distribution of abundance of Purple Martins in eastern North America during this post breeding period. We linked this abundance information to a previously published energetics model to map the geographic distribution and of insect consumption by martins across eastern North America.

Effects of social context on foraging behavior of participants in mixed-species flocks across space

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Hundreds of species participate in mixed-species flocks around the world, and they are a distinguishing feature of the fauna in the western Amazon basin. Knowledge of the variation of their behavior across space is key to understanding the behavioral ecology of mixed-species flocks. We investigated the influence of resources on space use and hypothesized that different social contexts among species in a flock lead to differences in perceived habitat quality and foraging rates. In southeast Peru, there are leader and follower species among the core flocking species. Because the leader species guides the flock, the leader species should choose to forage in areas more suitable for it than for the follower species. We predicted that the habitat surrounding the flock would suit the leader species better than the follower species and that foraging rates of the leader species would be more variable than the follower species. In order to test this prediction, we color-banded core individuals of four flocks at two field sites in Peru during May-Aug 2013, and followed flocks for 150 hours. We recorded GPS coordinates, vegetation density, and the foraging rates of all core species as the flock moved through their defended territory. Initial results indicate that the flocks use space in a clustered spatial distribution, which suggests there is some driver of their space use. The foraging rates of the follower species are more variable than the foraging rates of the leader species, which supports the hypothesis that social context affects foraging rates. We discuss resources as a potential driver of the clustered spatial distribution of mixed-species flocks, and suggest that habitat quality is perceived differently by leader and follower species.#

Foraging behaviour of Adélie Penguins throughout the Antarctic winter

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Winter is generally challenging for feeding birds, and this is especially the case for penguins that breed on the Antarctic coast. Antarctic penguins, foraging in the winter sea-ice environment, face two serious feeding constraints, namely, sea-ice coverage expands from the coast and daylight duration becomes very short. We examined how wintering Adélie Penguins *Pygoscelis adeliae* from Lutzow-Holm Bay, East Antarctica (latitude 69.2° S) respond to such feeding constraints by tracking their movements and diving behavior throughout their 8-month long non-breeding period, using leg-attached geolocation and depth recording loggers. From March, after the breeding season, penguins started to move over large distances (up to 1840 km, on average) northwest from the breeding colony before returning to the colony in early November. This northward movement (mean northernmost latitude: 57.5° S) generally corresponded with the seasonal extension of the pack-ice boundary until September. The daily light duration that penguins experienced was shortest in June, but was not less than 5 h per day, due to the northerly migratory movement of the birds. Penguins dived mostly during daylight hours throughout the winter months, and they dived deeper during winter than during the breeding period. We suggest that Adélie Penguins migrate northward with the extending sea-ice to secure enough daylight hours to forage, and increase their dive depth to cope with the short available foraging time during the Antarctic winter.

Habitat fragmentation as an evolutionary force shaping bird wings

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The effects of forestry practices on songbirds have been studied extensively in recent decades. Most researchers assume, or provide some evidence, that forest fragmentation reduces the fitness of boreal songbirds. Limited pairing success, because of barriers to dispersal, is one of the most frequently invoked mechanisms to explain fitness consequences. If true, this mechanism should lead to a strong selective pressure in favour of individuals with greater dispersal ability. I will present two lines of morphological evidence to address this hypothesis. First, I analysed the primary projection from 490 museum specimens of songbirds collected between 1900 and 2008 from parts of boreal Eastern North America that experienced strong regional variation in habitat cover in that period. Primary projection is a measure of wing shape positively correlated with sustained flight (dispersal) ability. Over the 20th century, mean primary projection increased in all six species whose habitat became more fragmented. Conversely, the mean primary projection decreased in three of the four species whose habitat expanded in the same period. The second line of evidence comes from an on-going study of the primary projection of adult birds caught in fragmented and contiguous habitat at Forêt Montmorency, Québec, Canada. In agreement with the museum skin study, a preliminary analysis of >500 specimens caught in 2013 suggests that conspecifics with a long primary projection relative to their species' mean are more likely to be found in fragmented nesting habitat. Together, these findings show that ecomorphology has strong potential to help in understanding patterns and processes in avian landscape ecology.

Estimating bending mechanics of extant and fossil penguin contour feathers

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The biomechanical behavior of biological structures results not only from the properties of their component materials but also from the spatial organization of those materials. Previous comparative studies have reported that feather rachis keratin is homogenous, meaning that the bending properties of feathers primarily result from differences in rachis geometry. We measured the cross-sectional properties of contour feather rachises in a phylogenetically and functionally diverse set of extant birds. Feathers were embedded in epoxy resin and serially sectioned at approximately 0.5 mm intervals. From thin sections, we measured the following structural parameters: maximum and minimum second moments of area (measures of resistance to bending), ellipticity (a measure of maximum resistance to bending), and polar moment of inertia (a measure of resistance to torsion). We found that ellipticity of the rachis is relatively constant along the rachis in all avian feathers measured but is approximately twenty times greater in penguins. Overall, the rachis of extant penguins is dorsoventrally flattened and ellipsoid in cross-section, in sharp contrast to other avians. Relatively homogenous feather morphology among extant penguins allows us to estimate the cross-sectional area and thus the mechanical properties of contour feathers from extinct stem taxa with similar rachis geometry. In fossils, rachises are modeled in cross-section using the measured diameter and the calculated dorsoventral depth based on regressions from extant birds. We are then able to estimate the same structural parameters for fossil feathers. Our results indicate that contour feathers in the extinct penguin, *Inkayacu paracasensis*, may have been approximately twenty times more resistant to torsion at their mid-shaft than similarly sized contour feathers in extant penguins. These results indicate diversity in feather morphology early in the penguin lineage and suggest another transition in feather structure between stem and crown clade penguins in addition to that recently reported in melanosome morphology.

Structural color production in avian eggshells?

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Structural coloration, the phenomenon of color production without pigments, occurs commonly in nature and is caused by light scattering from nanostructured biological materials that differ in refractive index. Understanding the mechanisms that produce structural coloration could inspire innovative and environmentally-friendly ways to produce color. Most research on structural colors has focused on butterfly wings, other insects and bird feathers. Here, we investigate the mechanisms that produce ultraviolet coloration in avian eggshells that are predominantly made of calcium carbonate ($CaCO_3$). Crystalline patterns of $CaCO_3$ have been shown to produce structural colors like iridescent nacre (mother of pearl). However, whether organized $CaCO_3$ in avian eggs can produce structural colors is unknown. Here, we use spectrophotometry, scanning electron microscopy, refractive index matching and nanostructural disruption experiments to determine whether the ultraviolet reflectance peak in white eggshells has a nanostructural basis. The uv peak was eliminated by refractive index matching with tea tree oil and nanostructural disruption by boiling, suggesting that it is produced by light scattering. Surprisingly, powdered eggshell produced the same color as intact eggshell, further indicating that the color may be produced by the crystalline chemical structure of $CaCO_3$ rather than its nanostructural organization. This inference is supported by the lack of nanoscale patterning on the eggshell surface revealed by SEM. Further chemical and physical analyses will help to identify the precise basis of this color.

The morphology of the bill tip organ in Anseriformes

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In some species of geese and ducks, the bill tip organ (BTO) was described in detail in the 1970s (Gottschaldt, Lausmann, 1974a; Avilova, 1975). Our morphological studies of 35 species yielded the following results. The BTO consists of different types of mechanosensitive nerve endings surrounded by connective tissues opening on the inner surface of the beak nails as horny columns (sensillar units) or alveolae (asensillar units). Morphological diversity of BTO in Anseriformes implies the size of the receptor fields, the number and size of receptor units in the upper and lower nails, and the BTO asymmetry as a whole. Swans have the largest receptor fields and units, more than 200 sensillar ones in the maxilla and about 100 asensillar in the mandible. Geese have sensillar units both in the lower and upper nails (on average 200 and 100, respectively). Sea ducks (Mergini) have big rough sensillar units only in the lower nails, from 50 in Goosander and 60 in Scoter to 100 in Goldeneye *vs.* 20-40 asensillar in the upper nail. Pochards have 140-150 sensillar units in the lower nail and about 35 in the upper one. Units of mandible in dabbling ducks are the tiniest and tall, total amount of them reaching 300 *vs.* 35-40 asensillar in the upper nail. The average density of the lower units is 3 per mm^2 in swans, 6.7 in geese, from 2 (Eider) to 7 (Smew) in sea ducks, 7 in Pochards, and 13.7 (8-25) in dabbling ducks. The BTO asymmetry increases from Anserini (K=1.7) to Anatini (K=7.0). It correlates with the number of BTO units in the mandible ($r=0.66; p<0.01$). The BTO of ancestry forms resembling Anchimae has, in contrast, more numerous and complicated sensillar units in the upper jaw.

The evolution of crypsis in nightjars (Caprimulgidae)

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Nightjars are a distinctive group of crepuscular or nocturnal birds with particular secretive habits. Being mainly ground-breeders, they rely heavily on visual crypsis during daytime, which is maintained by various shape-blurring plumage patterns. Thus, different nightjar species may strikingly resemble each other without being related very closely. Owing to their uniform overall appearance and their similar lifestyle, however, the systematics of nightjars has long been influenced by misinterpretations of inter- and intra-generic convergence. Consequently, recent molecular studies challenge traditional taxonomic arrangements. On the other hand, crypsis by itself is hitherto discussed mainly ecologically in terms of cost-benefit argumentations regarding its protective function. Because cryptic plumage characters are subject to considerable selection pressure, however, they also reflect the evolutionary history of lineages. Thus, the development of cryptic plumage characters might also be correlated with phylogeny. Nonetheless, no thorough examination of the evolutionary development of plumage crypsis in birds exists to date. Using a comparative morphological approach, I assessed cryptic plumage patterns and colour variation in nightjars in order to demonstrate the entanglement of speciation, adaptation and ecological constraints. My analyses show how cryptic patterns are formed on different scales, reaching from single feathers to the whole body, generating a variety of camouflage strategies. Based on the available molecular framework, a correlation of these findings with phylogenetic and biogeographic data allows interpreting crypsis as an evolutionary phenomenon in its ecological context.

Song structure and organization in California Thrashers (*Toxostoma redivivum*)

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California Thrashers *Toxostoma redivivum* sing complex songs, with repertoires of hundreds of different phrases. Here we examine songs recorded in natural circumstances from a population of thrashers in the Santa Monica Mountains of southern California; the songs were recorded from 14 territorial individuals during the 2012 breeding season. Our principal findings include the following: i. There is a large number of phrase types available for each bird, but ii. individual birds have distinct lexicons, with lexicon similarity decaying with distance and time. iii. On a short time scale the accretion of new phrases is not gradual, but rather phrases are added in bunches and episodically; over longer time scales the number of different phrases rises linearly with the accumulated number of phrases, at about 1/18 the rate of total accumulated phrases. iv. At any moment there is only a limited number of phrases actually "in play," 15-20, which can be grouped into themes within which transitions are much more common than amongst them. This feature gives rise to a small world (SW) structure. v. New small world themes arise abruptly, and old themes are abandoned during extended song sequences. vi. Songs are more likely to start with certain phrases and end with other, distinct phrases. Preferred start and end phrases differ from time-to-time and bird-to-bird; they tend to be longer and more complex than the phrases used commonly within the song. vi. Similarly, some SW themes themselves are also more likely to transition to certain others, or to occur disproportionately at the start or at the end of songs. The extensive sub-structure within the California Thrasher songs suggests a capacity to transmit contextually-relevant information to both adjacent territory holders and to mates.

Non-gradual vocal development through the stage of voice breaking in three species of Auks (Alcidae, Charadriiformes).

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Birds without vocal learning exhibit different styles of vocal development. For some Anseriformes, Galliformes and Charadrii species gradual changes of call-frequency variables throughout development have been reported, while for some Gruiformes, Procellariiformes and Coraciiformes species the changes are jump-like. Distribution of the vocal development types among other bird taxa, however, is poorly known. We analysed early vocal development in three auk species (Alcidae): Crested Auklet *Aethia cristatella*, Tufted Puffin *Fratercula cirrhata* and Horned Puffin *F. corniculata*. All three species have semi-precocial chicks that stay in nest-burrows until fledging. We recorded calls from 26–35 chicks of each species at four–five ages between hatching and fledgling and from six fledglings of Crested Auklet at a breeding colony on Talan Island, Sea of Okhotsk. We compared main temporal-frequency variables of chick calls across ages and with common adult calls. In all species we observed the lack of a gradual change in the fundamental frequency of calls between hatching and fledging despite a considerable increase in body size. Fundamental frequency actually increased slightly over development and was always higher then that of adult calls. Interestingly, calls of two Tufted Puffin chicks just before fledging and five Crested Auklet fledglings contained two non-overlapping independent fundamental frequencies in the spectrum. The upper frequency band didn't differ in values from juvenile fundamental frequency band, and the lower frequency band didn't differ from fundamental frequency measured in adult calls. Such two-frequency calls have also been reported previously for some other non-passerines and their appearance used as a marker of start of voice-breaking. Thus, we confirm the presence of jump-like vocal development through the stage of voice-breaking in Alcidae and speculate that such patterns of vocal development could be widespread among bird species across the altricial spectrum. This study was supported by the President Grant (MK-1781-2012.4) and by the RFBR (12-04-00414a).

Song discrimination before song learning in free-living sparrows: implications for learning and evolution

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Song learning in males and females influences both song production and mate recognition later in life. These learning processes are 'selective', such that conspecific songs are preferentially learned over heterospecific songs. The selectivity of song learning plays an important role in evolution: it can help maintain divergent songs in syntopic populations and promote assortative mating. Captive studies have shown that song learning in White-crowned Sparrows (*Zonotrichia leucophrys*) begins shortly after fledging, and they are able to discriminate conspecific songs from heterospecific songs during this sensitive period. I studied their sister species, Golden-crowned Sparrows (*Z. atricapilla*) in the field to determine whether these birds can also discriminate songs prior to learning. Using a set of field playback experiments to nestlings, I show that Golden-crowned Sparrows respond vocally to territorial songs while still in the nest (7-8 days old). These nestlings respond differently to songs of their own species and those of sympatric White-crowned Sparrows, demonstrating species discrimination before song learning. In addition, I find that nestlings discriminate between dialects of conspecific song, while adult males respond equally to dialects. Thus, the lack of dialect discrimination in adults does not reflect their cognitive abilities—they may have learned to generalize across geographic variations in conspecific songs. The ability to assay early song discrimination in nestling songbirds will open the door to further exploration of how evolution and learning together shape recognition systems in birds.

The plasticity of song learning as revealed by a cross-fostering and a multiple tutor experiments in Bengalese Finches.

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The Bengalese Finch (*Lonchura striata* var. *domestica*) is a domesticated strain of wild White-rumped Munias (*Lonchura striata*). Through the domestication, the courtship songs of Bengalese Finches have been differentiated from those of wild munias. The songs have tonal phonology and complex syntax in Bengalese Finches, although munia songs have a noisy sound with stereotyped syntax. The cross-fostering experiment revealed that there was a significant difference in the accuracy of song learning between Bengalese Finches and White-rumped Munias. The proportion of shared elements with tutors was about 90 % regardless of tutor strain in Bengalese Finches. Munias shared 75% song elements with the foster tutor (Bengalese Finches) although they could copy almost 100% from their own strain. The loss of accuracy in song learning in Bengalese Finches is expected to lead to increased plasticity of song learning instead. We set up a colony with eleven males and ten females of Bengalese Finches and let them bred freely. Under the multiple tutor condition, most out of 32 juveniles learned parts of songs from two tutors. They segmented the songs by transition probability and combined some parts into their own song. We also conducted a multiple tutor experiment in munias. Munia juveniles learned their father's songs and a few juveniles learned from two tutors. While munias learned songs from several tutors, munias tended to learn from familiar songs (their father). These results suggest that the accuracy of song learning is related to how many tutors juveniles select. I will discuss the relationship between plasticity and tutor choice.

A possible trade-off between song and a cognitive metric in a songbird

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Sexual ornaments can be honest signals of male quality if they are linked to traits that enhance female reproductive success. Males might be expected to invest maximally in traits important to females and thus in sexual ornaments. However, mechanisms that link sexual ornaments with other character traits also may be the basis for trade-offs between traits. Bird song is a sexual ornament that depends principally upon brain structure and function, making it reflective of at least some measures of neural capacity and cognition. We explored the possibility that constraints on brain growth could lead to a trade-off between song and cognition in Song Sparrows (*Melospiza melodia*). Specifically, we examined the relationship between song repertoire size and performance on a spatial task. We found an inverse relationship between repertoire size and speed of spatial learning and suggest that a developmental trade-off between the hippocampus and song control nuclei could be responsible for this relationship. Differences in how males resolve this trade-off between brain-dependent traits could contribute to the spectrum of variation in song and cognition. Such a trade-off suggests that song can inform females about a suite of male traits rather than a single metric of condition.

Response of a declining wood warbler to forest treatments: Preliminary results from a 100-year study

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The Cerulean Warbler (*Setophaga cerulea*) is a long distance Nearctic-Neotropical migrant wood warbler that breeds in mature deciduous forests of the midwestern and northeastern United States and Ontario, Canada, and winters on the slopes of the Andes in northern South America. Based on annual Breeding Bird Surveys, Cerulean Warbler populations have declined by 70% over the past five decades. It is listed as 'Endangered' in Canada, a 'Species of Concern' in the United States, and 'Vulnerable' by the International Union for the Conservation of Nature. There are many probable causes for its population decline, including degradation of breeding habitat through fragmentation, and reduced productivity. The Hardwood Ecosystem Experiment is a long-term (100 year) research project to determine the effects of silvicultural treatments on various taxa, including the Cerulean Warbler. We measured relative abundance and territory size during pre-treatment (2007-2008) and post-treatment years (2009-2013) across nine study sites in southern Indiana. Silvicultural treatments consisted of 3 sites receiving even-age harvests (clear-cut and shelterwood), 3 sites receiving uneven-age harvests (single and group tree removal), and 3 sites with no harvests (control). Cerulean Warbler relative abundance increased in even-age harvest and control sites in post-treatment years. Cerulean Warbler relative abundance decreased in uneven-age harvest sites during the two years post-treatment but has since recovered to pre-treatment levels. Territory size did not change significantly between pre- and post-treatment years. Reproductive monitoring since 2011 suggested that reproductive success did not differ significantly between even-age and uneven-age sites. Reproductive success was markedly higher at control sites; however, results are inconclusive due to the small sample size. Continued monitoring of relative abundance and reproductive output at our study sites is needed to assess long-term response to forest treatments and to account for inter-year variation.

Conservation and restoration of tern colonies in North America

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Populations of colonial seabirds, especially terns (Sterninae), are limited by availability of suitable breeding sites. Human disturbance, introduced mammalian predators, and anthropogenic habitat change contribute to reductions in tern nesting habitat. We monitored attempts to restore breeding colonies of Caspian terns (*Hydroprogne caspia*) in western North America by providing suitable nesting habitat on islands and attracting terns to nest. The overall goal of this and other tern restoration projects in North America is to provide a network of suitable colony sites for terns to chose from in order to grow tern populations and conserve these populations over the long-term in the face of stochastic events. Without an extensive network of suitable colony sites, local catastrophic events can have severe impacts on tern populations. We used a 4-step process pioneered by S. Kress to establish new breeding colonies of Caspian terns on especially constructed or managed islands: (1) provide suitable nesting substrate, (2) install social attraction (tern decoys and audio playback of vocalizations), (3) closely monitor the new colony site to identify impediments to colony formation, and (4) remove predators if they limit the new colony. Social attraction techniques resulted in Caspian tern breeding colonies forming on 12 of 14 newly-created colony sites in the first breeding season. The primary threats to these new tern colonies were predators (avian and mammalian), competitors for nesting habitat (mostly gulls *Larus* spp.), human disturbance, and collapse of the food supply. Mark-resighting studies indicated that Caspian terns from well-established colonies quickly found the new colony sites > 500 km distant, recruited as breeders, and moved among the new colony sites, depending on local nesting and foraging conditions. This approach is now being tried in the East China Sea to restore tern populations, in particular that of the critically endangered Chinese crested tern (*Thalasseus bernsteini*).

Threats to Lilian's Lovebird *Agapornis lilianae* in Malawi: disease, predators & waterhole poisoning

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The Lilian's Lovebird *Agapornis lilianae* is a small parrot and specialist of Mopane *Colophospermum mopane* woodlands. Its distribution is scattered across Zambia, Tanzania, Mozambique, Zimbabwe and along the Shire River in southern Malawi. We investigated the prevalence of the Psittacine Beak and Feather Disease Virus (PBFDV) in wild populations of Lilian's Lovebirds in Liwonde National Park (LNP), Malawi. In addition, the lovebird's natural predators during the breeding season were monitored using camera traps at nest cavities in LNP. The potential threat to Lilian's Lovebirds as non-target victims of illegal hunters poisoning natural waterholes to catch mammals was also investigated. All lovebirds sampled tested negative for the PBFDV. Only one snake species, the green mamba *Dendroaspis angusticeps*, was confirmed to prey on Lilian's Lovebird eggs. However other potential predators such as the Green Wood-hoopoe *Phoeniculus purpureus* and the European Honey Buzzard *Pernis apivorus* were recorded at nest cavities. An average of four poisoning incidents occurred in the park every year of which at least one caused Lilian's Lovebird mortalities. Poisoning incidents occur from as early as February through to November. Lilian's Lovebirds are more vulnerable to poisoning in the dry season because they congregate at waterholes with flock sizes of up to 100 individuals. Evidence of capture of these lovebirds for the illegal pet trade was not found during our study. Consequently, of the three potential threats to Lilian's Lovebird population in LNP, waterhole poisoning is the current major threat. There is a need for increasing law-enforcement patrols to prevent this lethal activity in LNP.

Determination of the nutrient requirements of kiwi (*Apteryx* spp.): a model for the development of synthetic diets for captive-held species

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Rearing kiwi (*Apteryx* spp.) in captivity is important for education, conservation advocacy, and for supplementation and re-establishment of wild populations, but adult captive kiwi suffer higher mortality, have lower fertility rates, and produce smaller eggs than their wild counterparts. Nutrient deficiencies in captive diets have been implicated in this. We undertook a systematic evaluation of the nutrient composition of captive diets and the diets of wild kiwi in order to develop a balanced synthetic diet comprised of readily-available ingredients. There were substantive differences in the macro- and micro-nutrient contents of captive (n = 7 facilities) and wild diets. Determining the fatty acid composition of depot fat of wild kiwi proved not to be helpful in clarifying the diet of wild kiwi. Analysis of the nutrient compositions of food items that are frequently consumed by wild kiwi but for which no published nutrient composition data exist did, however, refine our assessment of the nutrient intake of wild kiwi. Using these values and knowledge of the occurrence of these items in the diet of wild kiwi, we calculated mathematically the nutrient composition of a wild diet. We then synthesised a near-wild diet by combining food items known to be consumed by kiwi in amounts proportional to their published intake, assessed its nutrient composition to ensure that it was close to our predicted composition, and determined its apparent digestibility. Finally, we synthesised an artificial diet based on our refined assessment of the nutrient composition of the wild diet, and compared the apparent digestibility of the synthesised diet with that of the near-wild diet. We will discuss the application of this approach to other captive-held species, and the implications for animal welfare, husbandry, and conservation.

Factors affecting Saltmarsh and Seaside Sparrow reproductive success in New York City, NY, USA: implications for tidal marsh management action plans in urban areas.

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Sea level rise and anthropogenic factors have accelerated tidal salt marsh loss along the eastern seaboard of the United States. Saltmarsh and Seaside Sparrows (*Ammodramus caudacutus*, *Ammodramus maritimus*), tidal marsh obligate-breeding species, have mirrored this decline. Marsh characteristics that support the reproductive success of these sparrows must be identified to inform marsh restoration plans that may benefit nesting populations of these sparrows. New York City has on-going salt marsh restoration projects which seek to support these imperiled birds. In 2012 and 2013 we surveyed 4 marshes in the NYC area with breeding Saltmarsh and Seaside Sparrows. At each site, we performed twice-weekly grid-searches for nests as well as opportunistic nest searching using adult behavioral clues. Each nest was followed to completion and the fate of all individuals within the nest was monitored. Tidal influx within each nest was obtained by use of iButtons placed in the bottom of each nest and vegetation characteristics immediately surrounding each nest site were recorded. Using a logistic exposure nest survival model, we found that Saltmarsh and Seaside Sparrow nest survival in NYC is affected by site, stage (chick versus egg), and vegetation variables. Chick survival models are pending further analysis but appear to follow similar trends. Explanations for the outcomes of these survival models and implications for restoration plans in New York City will be discussed.

Poster Presentation Abstracts

p01-001

The use and relative importance of intra- and interspecific social information in a guild of cavity-nesting birds

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Social information use is a widespread strategy in the animal kingdom and it affects many important behaviours. Cavity-nesting birds are excellent model organisms for studying social information use in natural settings. Great and Blue Tits (*Parus major, Cyanistes caeruleus*) use conspecific cues in their breeding site choices. Early breeding resident tits are excellent social information sources for migratory Collared Flycatchers (*Ficedula albicollis*). Flycatchers have been shown to use both con- and heterospecific cues in their breeding site choices in separate studies. Previous research has ignored the multiple sources of social information. In this study wild birds were faced with conflicting social information from con- and heterospecifics. Thus, we were able to assess the relative importance of intra- and interspecific social information. Our results demonstrate that flycatchers prefer intra- and interspecific cues in different situations when both cues are available. In Great Tits conspecific copying is frequent in old males. Individuals usually live in multi-species communities amidst a continuous information flow from con- and heterospecifics, thus our results bring research on social information use closer to natural conditions.

p01-002

Genetic background of social interactions in a Siberian population of Pied Flycatcher

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On the basis of DNA analyses, we present here evidence for various social and mating relationships among Pied Flycatchers (*Ficedula hypoleuca*) in western Siberia. In 2005, we collected blood samples from all birds breeding in large study plots. In total 1969 blood samples were taken (250 nests, 485 adults, 1484 nestlings). For every DNA sample eight microsatellite loci (FHY336, FHY403, FHY427, FHY452, FHU1, FHU2, FHU3, FHU5c) were amplified by two multiplex-PCRs (Set FHY, Set FHU) and analysed by capillary electrophoresis (MegaBACE). 154 families (61.6 percent) were socially and genetically monogamous (every nestling in the brood was sired by the brood-rearing adults at the nest). In the rest of the families, we found evidence for a great variation of social and genetic interactions between birds. Males and females can copulate with more than one partner. Males can attract more than one female and sometimes do not feed nestlings or sometimes feed them in more than one brood (polygynous males which rear nestlings in a second brood). Males can adopt other (not genetically related) nestlings and participate in their rearing. Males can help other pairs of flycatchers to feed the nestlings. Females can adopt another clutch at the incubation stage. Females can lay eggs that were fathered by more than one male. Females can lay eggs in the nests of other pairs (egg dumping). In the studied population, 79.1 percent (1174) of nestlings were reared by their genetic parents, 12.1 percent (179) of nestlings were reared by their genetic mother and social father, 5.9 percent (87) of nestlings were reared by their genetic father and a social mother, and 2.9 percent (44) of nestlings were reared by social but genetically unrelated parents. Our study shows that almost all possible social and genetic interactions exist in a socially monogamous species.

p01-003

Cooperative breeding as an adaptive response to habitat fragmentation?

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Empirical evidence is growing that human-induced environmental changes, such as habitat loss, fragmentation, and degradation, impose novel selective pressures on populations of plants and animals. In facultative cooperative breeding species, the choice to forgo breeding independently and help relatives with raising their brood, is often linked to environmental constraints, such as habitat saturation or increased dispersal costs. However, whether cooperative breeders differ in sensitivity to habitat disturbance from non-cooperative species, and to what extent this plastic reproductive strategy might act as an adaptive response to environmental stress, is still poorly understood. Recent observations and video-recordings in a severely-fragmented cloud forest archipelago in SE Kenya (Taita Hills) revealed that a higher proportion of pairs of the forest-dependent Cabanis's greenbul (*Phyllastrephus cabanisi*) were assisted by at least one helper when breeding in small disturbed fragments compared to larger and more intact ones. This pattern suggests that cooperative breeding behaviour might help to overcome adverse fitness effects of habitat fragmentation. Here we present a novel field protocol that will allow us to rapidly assess whether helpers are present in a number of larger forest blocks that vary in quality, size and isolation across the Eastern Arc Mountains of Kenya and Tanzania. Ultimately, this will allow us to better understand the biogeography of cooperative breeding and test the hypothesis that facultative reproductive strategies, such as cooperative breeding, may comprise adaptive responses to anthropogenic stressors.

p01-004

Characteristic factors of loose colonies of common kestrels (*Falco tinnunculus*) in Japan

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Common kestrels (*Falco tinnunculus*) usually breed in solitary nesting sites. In Japan, however, common kestrels often breed in loose colonies of 2-20 pairs. Nearest-neighbour distances among pairs in colonies are 4-202 m. We found the following four characteristics common to loose colonies of common kestrels in Japan. First, nest sites were found on rock faces and buildings. Second, nest sites were located near rivers and far from rice fields, their foraging areas. Third, territory size was positively related to the size of a favourable foraging area near nesting sites, and was limited by the availability of nest sites near rivers. Fourth, nest sites on rock faces and buildings were large. Large grasslands were also suitable foraging areas for kestrels nesting in loose colonies. Therefore, we suggest that colonies are located in areas that minimize the risk of nest predation. However, the formation of loose colonies might not be related to nest site limitation due to their location in rock faces and buildings near rivers. It is possible that the formation of loose colonies is indirectly related to territory size and to favourable foraging areas. These results suggest that the locations of loose colonies of common kestrels in Japan are influenced by several factors.

p01-005

Is the Asian Stubtail a cooperative breeder?

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The Asian Stubtail *Urosphena squameiceps* is a small (ca. 10 cm) ground-nesting species of warbler, which breeds around Japan and over-winters in Southeast Asia. Although this species is socially monogamous, up to two extra-pair males are frequently seen at nests during the nestling stage. The extra-pair males rarely help the pair, but they spend their time at the nest looking at nestlings, singing, and resting all day. They often follow the parents around the nest when they leave the nest to forage. Both members of the pair tolerate the male and he does not behave aggressively towards the parents. Parentage analysis showed that the extra pair males were not genetically associated with the pairs and offspring. A possibility is that extra-pair males visit neighbors to seek EPC or to increase their probabilities of pairing with the social female in subsequent breeding attempts in the event of her nest failure or if she breeds for a second time. Further studies are needed to elucidate the adaptive significance of this behavior.

p01-006

Correlations among territorial management, nesting cycle, territorial conflicts, territory size and reproductive success of a tropical bird, the Pied Bush Chat (*Saxicola caprata*)

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A study was carried out in order to understand the relationship, if any, among territorial management (i.e. temporal changes in territory size), nesting cycle, territorial conflicts, territory size and reproductive success in a tropical bird, the Pied Bush Chat (*Saxicola caprata*). The correlations were examined between territorial management vs. nesting cycle, nesting cycle vs. territorial conflicts and territorial size vs. reproductive success. We studied 10 different males from various sites of district Haridwar of Uttarakhand near the foothills of western Himalayas in northern India (29º 55´ N; 78º 8´ E). The results reflected a constant decrease between the initial territory size and the final territory size with the advancement in the phases of their nesting cycle. In our model the number of territorial conflicts was also found to decrease during progression of their nesting cycle. The larger territory size is generally considered as a positive source of variance in avian reproductive success. However in the present study we found no significant impacts of larger territories on the reproductive success of Pied Bush Chat. The availability of food appears to be a key factor which determines the chances of avian reproductive success. In our study area the availability of food was not emphasized much as the habitats possessed abundant sources of food for each male studied.

p01-007

First formation of colonies of the Great Crested Grebe in Japan

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The Great Crested Grebe is a piscivorous bird, and widely distributed in northern Eurasia. It was a rather uncommon winter bird in Japan until 1970s. However, after the first discovery of its breeding in eastern Aomori Prefecture, it has been spreading its breeding area in Japan, including the western part of Aomori Prefecture. This bird is usually a solitary, territorial breeder. However, in 2012, we found two small colonies of the Great Crested Grebe in emerged plant zones at a river mouth in western Aomori Prefecture. One of the colonies was eventually abandoned probably due to water level fluctuation. At least some chicks fledged in the other colony, but the breeding success did not seem to be high. The causes for establishing colonies at locations where breeding conditions were seemingly poor will be discussed in relation to limitation of emergent plants, wave action and water level fluctuation, and available fish fauna.

p01-008

Spatio-temporal evaluation of *Spizella wortheni* territories in the Mexican Plateau.

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Spizella wortheni is a territorial sparrow with restricted distribution inhabiting short arid grassland and xeric bushes in the south Plateau of the Chihuahuan desert. Previous studies have demonstrated that *S. wortheni* breeds in a varied habitat across the Mexican Plateau being flexible to changes in vegetation composition and altitude. In our observations on territory establishment of this species, we detected a variation in territory size between individuals inside the same breeding site, in creosote bush in Nuevo León, and Coahuila. In the years 2012 and 2013 we evaluated 31 territories in four breeding sites with different vegetation composition in Coahuila and San Luis Potosí states. Though territory sizes clearly tended to differ between sites in Luis Potosí for the year 2012 ($\overline{X}$: 0.73 and 0.38) and two sites in Coahuila and one in San Luis Potosí in the year 2013 ($\overline{X}$ 0.13 and 0.15 in Coahuila and 0.37 in San Luis Potosí) it was not possible to confirm such tendencies statistically. The effect of strong variation and small sample size can be responsible for the results. We found a strong negative relation between vegetation cover and territory size for all sites. Since there is no other study about variation in territory size in *S. wortheni*, our study shows the flexibility of the species in response to the availability of resources like vegetation cover, and surely to other environmental variables not considered here. The absence in 2012 from some well known breeding sites in Coahuila, seems to confirm the response of the species to unfavourable climate (drought).

p01-009

Seasonal changes in plasma levels of sex hormones in a promiscuous bird: the greater rhea (*Rhea americana*)

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The greater rhea (*Rhea americana*) is a ratite species native to South America that reproduces seasonally and has a complex and "promiscuous" mating system. For that reason, this study is aimed at analyzing the endocrine basis of reproduction in greater rheas and its relation to their mating system. We used HPLC and electrochemiluminescence techniques to identify and measure plasmatic testosterone and estradiol levels in 21 breeding adults (6 males and 15 females) and 10 greater rhea chicks (5 males and 5 females) as a control, bred in captivity at an experimental farm in Córdoba Zoo, Argentina. Our results show that the sex hormones testosterone and estradiol fluctuate throughout the year in adult males and females, respectively. Lower levels of these hormones were observed during the non-reproductive season (February to July), whereas maxima were reached in September for males and November-December for females. By contrast, male and female rhea chicks had constant levels of sex hormones, which indicate that there is no seasonal control on gonadal function due to their sexual immaturity. As expected for species with a promiscuous mating system and male parental care, the high testosterone levels exhibited during incubation did not inhibit parental behavior in males, while high estradiol levels in females would be needed to maintain egg-laying behavior during the reproductive season.

p01-010

Extra-pair copulations in two species of reed warblers: Blyth's reed warbler (*Acrocephalus dumetorum*) and the large-billed reed warbler (*A. orinus*)

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Acrocephaline warblers show a diverse range of mating systems including monogamy, polygamy and promiscuity. Extra-pair copulations (EPCs) have been documented in several reed warbler species. We determined frequencies of EPCs in local populations of two closely related, socially monogamous species: Blyth's reed warbler (*Acrocephalus dumetorum*) and the large-billed reed warbler (*A. orinus*). Data were collected in the Unzha river valley, Kostroma Region, Russia (May–July 2009) and in the Ghund river valley, Gorny Badakhshan Autonomous Region, Tajikistan (June–July 2012). Genetic analyses were performed on five microsatellite loci (136 samples from *A. orinus* [52 adults and 84 chicks] and 140 samples from *A. dumetorum* [54 adult and 86 chicks]). We documented extra-pair offspring in both populations; however, Fisher's exact tests revealed significant differences in EPC rate between the two species ($P<0.05$). The rate of EPC was significantly higher in *A. dumetorum* than in *A. orinus*. This result is consistent with low genetic diversity observed in the local population of *A. orinus*. The study was supported by the Russian Fund for Basic Research and the Rufford Small Grants Foundation.

p01-011

Extra-pair males are similar with social males in House Sparrows (*Passer domesticus*), but just older

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In socially monogamous but genetically polyandrous bird species, females can obtain only indirect genetic benefits from their extra-pair mates. Also, females may suffer direct costs because social mates reduce paternal care when paternity is uncertain due to female extra-pair mating. Therefore, females are expected to choose extra-pair mates that can maximize their indirect genetic benefits, compensating any potential costs. According to the genetic compatibility hypothesis, females are predicted to mate with genetically less similar extra-pair males than their social males in order to produce extra-pair offspring with high heterozygosity. Alternatively, the good genes hypothesis posits that females would prefer extra-pair males with traits indicating high genetic quality, which can be passed on to the offspring. Such male traits may be body size, secondary sexual characters or age. We used a complete pedigreed dataset, collected over 12 years from an isolated population of House Sparrows (*Passer domesticus*) to investigate whether extra-pair males are either phenotypically or genetically different from the social males of given focal females. In accordance with the good genes hypothesis, we show that extra-pair males are older than social males. However, contrary to the prediction of the genetic-compatibility hypothesis, the genetic distance between a given female and both of her extra-pair and social males are similar. Further, extra-pair and social males show little differences in their body size (measured as tarsus length, beak length, wing length, tail length and weight) and secondary sexual characteristics (badge size and mask size), which is contrary to expectations from the good genes hypothesis. We conclude that female choice for extra-pair mating is probably based on neither morphological nor genetic differences between social and extra-pair males. However, the observed 'older' age effect, which has been shown in many bird species, warrants further investigation.

p01-012

Why do extra-pair copulations occur in the Northern Goshawk, *Accipiter gentilis*?

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Several studies have reported extra-pair copulations (EPCs) in raptors (Sodhi 1991, Birkhead, et al. 1992, Negro et al. 1996). Gavin et al. (1988) captured 103 adult Goshawks and 122 nestlings from 64 nests in Arizona, US, and revealed the occurrence of EPC using allozyme analysis. Rutz (2005) attached radio-transmitters to three breeding males in Hamburg, Germany, and concluded that EPCs involved intruding males. I attached Solar Argos/GPS Platform Transmitter Terminals to 16 Northern Goshawks (5 males and 11 females) in Japan and satellite tracked the birds. I observed that the females migrated to their wintering grounds that were on average 193.3 km away, after their nestlings had fledged. The males, on the other hand, stayed in their territories throughout the year. On the basis of my results, I formulated the following three scenarios: (1) EPCs occur as a result of female goshawks migrating to their wintering grounds; females return to their previous year's nests every year migrating through the territories of a range of males providing the females an opportunity to copulate. (2) When a female returns to the previous year's nest if frequently happens that the nest has been occupied by another female, after which fights may occur. The winner can stay in the nest, and the losing female has an opportunity to copulate with the territory holder during this period. (3) The loser moves to the territory of another male, and this gives her an opportunity to copulate. Satellite tracking showed that from year to year females frequently changed their nests, with one individual changing nests three times within five years, another changing nests two times within three-years, and two cases where females changed twice within two-years. I also observed that males frequently tolerated females that intruded and stayed in their territories.

p01-013

Behavioral analysis of dance in the red-crowned crane: a test of the pair bond hypothesis

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A coordinated mutual display (i.e., pair dance) is often seen in monogamous birds, but its structure and function remain little studied. The structure of dance can be complex as its sequences vary both within an individual and within a pair. Although several studies described behavioral elements of dance structure, quantitative analyses are rare. We investigated characteristics of dances in the Red-crowned Crane (*Grus japonensis*) in Japan and tested the hypothesis that pair dances function as signals to maintain pair bonds. We tested four predictions based on this hypothesis. 1) Pair dances may have a structured sequence. 2) Pair dances should be more complex and coordinated than sub-adult dances. 3) As the breeding season approaches, pair dances will be elaborated. 4) Complexity and synchrony of pair dances may positively correlate to both previous and future reproductive success between pairs. We measured duration, behavioral elements, and complexity of each dance bout, and analyzed the behavioral sequences. We made a range of key observations in relation to the four predictions. 1) Sequential analysis clarified that specific rules exist in a pair dance. 2a) Three behavioural elements that played key roles in pair dances were only infrequently observed in sub-adult dances. 2b) Pair (especially male) dances were more complex than sub-adult dances. 2c) Pair dances were more coordinated and structured than sub-adult dances. 3) The duration of each dance increased as the breeding season approached. 4) Pairs that succeeded reproduction in the last breeding season danced longer than ones that failed in reproduction. All results supported our predictions and were consistent with our hypothesis. These results suggest that the order and synchrony of behavioral elements may function as signals within a pair. Our study has broad implication for the understanding of mutual communication in birds.

p01-014

Extra-pair young in nests of the Wood Warbler (*Phylloscopus sibilatrix*) in the Middle Russia

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In passerine birds extra-pair copulations (EPCs) are widespread (50-60%) (Rosivall et al, 2009). EPCs are generally beneficial for males because they increase the number of sired offspring; females may probably participate in extra-pair copulation to increase genetic variability of the offspring. Frequency of extra-pair young (EPY) can vary from zero percent, as in the Fulmar (*Fulmurus gkuciulisto*) to 76 % in the Superb Fairy-wren (*Mulurus cyuneus*) (Fridolffson et al, 1997). Furthermore, the number of EPY can differ among populations of the same species, as in the Norwegian and Swedish populations of the Pied Flycatcher (*Ficedula hypoleuca*) where 4% and 24% of offspring are EPY, respectively (Gelter and Tegelstrom, 1992). In a Swedish population of Wood Warbler a low level of EPY was shown (Gyllensten et al, 1990). These data are in contrast with findings in related species like the Dusky Warbler *Ph. fuscatus* or the Willow Warbler *Ph. trochilus*, which have a considerably higher level of illegitimate offspring. We have assessed paternity in a population of Wood Warbler in the Middle Russia by using 7 polymorphic microsatellite loci. Blood samples for the analysis were taken from both parents and offspring in 20 nests. EPY were found in as many as 11 nests. We showed that 32 of 113 young (28%) were not related to the social father, and that 55% of the nests contained at least one EPY. In one nest the social father did not have his own young at all. Radio transmitters were also used to track bird flights which allowed us to estimate the maximum flight distance from the nest and male movements during parental care; the thus observed behavior correlated with the EPY proportions.

p01-015

The red beak is a condition-dependent indicator in the Himalayan Black Bulbul (*Hypsipetes leucocephalus nigerrimus*)

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Carotenoid pigmentation is now known to be one of the most frequent mechanisms for coloration of sexually selected ornaments, and is also correlated with individual's physical condition. Animals can not synthesize carotenoids by themselves; they have to obtain from the diets. Carotenoids could affect multiple physiologies at the same time, therefore, how individuals rearrange the distribution of carotenoids among different physiologies under different physical stress (like molting), could affect fitness of an individual. Studies showed that individuals containing higher carotenoids had redder or brighter ornamentation, and also had higher immunocompetence, competitive ability and better hunting skill; these individuals also could have better quality of territories and parental care. However, with additional studies, researchers found out that carotenoids might play different roles in different species. In order to re-examine that, we used Himalayan Black Bulbul (*Hypsipetes leucocephalus nigerrimus*) to test if the coloration of red beaks could reflect an individuals' physical condition. These birds were covered with black plumage; it made their red beak very obvious to each other. We randomly divided the birds into four groups by two treatments: carotenoid-supplemented and plucked treatments. We measured if immunocompetence (phytohaemagglutinin assay) and oxidative stress (heterophill/ lymorcite ratio) of an individual would be correlated with the beak coloration after molting. Results showed that in the no-carotenoid supplemented group, the birds had paler beaks and the immunocompetence was lower, the oxidative stress was higher in plucked groups. In the carotenoids supplemented groups, the birds had redder beaks, but there were no differences of immunocompetence and oxidative stress between plucked and unplucked groups. Our data also showed a significant positive correlation between imunocompetence and beak coloration, a significant negative correlation between oxidative stress and beak coloration. Our results suggested that red beaks are reliable signals of physical condition in the Himalayan Black Bulbul, and might play important roles in quality assessment of individuals, like mate choice or aggression behavior decision.

p01-016

Female mate preference for multiple male ornaments and territory quality in Barn Swallows

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The Barn Swallow (*Hirundo rustica*) is a model species for the studies of sexual selection and female mate preference. Using this species, European and North American researchers have clarified several important aspects of sexual selection, e.g. extra-pair paternity. However, until recently, no one has shown "how multiple ornaments have been evolved and are maintained", "the relative importance of territory and male ornaments", "how territory affects sexual selection on male ornaments", "how the multiple ornaments vary among populations and its predictability", even in this model species. Here, we present new insights obtained from Japanese Barn Swallows, *H. r. gutturalis*. We show how multiple male ornaments are maintained in populations, and how territory contributes to the evolution and maintenance of multiple ornaments, how variation in multiple ornaments can be evolved and maintained within and among populations. These insights have been obtained from a study with 7 years of field observation. We discuss these insights together with previous contributions from European and North American studies to clarify the evolution of female mate preference and male phenotypes.

p01-017

Extra-pair mating in the Barn Swallow in East Asia

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The Barn Swallow (*Hirundo rustica*) is a socially monogamous passerine that has an extra-pair paternity rate of approximately 30%. Recent studies have suggested that females actively pursue extra-pair copulation (EPC) to gain indirect benefits, and females paired with low quality males have a higher tendency to do so. However, the traits females use to evaluate the quality of males are not well understood, especially in the East Asian subspecies of Barn Swallows. To achieve EPC, females must escape mate-guarding by males, so the frequency of flights initiated by females away from their mate was recorded to represent female motivation to seek EPC. To test whether there is a male counter adaptation to EPC-seeking behavior in females, we investigated whether males would decrease provisioning of young in their own nests in order to reduce the cost of raising unrelated offspring. We found that female Barn Swallows that were paired with males that had a relatively small throat patch were more likely to fly out of their presence during mate guard. We suggest that throat patch size is a sexually selected signal in this subspecies, and females assess male quality according to this trait. We also found that male Barn Swallows reduce parental care in response to females that pursue EPC, suggesting that males use female evasions from mate-guard as a cue to assess the paternity of their nest.

p01-018

Repeated recaptures and body mass changes in Japanese White-eyes: Reinforcement against or desensitization of risk perception?

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Birds perceive capture and handling by human researchers as a risk; thus a released individual may decrease its body mass to avoid being captured again or may increase it to compensate the interrupted foraging time. Then, how do they perceive captures and adjust their response strategies if they are recaptured several times? Frequent recaptures may reinforce risk perception leading to a more effective response, or alternatively birds may become accustomed to the risks and be desensitized. We collected information on dates of captures and body mass of Japanese White-eyes (*Zosterops japonicus*) in a constant-effort banding station on Heuksan-do Island (SW Korea) in 2010 and 2012. Out of 1,218 individuals captured, 787 recaptures were recorded. We classified the recapture records into four groups according to the number of previous recapture experiences of each individual, from first to fourth recaptures. The body mass of the white-eyes was steeply reduced just after the capture and showed an increasing pattern in the 1st, 2nd, and 3rd recapture groups, but no significant change in the body mass was found in the 4th recapture group. We also found that the change in body mass between captures tended to decrease when the number of recaptures increased. Our results suggest that the Japanese White-eyes in the study site perceive captures by researchers as a predation risk, rather than a foraging interruption, and the perception of the risk tends to be desensitized as they experience recaptures repeatedly. It is well known that changes in body mass affect survival of birds. Although our results showed that frequent recaptures did not have a proportional effect to the ecology of the studied population, a careful approach is still needed in the analysis of body mass change in a population with a high recapture rate.

p01-019

Does the concealing posture in Collared Scops Owl (*Otus lettia*) have a masquerading function?

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Researchers have found that owls may change their body shape from oval to tall and slender while sensing danger. It was hypothesized that the change in body shape would help them avoid attack from predator or mobbing from small birds, yet it has not been tested. We tested the functions of such behavior in the Collared Scops Owls (*Otus lettia*) using two types of specimens, oval and tall/slender, on the campus of Pingtung University of Science and Technology and a nearby forest plantation in Taiwan. A total of 82 persons were asked to search one of the specimens in trees in six minutes. When testing for detection by prey, we exposed the two forms of specimens alternately at each site and recorded any mobbing behavior using an event data recorder. We found that human testers spent more time looking for the elongated specimen than for the non-elongated one. More people misidentified the elongated specimen as a branch than the non-elongated one. The number of mobbing event directed at the specimens was significantly lower for the elongated specimen than for the non-elongated one. We also found birds spending more time searching for the elongated specimen than for the non-elongated one. Chinese Bulbul (*Pycnonotus sinensis*) is the species which showed the highest mobbing frequency among the 12 species of birds participating in mobbing.

p01-020

Exploring morphological characteristics of two *Cuculus* species with different patterns of host use

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Cuckoo (*Cuculus*) species are famous for exploiting the parental care of other species, namely the host, as they dump their eggs in the host's nest. Natural selection acting on these two interacting species causes a coevolutionary arms race between them, which often gives rise to host-specific races within *Cuculus* species. As a result, each cuckoo chick reared by different host species may experience different environments with respect to food quality and quantity brought by host parents and the physical condition around host nests, etc. These environmental conditions in the early developmental stages of cuckoo chicks may play a significant role in determining physical characteristics when individuals reach adulthood, often leading to different fitness consequences. Furthermore, selection may also act directly but differently on the morphology of adult cuckoos according to respective host species with different nesting environments. Therefore, it is highly likely that adult cuckoos may exhibit morphological differentiation according to the host species on which they specialize. We collected the detailed morphological information from adults of two *Cuculus* species, the Common Cuckoo (*C. canorus*) and the Lesser Cuckoo (*C. poliocephalus*), which were compared according to host species, sex, region and their interaction. We will discuss the adaptive significance of morphological features of adult cuckoos in relation to brood parasitism and its potential for being used as a cue to facilitate host-specific assortative mating in *Cuculus* species.

p01-021

Effects of brood parasitism by the Asian Koel (*Eudymayms scolopacea*) on the breeding success of the House Crow (*Corvus splendens*)

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Instead of constructing nests, brood parasitic avian species deposit their eggs in the nests of one or more host species. The host then provides all parental care for the parasitic egg and nestling. This breeding strategy of the brood parasitic species has been proposed to lower the host fitness. However, despite the adaptive and evolutionary significance of this behavioural aspect, such studies are almost negligible from India. We studied the effect of brood parasitism by the Asian Koel (*Eudymayms scolopacea*) on the breeding success of the House Crow (*Corvus splendens*) in Haridwar, Uttarakhand, India. The unparasitised Crow nests had significantly larger clutch sizes than the parasitised nests, most likely as a result of host egg removal by the Koel. Similarly, other breeding parameters such as the mean number of Crow eggs that hatched, mean number of Crow chicks that fledged, hatching success and breeding success of the Crow were also found significantly lower in parasitised nests than unparasitised nests. Koel nestlings did not eject the eggs or the nestlings of Crows from the nests and thus nestlings of both species were raised together. Adult Crows were able to recognize the adult Koels as a threat and exhibited fierce aggression towards them. Nevertheless, Koels were found sufficiently successful to get their young reared by the Crows along with significantly reducing their breeding success.

p01-022

Evolution of bronze-cuckoo nestling ejection in *Gerygone* hosts: driven by the egg dilution effect?

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Cuckoo parasitism reduces the reproductive output in hosts, thereby inducing selection for anti-parasitic defence in hosts, which leads to a coevolutionary arms race. Even though numerous hosts of the Common Cuckoo *Cuculus canorus* discriminate against cuckoo eggs, once a cuckoo chick hatches, they usually raise cuckoo chicks despite their different appearance from their own chicks. The reason why hosts do not seem to recognise these huge alien nestlings is attributed to monopolization of host nests by cuckoo chicks because the monopolization is to deprive hosts of the opportunity to learn which are their true offspring and which are not. Recently, ejection of parasite nestlings by host parents has been found in 2 host species of the Little Bronze-Cuckoo *Chalcites minutillus* in Australia, even though parasite chicks eventually monopolize host nests. Both hosts are species of the genus *Gerygone*. The egg dilution hypothesis (Sato et al. 2010) predicts that hosts' acceptance of parasite eggs followed by parasite nestling ejection can reduce loss of hosts' offspring when there is a high chance of being parasitized by multiple cuckoo females. This benefit is introduced by the second cuckoo females that replace the formerly laid cuckoo eggs instead of a host egg, either intentionally or by chance. Additionally, this effect increases marginally with decreasing clutch sizes of hosts. We tested the egg dilution hypothesis by comparing 4 *Gerygone* species of bronze-cuckoo hosts from three regions of Oceania, which are different in clutch size, frequencies of both parasitism and multiple parasitism. The result was consistent with our hypothesis; the chick rejection behaviour was confirmed in species with small clutch sizes and those parasitized multiply by bronze-cuckoos.

p01-023

Does darkness limit cavity use by cavity nesting birds?

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The pattern of tree hole use differs among non-excavators. Although holes with narrow openings appear to be safer, they are not used equally often by all the bird species, even in primeval conditions where the birds have access to a wide spectrum of superabundant holes. Long-term observations on tits and flycatchers carried out in primeval Białowieża Forest (E Poland) show that Collared Flycatchers *Ficedula albicollis* usually occupy holes with entrances larger than the tits and larger than would be expected for their body size. They also lose more broods due to predation than the tits. One of several factors that could hinder usage of holes with small openings by Collared Flycatchers is insufficient cavity illumination (creating problems with seeing and feeding nestlings). We test this hypothesis using data on light intensity measured at the nest level in Collared Flycatcher cavities, and compared them with Marsh *Poecile palustris* and Great Tit *Parus major* cavities in the same forest. Collared Flycatchers controlled the amount of light reaching the nest by adjusting the distance of the nest from the cavity entrance (by bringing in more or less nesting material) to the opening size. Contrary to expectations, flycatchers commenced feeding young at lower internal light conditions than the tits. We found evidence that the amount of light in nest cavities could influence cavity use in all the studied species. We use these results to stress the possible importance of adequate cavity illumination for the evolution of the cavity nesting habit in birds.

p01-025

A genetic approach to understanding the mating system of greater rheas

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The greater rhea (*Rhea americana*) is a threatened ratite that has a complex mating system, in which several females lay eggs in communal nests and males incubate and care for chicks. We assessed relatedness within and among broods to clarify the genetic mating system. Feathers of 145 chicks and three incubating males in the wild belonging to 5 nests were sampled. Genotyping was determined for eight microsatellite loci developed for rheas, and sibship analysis was conducted using the program COLONY. The analysis revealed multiple progenitors per nest (14.8 females and 11.2 males). On average, a given female laid eggs in 1.9 nests and had 3.7 chicks, and each male had progeny in 1.75 nests and produced 4.5 chicks. Two males were the major male progenitor in the clutch they incubated (28.6% and 34.5% of chicks), while the third genotyped male was not the progenitor of any chick, neither within the brood in his nest nor in the other sampled nests. On average, each male mated with 3.4 females (range: 1-8), while females had 2.8 partners (range 1-5). Most adults (mean= 81%) sharing progeny in the same nest were potentially unrelated, and females were always less related than males. Although in general full-sib chicks occur within nests, both full-sib and half-sib relationships represented only 5.5% of all paired comparisons among all chicks; this means that 94.5% of paired comparisons revealed unrelated chicks. Our study showed that: (i) there were several progenitors within a clutch; (ii) no incubating male was the progenitor of the majority of the chicks produced in a nest; (iii) incubating males could have no progeny; (iv) females did not comprise a cohesive group laying their eggs in the same nests. This strategic promiscuity results in considerable genetic variability rates in this species.

p01-026

Breeding ecology of the yellow-bellied tit in China

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The yellow-bellied tit (*Periparus venustulus*) is a bird species endemic to China. Little information currently exists on the breeding ecology of this species. We studied the breeding ecology of the yellow-bellied tit in the Xiao Longmen Forest, west of Beijing, from 2009 to 2011. Yellow-bellied tits were summer breeders at this study site; they arrived on the breeding grounds at the middle or the end of April, and left at the beginning of August every year. A total of fourteen nests were found in the study area. All of the nests were placed in cavities excavated by the males in the ground, underneath stones or roots. The mean clutch size was 6.4 ± 0.5 eggs. The mean length of eggs was 15.36 ± 0.22 mm, while the width was 12.97 ± 0.13 mm. Mean egg mass was 1.20 ± 0.24 g. The female incubated alone, for a mean incubation period of 11.4 ± 0.2 days. The mean hatching rate was 0.90 ± 0.05. After the nestlings were 3 days old, only the female fed the young, and the mean nestling period was 14.3 ± 0.5 days. The mean survival rate of nests to fledging was 0.88 ± 0.07, and the average number of nestlings fledged was 5 ± 0.4 individuals per nest. Growth patterns in body weight, bill length, head and beak length, tarsus length, wing length, body length and tail length closely approximated a logistic model.

p01-027

Why the parents of Hair-crested Drongo dismantle their nest after the young fledged: a test of the "nest competition hypothesis"

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Hair-crested Drongos (*Dicrurus hottentottus*) are summer migrants in eastern China. It has been reported that the parents of this species will dismantle their nests after fledging of the young. This unique behaviour has rarely been found in other avian species and has never been studied systematically. The "nest competition hypothesis" suggests that nest owners may avoid or reduce the possibility that other drongos find and compete for their nest sites in the next breeding season by destroying the nests after the young fledged. We test this hypothesis through observations and nest-providing experiments at Dongzhai National Nature Reserve, Henan Province, central China. After the young fledged, natural drongo nests, which were made indestructible by processing them with fishing thread, were hung up in the nest trees as the experimental group, while some other nest trees where drongo nests were dismantled naturally were used as the control group. We carried out the experiments in two consecutive years from 2011 to 2012 and from 2012 to 2013. In both of the two rounds, the reuse rate of the nest trees in the experimental group (N=11 in first round, N=12 in the second round) was higher than the control group (first: N=19; second: N=15), but the difference is not significant (first: χ^2=1.93, P=0.239; second: χ^2=0.01, P=0.636). Although the experiment did not significantly affect the changing rate of owners in any of two rounds (first: χ^2=1.29, P=0.298; second: χ^2=0.72, P=0.389), it was higher in the experimental group in the first round (18.2% VS 5.3%) but then lower in the second round (8.3% VS 20.0%). We suggest that competition for good nest sites may play an important role in the causation of the nest-dismantling behaviour. Future work with larger sample sizes and other potential factors for exploring this behaviour has been designed.

p01-028

Egg cooling behaviour of the Little Tern

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The Little Tern *Sterna albifrons* is a summer migrant in Japan. They breed in colonies on sandy beaches, flood plains with pebbles, or, more recently, developed lands of bare grounds, where their breeding is disturbed by human activities such as land developments, recreations, and so on. As a result, this species is classified as vulnerable in the Red List of Japan. Since their nest is a simple shallow dent with a few small pieces of shells as nest materials and eggs are laid directly on the ground, eggs are influenced largely by outer temperature, as well as ground temperature. Abandoned eggs which seem to be denatured by high temperatures are often found during the summer. When temperature increases, Little Terns have been known to cool their eggs with water and/or by shading eggs from the sun through standing by the nests. However, the details of this behaviour have not been well studied. The aim of this study was to investigate the relationship between egg cooling behaviour and temperature. For this purpose, we put small temperature data loggers inside and outside nests to measure temperature changes, and at the same time, recorded the incubation behaviour by videos to identify egg cooling behaviour. We also investigated the possible cooling effect of shells spread around nests. According to the analysis of incubation behaviour and temperature changes, we found a threshold for changing behaviour to control temperature. Above ambient temperatures of about 34°C, terns tried to decrease the nest temperature by putting water contained in their abdomen feathers or standing above nests to shade eggs. On the contrary, terns incubated their brood normally and warmed the eggs when temperatures were below 34 °C. We also found evidence that presence of shells is effective for decreasing nest temperature.

p01-029

Breeding biology and life history traits of three pitta species in southern Vietnam

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The biology and behavioral traits of suboscines are much less known than those of oscines and most research on suboscines originates from the New World. Only Pittidae and Eurylaimidae represent the suboscines in South-East Asia. Many aspects of the breeding biology and behavior of these two families remain unknown. From 2010-2013 we collected data on the biology and behavior of Blue-winged Pitta (*Pitta moluccensis*), Bar-bellied Pitta (*P. elliotii*) and Blue-rumped Pitta (*P. soror*) inhabiting lowland monsoon forests of the Cat Tien National Park (southern Vietnam). We studied 13, 12 and 5 nests of *P. moluccensis*, *P. elliotii* and *P. soror*, respectively, including more than 590 hours of video-data on the breeding biology for 7 nests of the three species. Various biological features of these species were described with special attention to nest predation pressure and to the role of vocalization in bird communication. A very complete description and function of the vocal repertoires was obtained. For the first time, the short-distance vocalizations, nestlings begging calls and fledglings chirps were described. Among others the following unique data was collected during observations and video-registration: choosing place and building a nest, characteristics of clutches, brooding, feeding of young, nestling's ontogeny, parental investment. We also revealed the effect of nest predation to breeding success of pittas and described a diversity of animal species destroying pitta nests. Out of 26 nests of the three species with known outcome, only two were successful; one out of 9 that were under our intensive observation and one out of 17 nests that we did not disturb.We thus conclude that our work did not affect to this high nest predation rate. We hypothesise that breeding strategy of pittas consists of repeated nesting during the breeding season and that the adults are probably long lived.

p01-030

Determinants of reproductive success in a polyandrous population of the Snowy Plover (*Charadrius nivosus*): life history, behaviour and morphology

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Reproductive success refers to the number of offspring produced by a given individual. Within a single population, certain individuals exhibit life history, behavioural and/or morphological traits that confer them reproductive advantages over other individuals of their same sex (i.e. higher reproductive success). Here we investigated whether the i) body size and body weight, ii) age of the individuals, iii) egg-laying date, and iv) time until desertion, are associated to the reproductive success of males and females of the Snowy Plover (*Charadrius nivosus*). The Snowy Plover is a shorebird with a surprisingly variable mating system: polyandry, polygyny and monogamy may all exist within a single population. Both parents incubate the eggs; however, once the chicks hatch, one of the parents (usually the female) deserts the family, while the remaining parent is left providing care to the chicks. In this study we used 7-year data from a polyandrous population, located at Bahía de Ceuta, Sinaloa, Northwest Mexico. Our results suggests that, on the one hand, the reproductive success of males is positively associated to their age, the time at which they establish their nests (males arriving early to the reproductive site have a greater chance of rearing their young until independence) and the time they stay in the vicinity of the young. On the other hand, the reproductive success of females is negatively associated to egg-laying date, the weight of the females, and positively associated to the number of days they spend with the young. We argue that although a higher investment in care by the females greatly enhances the survival of their chicks, it may have negative consequences on the condition of females.

p01-031

Effects of small patches of broadleaf trees on the breeding ecology of Varied Tits in a Japanese cedar plantation

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About 40% of Japan's total forest area is occupied by conifer plantations. The species diversity and density of birds are considered to be poorer in these plantations than in broadleaf or mixed forests, mainly because of lower vegetation diversity and lower food availability. We examined whether small patches of broadleaf trees in a conifer plantation improved habitat quality, as measured by food availability, for bird populations. In a Japanese cedar (*Cryptomeria japonica*) plantation in central Japan, we investigated the feeding behavior of Varied Tits (*Poecile varius*; Paridae) with digital video cameras set outside nest boxes placed at different distances from small patches of broadleaf trees. We filmed all visits of parents for about 10 h throughout the day when nestlings were 11–14 days old. We also weighed each nestling on a portable electronic balance when 14-15 days old. From the images, we recorded the feeding times and intervals, and the species, size, and number of prey items carried to the nestlings. The composition of the diet —mostly caterpillars that feed on broadleaf vegetation— suggested that most Varied Tits foraged exclusively in the small patches of broadleaf vegetation. We discuss the significance of these patches in conifer plantations for the breeding success of Varied Tits.

p01-032

Patterns of parental food allocation to nestlings of Great Tits and Varied Tits

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The Paridae are a family of typically altricial birds, whose nestlings depend for nourishment on their parents exclusively. The Paridae usually raise many chicks per breeding attempt. Effective feeding of offspring is critical to breeding success and thus in maintaining populations. Among Paridae species, parents bring either one prey item back to the nest at a time (single-prey loaders) or multiple prey items (multiple-prey loaders). In our study area, a mixed forest of Japanese larch and broadleaf trees in central Japan, Great Tit (*Parus minor*), a single-prey loader, and Varied Tit (*Poecile varius*), a multiple-prey loader, breed sympatrically. To elucidate how parents of these two species carry and allocate prey to their nestlings over a day, we used digital video cameras set inside and outside nest boxes to monitor feeding behavior. From images collected throughout the day when nestlings were 10-14 days old, we analyzed the frequencies of feeding to each nest and to each nestling, and the type and size of prey items. Each nestling was weighed on a portable electronic balance at mid-growth stage and immediately before fledging. We discuss the differences in feeding behavior, particularly in terms of the patterns of parental food allocation to nestlings, between species.

p01-033

Bower orientation in the Great Bowerbirds

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It is known that bowers are consistently oriented in the avenue-type bower builders; north-south in Satin Bowerbird and Great Bowerbird, and east-west in Spotted Bowerbird. One hypothesis ("Optimal illumination hypothesis") suggests that such alignment enhances the illumination of decorations and displaying males when viewed by females in the shaded avenue (Frith et al. 1996; Doucet & Montgomerie 2003). This hypothesis predicts a NNW-SSE orientation of bowers in the Great Bowerbird living in tropical Australia, which was indeed confirmed by Frith et al. (1996) for a population of Great Bowerbirds in northern Queensland. However, we found another trend of bower orientation, not following the above hypothesis, in a north-western population of the Great Bowerbird near Darwin, Northern Territory, during our research conducted from 2004 to 2006. Orientations of most bowers were eastwardly biased from due north; NE-SW in 2004, NNE-SSW in 2005 and NNE-SSW in 2006, respectively. Given these orientations, females saw the male against the sun or saw them in the shade of walls during the peak displaying period (7 a.m – 9 a.m.). The surrounding light conditions did not cause the variation of orientation among bowers, because there were no significant differences between bowers under different canopy structures. Except for the bowers that were strongly biased towards the east, males displayed more in the better illuminated side, which suggests that the orientation was determined by factors other than the direction of the sun light and that males preferred the better sides of the bower platform, regardless of the bower's orientation. Although the light condition were worst, males whose bowers were strongly biased towards the east enjoyed higher mating success. These facts do not support the optimal illumination hypothesis.

p01-034

Effects of parental age on reproductive behavior of the Black-crowned Night Heron (*Nycticorax nycticorax*)

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We studied effects of parental age on reproductive behavior of Black-crowned Night Heron (*Nycticorax nycticorax*) through observation of the nests. We defined breeding individuals with juvenile plumage as subadults and adult plumage as adults. Watanabe (1998) and Fasola et al. (2001) showed that reproductive performance of adults was better than for subadults. But specific difference of behavior influencing reproductive performance has not been observed. The present studies were conducted in Aomori Pref., Japan from 2008 to 2013. We recorded the situations of individual parents and chicks in nests in heronries of only Black-crowned Night Heron by infrared cameras throughout the day.. In addition, body weights of the individual chicks were measured to monitor growth every two or three days until the chicks were 15 days old as chicks can walk after 15 days old.. We compared 9 breeding pairs consisting of adults and 7 pairs including at least one subadult. Reproductive success of adults was significantly higher than for subadults. Feeding frequency of pair with subadults was lower, especially in the daytime. Subadults parents were often absent from the nest during the period when they were expected to attend. These age-related behavior differences can be explained by foraging ability and optimization of reproductive effort. Since the foraging success improves with age, the lower reproductive success of subadults may be due to their immature foraging skills. On the other hand, subadults prioritize their own survival at the expense of current reproductive success to optimize their lifetime reproductive output (Pianka 1978).

p01-035

Changes in the phenology of Barn swallow viewed from multiple time scales

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Global warming is one of the main causes of biodiversity loss, and its impact can be measured by phenological changes. Studies in Europe have shown that the phenology of Barn swallow (*Hirundo rustica*) such as the first arrival or the first-egg date have advanced by increasing spring temperature. For example, the first arrival date of Barn Swallows in Britain has advanced with increasing spring temperature over the past 60 years, and the first-egg date of Barn Swallows in Croatia has become earlier over 27 years because of increasing spring temperature. However, these studies can confirm only recent change in the phenology of Barn Swallows, but are insufficient for understanding the effect of global warming as a long-term phenomenon. In this study, we clarified the change in phenology of Barn Swallows at multiple time scales, by combining the past phenological data in the Traditional Japanese Calendar established over 300 years ago and the current phenological data observed by the Japanese Meteorological Agency for the last 59 years. For the analysis of long-term changes in phenology, we found that the first arrival date of Japanese Barn Swallows has significantly advanced by 12 days compared to that of 300 years ago. In addition, the current breeding phenology of Barn Swallow has also become earlier. For the analysis of short-term changes in phenology, we found that the incubation period of Barn Swallows has shortened 0.27 days with an increase of 1°C temperature during the incubation period. These results indicate that the phenology of Barn Swallow is affected by climate change, and it is necessary to clarify the net effects of global warming on breeding of Barn Swallows because it seems to affect reproductive success in both good and bad directions.

p01-036

Differences in nest attendance pattern due to distances to feeding sites in Black-faced Spoonbills *Platalea minor*

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Black-faced Spoonbills generally breed on coastal uninhabited islands and feed on the nearest tidal flat from the breeding sites. The nest attendance pattern of Black-faced Spoonbills was studied and compared between the inshore and the offshore breeding island. Diurnal and nocturnal nest attendance of breeding pairs was fully recorded by an IR sensor trail camera set during the breeding season. In both the inshore and offshore breeding site, males mainly attended nests in the daytime and females showed a higher tendency of night time nest attendance. However, incubation shifts in offshore breeders were longer and less frequent than in inshore breeders. In addition, foraging trips of offshore breeders after hatching were longer compared to those of pairs that have feeding sites nearby. This result suggests that nest attendance patterns due to distance to feeding sites may affect reproductive output such as clutch size and brood size. The nest attendance patterns of inshore breeders can be more favorable for the breeding success than those of offshore breeders, even though inshore breeders were exposed to disturbances such as egg collection, fishing activities and development.

p01-037

Breeding ecology and the use of nesting platforms of the Cordilleran Flycatcher (*Empidonax occidentalis*) in SW Colorado

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Despite the fact that the Cordilleran Flycatcher is relatively common and widespread in western North American forests, it is one of the least-studied North American songbirds. We undertook this study to describe its breeding biology, to examine the willingness of this species to accept nesting platforms, and to use nesting platforms to manipulate opportunities for polygamy. This study took place at private residences and adjacent areas of the San Juan National Forest in Montezuma County, Colorado, during the breeding seasons of 2012 and 2013. Cordilleran Flycatcher pairs nested in a variety of man-made structures including the eaves of houses, and readily used nesting platforms that were placed on houses and on trees in the surrounding forest in 2013. Both parents provisioned the nestlings and fledglings roughly equally, although only the female incubated eggs. Polygamy was observed in 2012 but not in 2013, which was an exceptionally dry year. In 2013, we put radio transmitters on 4 nestlings (2 from a nest platform on a house and 1 each from 2 nests on natural structures) in order to track the brood after fledging. Two of the three broods moved upslope away from the river, and on most days we observed presumed transient adults attempting to feed or mount fledglings. We plan to expand this study in 2014 to examine the influence of yearly climate conditions on provision rates, polygamy rates, fledgling movement patterns, and disruption of fledgling feeding by transient adults. We demonstrate that the Cordilleran Flycatcher readily accepts artificial nesting platforms, and future studies could investigate the possibility of similar nest site enhancement for the conservation of related species.

p01-038

Trade-offs along the life cycle of a tropical mountain bird

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Highly demanding events that greatly affect individuals´ fitness tend to be temporarily separated in the life cycle of birds, though cases are known in lowland tropical forest and boreal areas where overlap occurs between events, such as reproduction and molt. Through a longitudinal study (from 2008 to 2012), of a Slaty-brush Finch (*Altapetes schistaceus*) population in cloud mountain forest in Colombia, we identified possible factors determining the overlap, as well as costs and consequences to it. Body mass and years were detected as best predictors of the proportion of individuals in overlap. We detected no correlation between duration of molting and probability of overlap, as has been shown in birds in the Amazon lowlands. Overlapping individuals had a higher ectoparasite load, lower feather quality and a reduced flight performance. The reduction in flight capacity, quality and increase of ectoparasites on feathers, confirm previous suggestions of a trade-off between both events. Changes in individual condition and their overlap status in relation to year and body mass suggest phenotypic plasticity in relation to life-cycle regulation. If this overlap is costly, the question remains why overlap is common in this population and the mountain bird communities in general, and whether it could be associated with a "bet-hedging" strategy.

p01-039

Incubation routine, egg temperature and sex role of Streaked Shearwaters *Calonectris leucomelas* at Sasudo Island, South Korea

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The incubation routine in Procellariiformes represents a sequence of alternating shifts taken in turn by female and male in a species-specific pattern. Hence, in seabirds coordination of individual incubation rhythms between partners is crucial for a successful breeding attempt. Therefore, breeding individuals must coordinate their incubation shifts with foraging trips at sea to ensure constant warming of the embryo and to regain their body condition after along fast. Maintaining a constant egg temperature is energetically demanding and can directly influence an individual's current and future reproductive performance. This study was carried out during the 2012-2013 breeding season at the Sasudo island, South Korea, to investigate the incubation routine, egg temperature and sex role of Streaked Shearwaters *Calonectris leucomelas*. In Streaked Shearwaters, the duration of incubation shifts and subsequent foraging trips are related to loss of body weight during the period of fasting. In addition, coordination of individual incubation rhythms affects their incubation schedule and hatching success. Consequently, this study demonstrates a relationship between individual quality and incubation behaviour in Streaked Shearwaters.

p01-040

Breeding ecology of the Eurasian Wryneck at Ogata village, Akita, Japan

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The Eurasian wryneck (*Jynx torquilla*) is a species of woodpecker which breeds throughout Eurasia and North Africa. In Europe, the population has decreased as a result of losses in habitat. Although they are not globally threatened with extinction, they are designated as near threated (NT) in Japan. However, there is a lack of data on even the basic breeding and ecology of Japanese populations of Wrynecks meaning that objective assessment of their status in Japan is difficult.

Therefore, the objective of our study was to establish basic data for their breeding ecology. We studied the breeding ecology of a population of Wrynecks breeding in nestboxes at Ogata village, Akita prefecture, Japan from April to August in 2012-2013.

We found that clutch size, the number of hatching eggs, and the brood size declined with later laying of the first egg. This effect has been found in many other species and may be related to a decline in food availability throughout the breeding season.

p01-041

Hatching asynchrony in the Pied Flycatcher, *Ficedula hypoleuca*: an experimental test of the brood reduction hypothesis

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Hatching asynchrony occurs in many altricial (and semi-precocial) birds, and has been interpreted as an adaptation to create a size hierarchy among siblings in order to facilitate brood reduction in times of food scarcity, i.e. “the brood reduction hypothesis”. However, there is still controversy about what is the adaptive value of hatching asynchrony in birds. In this study both food abundance and hatching pattern were manipulated simultaneously in a population of the Pied Flycatcher *Ficedula hypoleuca*. For all broods combined, pairs receiving supplementary food produced significantly more young, than pairs not receiving extra food. There was also a trend for a significant interaction between hatching asynchrony and food level, such that during poor/normal conditions, asynchronous broods produced on average one young less than synchronous broods. Synchronous broods also produced young with significantly longer tarsi compared to asynchronous broods during normal/poor conditions. If this year represented a so-called ‘poor year', this result is in contrast to one of the predictions from the brood reduction hypothesis. However, there was no difference in number of fledged young or size of young between broods (asynchronous and synchronous) when simulating 'good' breeding conditions, i.e. with supplementary food added to territories. This study does not unequivocally support the brood reduction hypothesis, but instead gives support for the idea that in species where only one parent incubates and broods the newly hatched young, females are in a time-conflict in the dual task of both feeding and brooding the young. This study suggests that female flycatchers were able to ”solve” this conflict when supplementary food was added to their territory.

p01-042

Nesting success of Oriental Magpie Robins (*Copsychus saularis*) in natural tree cavities and artificial nest boxes

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The Oriental Magpie Robin (*Copsychus saularis*), a passerine bird of the Indian subcontinent well-known for its complex and melodious song, is a secondary cavity nester which selects cavities in a wide range of tree species. Rapid rate of deforestation due to developmental activities such as industrialization, urbanization, extension of agricultural activities in the native range of Oriental Magpie Robin coupled with inter- and intraspecific competition for nesting activities has been associated with the declining population of this species. We studied the breeding biology of the Oriental Magpie Robin in natural tree cavities and artificial wooden nest boxes during 2008-2013 in Haridwar, Uttarakhand, India (i) to examine whether different parameters from nest boxes were comparable with data from tree cavities and (ii) to ascertain the potential of nest boxes as an alternative nest site for the conservation of this species. Results indicated that there were no significant differences in egg characteristics, clutch size, incubation period, hatching success and nestling period between nests in natural tree cavities and nest boxes. However, nesting success was found to be significantly higher in the nest boxes as compared to tree cavities. This was caused mainly due to higher rate of predation and mortality of young in cavities than nest boxes. Thus it is clear from the results that nest boxes provide safe nesting site to the Oriental Magpie Robin which in turn increase its breeding output.

p01-043

Breeding density decreases hatching success and unhatched eggs are male-biased in Eurasian Tree Sparrows

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In many passerine birds, unhatched eggs are unusual and almost all eggs successfully hatch. However, it has been reported that Eurasian Tree Sparrows (*Passer montanus*) and House Sparrows (*P. domesticus*) have a lower hatching success than other passerine birds. This seems maladaptive because they lose their investment in egg production. Here, we aimed to find the causes of the decreased hatching rate in Eurasian Tree Sparrows. We surveyed a population of Eurasian Tree Sparrows in Ogata village, Akita prefecture, Japan. We manipulated the density of nest boxes (high and middle, low) to examine the effect of breeding density on hatching success. We found that hatching success decreased with an increase in breeding density. The first egg date and egg-laying order did not influence hatching success. In addition, we observed the developmental stage of the unhatched eggs and determined the brood sex ratio. Most unhatched eggs showed no sign of embryo development and the sex ratio was biased to female in broods with lower hatching success, which suggests that the sex of the unhatched eggs were biased towards males. These results are in agreement with those from previous studies, which analyzed the sex of unhatched eggs. Our study shows that breeding density increases male mortality, which could result from individual interactions or stress, disease, etc.

Our research was supported by a grant from the MITSUI & CO., LTD. Environment Fund.

p01-044

Nest site selection of the exotic Eurasian Magpie (*Pica pica*) colonizing the city of Tomakomai, south-western Hokkaido, Japan

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Some species, especially exotic species, maintain their population or increase the number of individuals in urban environments, although many native avian species decrease there. Exotic species can succeed to acquire resources by displacing native species or exploiting resources unused by native species in a novel environment. The Eurasian Magpie *Pica pica* is an exotic species in south-western Hokkaido and has been increasing in number rapidly. In this study, we investigated the nest-site selection of magpies to clarify the cause of increase in urban environment. We predicted that magpies preferred urban environment for nest site and their preference of the nesting substrate was affected by urbanization. We studied their nesting environment, characteristics of nesting substrate, and heights of nesting substrate and nests. Magpies preferred urban environments for nesting. They used trees and human-made structures as nesting substrates, and preferred sites where tree density was high when nesting on trees, while magpies chose human-made structures when tree density was low. When nesting on trees, they chose higher trees than those nearby. We suggest that the urban environment provides magpies with good nest sites. Human-made structures may be new resources for them to nest. Although the urban environment may be effective to avoid avian predators, we could not detect a difference in the occurrence of crows, a potential predator and competitor. In conclusion, magpies established in the urban environment as novel habitats, and chose nest sites flexibly.

p01-045

Temperature variation in Water Rail and Little Crake nests

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Water rail (*Rallus aquaticus*) and Little Crake (*Porzana parva*) inhabit dense wetland vegetation. To reveal how nesting habitat, nest placement and structure influence the incubation temperature we investigated the temperature variation inside active and inactive nests of these two species. Using "iButton Maxim" devices, temperatures were recorded for 12 nests (9 active and 3 inactive) during a period between May – June. For three Water Rail nests and two Little Crake nests we could additionally compare the temperature variations during the same periods of time. The temperatures inside the nests varied between 37.0 – 20.0 ^{o}C in Little Crakes and between 33.5 – 14.0 ^{o}C in Water Rails. We found that the temperatures from the inactive and active Water Rail nests show the same tendency, while there were no apparent similarities in the direction of the temperature changes between the active and inactive Little Crake nests. Additionally, the microclimate around the Little Crake nests was found to be more variable (40.5 – 8.0 ^{o}C) compared to the one around Water Rail nests (23.0 – 7.0 ^{o}C). Variations in temperature around the Little Crake nests may be the consequence of sunlight and air currents exposure while the Water Rail nests are more protected by vegetation, being exposed to a lower temperature variation. Nevertheless, the tendencies found in the temperature changes of Little Crake active nests indicate that they seem to be more isolated than the Water Rail ones, being able to maintain a more stable temperature while incubating the eggs. This may be a consequence of the material used in building the nest. Little Crakes use almost only cattail leaves which are thicker with developed aerenchyma compared to reed leaves used by Water Rails. In this way the nest material is implicated in regulating the nest temperature, thus compensating the nesting microhabitat climate.

p01-046

Does threat to the nest affect parental provisioning behavior in a small passerine bird?

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In altricial birds, nest predation is an important cause of breeding failure and parental activity around the nest increases the risk of predation by visually oriented predators. One possible way to reduce parental activity during the nestling period is to coordinate parental visits to the nest. Such behavioral synchrony has been investigated in several species of cooperative birds and these studies indicated that the nest visit synchrony can increase brood survival or reduce sibling competition. However, reductions in parental activity in response to predator presence at the nest during nestling period have been rare and documented in a few species with bi-parental care. Here, we experimentally examined the effects of the presence of a common visually oriented nest predator on the provisioning behavior of a small passerine. Parents coordinated provisioning rate and frequently fed chicks together. Provisioners were more likely to synchronize feeding visits for older nestlings as they were louder and possibly more conspicuous to predators. When the parents were exposed to the calls of a nest predator, they returned to the nest later for preventing nest disclosure. However, the parents neither reduced their provisioning rate nor increased percentage of nest visit synchrony even during the manipulated predator presence. Furthermore, we found that nest visit synchrony was not correlated with brood survival. These results document the ability of birds to assess the nest predation risk and adjust their provisioning strategy accordingly. Our results also suggest that more study is required to understand the costs and benefits of nest visit synchrony in this species.

p01-047

Nest usurpation by Russet Sparrows *Passer rutilans*

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Nest usurpations are thought to be a form of kleptoparasitism, where individuals attempt to steal other's resources such as food, nest sites and nest materials, and it is possibly a good nesting strategy to obtain more suitable resources for secondary cavity nesters, though host species may be seriously damaged. In Japan, Russet Sparrows *Passer rutilans* frequently usurp woodpecker nests for using them as nest cavities. I studied 28 sparrow's nests during 2006 to 2012 in a forest of Hokkaido, Japan. Out of 28 nests, 27 were confirmed as being obtained by usurpation of Japanese Pygmy Woodpecker cavities (10 nests) or Nuthatch's plastered nests (2 nests) or by reuse of vacant cavities (12 nests). The Japanese Pygmy Woodpeckers, which excavate small-sized cavities, often experienced harassment by sparrows and lost newly excavated cavities by usurpation, while the Nuthatches more successfully defended their own cavities from usurpers. Moreover, Russet Sparrows do not compete for old cavities. Reproductive success of Russet Sparrows was higher in the usurped nests (12 / 15 nests = 0.44) than in the reused nests (5 / 12 nests = 0.18), suggesting that the usurpation of cavities newly excavated by Japanese Pygmy Woodpeckers or plastered by Nuthatches raises the fitness of Russet Sparrows. However, for this woodpecker species, re-excavation after usurpation does not seem to be a critical cost for breeding, because breeding success rates were not significantly different between first and later cavities.

p01-048

Introduction of GPS-TX, a powerful enabler of real time observation - Utilizing the real time telemetry system GPS-TX 1

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We developed GPS-TX, a system for tracking wild birds and mammals in real time. The GPS-TX enabled us to reach animals in real time, making it easier to locate the target animals and directly observe their behaviour and foraging. GPS-TX comprises a transmitter and a receiving station. The transmitter obtains the animal's coordinate by a GPS receiver. Then the coordinate is transferred to the receiving station and visualized immediately. As a result, the pursuer can learn the animal's location with GPS level accuracy in real time. GPS-TX utilizes MAD-SS, a long range radio communication technology with the best performance in the world. This technology has the capability of transmitting data as far as 10 to 30 km (avg.) or more than 200 km (max.) The transmitter weighs 20 g to 900 g, depending on the capacity of the batteries and shell. Larger capacity enables the transmitter to locate animals for a long period. Transmitters for deer and bears can be loaded with large batteries, while birds can be loaded with only small batteries. Also we must consider that tough shells are heavy. The interval of GPS positioning can be selected arbitrarily. Generally, the number of GPS positions determines the operating duration of the transmitter. If GPS positioning takes longer, batteries drain more quickly. The location of the receiving station should be considered carefully. It is preferable to settle the station at high altitude with clear line of sight. The top of mountains and buildings are appropriate, while low altitude places are not. A low radio noise environment is also preferable. We rarely carry the receiving station for tracking target animals, when those animals move very long distances. We sometimes connect the receiving station to the internet. In this way, we can also know the animal's location remotely as well as in real time.

p01-049

The real time monitoring of jungle crows - Utilizing the real time telemetry system GPS-TX 3 –

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The jungle crow (*Corvus macrorhynchos*) is a common Asian species, whose numbers has successfully increased in Japan. The habitat of jungle crows is often associated with human modified environments such as agricultural areas, farms, residential and urban areas. Recently, the negative interactions between humans and jungle crows, such as crows attacking people in the breeding season, scattering waste dumps, depositing fecal droppings and creating noise have been reported in Morioka, Iwate prefecture. Although it is necessary to understand the crows' movement to solve those problems, little is known about fine-scale habitat use and resource selection of jungle crows. The overall purpose of our poster is to analyze data on daily movements of jungle crows, focusing on the fine-scale within-day movements and resource selection, and compare differences between winter and summer.

From 2012 to 2013, we fitted 17 jungle crows with GPS-TX, which is a GPS-based radio telemetry system enabling researchers to monitor animals in real time. Owing to this real time monitoring we could easily locate the tagged jungle crows in the field. Based on direct observations we were able to record novel data about their behavior and diet through field notes and films.

We observed daily and seasonal changes in movement and resource selection by jungle crows. Although they spent most of the daytime in foraging and resting sites throughout the year, the types of foraging sites differed. In the winter, large numbers of jungle crows visited pastures and fruit farms to forage; on the other hand, they visited fruit farms and dunghills (to forage for insects) in the summer. According to the direct observations in the field, daily fine-scale movement patterns of jungle crows vary between individuals and seasons. Therefore, our results suggest that we need to consider how crow movement is associated with available resources to resolve social issues.

p01-050

An experiment with pigeons and crows using GPS-TX
- Utilizing the real time telemetry system GPS-TX 2 -

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A common biological research method to study animal movement is direct observation. However, in many situations, direct observation is difficult due to broad range of habitat and movement of wild animals. As an alternative approach, we have started developing a biolocator with real-time tracking capability for animals since 1998. The first prototype became available in 2008. Here we report how we tested our real-time tracking biolocator on pigeons, crows, sika deer and bears.

Thus far we have fitted a total of 61 GPS-TX devices on pigeons, crows, sika deer and bears and traced their movement. In this presentation we show our tracking results using the GPS-TX on pigeons and crows. In the tests with pigeons, we used carrier pigeons so that we could take advantage of their homing instinct and tried to track their flight path. The study was designed to release the pigeons at a distance of about 25 km from the reception station and track them during 36 minutes with 17 second intervals after release. We were able to continually capture 96% of the GPS position data from the pigeons along their flight path. Also, we conducted 5 tests with crows. In the tests with crows, we configured GPS sampling rates with intervals of 15, 30 and 72 minutes. Following our invented tool, Trace Mapping System (TMS), which provides visualization of an animal's location, we want to take advantage of tools such as GoogleMap and MoveBank to show position data of tracked animals as next steps.

p01-051

Habitat use of a Jungle Crow
- Utilizing the real time telemetry system GPS-TX 4 -

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Jungle Crows, *Corvus macrorhynchos*, are common residents in Japan. They were originally restricted to the forested regions, but recently have adapted to sylvan residential areas and urban areas, increasing in population. In Morioka, Iwate prefecture of northern Japan, they often scavenge food from garbage cans around urban and residential areas, causing a social problem. Previous studies of Jungle Crows conducted in Tokyo, Japan have shown that, in those metropolitan areas, food scraps from garbage are their main food resources. However, little is known about their diet and habitat use in Morioka, which represents a suburban city, comprising various environmental structures such as urban areas, agricultural areas including rice paddy fields and fruit farms, and forested regions. The purpose of our study is to understand what factors determine their movements and to solve the social issues between Jungle Crows and human beings, investigating their fine-scale habitat selection based on various environmental factors.
Accurate location information, with a high data point density in terms of time, were obtained from 17 Jungle Crows fitted with GPS-TX from 2012 to 2013. Furthermore, we visually observed the behavior of tagged Jungle Crows as much as possible, and based on the visual observation, we analyzed the location information. In order to examine habitat use of Jungle Crows, we overlaid positioning points on the 1/25,000 vegetation map published by the Ministry of the Environment in GIS and aggregated vegetation at the positioning points. Our results showed that Jungle Crows often used the residential areas next to forest, fruit farms, and developed riparian forest in summer. In winter, they often used livestock barns, urban areas, and fruit farms. Their frequent appearance in those areas suggests that they stop by waste dumps to scavenge food on the way from aggregated roosting habitat to fruit farms and livestock barns.

p01-052

Why do seabirds migrate away from their breeding area?

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Why birds migrate is a challenging question in ornithology. Since migration is costly in energy, we expect that large-scale movements must bring some benefits in terms of reproduction or survival. The most frequent hypothesis invoked to explain why birds leave their breeding habitat at the end of the summer is a lack of food. In a population of partial migrants, we thus expect that individuals wintering close to their breeding range will spend more time searching for food. In this study, our aim was to understand why Northern Gannets (*Morus bassanus*) nesting on Bonaventure Island (Quebec, Canada) migrate and winter at various distances from their breeding grounds. Thus our objectives were (1) to calculate the cost of migration for various wintering locations, and (2) to evaluate the time spent searching for food in their respective range. To do this, we determined the wintering range of 58 Gannets using light-based geolocation loggers. The loggers recorded wet/dry information and were used to identify flights and searching behaviour while on their respective wintering ranges. The time spent flying was significantly lower for individuals wintering furthest south (Gulf of Mexico) compared to individuals wintering close to breeding range (Atlantic Coast) indicating that foraging behaviour is less demanding in terms of energy and time for the former group. These results suggest that it would be advantageous for Gannets to go to the Gulf of Mexico in winter since there would be a lower intra-specific competition and / or prey would be more abundant and / or they would be easier to locate and capture.

p01-053

The different arrival strategy of matured and immature Narcissus Flycatcher *Ficedula narcissina*

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Upon arriving from their spring migration, birds quickly establish territories, find mates, and attempt to breed. In many species, males that arrive earlier to the breeding grounds are able to choose the best territories and consequently have the highest reproductive success. At the individual level, the timing of the arrival is thought to reflect differences in individuals' phenotypic quality with higher quality males arriving earlier than poorer quality ones. Therefore, early arriving males are considered to be high quality individuals that are able to choose territories in the best habitats. The territory quality should also be important for the male arrival strategy because if females do not care about territory quality the effect on mating success will disappear. In this study, we examined the difference in arrival tactics of mature and yearling male Narcissus Flycatchers *Ficedula narcissina* over 5 years on Mt. Fuji, Japan. We found that mature males having reddish plumage color arrived later at the breeding site, but mated earlier than others. Interestingly, we neither found a correlation between a mature male's arrival time and the quality of the territory where it settled nor between territory quality and mating order. Conversely, yearlings that arrived earlier tended to have higher body masses on their arrival than late arriving males and also won better territories and had larger clutch sizes. Our results show that arrival time was important for yearling males and that it affected their reproductive success, but that for older birds this arrival date was of no importance.

p01-054

A behavioural study on the wild Copper Pheasant, with particular reference to tameness towards people

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The Copper Pheasant *Syrmaticus soemmerringii* is a species endemic to Japan, and is popular among Japanese people from the days of Manyo-shu (the oldest anthology of tanka). It occurs in forest areas in Honshu, Shikoku and Kyushu as resident birds, living in a deep forest with dense forest floor. The pheasants are so shy that they are quite difficult to see. Therefore, their behavior and life cycle are not clear yet. However, the pheasants become very tame towards people on rare occasions. Recently we observed some Copper Pheasants in Kumamoto, southern Japan. They came out from the forest they live, in response to one's calls just like "hello!", or the sounds of a car radio. Of course they are wild, and are not fed by people. We have collected such examples from different parts of Japan in order to show in which seasons the pheasants show this behavior, to what extent the male and the female are involved in such occasions, and how they become tame towards people. In this presentation, we will show some of the results on this interesting behavior.

p01-055

Fine-scale diving strategies of Rhinoceros auklets feeding on Japanese anchovy

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Seabirds are expected to adjust searching and foraging behaviour to fine-scale feeding conditions. Diving seabirds can adjust diving angles or time spent diving to feed on their mobile prey fish efficiently. However, the fine-scale adjustments of diving behavior to feeding have been examined little, largely due to technical difficulties in monitoring bird behavior and prey capture events simultaneously. In this study, we examined the diving behavior of Rhinoceros Auklet *Cerorhinca monocerata* feeding on Japanese anchovy *Engraulis japonicus,* with data-loggers that can record depth, temperature and 3 axes accelerations during breeding season. From acceleration data, we computed the pitch angle and wing beat frequency of diving auklets for each second. From the time-series pattern of wing-beat frequency, we classified dives into two types; *Dive type -1*. wing beat frequency stayed constant (2-3Hz) during descent phase, and decreased slowly toward ascent phase; *Dive type -2*. patterns in wing beat frequency during descent phase was similar to *Dive type -1*, but a period with higher wing beat frequency (4-6Hz) observed after descent phase. The auklets are known to accelerate to chase and capture fish from previous underwater observations. Therefore, we assumed that *Dive type -1* was 'cruising dive' (non-foraging dive), and *Dive type -2* was 'foraging dive' with prey-chase phase. The pitch angle of 'foraging dives' were steeper than 'cruising dives' during both descent and ascent phases. The auklets can reach target depth sooner with steeper pitch angle during descent phase of 'foraging dives', and can search over larger horizontal distance with shallower pitch angle during both descent and ascent phase of 'cruising dives'. We suggest that Rhinoceros Auklets adjust their diving pitch angles to searching or feeding context to feed efficiently on mobile and ephemeral schools of Japanese anchovy.

p01-056

How young geese learn their way during migration

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Most species of migratory geese fly between their breeding and wintering grounds in family groups. So, from observation studies it has been concluded that the juveniles learn migration timing and the route from their parents. However, how exactly this knowledge is passed on is still unknown. What is the role of each of the parents and do the young stay close to them during the complete migration? To pursue those questions we have tagged 38 juvenile and 54 adult greater white-fronted geese (*Answer a. albifrons*) in family groups in their Russian breeding sites using GPS loggers. A few of the tags also contain 3D accelerometers for behavioural recognition, which can give us insight in the foraging behaviour of the geese during migration. First results from the breeding sites indicate that the young stay very close to the parents most of the time, but also take small detours. During those detours the young seem to usually stay together. We expect to see similar dynamics during autumn migration as families aggregate into larger flocks. From GPS tracks of adult white-fronted geese of the same population that were collected in 2006-2010 we know that they migrate in a narrow front from the Russian Tundra to their Central European wintering sites, stopping at sites along the sea or on large lakes to refuel. There was high variation in timing of autumn migration between years and individuals indicating that it is important for young geese to learn about the correct cues and suitable stopover sites. Such knowledge will influence their future survival and reproductive success, giving us baseline insight into the beginning of complete life time tracks of individual animals.

p01-057

The olfactory potential of the Oriental Honey Buzzard in foraging

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It has been generally believed that birds have limited sense of smell, except for a few species such as vultures, tube-nosed seabirds and kiwis. Although research in recent decades discovered more functions of olfaction in avian ecology, they were limited to passerines and seabirds. Oriental Honey Buzzards (*Pernis ptilorhynchus orientalis*, OHB) in Taiwan forage in apiaries and eat pollen dough, a mixture of pollen, soybean meal, and sugar provided by beekeepers as a supplementary food for bees in winter. We hypothesized that OHB identified the pollen dough as food through olfaction and conducted an experiment by presenting to OHB the original pollen dough and visually indistinguishable dough lacking pollen, soybean meal, or sugar. Colors of the pollen dough were also manipulated to test the influence of visual cues. We also compared the number of olfactory receptor (OR) genes in OHB and other bird species to evaluate the relationship between OR repertoire and olfactory potential. Results showed that OHB predominately chose any dough that had pollen and ignored dough lacking it, regardless of color and other ingredients, indicating that OHB recognized the pollen as food by smell. The estimated OR repertoire in OHB was 283, lower than the average of 369 in other birds. The proportion of functional OR genes in OHB was 81.5%, close to the average of 83.4% in other birds. Our study showed that a diurnal raptor species highly depending on vision in searching for food actually used its sense of smell to identify food at close distance. A number of functional OR genes as low as 200 appears sufficient to provide a bird species considerable olfactory ability. The ability and use of olfaction is probably more widespread in birds than previously believed.

p01-058

Individual variation and the ecological significance of intra-specific kleptoparasitism in Rhinoceros auklet

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Intra-specific kleptoparasitism (ISK), or the stealing foods from the other members of the same species are sometimes observed in the wild bird's communities. However its individual variations and the ecological consequences of ISK are rarely studied. We firstly observed ISK in colonial seabird, Rhinoceros Auklets (*Cerorhinca monocerata*). The study was conducted continuously during their breeding season of 2006 to 2010. During birds landing with foods in their bill to feed their chicks, many (7%) birds are attacked by conspecifics, and of these, 16% birds have food stolen. Those pirate individuals were usually male (88%). This male-biased tendency in engaging in ISK might be the result of larger male bill size and body mass. Furthermore, within males, there was large individual variation in tendency of piracy. Among 90 videotaped pairs, only 21 parents (17 males and 4 females) often (0.1-0.8 times per night) brought meals resulting from ISK. However, those pairs were also monitored during their diving behaviour during foraging by data logger (temperature-depth), there are no differences in foraging effort between pirate and non- pirate birds. Thus, pirate birds were not ISK specialists. ISK increased the total daily meal mass by 40% and daily chick mass increment by 80%. Parents that engaged more in ISK tended to fledge chicks at a younger age (P=0.057) though the effects on chick growth and fledging mass were not significant. These results suggest that ISK provides short-term benefit in the auklets.

p01-059

Mechanism of the allocation of food in the Barn Swallow

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The nestlings of altricial birds have been suggested to increase their allocation of food from parents by begging. For example, nestlings that begged first or are close to the parental feeding location are known to have higher chances of being fed. On the other hand, parents will not be completely passive distributors of the food. To maximize their fitness, parents must make decisions about the allocation of limited resources between nestlings, whereas nestlings may attempt to extract more resources than is optimal in terms of parental fitness. In the context of such parent–offspring conflict theory, it is important to shed light on how much control parents versus nestlings have over the allocation of food. In order to address this question, we here examined the allocation of food to Barn Swallow (*Hirundo rustica*) nestlings in relation to various conditions. First, as conflicts will be higher when resources are insufficient for growth of the entire brood, we assessed the seasonal changes in growth rates and detected the favourable season and/or other brood-rearing conditions for Barn Swallow nestlings. Second, we tested whether the begging behaviour of nestlings and the parental responses to nestling behaviour differ between favourable and unfavourable conditions. We also examined the choice of feeding locations by parents as a way of controlling the allocation of food.

p01-060

Landscape of prey in a Hoopoe population: sex-specific consequences of spatial variation of mole cricket availability on reproductive success

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In Switzerland, a major part of the population of the endangered Hoopoe *Upupa epops* breeds in intensified orchards in artificial nest boxes. Previous studies indicate that mole crickets, *Gryllotalpa gryllotalpa*, are important prey items that can make up 80% of the delivered biomass. Here, we aim at investigating the relationship between the importance of mole crickets as prey and fitness-related traits in Hoopoes. We quantified spatial variation in the food allocation pattern of Hoopoes over the whole study area and analysed the importance of this prey on occupancy rate (2001-2012) and current reproduction. Our results show considerable, repeatable spatial variation of mole crickets over the whole study area, which affected the number of breeding attempts in the past (i.e. occupancy rate of a territory) and additionally the current reproductive success. Pairs that fed high proportions of mole crickets produced more eggs, and chicks were in better body condition and showed a higher fledging rate. Interestingly, the importance of mole crickets was most pronounced in male feeding patterns. Males invest more in offspring food provisioning and mainly fed the larger and older offspring with large mole crickets, while females compensated a male's feeding pattern and fed smaller prey items to the younger chicks. These sex-specific feeding patterns are expected to be adaptive where the female's compensatory feeding behaviour will largely depend on a male's ability to provide enough food – in our case mole crickets – to the brood. This study highlights the importance of a single prey species on sex-specific food provisioning patterns and ultimately on the reproductive success of a bird species.

p01-061

Dynamics in spatial use of orchards by small passerines during the breeding season, case studies in UK and Spain.

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The central feature of bird home ranges is the spatial use of resources to survive and reproduce. Constancy in the use of space in the short term is supposed to be of advantage for most of small passerine species. Here we determined repeatedly the daily home ranges of individual birds of five different species in apple orchards in UK and in citrus orchards in Spain. The application of an insecticide during the study period provided the opportunity to gain insights in the dynamic of spatial use with respect to a large-scale food decline. This is of great interest as the application of insecticides in modern agriculture systems is a standard procedure and the ability of species to react on this determines the viability of their populations inhabiting this type of habitat. According to our results a certain proportion of the home range was used constantly at different days in most of the cases. The remaining proportion of the home range varied in terms of area and location used. The total area covered by a home range was constant for most of the species within the three month of study period. With respect to the application of the insecticide the reaction was species specific. E.g. the Great tit (*Parus major*) spent less time and was found to a lesser extend in the orchard a few days following the treatment. The results show that small passerines birds optimise their space use by steadily varying parts of their home range around a constant base.

p01-062

Feeding position is not fixed in the Varied Tit – comparison with the Japanese Tit

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In some species, each parent feeds from a fixed position on the nest and nestlings compete for the best position from the parent. (McRae et al. 1993; Kölliker et al. 1998; Lessells et al. 2006). Parents may gain optimal fledging success through brood reduction by means of fixed feeding position. So far, fixed feeding position has been reported only in single-prey loader species. The Varied Tit *Poecile varius* lives in sympatry with the Japanese Tit *Parus minor* in the evergreen broadleaved forests in Japan. The former has a smaller clutch size (five is commonest) and carries one or more prey items, while the latter has a larger clutch size (eight) and is a single-prey loader (Eguchi 1995). It is probable that multi-prey loaders can allocate food more equally than single-prey loaders and that feeding position is not fixed in the latter.

We studied the pattern of parental feeding and feeding position of Varied Tits comparing with Japanese Tits in a forest at Fukuoka, southeastern Japan. Feeding behavior and positions of parents and nestlings were recorded with a micro-video camera set at the ceiling of the nest box, from 7 to 13 days after hatching.

As predicted, each parent stood at a consistent position in Japanese Tits, but not in Varied Tits. Varied Tits divided food among nestlings. Asynchronous hatching and large clutch size may cause sibling competition and brood reduction in the Japanese Tit. Parents may facilitate the competition by feeding at a fixed position. On the other hand, clutch size was small and hatching occurred synchronously in the Varied Tit, which may suggest parents feed nestlings equally to fledge without brood reduction.

p01-063

Foraging strategies of coexisting shorebirds at rice fields of Central Western Korea during migration

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Rice (*Oryza sativa*) fields constitute one of the important man-made wetlands for waterbirds. In particular, flooded conditions in rice fields clearly provide foraging habitats. This study was conducted during the spring migration period in 2009, 2011 and 2012 at rice fields of Midwestern Korea. It was aimed at foraging strategies of two wader species (Wood Sandpiper *Tringa glareola* and Black-tailed Godwit *Limosa limosa*) not specialized in terms of feeding techniques. These species were common in our study area during migration and represent different morphological classes. There were distinct differences in foraging strategies between Wood Sandpipers and Black-tailed Godwits. Wood Sandpipers foraged significantly more often in shallow water level and on carnivorous prey items, whereas Black-tailed Godwit preferred relatively deep water level and granivorous prey items. The main foraging method of Wood Sandpipers was surface feeding using visual cues. Black-tailed Godwits, on the other hand, fed by probing and using tactile cues. Wood Sandpipers foraged less intensively but with a proportionally high efficiency of foraging. In contrary, Black-tailed Godwit foraged very intensively and less effectively. Moreover, they were influenced by microclimatic factors. This suggests that two shorebird species in rice fields adopt an opportunistic foraging strategy during migration.

p01-064

Current state of bait-fishing by Green-backed Herons in Kumamoto, Japan

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Very sophisticated bait-fishing by the Green-backed heron (*Butorides striata)* was found in Kumamoto, southern Japan in the 1980s. The behavior has been observed in every summer of the following 30 years in the same area. This fact suggests that there are cultural transmissions among the herons. We were interested in this fact and started this research in 2012. It is shown that the herons that have continued sophisticated bait-fishing would be the colony which build nests in the Kumamoto Terrsa hotel. We also succeeded in shooting the bait-fishing with a video camera and performed animation analysis. The analysis showed that there were differences in techniques of the fishing between adults and juveniles. First the baits which adults often used were many animal materials, while the baits that juveniles used were vegetable materials and artifacts. Second, the adults put bait quietly on the surface of the water and picked it up if unsuccessful so that they are not found by a fish, but juveniles did bait-fishing without such procedures. These results were similar to Higuchi's observations reported 30 years ago.

p01-065

Incubation constancy of American Avocets (*Recurvirostra americana*) nesting in an extreme environment

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Reproduction in birds is extremely conservative with the vast majority of species adopting bird-egg contact incubation to maintain an appropriate microclimate for embryonic development. The Great Salt Lake is an important nesting site for thousands of American Avocets (*Recurvirostra americana*) each year. However, the local climatic conditions can be extreme during the breeding season with very low humidity and daytime temperatures often reaching above 38°C. In addition, nesting success at Great Salt Lake can be very low for this species (14% of nests producing young). These extreme conditions may negatively affect the fitness of American Avocets by interfering with the development of embryos, or resulting in increased energy expenditures of incubating adults. Constancy of incubation, the time that the eggs are in contact with an adult, has been shown in other species to be a major indicator of nesting success. We examined the costs associated with nesting in such a hostile environment and determined if behavioral modifications can ameliorate these effects. We examined incubation constancy and the thermal environment of eggs by placing temperature probes in active American Avocet nests. Artificial nests were also monitored to measure the thermal environment in the absence of adult incubation. A motion sensitive camera was placed at nests to examine variation in parental care during incubation. Temperature and video data demonstrated incubation constancy varied throughout the nesting cycle and across nests. In addition, ambient conditions had a significant effect on parental behavior. These data provide important information on the behavior and adaptation of this species to an extreme environment.

p01-066

The validity of mobbing call playbacks as a method to estimate abundance of forest birds

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Sound playbacks are widely used as a method to investigate the species identity and abundance of birds in study populations. In particular, mobbing calls have been known as an effective sound, because they attract both conspecific and heterospecific individuals. However, recent studies revealed that avian mobbing calls can vary with the risk of predators (i.e., predator type, size, and distance), and such information can be detected not only by conspecifics but also by heterospecifics. Therefore, the type of mobbing calls could affect the number and species of birds that researchers can record, and may consequently influence the estimation accuracy. In the present study, we tested the validity of mobbing call playbacks in the estimation of bird abundance by investigating intra- and inter-specific attraction to two types of mobbing call of Japanese Tits (*Parus minor*). Two types of mobbing call were played back at 14 separated sites in mixed deciduous-coniferous forests on different days, and the number and species of birds attracted were recorded. We also conducted a point count in each playback site. Playbacks of mobbing calls attracted a number of bird species in a short time (15 min), but the number of individuals attracted differed between the two types of mobbing call. The species of birds observed during the playbacks was not different between the two mobbing call types. Several warblers were never observed during the playbacks, while they were frequently observed by point counts. We conclude that, although playbacks of mobbing calls were useful to estimate the abundance of some species of birds, researchers should pay heed that the attraction to mobbing call playbacks depends on the types of mobbing calls and species of birds.

p01-067

Wintering ecology of the Red-crowned Crane (*Grus japonensis*) in eastern Hokkaido, Japan

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In winter, the Japanese population (over 1500 individuals) of the Red-crowned Crane (*Grus japonensis*) is dependent on artificial feeding in eastern Hokkaido, northern Japan. They fly into the feeding stations to peck the corn scattered there in the daytime and roost in the river near the stations at night. The individual behaviors in relation to age and social status were observed by identifying marked individuals and juveniles at the major feeding stations. Most of the males and females three years of age or older uttered unison calls to form a pair bond, whilst only a few younger cranes called in unison. The family cranes appeared at the stations later than younger cranes in early winter. They were more apt to visit a particular station throughout the winter months and occupied a particular location at the stations. Only a part of the younger cranes frequently moved among the stations. In early winter (December), the cranes devoted more time to forage and less time to preen and rest. Among them, the juveniles spent more foraging time than other individuals. In mid winter (January and February), the foraging time of the cranes decreased and the preening and resting time increased. There was no significant difference in the proportion of foraging time between juveniles and other individuals. In late winter (March), only younger cranes including the juveniles independent of their parents visited the stations. The cranes showed a high alertness and frequent fighting behaviour at the feeding areas throughout the winter months. Some individuals had to depart from the feeding areas after foraging. The enlargement of feeding area at the feeding stations and establishment of new station are necessary as the population increases.

p02-001

Predator-prey interaction drive the evolution of red plumage trait in Barn Swallow *Hirundo rustica gutturalis*

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Interaction between species, such as resource competition and predator-prey interaction, is an important factor in phenotypic evolution. In birds, red color is considered to be subject to sexual and/or natural selection. In some cases, red color is conspicuous and thus, might increase predation risk, while in other cases, red color might play a role in warning signal or crypsis, which decreases predation risk. Here, we investigated the relationship between the plumage color traits and nest attack rates in Barn Swallows (*Hirundo rustica gutturalis*), whose half-cup nests are often attacked by Jungle Crows (*Corvus macrohynchos*), Tree Sparrows (*Passer montanus*) or White Wagtails (*Motacilla alba lugens*). During their breeding season, a single dummy swallow having one of four different throat colors (red, light red, white and black) was placed into a swallow nest and after 7days, the presence or absence of the dummy was checked as an indicator of predatory attacks. Red throat dummies fell down significantly less frequently than those with other colors (red 4.2%, light red 8.7%, black 17.4%, white 29.2%). The rate at which dummies with reddish (red and light red) throat fell down was significantly lower than those of dummies with monochrome ones (white and black) ($P<0.05$, Fisher's exact test). This suggest that red throat trait in barn swallows has function in avoiding attacks by predators. Therefore, not only sexual selection but also predator-prey interaction might have influenced the evolution of the red phenotypic trait in Barn Swallow.

p02-002

What is the influence of motion on predator perception by the European Starling (*Sturnus vulgaris*)?

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It is generally admitted that birds are particularly sensitive to some biologically relevant visual stimuli. Thus, fixed "eyes" or "raptor" 2D pictures are predominant in studies aiming to test repellent signals. But the question is how such representations are really perceived by birds and whether the addition of motion influences this perception of danger. In this study, we tested the hypothesis that reactions to supposed "repellent" visual stimuli may depend of the presence/ absence of motion, and the type of motion applied. Captive wild caught European Starlings were exposed to a variety of supposed repellent visual stimuli presented on a LCD monitor: human, eyes, snake, raptor, as well as neutral stimuli. These visual stimuli were either fixed or moving (rippling, beating or looming). Starlings expressed approaches and avoidances as well as gazes towards the screen. The birds reacted differently according to the presence of motion. The decrease of fear reaction of birds in the presence of some moving visual stimuli compared to their reaction to the same visual stimuli without motion, may raise questions about the efficiency of supposed repellent stimuli in an artificial context. It seems that the perception of a rapidly approaching predator is crucial in the decision for the birds to flee or not. The effect of experience has been further tested by using hand raised starlings.
The significance of these results both in terms of cognitive abilities of birds and experimental set ups will be discussed.

p02-004

Skype birds: quantitative evaluation of audio-visual online communication in Budgerigars (*Melopsittacus undulatus*)

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Are humans the only ones capable of using audio-visual online tools such as Skype? Establishing an animal model for cognitive processing in this kind of communication would help us to understand what communication is. Some birds could be a better model for this purpose than rodents because of the similarities in their sensory modalities with those of humans, such as their visual and auditory dominance and range of normal hearing. Budgerigars may be among the best species because they imitate vocalizations in affiliated groups and modify their own behaviours after viewing video playbacks of other Budgerigars. Previous studies suggest that Budgerigars may establish communication with others not only in face-to-face but also in computer-mediated settings. In this study, we put two Budgerigars separately in each experimental box equipped with a monitor, speaker, camera and microphone, to enable them to establish real-time ”online communication”. We conducted three conditions: paired (two-way, interactive), pseudo-paired (one-way, noninteractive) and solo (no bird in one side). Results revealed that their activity increased in the paired and pseudo-paired conditions. Some birds showed different levels of movement synchrony with partners via monitors under different conditions. In addition, we examined whether such kind of indirect audio-visual communication could function as a reinforcer of operant conditioning task. To our knowledge, this is the first study that provides a quantitative evaluation of online communication in non-human animals. We establish an experimental system to perfectly control audio-visual information in this experimental setting.

p02-005

Visual exposure to non-specific point-light animation induces a predisposition for biological motion in domestic chicks.

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A motion picture composed of a set of moving points of light creates a vivid perception of living organism, a phenomena known as Johansson's biological motion (BM). We investigated the effects of early visual experiences on preference for BM by using the training paradigm of imprinting. Chicks were trained by visual exposure to a point-light animation depicting a walking hen (W-hen, a BM stimulus) or one of the following non-BM animations, i.e., rotating hen (R-hen), pendulum, random motion and stationary pattern. If trained with an animation, males showed a strong preference for W-hen to R-hen at test, irrespective of whether the animation was BM or non-BM. Stronger preference appeared when chicks approached the stimuli more actively in training, similarly to the “law of efforts” reported in imprinting. If trained with a stationary pattern, males showed similarly active approach in training but did not show BM preference at test. In females, on the other hand, only those chicks trained with W-hen showed an obvious preference to W-hen, and no correlation was found between the approach and the BM preference. The BM preference is thus supposed not to be learned, but is a permissively induced innately predisposition. Furthermore, females (but not males) trained with random motion showed a preference for walking hen over walking cat (a biological motion animation depicting a cat), indicating that females are choosier than males. Chicks trained with a stationary pattern and untrained controls did not show a significant preference. The induction of BM preference is discussed in terms of possible ecological background.

p02-007

Crow cannot discriminate between the real ham and replica under the minimal ultra violet light condition

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Many birds have ultra violet (UV) vision. The light condition without UV may affect avian vision because it is well known that bird vision uses UV light. Jungle Crows (*Corvus macrorhynchos*) also have UV vision. In this study, the discrimination tests were done with crows using a real ham and replica under different light conditions. Four light conditions (minimal, weak, middle and strong UV irradiation) were setup in the experimental room using a UV cut fluorescent, normal fluorescent and UV lamp. A crow can chose either the ham or replica in a cage under each condition in the room. Five crows were used in each condition and a total of 20 crows were used. Almost all crows in the weak, middle and strong UV irradiation conditions could choose the real ham significantly. However, all crows in the condition of minimal UV irradiation could not discriminate between ham and replica. Thus, UV reflection of some objects may be one of the clues crows use to recognize some objects.

p02-008

Adult deprivation during development affects social motivation of a songbird

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One characteristic of sociality is the fact of being attracted by conspecifics. However, individuals reared in isolation may be disturbed by the presence of conspecifics and they can even stay away from conspecifics when given the opportunity to interact with them. This may reflect troubles in discrimination and/or social attraction. Here, we evaluated whether Starlings (*Sturnus vulgaris*) reared with no adults would be attracted by conspecifics depicted in pictures when socially isolated. Hand-reared male Starlings were offered the possibility to see either social pictures (i.e. pictures of unfamiliar conspecifics) or non-social pictures (pictures of landscapes) by triggering sensors freely. Our data showed that only half of the Starlings used the sensors steadily to see pictures, and, as a group, they did not exhibit any preference for one type of pictures or the other. This contrasts with the fact that adult wild-caught Starlings, when isolated, show a high motivation to obtain pictures of conspecifics. This suggests that adults are necessary for attraction by conspecifics to develop.

p02-009

Is the Pied Bush Chat (a tropical song bird) a close ended song learner?

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Based on the ability of song memorization, songbirds are traditionally categorized as open- and close-ended learners. Open-ended learners continue to learn new songs in adulthood and add them in their song repertoires throughout their life while in close-ended learners, learning is restricted to an early sensitive phase and birds repeat these songs in a stereotyped or crystallized manner for the rest of their lives. In the Pied Bush Chat (*Saxicola caprata*), a tropical songbird with large song repertoires, males deliver dawn chorus to mediate social relationship with neighbours through counter-singing during breeding season. However, there exists no information on when song learning occurs in this species. To test whether the Pied Bush Chat is a close- or open-ended song learner, song repertoires of eighteen males were recorded and compared over the years during 2008-10. Males, with few exceptions, delivered identical repertoire sizes across years. A few males dropped a single song type each from their song repertoires in the next year. However, no male acquired any new song type during adulthood. Results suggest that males possibly memorize their song repertoires early in life that remain stable after crystallization. Therefore, the Pied Bush Chat may be considered as a close-ended song learner.

p02-010

Songbirds and humans apply different strategies in a sound sequence discrimination task

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The abilities of animals and humans to extract rules from sound sequences have previously been compared using observation of spontaneous responses and conditioning techniques. However, the results were inconsistently interpreted across studies possibly due to methodological and/or species differences. Therefore, we examined the strategies for discrimination of sound sequences in Bengalese Finches and humans using the same protocol. Birds were trained on a GO/NOGO task to discriminate between two categories of sound stimulus generated based on an "AAB" or "ABB" rule. The sound elements used were taken from a variety of male (M) and female (F) calls, such that the sequences could be represented as MMF and MFF. In test sessions, FFM and FMM sequences, which were never presented in the training sessions but conformed to the rule, were presented as probe stimuli. The results suggested two discriminative strategies were being applied: (1) memorizing sound patterns of either GO or NOGO stimuli and generating the appropriate responses for only those sounds; and (2) using the repeated element as a cue. There was no evidence that the birds successfully extracted the abstract rule (i.e., AAB and ABB); MMF-GO subjects did not produce a GO response for FFM and vice versa. Next we examined whether those strategies were also applicable for human participants on the same task. The results and questionnaires revealed that participants extracted the abstract rule, and most of them employed it to discriminate the sequences. This strategy was never observed in bird subjects, although some participants used strategies similar to the birds when responding to the probe stimuli. Our results showed that the human participants applied the abstract rule in the task even without instruction but Bengalese Finches did not, thereby reconfirming that humans have to extract abstract rules from sound sequences that is distinct from non-human animals.

p02-011

Graphical analysis of the structure of complex bird songs in natural environments

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Many birds have complex songs that convey meaning. Characterizing their statistical structure is likely to help us understand that meaning. Such songs can be viewed as strings of phrases that follow one another. We may view each song as a graph, consisting of nodes (vertices), and transitions among phrases represented by line segments (edges) linking them. Markov processes are commonly drawn in this manner, but the representation is more general. Sequences of words in English sentences and phrases in bird songs can both be visualized this way. One can be precise about such graphs, including the number of nodes (lexicon size), transition frequency distributions, and connectedness features. In those instances where the sequences can be characterized by Markov processes, then a great deal of statistical theory is available to aid in their analysis and interpretation. These methods are well known in studies of human languages.

We have characterized the songs from several natural populations of birds in this manner, including California Thrashers *Toxostoma redivivum*, Cassin's Vireos *Vireo cassinii* and Black-headed Grosbeaks *Pheucticus melanocephalus*. Each of these has a complex song with 100 or more consistent phrase types, each with one or more syllables and concatenated into strings. Not unexpectedly, these species differ greatly from one another: some have limited lexicon size, whereas others seem to increase without limit; some have extensive phrase-sharing, while others do not; some have patterns of node connectedness that are sharply "small world", while others are much less definitively so. To the extent that these songs can be described by Markov processes locally, the transition frequencies change, so that they are inhomogeneous. In no case have we observed that the Markov processes are reversible, a result with important consequences for song learning. We document these results in more detail and relate them to observations by others.

p02-012

Is the soft song of the Brownish-Flanked Bush Warbler an aggressive signal?

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Soft songs (sub-song) have been detected in many songbirds, but in most species, research on soft songs has lagged behind studies of broadcast songs. In this study, we describe the acoustic features of a soft song in the Brownish-flanked Bush Warbler *Cettia fortipes*. Compared with the broadcast song, the warbler's soft song was characterized by a lower minimum frequency and longer duration, and it had a higher proportion of rapid frequency modulation notes. Using playback experiments, some in combination with mounted specimens, we found different responses to soft and broadcast songs, and we found that soft song can predict aggressive escalation (attack). We conclude that the soft song is an aggressive signal in this species.

p02-013

The stereotypy and variability of repertoires in two groups of nonpasserine birds in evolutionary perspective

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The repertoire of non-passerine birds consists of different type of calls. It is known that in some cases different call types can be intergraded. This phenomenon can be called the structural continuality. It is not clear whether structural continuality in call repertoire is an evolutionarily advanced trait or a primitive condition? To address this question I compared the vocalizations of two groups: (1) cranes (*Sarcogeranus leucogeranus*, *Grus vipio*, *G. japonensis*) and (2) terns (*Sterna hirundo*, *Thalasseus sandvicensis*, *Sternula albifrons*) with their molecular phylogenies. Crane vocalization was studied in captivity. The interspecific differences in crane vocal repertoire revealed reflect both the dissimilarity in vocal repertoires and the pattern of vocal element switching. In particular, in *G. leucogeranus* (which stands close to the root of the Gruinae) the vocal repertoire is minimal and sequences emitted by individuals are a constant repetition of near-identical notes. Patterns of vocal element switching within bouts of vocalization in other crane species studied show much more variability. The vocal behaviour of terns was studied in the Azov Sea by focusing on vocalization during aerial courtship. The structural continuity of repertoire structure is characteristic for *S. hirundo*: its repertoire can be presented as a continuum in which components pass from one to another. The repertoire of *S. sandvicensis* can be divided into several call types, but there is typically considerable variability in the calls forming a series. The vocalization of *S. albifrons* (which holds a more basal position) seems much more stereotyped in that it expresses little structural continuity in repertoire structure or variability of acoustic series. Thus, in both groups of birds the structural continuity in repertoire structure and variability of acoustic sequences can be a sign of evolutionary progress.

p02-014

Is acoustic communication of European Robins (*Erithacus rubecula*) affected by wind farm noise?

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The number and distribution of wind farms has increased considerably over the last 20–30 years. Their impact on wildlife is not fully understood, but it is clear that some species avoid wind farms, possibly because of the masking effect of wind turbine noise. Previous studies have shown that urban and traffic noise alters singing behaviour in a variety of bird species such as the Great Tit *Parus major*, Eurasian Blackbird *Turdus merula* and European Robin *Erithacus rubecula*. Furthermore, noise could affect the receiver's ability to determine the signaller's distance, such that birds might perceive a nearby neighbour to be further away than they actually are. We investigated whether the territorial response of male European Robins is affected by wind turbine noise. Initial results from playback experiments show that robins did not alter their singing behaviour when exposed to turbine noise. However, they did perform more flights and flew over the speaker more often during playback of robin song with wind turbine noise in the background than they did during similar playbacks with no background noise. This could indicate that in the presence of turbine noise the receiver had difficulty locating the signaller and perceived the signaller (playback) to be at a greater distance than it actually was.

p02-015

Seasonal changes in vocal activity in two nocturnal colonial seabirds (*Oceanodroma furcata and O. leucorhoa*; Procellariiformes) in relation to abiotic factors.

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Seabirds are good indicators of the condition for marine ecosystems. However the patterns of colony attendance in nocturnal seabirds are still not clear for many species, thus complicating the monitoring of their populations. We studied seasonal vocal activity on the colony surface in two nocturnal seabirds, Fork-tailed (*Oceanodroma furcata*) and Leach's (*O. leucorhoa*) Storm-petrels, and tested the impact of abiotic factors. The work was conducted from 14 June to 23 August 2012, on Medny Island, the Commander Archipelago, where the both species are common and usually share the breeding grounds. We used two automatic SongMeter acoustic sensors that nightly recorded first 5 minutes of each half-hour period from sunset to sunrise on the two colony sites that differed in storm-petrel's nest density. We also regularly noted the weather conditions: air temperature, wind speed, cloud cover, amount and form of precipitation, sea state *etc*. Storm-petrels acoustic activity (defined as total flight call number recorded per night) varies greatly from night to night (on the study site with higher density – 10-180 calls for *O. furcata* and 4-91 calls for *O. leucorhoa*). However we didn't find any significant effect of air temperature and cloud cover on the vocal activity in both species. But vocal activity significantly and negatively correlates with wind speed in both species, and with humidity and sea state in *O. leucorhoa* but not in *O. furcata*. Interestingly, we found that nightly peaks of vocal activity of two species on Medny is quite divergent (*O. furcata* – 164±26 min and *O. leucorhoa* – 233±36 min after sunset), maybe due to competition for noise-free periods of night. We discuss the possible impact of our study for improvement of methods of acoustic monitoring for storm-petrels populations.

p02-016

Ontogenesis of vocalization in nocturnal (Strigiformes) and diurnal (Falconiformes) birds of prey

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Nocturnal and diurnal birds of prey have different types of ontogenesis: while owls hatch blind, diurnal birds of prey hatch with fully-developed eyes. Here we present the first data on ontogenetic changes in the vocalizations of chicks of two owl species (tawny owl, *Strix aluco,* and great grey owl, *Strix nebulosa*) and three species of diurnal birds of prey (saker falcon, *Falco cherrug*; merlin, *Falco columbarius*; and Northern goshawk, *Accipiter gentilis*). Measurements of the calls were made with Avisoft-SASLab Pro 5.1.10 (Avisoft Bioacoustics, Berlin, Germany). Data analyses were carried out with the statistical package STATISTICA 7.0 (StatSoft, Tulsa, OK, USA). We examined changes in the structure and acoustic parameters of the begging calls of hatchlings, nestlings and fledglings. We found that nestling calls changed during maturation both in structure and time-frequency characteristics. Abrupt changes occurred in the structure of owl calls by the time of eye development completion. In diurnal birds of prey such abrupt changes in call structure were not found. Calls of chicks of diurnal and nocturnal birds of prey differed. Along with ontogenetic changes in structure and acoustic parameters of calls we investigated the data on the subject of possible individual- and sexual-dependent features. Begging calls of chicks were compared to those of adult birds of the same species. The study was conducted at Vitasfera Rare Bird Species Breeding Centre and supported by RFBR grant No 11-04-00062a.

p02-017

Patterns of dawn singing by a tropical suboscine, the black-capped flycatcher (*Empidonax atriceps*)

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Many passerine species exhibit a short bout of intense singing just before, or at, sunrise (dawn chorus). The function of dawn singing remains controversial, despite increased investigation in recent years. However, almost all studies have involved migrant species breeding in temperate regions. Although the behavior is exhibited by many resident species in tropical regions, it remains unknown whether dawn singing shows the same characteristics, and functions in the same manner, in these birds. We recorded dawn singing of a resident population of black-capped flycatchers (*Empidonax atriceps*) in Costa Rica in March-April 2009. Dawn song began about 15 minutes before sunrise and continued for about 20 minutes. Each male sang two song types in almost strict alternation, except near the end of bouts when the proportion of song type 1 increased. Songs were given at rates of approximately 40 songs/minute. Singing rates increased during the first half of dawn-singing bouts, then slowed toward the end. Many bouts ended when the singing male was approached by a second bird, presumably the mate, giving call notes. In contrast to the highly-stereotyped songs of *Empidonax* species studied in North America, both song types of black-capped flycatchers showed considerable variation in the number of introductory notes at the beginning of each song, giving a "stuttering" quality to their singing. We compare the dawn singing of this species with that of a migratory population of its sister species, the buff-breasted flycatcher (*E. fulvifrons*), in Arizona.

p02-018

Song structure, song rate, hormonal level and immune challenge in the Canary

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Bird song may be an honest signal of mate quality and reflect the physiological (hormonal level) and psychological (stress level) condition of a male. We studied the relationship between song performance, song structure, and hormonal level in male Canary (*Serinus canaria* var *domestica*) by experimentally challenging their immune system with a novel antigen, sheep red blood cells (SRBC, 5 X 107 SRBC in 100 µl sterile PBS) in 2008-2011. Control males received intraperitoneal placebo injection (100 µl sterile phosphate-buffered saline PBS). The level of corticosterone and testosterone measured in the litter with the help of the enzyme immunoassay. Three phrase categories were identified in the Canaries' song: whistles, rapid trains and bifonic trills. Immune challenge led to changes in song structure and song rate of experimental males. Injection of SRBC caused a change in the ratio of the phrases in the songs of the Canaries. Immune challenge caused a significant (relative to the control group) increase of corticosterone ($p<0.001$). The level of testosterone decreased in the course of the experiment in control and experimental groups. Our study has shown the influence of immune challenge on song structure, song rate, and hormonal level in the Canary. The work is supported by RFBR grant № 11-04-00062a and the Fund for the support of the Russian Canaries.

p02-019

Development of cues to individuality and sex in calls of three crane species (Gruidae, Gruiformes)

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Individual and sex differences were reported for many bird species, but only a few studies have concentrated on development of such differences in ontogenesis or on comparison of such differences across species. However, it is usually assumed that individual recognition between parents and chicks and sex recognition between conspecifics develops when and where they are needed to restrict parental care to the bird's own offspring or to protect individuals from mistakes during pair bonding. Here, we tested this hypothesis on three related species of cranes, the Demoiselle (*Anthropoides virgo*), Red-crowned (*Grus japonensis*) and Siberian (*G. leucogeranus*) cranes, that differ in their growth and development rates, vocal characteristics and a few behavioral traits. We analyzed peep calls of 33 captive crane chicks (11 chicks per species, 40 calls per chick), recorded in two Ages (4-45 days and 83-183 days of life) in Oka Crane Breeding Center (Russia). First Age corresponds to period of settled way of life when crane families stay inside their breeding territories; second Age – to period of autumn migration when cranes join in flocks and parents need to recognize their own chick among hundreds of strangers. DFA stepwise analysis showed that vocal indicators of sex were poorly expressed during the first six months of the crane's life i.e. sexual dimorphism reported for adult crane calls develops later, maybe during sex maturation. However, expression of individual features considerably and significantly increased with fledging and transition to migratory lifestyle. There weren't any differences in expression of individuality and sex in chick calls of all three species regardless of Age. Interestingly, during the autumn migration, non-linear phenomena percentage increased dramatically in the calls of all three species. We assume that enhancing of individual vocal features expression serves for increasing success of parent-chick recognition in migratory flocks.

p02-020

Conspecific odour recognition in the South Island Robin: I can smell you before I even see you!

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Recent evidence has shown that some birds can use olfactory cues ("odours") when homing to nests and in assessing potential mates. Most bird odours originate from preen waxes produced by the uropygial gland, a structure located on the rump. Preen waxes are spread over the feathers by preening, and although their exact functions are debated, a role in social signalling is becoming apparent. In this study, we tested whether preen wax odours play a role in social signalling in the South Island Robin (*Petroica australis*). Robins are unusual as they switch to producing more volatile preen waxes during the breeding season, a pattern opposite to that found in other species, suggesting their preen wax is linked to social chemosignalling. Using a remotely controlled chamber that allowed us to expose free-living robins to a sample of preen wax, we recorded whether male robins reacted to the odours of conspecific male robins or to a control. Robins exposed to conspecific odours showed a tendency to increase stress behaviours such as alarm calls and physically attacking the chamber. This suggests preen wax odours could be detected by conspecifics and could function in intraspecific communication, including mate choice and territoriality.

p02-021

Experimental evidence for an adaptive response towards olfactory Predator cues in *Alectoris rufa*

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Whereas in the majority of vertebrate groups it is already well accepted that chemical signals are of importance in different contexts of behaviour, birds were for a long time regarded to use mainly visual and acoustic stimuli to gather information about their environment. Even though opinions about the complexity of the avian olfactory systems are still diverging, there is growing evidence that birds can perceive scents and use this information in foraging, mate choice, orientation, nest-site and even kin-recognition. Since mammalian predators in particular use olfaction as their communication channel, it may be advantages for birds to use these chemical signals for their own purpose, e.g. to detect and get information about predators. To investigate the role of avian smell perception in this context, we conducted a non-invasive experiment on a ground breeding species, namely the Red-Legged Partridge (*Alectoris rufa*). We offered three different types of olfactory stimuli, representing (i) danger; (ii) predator presence (iii) neutral smell, by scenting sand for soiling with either of the stimuli. Red-legged Partridges showed significant differences in the preferences for the three scents. Our results indicate that birds can discriminate between different scents and olfactory cues might play a bigger role in predator detection and avoidance than originally thought.

p02-022

Effect of social status on vocal behavior in group-living Large-Billed Crows

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Dominance hierarchies can be found in animals that live in a society where repeated encounters with the same individuals can occur. In such societies, higher ranking individuals often give signals that advertise their dominance. One of such signals is vocalization. It is reported that dominant individuals give calls more frequently (Leonard & Horn 1995) or have distinct acoustic characteristics (Hoeschele et al. 2010). The Large-billed Crow (*Corvus macrorhynchos*) is a social bird, living in a fission-fusion society. Captive Large-Billed Crows are reported to form linear dominance hierarchies in dyadic encounter experiments (Izawa & Wtanabe 2008). However, neither the formation of dominance hierarchies under group-living conditions nor the influences of social dominance on their vocal behaviour are known. In this study, we observed a flock of captive Large-Billed Crows with the aim to investigate their social dominance and its influence on their vocal behaviour. As a result of 2925 minutes of observation, we found a linear dominance hierarchy among the observed crows. The influence of social dominance on the vocal behaviour differed between call types. The 'ka' call (contact call; Kondo et al. 2010) was given by all individuals in the flock, irrespective of their social rank. On the other hand, the sequential call was mostly given by the highest ranking male. These results suggest that the sequential call, but not the 'ka' call, may function to advertise social dominance to conspecifics in Large-Billed Crows.

p02-023

Song alteration and maintenance modulated by behavioral context in adult male Bengalese Finches

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Singing behavior in oscine songbirds is divided in two different social contexts. 'Directed song (DS)' is mainly used during courtship of females, while 'undirected song (US)' is not overtly targeted to any particular recipient. In many species, such as Zebra and Bengalese Finches, song patterns (i.e., song motifs and acoustic structure of syllables) in both contexts look very similar. Recent studies reported that US showed higher variability in song pattern than DS, while DS was more stereotyped. This different song variability may be caused by different neural activity in the anterior forebrain pathway (AFP). AFP in songbirds is homologous to basal ganglia-thalamo-cortical circuits in mammals and involves in song learning, modification and maintenance. During US, neural activity in the AFP is much higher than that in DS, suggesting that the AFP evaluates song feedback and modifies vocal output while singing US. Elimination or alteration of song feedback induces activation of AFP and generates error signals to modify song. Therefore, US is expected to become more variable if auditory feedback is deprived. To examine this hypothesis, we compared the degree of song alteration in US to that in DS after deafening in adult male Bengalese Finches (*Lonchura striata* var. *domestica*). In this study, we first confirmed that songs were stable, and then we surgically deafened seven birds by bilateral cochlear removal. After deafening, song patterns showed rapid alteration followed by stabilization with different patterns after two months. The index for song stereotypy showed lower values in US than in DS two months after deafening. Results indicated that effect of deafening on song alteration is larger in US than in DS, suggesting that the AFP contributes to make song patterns variable during US even after deprivation of auditory feedback.

p02-024

Do birds recognize foreign dialect singers as the same species? Effect of sympatric species singing similar songs

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Bird song has an important role in species recognition. Therefore, when the songs of sympatric species resemble each other, they have the ability to distinguish between the songs of conspecifics and heterospecifics. This ability may be connected with the discrimination of own dialect from foreign one in a species. I hypothesized for species with geographic song variation that those individuals that live in sympatry with heterospecifics having similar songs are able to discriminate their own dialect from foreign dialects and that individuals not exposed to heterospecifics with similar song, do not. Japanese and Varied Tits (*Parus minor, Poecile varius*) show strong resemblences in their songs. In the Ryukyu Archipelago, Japan, some islands are inhabited by both tit species, while other islands are only occupied by one of the species.. For both species, acoustic analyses showed song variation among birds from the various islands. Playback experiments revealed that Japanese Tits on islands with Varied Tits responded less to dialects of conspecifics on islands without Varied Tits than to their own dialect, whereas Japanese Tits living in allopatry responded similarly to both dialects. This asymmetric response pattern to dialect playback was also found in Varied Tits. These results suggest that, when two populations of a songbird species meet, the existence of sympatric species singing similar songs may affect the direction of gene flow.

p02-025

Can female Daito Scops Owls distinguish hoot-calls of their socially paired males from strangers?

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Vocalization is an important form of communication in nocturnal birds. Although nocturnal owls have simple hoot-calls, they also exhibit distinct individuality. We conducted a playback experiment on Minami-daito Island, an isolated oceanic island, in Japan and determined that male Ryukyu Scops Owls (*Otus elegans interpositus*) could distinguish hoot-calls of neighbouring territorial males from strange males. We also determined whether or not females could distinguish hoot-calls of their socially paired males (mates) from other males (strangers). We broadcasted two types of hoot-calls (a mate and a stranger) using a speaker near the box of a nesting female during incubation. Using video recorders placed in each nest box, we sampled behaviour of 20 females (head direction, eyes open or close, call types, and the number of calls) every one-second. Sixteen females reacted by calling to the hoot-call of each mate and nine of them reacted by uttering high-pitched calls. When a pair of socially paired birds called to each other frequently, females usually utter high-pitched calls unlike hoot-calls. In response to strangers, nine females reacted by calling to the hoot-call and two females reacted by uttering high-pitched calls. Females rarely responded to hoot-calls of their mates by climbing to the entrance of nest boxes, while females responded to hoot-calls of strangers by climbing to the entrance more quickly than when they responded to calls of their males. Hoot-calls of their mates made females utter hoot-calls, especially high-pitched calls. Although females had a rapid and strong reaction in response to strangers, they had a slow and weak response to their males. They might respond to the intrusion of strangers with caution and climb to the entrance to investigate the intruder while they may react less aggressively to their husbands. We inferred that females were able to distinguish the hoot-calls of their males.

p02-027

Context dependent variability in note sequences in Bengalese Finches

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Songbirds do not always sing a song in the same manner; there exists some variability in songs in tempo, pitch, the number of notes in trills, and so forth, and the extent of the variability depends on contexts. For example, songs in Zebra Finches exhibit circadian changes in tempo. Also in Zebra Finches, songs directed to females are faster and more stereotyped in pitch than those not directed. Note sequences in songs in Bengalese finches are also more stereotyped when directed to females than when not directed. Examining such variability and the extent of the variability in the different contexts are helpful for elucidating the neural basis for production, perception, and learning of the birdsongs. In the current study, circadian changes in the note sequences in Bengalese finches are examined. Songs in Bengalese finches are not stereotyped and not completely random. They consist of notes, sound elements divided by silent intervals, and there are some notes that tend to appear in a chunk. The chunk-to-chunk transitions exhibit randomness. Thus the transition probabilities of successive chunks within a certain time window can be calculated. Currently note-to-note transition probabilities in Bengalese finches are being investigated, and some transitions exhibiting indication of circadian changes are found. This result suggests that transition probability as well as other song parameters in Bengalese finches is variable and may be regulated (actively and/or passively) by some brain functions.

p02-028

Aperiodic light environment can affect song in the Zebra Finch

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Previous studies have shown a timed song production indicating the role of a biological clock in singing behavior. We hypothesized that bird song is a circadian system driven behavior. In this study, we have examined whether disruption of the circadian clock function also affects the learning and production of song in Zebra Finches. Eight pairs of Zebra Finches were raised under two light conditions: 12h light: 12h dark (12L: 12D) and constant light (LL). Activity-rest pattern of individual birds were recorded as a measure of the circadian behavior. Song was recorded over three days in each condition at a sampling rate of 44.1 KHz and 16 bit accuracy. Ten song bouts from each bird were used for the analysis of song complexity, singing performance and acoustic features. Birds raised in LL had arrhythmic song patterns. There was a significant difference in the structure and ordering of syllables constituting a song. Both groups also significantly differed in other acoustic features of the song, namely the amplitude, pitch, frequency, goodness and entropy. It is suggested that disruption of the circadian clock under LL affected the song pattern in Zebra Finches. However, it remains possible that the exposure to LL acted as a stressful agent and affected the song pattern in Zebra Finches. We hope to resolve this by measuring melatonin and corticosterone in blood samples taken during the experiment.

p02-029

Song parameters of Fuscous Honeyeater *Lichenostomus fuscus* correlate with habitat characteristics in fragmented landscapes

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Habitat loss, fragmentation and degradation are drivers of major declines in biodiversity worldwide. Understanding the processes leading to these declines is essential for successful conservation management. The Fuscous Honeyeater *Lichenostomus fuscus* is a common eastern Australian bird, disappearing from habitats where landscape-level of tree-cover falls below 17%. Recent analyses of genetic, morphological and haematological variation of a wild population in north-central Victoria suggest that this decline is not due to birds' inability to reach isolated patches or effects of habitat quality on individuals' health or neutral genetic diversity. We tested if decline of habitat quality in fragmented landscapes drives changes of birds' song characteristics, leading to disruption of social interactions. To do that, we collected acoustic data for Fuscous Honeyeaters occupying the same landscapes where other types of data on birds and their habitats were previously collected. In 2009 we recorded a total of 195 songs in 10 sites of 6 landscapes ranging in tree cover from 11 to 72%. We then tested whether the landscape level of tree cover or habitat characteristics are correlated with measured song parameters. Song length, frequency bandwidth and maximum song frequency positively correlated with number of large trees per hectare ($p<0.02$, Spearman rank correlation), and the length and the frequency bandwidth of a common song element shared by the birds in all sites positively correlated with landscape level tree-cover ($p<0.005$, Spearman rank correlation), showing that birds from poor quality sites have shorter songs and narrower frequency bandwidth than those in good quality sites. Three explanations are possible: (1) poor quality habitats might be occupied by birds in poor condition, (2) in cluttered environments song has a greater bandwidth to aid ranging (distance estimation) and (3) cluttered environments represent older more established populations which differ in the cultural transmission capacity to tutor offspring.

p02-030

Establishment of a quantitative calculation method for repertoire size in Bull-headed Shrikes.

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Most oscine birds sing loud species-specific songs that generally have two functions; attracting mates and defending a territory. Although the Bull-headed Shrike (*Lanius bucephalus*) is a songbird, the males do not have species-specific songs, but sing quietly mimicking the songs of other birds. The function of these mimicked songs, called subsongs, has not been examined. Repertoire size is usually an important predictor of song function, because a correlation exists between repertoire size and reproductive success in many oscine species. Repertoire size was estimated by classifying notes, defined as continuous elements of sound on a spectrogram, into different note-type groups visually. Since this method relies on each researcher's visual interpretation, we aimed to establish a quantitative method to calculate repertoire size and used this to measure the repertoire size in Bull-headed Shrikes. To quantitatively evaluate repertoire size, we introduced a similarity index that indicated a degree of approximate similarity in the shape of notes on a spectrogram (0–100 %; 100 % = a perfect match). We sampled 1,000 notes from subsongs of each individual and computed repertoire size based on about 500,000 ($\approx {}_{1000}C_2$) similarity scores. Mean repertoire size was 603 ± SD 93 (n = 5) and 756 ± SD 40 (n = 5) in the non-breeding and breeding seasons, respectively. The versatile Northern Mockingbird has a repertoire of only 150 songs. Repertoire size was significantly larger during the breeding season but the coefficients of variation were smaller during the breeding ($CV_{breeding} = 0.049$) than in the wintering season ($CV_{non\text{-}breeding} = 0.16$). Since repertoire size varied little among males, repertoire size may not indicate the presence of a competitive advantage in male Bull-headed shrikes. We should evaluate other features of subsongs, e.g., the number of notes per unit of time or combination of notes used in subsongs.

p02-031

The evolution of the Lombard effect

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The emergence of adaptive signal plasticity is considered a crucial step in the evolution of animal communication. In acoustic communication, signal transmission is often constrained by background noise. One way to evade acoustic signal masking is the Lombard effect, in which an animal increases its vocal amplitude in response to an increase in background noise. This form of signal plasticity has been found in mammals, including humans, and some bird species, but not frogs. However, the evolution of the Lombard effect is still unclear. Here we will provide the first comparative analysis relating a complete review of the evidence for the Lombard effect in birds to new experimental studies in which we addressed noise-dependent vocal plasticity in non-avian sauropsids. By doing so, we take a step towards reconstructing the evolutionary history of noise-dependent vocal plasticity in birds. The results of our experiments and subsequent phylogenetic reconstruction will help to resolve the question of whether the Lombard effect evolved independently in the most recent common ancestor to mammals and again in ancestral birds or whether it is a trait shared through common descent. If the latter is true, it would mean that the sophisticated plasticity of the vocal signals of birds and mammals can be traced back to early amniotes.

p02-033

Why do Moustached Wren (*Pheugopedius genibarbis*) sing in duet?

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Birds can emit sounds in different situations with distinct biological meaning. The sound that encodes the species-specific recognition is known as the song. There is a wide variety of songs and strategies of emission; one of them is the duet song that happens when female and male coordinate their bouts to utter a unique song. The development of duet song in birds attracted a lot of attention, and there are numerous studies hypothesizing the ecological meaning of singing in duet, however, there is no consensus about why some bird species have duet song when most do not. The Moustached Wren (*Pheugopedius genibarbis*) is a tropical duetting bird fairly common from the south of the Amazon River until central Brazil, occurring also in part of southeast Brazil, Bolivia and Peru, especially under the Andes. The aim of this study was to propose the ecological function of moustached wren's duet song, so we performed playback experiments with Moustached Wren pairs in Gunma Ecological Park (1º12'S; 48º17'W) and the campus of Federal University of Para (1º28'S; 48º27'W). We tested three different categories of sound: the duet song, the male bout and the female bout and analysed the pairs' behavioural answer. Moustached wrens responded aggressively to all the categories tested and there was no significant difference in the intensity of the answer presented for them. These results indicate that the duet song in this species seems to be a cooperative mechanism developed to optimise the territorial defence.

p02-034

The effect of begging calls by female Bull-headed Shrikes on feeding by males

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Male birds often feed their mates while the females stay on the nest to incubate their eggs. In some species, females also noisily beg for food when their mates approach the nest. In previous studies, the length of begging calls at nest, before and after the females were fed by males, have been treated as a single parameter. However, the function of begging calls before or after being fed by a male may be different depending on the types of situation in which the female begs. Here, I analyzed whether the length of each begging call has a different effect on the interval of feeding visits by males in Bull-headed Shrikes *Lanius bucephalus*. I found that the length of time that females begged after receiving food was negatively related to the time until the next male feeding visit. Conversely, the length of female begging calls before feeding by males did not affect the interval until the next feeding visit. These results suggest that information that females encode in begging calls at nest differs according to the situation of male feeding.

p02-035

Social complexity hypothesis: an examination through vocal complexity of corvids

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Animals with complex social interactions seem to have a predisposition to evolve complex communication systems. In birds, this hypothesis has been mainly supported by examining the vocal complexity of the 'chicka-dee'call system in the Paridae family. Investigations of the predictions of the social complexity hypothesis are needed, using other systems and controlling for phylogeny. The members of the corvidae family (magpies, crows, jays and allies) show different levels of social organization and complex vocalizations and thus, provide a good model to test the predictions. In this study, we will test how social complexity hypothesis predictors such as group size, unit density (group size/ territory size) and social group stability (presence *vs* absence of territoriality), influence vocal complexity measures, including the vocal repertoire size and the variation in the structure of common shared call type ("caw","rattles/staccato", "crack") in many corvids. The study will contribute to our understanding of the evolution of communication systems in complex social groups.

p02-036

Advertising vocalization of the Large-billed Reed Warbler (*Acrocephalus orinus*)

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The history of rediscovery of the Large-billed Reed Warbler is extraordinary. This species was described by a single specimen and considered to be extinct until 2006, when a living bird was mist-netted in Thailand. Several years later the nesting area of these birds was discovered around the border of Tajikistan and Afghanistan. In 2011 and 2012 our working group was studying different aspects of breeding biology of *A. orinus* in the Pamir mountains (the valley of Panj river in SE Tajikistan). This study is a part of this huge work and it is about advertising vocalization of the Large-billed Reed Warbler.
In the vocal stream of *A. orinus* males songs separated by pauses could be distinguished. Both songs and pauses between them are highly variable: songs last from 0.1 s to 31.4 s (median 2.78, *n*=367), pauses from 0.5 s to 23.3 s (median 3.4, *n*=364). In the male repertoire we distinguish a number of song types (10, 21 and 21 in 3 males) which can be divided into parts (=songs) in the vocal stream. The song type starts with the most stereotype part and ends with more variable sequence of syllables. In one most studied male repertoire there is a tendency for songs to order as a first-order Markov chain.
The differences in advertising vocalization between *A. orinus* and the closely related Blyth's Reed warbler (*A. dumetorum*) are: 1) discrete structure of the vocalization instead of continuous type correspondingly; 2) chattering notes are not used for syllables separation as it is typical for Blyth's Reed warbler; 3) notes are packed more dense than in *A. dumetorum* song (more notes used at the same time interval).

p02-037

Cryptic flutter produces klaxon-like song in *Smithornis* broadbills

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Vocally, birds can produce a plethora of sounds covering a wide range of spectral, temporal, and syntactical complexities. Less well known are non-vocal sounds used in communication by birds, and the range of mechanisms used to produce these sounds. We investigated wing sonation in *Smithornis* broadbills, which produce a loud klaxon-like sound in an elliptical display flight. We describe the sonation through a combination of synchronized high-speed videos and sound recordings of displaying birds in the field in Uganda, and tests of sound production capabilities of feathers in a wind tunnel. We then performed wing manipulation experiments in the field in Tanzania to determine the effect of specific wing feathers on sound production. We also measured wing length of museum specimens and recordings of song from a wide geographic range to determine the extent wing morphology might have on spectral and temporal features of the sonation in the three species. Results of both the synchronized high-speed video and sound recordings, and wind-tunnel experiments suggested wing feathers P6 and P7 have aeroelastic flutter characteristics most consistent with the sound produced. Field manipulations of these feathers in the field provided consistent results with changes in the timbre of the sound, and specifically a reduction in the tonal quality. We consider the factors that may have led to the evolution of this unique mechanism of sound production in broadbills.

p02-038

Female preference for syntactically complex trills in the Java Sparrow song

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Male oscine birds sing songs to attract females as a form of courtship displays. Like many other sexual traits, bird song is assumed to serve as a male honest signal and evolve via female choosiness. Song quality can basically be determined by two measures: the degree of elaboration (e.g. song/note repertoire, syntactical complexity), and the intensity of performance (e.g. song length, tempo, amplitude). A trill, which is generally defined as a series of repetitive syllables, is a notable example of song traits associated with the two measures. While evidence is accumulating that trilled performance reflects male quality and relates to female preference, elaboration of trills (e.g. number of notes in syllables of trill) has gathered less attention. The songs of individual Java Sparrows (*Lonchura oryzivora*) are characterized by both trills and non-trill parts, and their trills are often comprised of multiple notes, which led us to test female preference for trill performance and complexity. Female Java Sparrows were presented with song playbacks, and then the singer of the songs in one-way choice chambers in order to test song preference with consideration of consistency of female preferences toward song and live stimuli. As an index of female preference, we counted the number of females' movements. Our result was not in accordance with previous studies of other species with trills, as trill complexity but not performance was important for females. Specifically, females preferred songs that involved longer duration of multi-note trill parts, but not those with one-note trills. In addition, female preference was consistent between song and live stimuli. These suggest that female Java Sparrows assess male quality based on trill complexity. Our findings are the first to demonstrate the possibility of evolution of syntactically complex trill structures under inter-sexual selection pressure.

p03-001

Influence of distance between patches and landscape-level factors on bird communities in a fragmented Mediterranean forest of Morocco

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The present study examines the effects of structural connectivity between pure cork oak patches and non-indigenous plantation plots. We also investigated the effect of the distance between the cork oak forests patches on forest bird communities. A systematic sampling of habitats and bird communities was done in a set of 44 cork oak patches. The long-term monitoring of birds by using point counts may provide useful data on species movements in forest corridors between fragments and in the surrounding matrix. The Maamora forest is very fragmented; cork patches are integrated in a matrix of exotic plantations. We then defined Maamora forest as (cork oaks + non-indigenous plantations). Two indexes of similarity were used: Sorensen (Is) and Jaccard (IJ). These two indexes and the terms of autocorrelation (*Autocor*) were used to calculate the effect of distance on different bird assemblages. We used also ANOVA tests to assess the recruitment of forest birds in the different patches depending on the matrix type.

Results indicate that there is no significant effect of distance on the different bird assemblages, whereas matrix composition had a very significant effect on bird dispersal. We concluded that the type of vegetation near the cork oak forest fragments had a significant effect on the composition of the bird assemblages. This would temporarily reduce the effects of fragmentation.

This study emphasizes the importance of considering species' perceptions of landscape, especially functional connectivity, in understanding the effects of habitat fragmentation.

p03-002

What makes an urban bird? Bird species in the city are not big-brained but simply more common in the surroundings

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Several life history and ecological variables have been reported to affect the likelihood of species becoming 'urbanized', and recent work has focused on the role of brain size in explaining the ability to adapt to urban environments. However, little is known about the effect of colonization pressure from surrounding areas, which may confound conclusions about what makes a species urban. We recorded presence/absence data for birds in 93 green spaces in Oslo (Norway) and compared these with species lists generated from 137 forest and 51 farmland sites surrounding Oslo which may reflect source populations. Phylogenetically controlled analyses showed that the frequency (proportion of sites where present) of a species within the city was strongly and positively associated with its frequency in sites surrounding the city. In contrast, there were generally no effects of brain mass or other covariates (habitat, nest site, migratory status, body mass) on urban frequency. Furthermore, analyses of previously published data showed that urban density of birds in six other European cities was positively associated with density in areas outside cities, whereas relative brain mass showed no such relationship. These results suggest that urban bird communities are determined by how common a species is in the surrounding landscapes, and not by its brain size.

p03-003

Changes to local bird communities as a result of supplementary feeding

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The practice of bird feeding is a global phenomenon, involving millions of people and vast quantities of food annually. While it is an important socio-ecological link in an increasingly urbanized world, many people engage in the practice of feeding believing the birds gain some benefit from the food they provide. There are, however, a number of potentially negative ecological effects that may arise as a result, including dependence, increased aggression, and disease outbreaks. In New Zealand, an important concern is the potential for feeding to enhance populations of introduced species, yet the practice has received virtually no attention from the scientific community. We carried out an 18-month experimental feeding study in Auckland, New Zealand's largest city, to investigate the effects of common feeding practices. A key aim was to examine whether feeding causes changes in local avian community structure. In addition, baseline information on seasonal variation in feeder use was collected, both at the individual and species levels. Dramatic increases in local abundance of some species, House Sparrow *Passer domesticus* and Spotted Dove *Streptopelia chinensis* in particular, were observed at experimental feeding sites. All species observed visiting feeding stations during the study were introduced, with the exception of the Silvereye *Zosterops lateralis*, which was a seasonal visitor in winter months only. The findings from this study indicate that bird feeding contributes to the patterns of avian community structure observed in urban New Zealand, with the potential to inflate numbers of invasive birds.

p03-004

Bird responses to plantation intensity indicate comparable benefits of land sparing and sharing

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We examined potentially contrasting conservation benefits of land sparing and land sharing strategies in forested landscapes by investigating relationships between bird functional group densities and basal areas of coniferous trees (an index of plantation intensity) in Sakhalin fir (*Abies sachalinensis*) and Sakhalin spruce (*Picea Glehnii*) plantations. Densities of most bird functional groups were inclined to increase with decreasing plantation intensity in both plantation types. In many cases, linear models were best for exploring bird density–plantation intensity relationships, but statistical support of linear and nonlinear (quadratic) models was similar. This outcome indicates that ecological benefits of land sparing and land sharing are potentially comparable in the plantations we studied. In real landscapes, land-use decision making depends on a variety of factors other than biodiversity conservation (e.g., social and biophysical factors), and niche theory predicts that population densities could respond linearly to environmental gradients. When density–intensity relationships are linear or when relative supports of linear and nonlinear models were similar, contrasting land-use strategies would be flexibly chosen to enhance the accommodation of biodiversity conservation to resource production.

p03-006

Landscape factors influencing ardeid species richness, abundance and distribution in Macao

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For herons and egrets (Ardeidae), foraging excursions may be limited to nearby feeding areas or may involve travel over considerably greater distances. Previous study has shown that nesting distributions of herons and egrets, and the extent or quality of wetland feeding areas, are associated with landscape features at larger spatial scales. However, other factors of ecological significance may influence ardeid distribution regionally. To estimate the relationships between ardeids and their habitat landscape features, we surveyed all the colony sites of herons and egrets within 30 km^2 of Macao, including feeding and nesting areas, and selected landscape indices related to nesting and foraging behavior. A total of 12 ardeid species were recorded in Macao over 3 years. Their habitats there can be divided into three types--nesting, feeding and roosting--by seven landscape indices using CCA ordination. This approach presented a convenient method of distinguishing habitat use by ardeids at the landscape level. Both species richness (r_{12}=0.676, P=0.016) and abundance (r_{12}=0.664, P=0.018) were positively correlated with landscape area. Fractal Dimension Index (r_{12}=-0.586, P=0.045) and Perimeter-Area Ratio (r_{12}=-0.782, P=0.003) were each negative for species richness, suggesting that most ardeids preferred relatively large and simple-shaped habitat. Analysis of co-occurrence among all species showed a high Standardized Effect Size (SES) (=1.57) using the checkerboard index, indicating ardeids were randomly assembled, but showed aggregation trends in their spatial associations. While the low SES (=-1.12) of nesting species using the C-score index also indicated random distribution, summer breeders and residents still exhibited a weakly negative co-occurrence pattern. Given that the largest nesting site and all the feeding sites occurred in a single reclamation area named Cotai, conservation plans should keep this area wide open so that herons and egrets can fly undisturbed between nesting and feeding habitats.

p03-007

Altitudinal variation in the richness and capture rate of birds in the Atlantic Forest, Rio de Janeiro, Brazil

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The Atlantic Forest is an excellent biome for studies on altitudinal patterns of distribution because its altitude ranges from sea level to 2,890 meters, and it has one of the highest levels of biodiversity and endemism on the planet. This study evaluated altitudinal differences in richness, capture rates, and trophic levels of understory birds in the central highlands of the state of Rio de Janeiro, Brazil. We sampled the understory birds at 170, 370, 570, 770 and 1,000m altitudes (July/2010-July/2012). We used capture-mark-recapture with 10 mist nets (12 x 2.5m, 32mm mesh) exposed for 7 hours/day at each altitude, with a total sampling effort of 6,300 net-hours. We recorded 95 bird species (1,030 individuals), including 53% of the Atlantic Forest endemics (n=50). The families most represented were Furnariidae, Thamnophilidae and Trochilidae. The highest capture rate was at 370m and highest richness at 770m. There were statistically significant differences in richness ($F_{4,90}$=10.29; $p<0.01$) and capture rate (H=28.90; df=4; $p<0.01$) between 170 m (lower richness and capture rate) and the other altitudes. The dominant trophic categories were insectivores (n=44) and insectivores/frugivores (n=20). Significant differences were seen between altitudes in the richness of insectivores, insectivores/frugivores and nectarivores, and in the capture rates of granivores, insectivores, insectivores/frugivores and omnivores. The diversity and large number of endemic bird species of the area underscore the importance of the region to protect the Atlantic Forest avifauna.

p03-008

Using Inexpensive satellite images and long-term census data to evaluate the evolution of habitat selection

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Ornithology is a discipline famous for having a large amount of long-term data of population and community dynamics. However, not many studies have used those long-term data in an evolutionary perspective. In recent years, free satellite images of the past 25 years have become available for examining relationships between longitudinal data of avian population dynamics and surrounding environmental and landscape changes. The combination of avian census data and land use maps recreated from the satellite images for 25 years enables observation of some evolutionary trends on bird species behavior. To examine changes in habitat selection strategies, we used satellite images and long-term data of colony locations of herons and egrets that breed in Ibaraki, Japan. We created land use maps using Landsat satellite images of the past 25 years, corrected them radiometrically and atmospherically and then applied a supervised classification, using a classification trees algorithm to obtain different land uses of the region. Then we constructed models to predict colony-sites with the random forest algorithm; a classification algorithm using multitude of decision trees as training time and outputting the mode of classes output by each tree. We examined changes of the habitat selection strategy in terms of the scale of selection and the importance of the different land uses. Colony site selection is a collective decision making process. The observed differences among years could be a first sign of evolutionary changes in the collective behavior of herons and egrets in the changing environment.

p03-010

Avian community responses to hydrological disturbance: climate change implications

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River flows are a major driver of morphological structure and community dynamics in riverine landscapes. As river flows are coupled closely to atmospheric drivers, shifts in precipitation patterns will lead to the creation of novel flow regimes characterised by an increase in the frequency and intensity of both floods and droughts in certain regions. This will exert strong selective pressures over aquatic and riparian fauna and flora by removing species sensitive to variation and restructuring food networks. River birds are sensitive to spatial and phenological mismatches with aquatic prey following flow disturbances. However, the role of flow as a driver of riparian ecological structure remains poorly quantified. This limits current understanding of potential climate-induced shifts in river flows on avian taxa. In this study we assess the ecological significance of river-flow variability on avian populations in riparian corridors. We develop an analytical framework that couples long-term hydrological data with national bird survey data from the British Trust for Ornithology's (BTO's) Waterways Breeding Bird Survey (WBBS). Species showed complex but biologically interpretable associations with hydrological parameters, with some species showing an affinity or aversion to measures of variability around flood and drought frequency and duration depending on ecological traits. Our findings indicate that hydrological disturbance can structure the distribution of species at high trophic levels in riparian food webs and demonstrate the potential vulnerability of river birds to the impacts of changing flow variability. We discuss the need to include river flow data in climate change impact models of species' distributions.

p03-011

Factors responsible for population decreases in native species– a case of *Acridotheres cristatellus* in Taiwan

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Invasive species threaten native biodiversity, but are they the only one to blame? In Singapore, Australia and other places, starlings like *Acridotheres tristis* and *Acridotheres javanicus*, have become invasive species, affecting the survival of native species. In the 1970s, *A. tristis* and *A. javanicus* were introduced into Taiwan and experienced an ongoing population increase. Meanwhile, populations of the native myna species *Acridotheres cristatellus* continue to decline after 2000. It is generally considered that the decrease of *A. cristatellus* is due to competition with the alien mynas. However, direct evidence of competition between these mynas has not yet been determined. Furthermore, recent observations suggest that habitat preferences may differ between native and alien mynas. In the Taipei metropolitan area where the 3 species coexist, *A. tristis* and *A. javanicus* were common in most urban parks, but *A. cristatellus* were found only in parks located within woodland dominated landscapes. The importance of woodland coverage as a habitat requirement was proposed to be a crucial point to explain the different population densities between the native and alien mynas species. In this study, we aim to answer the following questions: 1. Is the proportion of woodland in *A. cristatellus* home range higher than in the alien mynas? 2. Does the temporal change of woodlands area match the population change of *A. cristatellus*? Research results will verify whether or not that habitat loss is an important factor causing the decline of the native myna. Moreover, it will be an important reference for conservation of *A. cristatellus*, which have been classified as an endangered species in Taiwan.

p03-012

Urban ecology in the Tokyo metropolitan area: spatiotemporal change of avian diversity during four decades

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The world is becoming increasingly urban. Rapid urbanization around the world causes a major change of the regional biodiversity and it leads to a global change. Thus, it is urgent to clarify the change of biodiversity with urbanization and its causes. Urbanization often causes the loss and modification of habitat for many birds, changes in the water cycle, the increase of pollution (e.g., water, air, and soil), soil compression, and the reduction of ecosystem services. On the other hand, there are abundant resources (e.g., water availability, organic material), high productivity, and moderate climates in urbanized cities. In this study, we show the spatiotemporal change in an avian community along a gradient of urbanization in the highly-urbanized city of Tokyo, Japan. Firstly, we will report on temporal changes for the past four decades. The bird census was conducted during breeding seasons using the line transect method in about 300 study sites (1 × 1 km) across Tokyo. Secondly, we will report on spatial changes in the avian community across Tokyo. Especially, we show the relationship between avian biodiversity and landscape mosaics (e.g., green spaces, urban parks, and built-up environments). Finally, we will discuss the urban avian community and the loss of biodiversity based on our results.

p03-013

Area dependent relative breeding densities in two competing species: Varied Tit *Parus varius* and Great Tit *P. major* in Korea

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Competition for limiting resources, which determine fitness, has important evolutionary effects. As a result of interspecific competition, competing species may use different resources and habitats. In Korea, Varied Tit and Great Tit are predominant species and compete with each other. In general, the Varied Tit is regarded as a forest interior species, and Great Tit as a forest generalist. In addition, Varied Tits live in large green patches, but the Great Tit is ubiquitous including urban areas. Therefore, the two competing species may differ in habitat preference at the landscape level. In other words, Varied Tits may be more abundant in larger forests than smaller forests and Great Tits may have no preference if other factors are fixed. Here, we hypothesize that the relative density of Varied Tits to Great Tits will increase when forest size increases. We used occupancy data of nest boxes as indirect relative breeding densities of the two tit species (ratio = the number of nests occupied by Varied Tit / the sum of nests occupied by Varied Tit and Great Tit). As expected, the relative breeding densities of Varied Tit to Great Tit increased when areas increased. The relationship between relative breeding density and area was log-linear: log (ratio+1) = 0.0729 log (area (km^2) +1) + 0.0647. Therefore, area sensitivity of birds may be a result of interspecific competition.

p03-014

Effects of urban green patch characteristics and landscape structure on *Dendrocopos major* and *Dendrocopos kizuki* distribution

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Increased urbanization typically leads to a reduction in forest bird habitat. Woodpecker species prefer specific forest habitat, which are particularly sensitive to fragmentation, probably due to their high habitat specificity. We compared the distribution of Great Spotted Woodpecker (GSW) with Pygmy Woodpecker (PW) depending on urban green patch characteristic and landscape structure. Abundance data was collected during the breeding season from April to July 2012 at 45 urban parks and remnant forests in Seoul and surrounding cities. The Random Forests data mining technique was applied to develop the prediction model. Results showed that the area and vegetation coverage of natural habitat were important factors in the distribution of the two woodpeckers. Predicted occurrences of both woodpecker species decreased with increasing distance to roads. Connectivity with surrounding green patches was a significant factor in explaining the distribution of PW, however it did not affect that of GSW. Among landscape factors, local habitat structure and quality were important factors in the distribution of GSW, however landscape connectivity was an important factor in that of PW. To conserve two dominant woodpeckers in urban landscapes, management for intra-patch and inter-patch levels should be considered simultaneously considering the ecological traits of each woodpecker. This work was supported by the Korea Research Foundation Grant funded by the Korean Government (No. 2011-0024289)

p03-015

Living with the enemy: does Honey Buzzard *Pernis apivorus* select its nest-site to avoid predation by Goshawk *Accipiter gentilis*?

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Preferences for nest-sites in birds of prey have presumably evolved in relation to (i) local habitat resources and/or (ii) interspecific interactions. The selection of a suitable nest-site is essential for successful reproduction. In eastern Austria, the importance of these two components in the nest-site selection of the Eurasian Honey Buzzard *Pernis apivorus* was tested in two different study areas, the mixed fragmented coniferous forests in southern Burgenland and the extensive deciduous forests along the Danube in Lower Austria. In each area, macro- and micro-habitat features were compared between nest-sites and randomly selected plots. Interestingly, there was almost no difference between nest-sites and random plots. This suggests that the Honey Buzzard does not appear to base its choice of nest-site on habitat considerations. It was remarkable that nests were placed significantly further away from Northern Goshawk nests than random plots. The Goshawk is the main predator of other medium-sized raptors like Honey Buzzards. However, data from both study sites show that predation was higher in territories that were closer to a breeding pair of Goshawks. No such effect was found for breeding Common Buzzards (*Buteo buteo*), who are not dangerous for the Honey Buzzard. Buzzards only interfere with Honey Buzzards when they are defending their nesting area. No habitat variable correlated significantly with the loss of young. We conclude that although Honey Buzzards have a clear preference for forests, their choice of nest-sites appears to be made largely to avoid intra-guild predators.

p03-016

The effect of abandoned paddy fields on Japanese Yellow Bunting (*Emberiza sulphurata*) in mountainous regions

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The Japanese Yellow Bunting is a summer visitor and breeds only in central and northern parts of Japan. The bunting may select habitat intensively because it has a very limited distribution in Japan (especially Niigata, Nagano and Iwate pref.). It lives in edge of secondary growth forest and bush around mountain streams and marshland in low altitude mountains.

In Niigata prefecture, the buntings have a dense population around streams with slopes in low mountains especially in heavy snowfall regions. People used to use these lands as rice crops. However recently a number of paddy fields have been abandoned and become reed beds caused by succession.

The increase in abandoned paddy fields affects birds that live in and around paddies. Some of them lose their foraging sites, for example Intermediate Egret *Ardea intermedia* and Grey-faced Buzzard *Butastur indicus*. However distribution of the bunting tends to extend in Niigata and there is a possibility that abandoned paddies like marshes provide the buntings with good habitats. We conducted a study along seven streams (500m) and classified land use around the stream (cultivated: 3 sites, abandoned: 2, other: 2) and investigated the relationship between the number of singing male bunting and type of land use.

The mean number of singing males found in May to June 2013 had a tendency to be greater in the abandoned paddy (cultivated: 2.38±1.2 SD, abandoned: 3.20±1.9 SD, other: 1.83±1.1 SD). We will analyze the number of singing male and the area of land use type and discuss the relation between Japanese Yellow Buntings and abandoned paddies.

p03-017

A fine scale examination of stopover habitat use by buntings during spring and autumn migration on an East Asian flyway

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Many migratory birds have generally different strategies of stopover habitat use between spring and autumn migration. The different purpose of migration between both seasons is well known to influence arrival patterns of passerine migrants on the stopover site. Some buntings on the East Asian flyway cross the Yellow Sea from SE China and stop over on Heuksan-do Island, which is one of the first islands of Korea that birds land. These birds may have a stronger pressure for refueling energy and speed up the return migration in spring. Therefore, we expect most buntings on this stopover site to be concentrated on the most efficient foraging grounds in spring, whereas they show less specificity in habitat use because of less pressure on the migration timing in autumn. We aimed to determine differences in stopover habitat selection between spring and autumn and biases in capture frequency among the habitat types of buntings using mist-nets during spring and autumn migration in 2011 and 2012. We used 6 mist-nets (12m long x 2.6m high, 30mm) located at least 30m apart in wetland areas near the coastal line and classified them into 3 habitat types after measuring vegetation structure at the fine scale. As a result, more than 65% of the buntings (more than 70% of them were males) have been captured at the ground cover which is the dominant type in spring. All studied bunting species showed similar patterns of habitat use in spring, whereas in autumn they showed different patterns of habitat use in each species and no difference in capture frequency among the habitat types. We conclude that the fine scale vegetation structure can affect spatial distribution of buntings at a stopover site, and the birds differ in their dependency on habitat types between migration seasons.

p03-018

Assessment of habitat selection and the effects of anthropogenic disturbance upon Pallas's Fish Eagle (*Haliaeetus leucoryphus*) in Mongolia

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Pallas's Fish Eagle (*Haliaeetus leucoryphus*) is a globally vulnerable species with a declining population trend. The species depends upon freshwater sources, such as rivers and wetlands, for foraging and breeding habitat. However, wetland habitat is disappearing and Mongolia's migrant population of Pallas's Fish Eagle is declining. Human disturbances, such as hydroelectric dams, are also potential conservation concerns. The study assessed Pallas's Fish Eagle habitat landscape features, including vegetation composition and freshwater availability, throughout Mongolia. Investigators surveyed from June to August 2013. Twenty-six GPS coordinates were collected for observed Pallas's Fish Eagles in Arkhangai and Byankhongor; the coordinates' distance from the nearest freshwater source and anthropogenic disturbance were estimated with Google Earth. In addition, a 10 m transect line with ten 1x1 m subplots was utilized to evaluate vegetation composition for each observation point. Habitat data at each eagle observations' nearest anthropogenic disturbances (ie. tourist camps) and random locations within 15 km of the sighting were collected in a manner identical to the previously described methods. The presence of potential prey species, such as Brandt's Vole (*Lasiopodomys brandtii*), or competitive mesocarnivores, such as the Corsac Fox (*Vulpes corsac*), was recorded for species assemblage analysis. Pallas's Fish Eagle selected habitat data were compared to randomly collected habitat data to assess the value of each landscape feature. In addition, selected habitat data were compared to disturbance data to determine if Pallas's Fish Eagles are avoiding potential habitat due to human influences. Preliminary analysis exhibits a distinct avoidance of people and the areas they regularly inhabit. Furthermore, the presence of Brandt's Voles and an array of mesocarnivores may directly impact habitat occupation. The project will provide a baseline study for future conservation studies and protective legislation.

p03-019

The role of mixed species flocks in community assembly and elevational ranges of tropical birds

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In any tropical habitat, whether it be lowland or mid-high elevation forest, one of the most fascinating and complex highlights of bird communities are mixed species flocks. Flocks are a common and prominent feature of bird communities and are used by up to one quarter of forest tropical bird species. Previous studies of lowland mixed species flocks have documented cohesive groups that exhibit high long-term stability, sometimes over decades. By comparison, studies of mid-elevation flocks have suggested a more dynamic structure, but such studies tend to be less comprehensive or anecdotal. The stability of mid- and high-elevational flocks, and the importance of ecological relationships among flocking participants in tropical montane communities is still poorly understood.
We studied mixed flocks along an elevational gradient stretching from lowland rain forest to treeline (400-3400 m) on the eastern slope of the Andes in Manu National Park, Peru. We integrated data from flock observations, occurrence within and outside of flocks and elevational ranges of species to address two topics that have long been neglected in tropical bird communities. First, we describe how mixed species flocks change in composition and stability with elevation. Second, we test the hypothesis that elevational ranges of permanent, or obligate, flocking species are constrained by interspecific associations in flocks. Our observations of mixed-species flocks showed that, like lowlands flocks, mid- and high-elevation flocks are diverse and cohesive multi-species groups composed of both obligate species, as well as species that opportunistically join flocks. Moreover, the ecological dependency of obligate species on mixed-species flocks may constrain elevational ranges of some permanent flocking species.

p03-021

A proposal to calculate basic nutrient units from waterfowl and estimating the amount of nutrient transport from waterfowl by process analysis

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Most wildfowl overwintering in Japan come and go between roosting places and feeding places because they feed on plants on the shore or in the water and roost on the water. They input nutrition by excretion, to roost ponds from feeding places, and it is easily predicted they play a role in the eutrophication at their roosting ponds. Recently, it has been reported that in roosting areas the nutrition from waterfowl has a negative effect on water quality. Therefore, it is important to calculate or predict the amount of nutrient transport from waterfowl. In this study, we tried to calculate basic nutrient units from waterfowl in roosting water per one kilogram, as can be applied to areas with different species composition of waterfowl. First, we calculated the excreted nutrient amount per 1 kg waterfowl per day (LI) by the nutrient content and amount of excretion. Second, the amount to be reflected in the water quality in practice (U) is computed by multiplying LI by the decomposition rate of excretions in water. Last, the total nutrient transport in the roosting area has been accumulated from U, Total Waterfowl Weight (TWW) and residence time (RTF). We made a comparison between the calculation results and the measured values, and found no significant differences. For future work, it is necessary to perform additional comparisons and refine the calculations of each parameter. However this method of estimating nutrient transport from waterfowl by process analysis is useful, since the amount of nutrient transport can be calculated quickly by the number of waterfowl, stay period (TWW) and the residence time (RTF) in each body of water.

p03-022

Temporal gradient of prey availability and shorebird breeding phenology in the Nearctic

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Responses to climate change have been shown to vary across functional groups and trophic levels, which can cause decoupling of biological interactions or a 'phenological mismatch'. Recent studies that have tested the phenological mismatch hypothesis are limited to 1) model systems and 2) small spatial scales with a single breeding population. In this study, we examined timing of hatching in shorebird communities in response to the environmental constraints at a regional scale. At five Nearctic breeding sites along the coast of Alaska and Canada, nests of six small shorebird species (N = 1671; Semipalmated Sandpiper (*Calidris pusilla*), Western Sandpiper (*C. mauri*), Dunlin (*C. alpina*), Pectoral Sandpiper (*C. melanotos*), Red Phalarope (*Phalaropus fulicarius*), and Red-necked Phalarope (*P. lobatus*)) were surveyed daily and the abundance of invertebrate prey were surveyed every three days during 2010 - 2012. Ordination analysis showed that the invertebrate community composition was similar among five study sites. The most abundant prey source was Chironomidae (midges) at all sites, followed by Araneae, Brachycera and Carabidae. The timing of initial increase in the Chironomidae abundance coincides with the onset of hatching for all shorebird species at most sites. However, the peak hatching of the shorebirds preceded the peak prey abundance by up to 15 days, indicating that the hatching is likely mistimed for maximal food abundance. We defined the degree of phenological mismatch at individual level as the temporal difference between the date of food peak and the date when food requirements are greatest for the shorebird young (i.e. five days after hatching). We found geographic variation in the degree of phenological mismatch among five sites and also found inter-species variation within each site. We will discuss patterns of variation in phenological mismatch among shorebird communities and its potential causes as well as its implications for declining shorebird populations.

p03-024

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Modeling wintering habitat distribution of a migratory raptor, the Oriental Honey-Buzzard, based on satellite tracking data in West Java Indonesia

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Knowledge of the wintering habitats of migratory raptors is a prerequisite to understanding their wintering ecology and managing their habitats. Oriental Honey Buzzards (OHBs, *Pernis ptilorhynchus*) are migratory raptors with wintering grounds in Indonesia. OHBs' wintering habitats can be divided into core and edge habitats with unique landscape characteristics, which influence wintering site selection. OHB migrate very long distances from the breeding sites in Japan to Southeast Asia as the wintering sites. Nowadays, satellite tracking of migratory raptors is a powerful research tool to provide the migration route, stop over and wintering habitat data. A total of 56 OHBs have been satellite-tracked since 2003 and most of them visited Borneo as wintering habitat. Only 2 OHBs been tracked have used Java Island as their wintering site. Limited information of their wintering habitat in Java Island is making the management of habitat conservation of OHBs quite problematic. Therefore the information regarding the distribution of wintering habitat of OHB in Java is really required since the habitat destruction in Java is very high. This study aims to model the distribution of wintering habitat of OHB in West Java and simultaneously identifies the environmental variable which is characterized the wintering habitat selection of OHB. This study was conducted in Talaga Bodas and surrounding areas, West Java. The main methodology used in this study is combining satellite-tracking data of OHB as the presence sites data by environmental variables using logistic regression. From 18 environmental variables, only 7 variables were detected as important variable for characterizing the distribution of wintering habitat. Wintering habitat distribution was predominantly influenced by slope 25%-40%, elevation 0-100 m, elevation 100-300 m, elevation >1000 m, the nearest distance to forest, paddy field and water body.

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p03-026

Avian guilds of tropical rainforest disturbed by logging

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This study was carried out in Paragominas (Pará), at the Roberto Bauch Forest Management Center. Pará state produces more than 50% of wood in Brazil, affecting populations of wildlife and vegetation. Fieldwork was conducted from October 2010 to April 2011 during dry and wet seasons in six areas that had been logged at different times: 1997, 2000, 2003, 2006 and 2009, and in a non-logged area. We conducted six fixed width (50 m) 15-min. point counts per transect; 6 transects per area. Thirteen guilds were registered but only twelve were represented in all sampled areas. Frugivores were the most abundant guild (108 species) without a difference in richness between areas; thus, we confirmed that frugivore birds are not intolerant to changes in forest structure. Mid-level and canopy insectivores were the second guild with highest abundance and also did not show a difference between areas. Understorey army ant-followers are the most specialized guild and had lowest richness in the 2003 logged area and non-logged area due to forest management activities and natural disturbances, and had the highest richness in the 2000 and 2006 logged areas due to their location around a forest matrix and lowest logging intensity; thus, we confirmed that understorey specialists are affected by natural and human disturbances. Understorey insectivores and nectarivores had the highest richness in 2000 logged area (19 and 9 species, respectively) followed by 2009 logged area (17 and 9 species, respectively). The non-logged area had the lowest richness for those guilds (7 and 3 species, respectively) due to forest management activities and natural disturbances. Mid-level nectarivores had a constant richness between all sampled areas, showing the highest tolerance to changes in the forest structure. These results of guilds behavior are strongly supported by similar results in neotropical forests by different researchers.

p03-027

Diet of the passerine assemblage in the southernmost forests of the world, Omora Park, Cape Horn, Chile (55° S, 67° W)

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Bird communities of the temperate forests of South America have been researched mostly in short-term studies, and have focused on bird censuses in the summer months and in the temperate region rather than the sub-Antarctic region (>47°S). In this study we overcome these four biases, filling a significant gap in ornithological information by providing the results of a long-term ornithological study (2000-2014), examining the feeding ecology and its seasonal variations in the southernmost forests of the world at Omora Park (55°S 67°W) in the UNESCO Cape Horn Biosphere Reserve. This paper focuses on the diet of forest passerines to examine seasonal variations and the degree of generalization of the diet in these forests which are significantly poorer in food resources as compared to lower latitude ones within the biome of South American temperate forests.

We analyzed feces from 14 species of passerines captured with mist-nets and banded between January 2000 and 2013. The seeds were determined to species level and the arthropod to order level based on reference collections. A 100% of the examined species consumed arthropods. Five species consumed only arthropods, and nine also included plants. Insect orders included: Diptera (43%), Coleoptera (27%), Hemiptera (11%), Hymenoptera (10%), Homoptera (4%), Neuroptera (3%), Lepidoptera (2%), Arachnids (8%), and not-identified arthropods (33%). The seeds and plant debris belonged to five species: *Drymis winterii* (10%), *Ribes magellanicus* (2%), *Berberis buxifolia* (3%), *Maitenus magellanica* (1%), *M. disticha* (1%) and plant remains not-identified (28%).

The consumption ratio of insects versus fruits and seeds is significantly higher than ratios recorded for passerine assemblages at lower latitudes in Chile. The higher incidence of insects in the diet of the sub-Antarctic forest birds could be related to the high diversity and abundance of flies and beetles that contrasts with the short period of ripe fruits availability at these austral latitudes.

p03-028

Patterns of bird functional diversity on land-bridge island fragments

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Habitat fragmentation is widely recognized as one of the greatest threats to global biodiversity as reduced habitat area and increased isolation almost invariably lead to rapid decline in local species richness and/or to increased extinction risk of remnant populations. The loss of species diversity due to habitat fragmentation has been extensively studied. In contrast, the impacts of habitat fragmentation on functional diversity remains relatively poorly understood. We conducted bird functional diversity studies on a set of 41 recently isolated land-bridge islands in the Thousand Island Lake, China. We analysed differences in bird species richness and a recently developed suite of complementary functional diversity indices (FRic, volume of functional space occupied; FEve, evenness of abundance distribution in the functional trait space; FDiv, divergence in the distribution of abundance in the trait volume) across different gradients (island area and isolation). We found no correlations between FRic and FEve or FEve and FDiv, but negative correlations between FRic and FDiv. As predicted, island area accounted for most of the variation in bird species richness, whereas isolation explained most of the variation in species evenness (decreasing species evenness with increasing isolation). Functional diversity appears to be more strongly influenced by habitat filtering as opposed to limiting similarity. More specifically, across all islands, both FRic and FEve were significantly lower than expected for randomly assembled communities, but FDiv showed no clear patterns. FRic increased with island area, FEve decreased with island area and FDiv showed no clear patterns.

Our finding that FEve decreases with island area at TIL may indicate low functional stability on such islands, and as such large islands and habitat patches may deserve extra attention and/or protection. These results help to demonstrate the importance of considering the effects of fragmentation on functional diversity in habitat management and reserve design plans.

p03-029

Temperate bird–flower interactions as entangled mutualistic and antagonistic sub-networks: importance of plastic feeding behaviours of birds

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In a community, individual species are simultaneously positioned in various types of interactions. Therefore, various types of interaction networks are present and entangled within the community. The ways in which different network types are merged and entangled, and the variations in network structures between different sympatric networks, require full elucidation for revealing community stability. To solve these problems, we focused on the interaction between birds and flowers of temperate plants in Japan, where flower-feeding birds are mainly generalist passerines, acting as pollinators and predators of flowers. Analysing flower-feeding episodes of birds, obtained by long-term volunteer monitoring in Kanagawa prefecture, we constructed the whole network (WN) between birds and plants, decomposing the network into mutualistic and antagonistic sub-networks (MS and AS, respectively). We investigated structural properties of the three networks using representative network metrics, and species-level characteristics of the main flower-feeding birds. Our results demonstrate that WN comprises entangled MS and AS, sharing considerable proportions of bird and plant assemblages. We found distinctive differences in the network structural properties between the two sub-networks. In comparison with AS, MS had lower numbers of bird and plant species, showed lower network-level specialisation (H_2') and modularity (M) and exhibited higher nestedness (WNODF). In WN, the Japanese White-eye *Zosterops japonicus* had most flower-feeding episodes, followed by the Brown-eared Bulbul *Microscelis amaurotis*. While the white-eye acted as legitimate pollinator for most plants, the bulbul showed large plasticity in feeding behaviour and acted as both pollinator and predator for diverse flowers. The pattern of feeding behaviour of the bulbul was largely defined by flower size and plant origin. Our results highlight that understanding the interaction type for each species pair and considering the behavioural plasticity of animals are crucial for elucidating structures of integrated interaction networks.

p03-030

Do owls play a role as ecological engineer for insect communities in tree cavities?

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Tree cavities play an important role in forest biodiversity as a separate habitat. The unique community situated within tree cavities, using plant derived material (i.e., litter and rotten wood) and water as base resources, has been well studied. Birds and mammals use tree cavities as nests or roosts and leave nest materials, feces and leftover foods. However the effects of their usage on the tree cavity were not studied. Especially, we took notice of owls because owls do not clean their nests, leaving a large amount of feces. This may change the a-biotic environment and community structure of tree cavities significantly. Examining the above prediction, we put up 156 nest boxes especially designed for owls, with wood chips of broad-leaved trees laid on the bottom as a base resource, with the aim of compare the a-biotic environment and community structure between used and unused cavities in chronological order (shortly after fledging to 4 months after). Our result showed that 1) owl usage makes wood chips laid on the bottom highly alkalic (about pH 8.8-10) and increases humidity (about 40.3-47.3%) immediately after fledging up to one month later. Two months after fledging, the pH score of wood chips returns to neutrality but humidity was maintained. In contrast, the environment of unused nest boxes was stable (neutral pH and low humidity). 2) In used nest boxes, insects which adapt to the alkali environment and forage on feces and leftover foods dominated immediately after fledging up to one month later. After two months, wood decomposing insects dominated the nest boxes. On the other hand, unused nest boxes were inhabited by wood decomposing insects all through the study period but the number and species diversity were low compared with used nest boxes. From these results, we conclude that usage by owls dramatically changed the environment inside nest boxes and the community structure of insects in nest boxes. In other words, we suggested the possibility that owls play an important role as ecological engineer by affecting community structure in tree cavities.

p03-031

The fauna and vertical distribution of birds in Mount Qomolangma National Nature Reserve

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From October 2010 to October 2012 (126 days), a line transect method combined with interviews has been adopted during seven individual surveys to explore the bird fauna of Qomolangma National Nature Reserve (QNNR). Based on the historical records and our results, 390 bird species, belonging to 62 families and 18 Orders, have been confirmed. Our results indicate that QNNR plays a vital and unique role in bird species preservation and scientific study, especially for the endemic and endangered species. Although the species richness of birds originating from the Palearctic realm and Oriental realm were only slightly different, with 164 and 178 species respectively, the species differences between the northern and southern flank of QNNR were remarkable. The northern flank was characterized with enriched endemic plateau species and a small total number of species, whereas the southern flank showed a complex composition and much more abundant species. Moreover, on the southern flank, the peak of breeding bird richness occurred at 2 500-3 100 m.a.s.l., supporting the mid-domain effect hypothesis. Meanwhile, as the elevation increased, the richness of Oriental species decreased, and that of Palearctic species showed the opposite. The percentages of Oriental and Palearctic species were similar at 3 100-4 000 m a.s.l.. Accordingly, we estimated that the boundary between Oriental realm and Palearctic realm was at 3 100-4 000 m a.s.l., and the species invasion from Palearctic to Oriental realm was more obvious than the other way round. Moreover, the specific distribution patterns of bird species along vertical gradients also indicated their corresponding adaptation strategies.

p03-032

Estimating bird species composition and habitat characteristics in urban green spaces in Tokyo

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Thanks to the Convention on Biological Diversity Conference of the Parties being held in Japan in 2010 and other such events, efforts in consideration of biodiversity by Japanese corporations have increased in recent years. Creating an environment that allows coexistence with animals in urban areas is underway, for instance by installing nest boxes for birds around large-scale redevelopment buildings. A typical effort in consideration of biodiversity in urban area would also be to create green spaces available to animals, and such a movement seems to increase in the future. However, we need knowledge and solutions clarifying how we should take advantage of limited green spaces, because studies which evaluate urban green spaces as habitats for animals in Japan are limited. Therefore, by focusing on birds which are often considered as an indicator of biodiversity, we conducted a study aiming to determine factors influencing bird composition and habitat characteristics in urban green spaces based on the relationship between the occurrences of urban birds, the vegetation and surrounding land uses.
We investigated occurrences of birds by using point counts in 14 urban green spaces, such as public open spaces and rooftops owned by private companies and ward offices in Tokyo during two years. Bird species richness and species composition were estimated by modelling species occurrence and their detectability. Additionally, we measured vegetation parameters at these study sites such as tree height, species composition, green area at each hierarchy of tree and green coverage rates around the site and estimated the factors influencing bird species composition and habitat characteristics in urban green spaces by using multivariate statistics.

p03-034

Effects of vegetation modification due to high deer density on breeding bird communities in Oku-Nikko, Japan

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We aimed to assess the effects of vegetation modification caused by deer on birds. We examined the effects of deer density on vegetation modification and the relationship between the species composition of bird communities and the vegetation structure in 3 areas (8 plots/area) with different deer densities in Oku-Nikko, central Japan. The number of living trees, number of tree species, and basal area of living trees decreased significantly with an increase in deer density, suggesting that deer density contributes to vegetation modification. Using TWINSPAN, the 24 plots were divided into groups A (high deer-density) and B (low deer-density) and 32 bird species were divided into groups 1–4. Bird species with a preference for open habitats tended to belong to group 1 and were observed primarily in group A plots. Bird species with a preference for foraging in shrubs tended to belong to group 4 and were observed primarily in group B plots. Tree-hole nesting birds tended to belong to group 2 or group 3 and were observed equally in group A and group B plots. Discriminant analysis indicated that the plot classification by TWINSPAN could be interpreted according to the number of shrub trees, sub-canopy trees, and shrub species. These results indicate that vegetation modification because of high deer density may contribute to changes in the species composition of bird communities.

p03-035

Shinto shrines and Buddhist temples provide different habitats for birds living in Japanese cities

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Biodiversity conservation in urban areas is an important issue because it can help maintain regional biodiversity and promote human sustainability. The importance of this issue is increasing because urban areas expand with the increase in the human population. Urban green spaces are important habitats for city-dwelling birds. In Japanese cities, many green spaces are on the properties of shrines and temples. Shrines are places to worship Shinto gods, whereas the temples are places to worship Buddha. Shinto and Buddhism have been coexisting relatively harmoniously since the 6th century and are the two major religions in Japan. Most Japanese people believe somewhat in both of them. These two religions are different, leading to certain differences in shrines and temples. For example, shrines are separately located throughout the cities, whereas Buddhist temples are often placed together, a relic from the 15th to 18th century intended to function as a defensive wall for a city. Shrines sometimes have huge trees that are considered sacred, whereas temples have graves. Shinto priests usually visit from outside of the shrines, which usually have no residents. In contrast, a Buddhist priest lives in a temple with his or her family and manages the temple. The above differences may be significant for birds. Here, we compared bird species composition between the temples and shrines in Aomori and Iwate prefectures in Northern Japan. We found that the average number of species was not very different, but the total number of species observed in all the shrines was larger than that observed in all the temples. This suggests that each temple provides a similar habitat for birds, whereas each shrine provides a different habitat. Thus, these two religions have roles in providing different habitats for birds in Japanese cities. This work was supported by JSPS KAKENHI Grant Number 23780028.

p03-037

Role of eagles in the flow of salmon-derived nutrients into a terrestrial ecosystem

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Transportation of salmon derived-nutrients by terrestrial animals has been recognized as an important role of riparian ecosystems. However, it is difficult to track such vector animals and confirm the spatial patterns of nutrient inputs to riparian forests. We attempted to develop a behavioral measuring method based on the use of data loggers attached to typical free-ranging large birds in the riparian ecosystem: Steller's Sea Eagle *Haliaeetus pelagicus* and White-Tailed Sea Eagle *H. albicilla*, generally considered salmon feeders. A newly developed time-scheduled release system was used for eagles. The system releases data loggers from the eagles and allows the loggers to be retrieved via VHF radio signals. Recapture of the eagles is therefore not necessary. Measurement of body movement using acceleration data loggers was carried out in order to provide information about the detailed behavior of eagles while GPS loggers recorded their locations. The activity of eagles was classified into 5 behavioral groups. Though shapes of acceleration profiles during feeding and walking seemed to be similar with less periodical cycles, profiles during flapping flight exhibited relatively steady cycles (0.2-0.3 sec) and dynamic fluctuations. Resting (sitting) was distinguished from other behavioral groups as upright posture without motion. Thus, measuring acceleration at high frequency intervals and using a time-scheduled release system with GPS recording can be a powerful tool for monitoring behavior of sea eagles as salmon-nutrient vectors.

p03-038

Habitat selection of Nightjars in a fire-burnt area: changes after 20 years

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Nightjar (*Caprimulgus europaeus*) occurrence in the closed forests of Eurasia is determined by the proximity of open areas, which are used as a foraging sites. In managed forests, these are mainly forest clearings or young forest stands. Fires and other abiotic factors may lead to extensive environmental disturbances , making habitat suitable for Nightjars. Although large-scale forest fires are relatively rare in temperate regions of Europe, in 1992 an extensive fire destroyed 9062 ha of forests near Rudy Raciborskie (southern Poland). As a result of fire and post-fire habitat restoration a large area of homogeneous environment has appeared. The aim of this study was to determine habitat selection of Nightjars on a fire-burnt area. The study compares the habitat parameters for Nightjar breeding territories and randomly selected control points. Survey was conducted in 2003-2004 and 2011-2012. The Nightjar density at fire-burnt areas was higher than in other studied forest habitats, indicating high habitat suitability. In the first period, immediately after forest restoration Nightjars preferred dense and uniform young stands of Scotch pine (*Pinus sylvestris*), avoiding the presence of open areas within the territory. In the second period however, after forest maturation the species' distribution was close to random. Results of this study indicate that avian spatial distribution may be random in homogeneous habitats. The possible explanations for this pattern and the role of the large-scale forest disturbances are discussed.

p03-039

Effects of Hurricane Iris on riparian bird community structure in Belize.

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Hurricanes are frequent and integral features in the Caribbean environment, but limited quantitative data exist on response of bird communities to their influence. Lack of pre-hurricane data in affected areas is the primary factor limiting those studies. We began a study of the riparian birds associated with the Bladen branch of the Monkey River in the Bladen Nature Reserve in southern Belize in February of 2000. Two transects were established, one in old secondary-growth (T1) and one in mature forest that did not appear to have been logged (T2). In October of 2001, Hurricane Iris, a category 4 hurricane with sustained winds of 225 km/hr, passed directly over our study sites, effectively destroying the tropical riparian forest along the two transects we had censused from February to June in 2000 and 2001. Although obviously different, we compared pre-hurricane vegetation data (2001, N = 80 plots) with post-hurricane vegetation data (2002), using a modified James-Shugart method for 21 variables. In 2001, 33 species of migrants and 143 permanent residents occurred on T1 and 28 migrants and 111 residents occurred on T2. After the hurricane in 2002, 34 migrants and 133 residents occurred on T1 and 26 migrant and 122 residents occurred on T2. Although numbers of species are superficially similar between years, relative abundances changed dramatically, with common species becoming rarer and rare species becoming more common. Some species disappeared post-hurricane, while some new species appeared. Significant changes also occurred based on strata a species foraged in, foraging substrate, and diet. The dramatic change from forest to early successional vegetation had an equally dramatic change in the composition of the riparian bird communities.

p03-041

The effects of local- and landscape-scale habitat characteristics and their interaction on wintering waterbirds in lotus fields

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Agricultural wetlands such as rice fields are known to provide habitats for waterbirds in many parts of the world. Although earlier studies have investigated the effect of local- or landscape-scale factors on bird communities separately, few studies have compared the effects of the two factors and their interaction. The objective of our study is to quantify the effects of local habitats (e.g., water depth), landscape characteristics (e.g., proportions of agricultural and forest areas) and their interaction on waterbirds in agricultural wetlands in Japan. We focused on lotus fields that are kept flooded almost year round, providing habitats for waterbirds in winter when most of rice fields are not flooded. In Ibaraki Prefecture, a lot of lotus fields are located in different landscape types (e.g., homogenous agricultural landscapes and agricultural-forest mosaics). We selected approximately 60 lotus fields around Lake Kasumigaura with each field more than 2 km apart to avoid spatial autocorrelation. Field surveys were carried out from late January to middle April 2014. In each field, we recorded bird species, number and location (within the field or at the levee) observed during 5-minute point count surveys. Local habitat variables (e.g., mean water depth and degree of lotus cover) were also measured. Landscape variables (proportions of lotus fields, non-flooded rice fields and forest within a 1-km from each field) were extracted from aerial photographs and vegetation maps on Geographic Information System (GIS). In total, we recorded 14 waterbird species and 15 terrestrial species (277 and 169 individuals, respectively). We expect further analyses of these data will lead to a quantitative evaluation of the effect of local- and landscape-scale factors on waterbirds' use of lotus fields.

p03-043

Insects, climate and winter territories of parids in northern Europe

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In this study we investigated arthropod distribution within the canopy of Scots pine in relation to the distance of the trees from forest lakes. Pine canopy near lakes contained larger arthropods whose biomass was significantly larger than the biomass of arthropods from the pines of the same age growing away from the lakes. In winter, home range size of two species of insectivorous forest birds was smaller near lakes than away from lakes. The increase in the foraging territory may be explained as a compensation for decrease in the profitability of trees, with increasing distance from forest lakes while the reduced arthropod carrying capacity of pines can be explained as a response to temperature-related stress. We found that during the warmest days maximum ambient temperatures were 2.32°C lower near lakes than away from lakes indicating a direct effect of the lake micro-climate on ambient temperatures. Since conifer mortality is best explained by temperature-sensitive carbon starvation, pines near lakes may have more needles, thus carrying larger arthropod biomass. To the best of our knowledge this is the first documentation of the relationship between climate-change related reduction of pine condition and other components of the food web such as arthropods and their predators.

p03-044

Investigating the effects of increasing levels of bushfire frequency on threatened woodland birds in southeastern Australia

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Victoria Australia, with its unique meteorological and biophysical arrangement, is internationally regarded as being one of the most bushfire prone parts of the world. February 2009 wildfire events, whilst not unprecedented, created widespread devastation and greatly affected many people. A subsequent Royal Commission Inquiry recommended that the State implement a program of prescribed burning with a rolling target of 5 percent of public land, effectively doubling the level of prescribed burning annually. Prescribed burning is now carried out all year, with weather conditions being the only limiting factor, not seasonally, as we have seen in the past. This may have major repercussions for biodiversity. Woodland bird species in southeastern Australia are declining. Already negatively impacted by urban development, the effects of climate change on fire regimes are likely to further impact on avifauna. Currently, fire planning holds the view that 'has plants birds will come' or that 'pyrodiversity begets biodiversity' yet few studies have quantified the effects of increasing fire frequency on avifauna. It could be expected that increasing fire frequency would change the species composition and structure of vegetation, which may in turn affect food and nesting site availability for birds. Bird monitoring over two spring/summer seasons and two winters, along with habitat assessments, have been completed on 84 sites in western Victorian woodlands. These 84 sites are nested in 14 site mosaics and have different fire histories. With the completion of the field work, the project now involves testing predictions of the impact of fire on birds and their habitats considering time-since-fire and fire type (planned vs wildfire).

p04-001

Evaluating and improving the reintroduction success of captive-bred Helmeted Honeyeaters

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Reintroduction of captive-bred animals is a key component of many threatened species recovery programs. However, a common concern for many of these programs is that individuals bred in captivity may perform poorly when released to the wild. Here we evaluate the survival and breeding success of several hundred Helmeted Honeyeaters (*Lichenostomus melanops cassidix*) released over a 20 year period, and compare with wild-reared conspecifics in the same populations. This critically endangered bird has an extremely restricted distribution to the east of Melbourne, Australia, and a wild population that currently numbers fewer than 100 individuals. We found that captive-bred birds have lower survival rates, at least over the first three months after release. Radio-tracking of released individuals suggests that predation by raptors is the most important cause of mortality during this early post-release period. Consequently, predator awareness training is underway at Healesville Sanctuary in Victoria that is designed to experimentally assess if the survival of released birds can be improved through pre-release training. This could significantly enhance the breeding program's contribution to the overall recovery effort.

p04-002

What is happening to the Chestnut-cheeked Starlings breeding in Hokkaido?

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Chestnut-cheeked Starlings (*Agrospar philippensis*) breed in central to northern Japan and winter in Southeast Asia. The breeding population of this species in my study area in Sapporo, Hokkaido began to decline around 2007. Between 1994 and 2006, there used to be ten to eighteen breeding pairs. The number declined steadily in the following few years and was reduced to only two pairs or less in 2010-2013. This drastic decrease in the breeding population was accompanied by delayed arrivals. While the first sightings of the Chestnut-cheeked starlings were between April 23 and 29 in the 1994-2007 period, none was observed prior to May 2 after 2008. Most of the arriving breeders appeared exhausted and in poor physical condition during and after the decline. Moreover, the desertion of nests with viable nestlings occurred frequently, a behavior that had never been observed before the decline. As the environment in the study area showed very little change over the 19 years, the decreasing number of breeding Chestnut-cheeked starlings and their delayed arrivals suggest that the environment of their wintering grounds or along their migration routes may have deteriorated considerably.

p04-003

Assessing Black Rail occupancy and habitat along the Texas Gulf Coast

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The Black Rail (*Laterallus jamaicensis*) is one of the most secretive birds in North America, and little is known about the habitat requirements of Black Rails along the Gulf Coast. Anecdotal observations suggest that this species' population has declined during the last century, and wetland surveys document a substantial loss of breeding habitat. We conducted breeding bird surveys to estimate occupancy and detection probability for the Black Rail in estuarine wetlands. Surveys occurred in the Big Boggy, Brazoria, and San Bernard National Wildlife Refuges along the Texas Gulf Coast from April to May of 2013. These surveys served to identify the habitat preferred by breeding birds. We located birds using playback calls, and we recorded the locations of vocalizing individuals. Black Rails were located in two habitat types: salty prairie and high salt marsh. Habitats known to contain Black Rails will be surveyed more extensively in the spring of 2014 to yield information on how these birds respond to burn regimes, hydrology, vegetation composition, vegetation structure, patch size, and other landscape attributes. This information will be used to determine optimal habitat and management regimes for Black Rails along the Texas Gulf Coast.

p04-004

Modelling the distribution of Henslow's Sparrows (*Ammodramus henslowii*) in eastern North America by the 2050s

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Henslow's Sparrow (*Ammodramus henslowii*) is a declining North American grassland bird. Increasing temperatures, frequent fires, and habitat loss may hasten the decline. Henslow's Sparrow utilizes different geographic areas for breeding and wintering, so it is important to explore how these areas may be affected by a warming climate. We used Maxent, a maximum entropy approach, to predict the potential future distribution of Henslow's Sparrow under various climate change scenarios. An initial model was used to identify the most important ecogeographical variables for the species' distribution. We then used three (A1b, A2, B2) IPCC 4 climate change scenarios to project the range into the 2050s. We found that a combination of temperature seasonality, maximum temperature of the warmest month, mean temperature of the warmest quarter, annual precipitation, and elevation were the most important variables for the distribution of Henslow's Sparrow across North America. The amount of potentially suitable wintering area depended on the amplitude of warming, with the scenario that had the highest emissions increasing the potentially suitable area for wintering habitat while the scenarios with lower emissions resulted in a slight reduction in suitability. Under all scenarios, only a marginal decline was observed in suitable breeding areas. Based on these models, climate change will not strongly affect the Henslow's Sparrow through the 2050s and we suggest that management efforts should focus on maintaining suitable habitat in both the breeding and wintering ranges.

p04-005

The breeding status of *Grus japonensis* in Kushiro Marsh, Japan, and the southeast marsh around Khanka Lake, Russia

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There are two isolated populations of *Grus japonensis* (Japanese or Red-crowned Cranes) in north-eastern Asia: a Japanese resident population in Hokkaido and a continental population migrating from the Amur River basin to the Korean Peninsula and the east coast of China. Although the Japanese population faced a crisis of extinction in the late 19th century due to hunting and habitat destruction, the number of cranes has increased to about 1,400 in 2013, primarily due to artificial feeding in winter. Along with this population growth, however, death by traffic accidents is recently increasing, and population sizes are approaching carrying capacities in both breeding and wintering habitats. Therefore, it is important to verify the species' breeding status for sustainable conservation of the population. In the spring of 2013, we conducted aerial surveys to assess the breeding status of the species in Kushiro Marsh in Japan (KMJ) and the southeast marsh around Khanka Lake in Russia (KLR). In these surveys, a few researchers boarding small aircraft searched and took photos of the cranes. As a result, 45 breeding pairs were found in KMJ, and 33 pairs in KLR. The area of KMJ was about 210km^2 and that of KLR was estimated at 590km^2. Therefore, the density of breeding pairs in KMJ was more than triple to that in KLR. This difference in density is probably due to environmental factors such as vegetation, food availability and topography.

p04-007

The current status of the Emerald Dove at the northern end of their range, on Miyakojima Island, Japan

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The Emerald Dove, a species that occurs on the Sakishima Islands in southwestern Japan, has been designated as a natural monument and an Endangered Species in Japan, and is ranked as a Least Concern species on the IUCN Red List. Despite the fact that the dove population was believed to be small until the first half of the 1990s in Japan, since then the Japanese population appears to be increasing; however, the population size has yet to be quantified. Our study of dove populations was initiated in 1999 on Miyakojima Island, located at the northern limit of the range of this species. Little information related to the status and breeding ecology of the dove is available either on the island or on the mainland of Japan. From April to July, 2013, roadside censuses conducted on Miyakojima Island recorded 49 individual singing males in our study site (1.2 km^2). It was impossible to determine the number of breeding pairs from this data because song sites in each male did not always correspond to their nesting location. Males may have multiple singing positions. Mean nest height was about 2 m above the ground (range1–5 m) and 19 of 37 nests were constructed on branches of *Calophyllum inophyllum*. Sometimes a new nest was constructed on top of an old nest; both male and female were involved in incubation and brooding. Males and females shared incubation duties by staying on the nest in the daytime and at night, respectively. All pairs had two-egg clutches, although breeding success, measured as the fledging of at least one nestling, was only 33 % (4/12). Five out of eight nests failed because of predation by feral cats, weasels, *Rattus* spp., Jungle Crows, and snakes, and predation was the main cause of nest failure.

p04-008

Seasonal distribution of Green Peafowl *Pavo muticus*, Linnaeus 1766, in Wiang Lor Wildlife Sanctuary,Chun District, Phayao Province

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The Green Peafowl research in Thailand is very limited, particularly in natural habitat. Studies of seasonal distribution and habitat types of Green Peafowl (*Pavo muticus*, Linnaeus 1766) were conducted in Wiang Lor Wildlife Sanctuary, Chun District, Phayao Province. Seasonal distribution was surveyed based on a grid system covering a 2.5 x 3 square kilometer area, containing 100 square meter sub grids. Each sub grid was visited once a month. Numbers of Green Peafowl, group size, sex, age, and tracts (foot prints, feathers, feces and calling) were recorded. The positions of Green Peafowl and forest types were recorded by global positioning system (GPS). The study in the dry season (March-May 2013) showed that the Green Peafowl was most frequently observed in dry-dipterocarp forest (52.38%) along a mountain ridge, where the males establish their territories and display to attract the females. The second habitat used was mixed-deciduous forest (34.92 %) distributed around a water reservoir. This forest type has dense groundcover that could provide food resources such as seeding plants, arthropods and small invertebrates. The habitats that were used in low frequency by the Green Peafowl were agricultural areas (9.52%) and secondary forest (3.17%), respectively, because the Green Peafowl used the secondary forest as a temporary habitat before access to agricultural area for seed foraging. Finally, the distribution of the Green Peafowl in the wet season will be studied further.

p04-010

Current status of Little Tern *Sternula albifrons* in North East Europe: regional population productivity, threats, migration routes and conservation priorities

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The Little Tern *Sternula albifrons,* Pallas 1764 is a widespread but patchily distributed summer visitor to much of Europe with its status evaluated as declining. The recent European breeding population is rather small (<55,000 pairs; *BirdLife International, 2013; downloaded from http://www.birdlife.org on 07/10/2013).* The species is listed in the Directive 2009/147/EC of the European Union since most regional populations are decreasing (BirdLife International 2004; Scarton 2010). Within recent decades the population has declined mostly because of its poor breeding success, which has resulted from a combination of natural and human-related factors. Because of their specific nesting habitat preference, coastal breeding populations are potentially at risk from rising sea levels (Scarton 2010). In these circumstances mainland populations can be of high species conservation value. In 2014 we are planning to start a joint Japanese-Lithuanian applied research project on the ecology of the Little Tern in North East Europe. The project will continue for the next several years. The main research topics will be as follows: local population productivity, factors contributing to the low productivity (predation of chicks and eggs; nest loss due to flooding; food shortage; disturbance by humans, etc.); study of migrating routes and movement phenology. The use of geolocators will make it possible to map their migrating routes and to study movement phenology. We are planning to use the MK5090 model geolocators. 30 adult individuals will be supplied with this ultra light equipment (up to 1.2 g weight) in 2014. The birds will be captured in breeding colonies on the mainland.
We will report on the methods used and some of the results.

p04-011

Records of the Spoon-billed Sandpiper in Japan: what do they tell us for conservation?

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The migratory flyway including waterbird breeding sites in the northern Arctic and non-breeding sites in southern East Asia and Oceania is called the East Asia - Australasian Flyway (EAAF). More than fifty million migratory waterbirds of over 250 different populations use this flyway, including 28 globally threatened species (Delany and Scott, 2006). Among these, the Spoon-billed Sandpiper (*Eurynorhynchus pygmeus*) is one of the most threatened. Previous observations indicated that records of Spoon-billed Sandpiper are distributed throughout the Japanese Archipelago. However, 1) the spatial distribution of these records varies across the Japanese Archipelago, 2) an analysis of habitat preference inferred from sighting records based on clear data is still lacking. These insights should contribute to the understanding of the ecology of the species, and its conservation in Japan.

p04-012

Comparision of abundance and status of Indian Peafowl *Pavo cristatus* in restored and unrestored areas in Delhi, India

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Due to mining activities in the past, Delhi has lost its native biodiversity over the years. To restore the vanished natural heritage of the ridge area of the Delhi, the government has started restoration work and established Aravalli Biodiversity Park. Indian Peafowl was selected for the comparision of restored and unrestored areas of the park as it is the world's largest pheasant species and the national bird of India. Six different transects of varying lengths were laid (3 in each area) and monitored twice i.e morning and evening for one year. A total of 789 individuals of peafowl were sighted during the period and the overall density was 2.01 individuals/ ha (95% CI = 0.45-3.02). The overall mean group size of peafowl was 1.25±1.07. Habitat plays an important role in the distribution of peafowl and it was found largely in high tree canopy cover, grass cover and low shrub cover in the biodiversity park.The study showed that peafowl were found in a clumped population in the area and they were encountered more in restored areas than unrestored areas. During the study, many nests were also found only in the restored area. The higher encounter of chicks in the restored area showed the preference of this particular habitat by peafowl in the park. Because the park is surrounded by human habitation, peafowl are facing problems of stray dogs and the forced feeding habit of locals. An awareness programme is required for walkers and residents in surrounding localities regarding conservation of peafowl and its habitat. Positive results clearly indicated that further restoration of unrestored areas of the biodiversity park will conserve the peafowl in an effective manner. Much longer–termed research is necessary to understand the restoration effect on peafowl status.

p04-013

Diversity and conservation of pheasants in the Qilian Mountains at the Northeastern Tibetan Plateau

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The Qilian Mountains are one of the main areas of pheasant distribution in the Qinghai–Tibet Plateau. The Chinese Grouse (*Tetrastes sewerzowi*), Monal Partridge (*Tetraophasis*), Tibetan Partridge (*Perdix hodgsoniae*), and Tibetan Snow Cock (*Tetraogallus tibetanus*) are endemic species in this plateau. The two subspecies of the Blood Pheasant (*Ithaginis cruentus*) and one subspecies of the Common Pheasant (*Phasianus colchicus satsheuensis*) are endemic in the Qilian Mountains, and these animals require significant protection. Six species are protected by law in China, accounting for 55% of pheasants in the Qilian Mountains. The Chinese Grouse and Monal Partridge are listed as class I protected species, whereas the other species belong to class II. Several grazing partridges such as the snow cocks (*Tetraogallus himalayensis* and *Tetraogallus tibetanus*) and Chukar Partridge (*Alectoris chukar*) are currently under threat because of insufficient precipitation and grasslands. Pheasant diversity was formed within a complex multidimensional space through changes in vegetation, niche differentiation, and ecological isolation at the Qilian Mountains.

Key words pheasants, protection, Qilian Mountains

p04-014

The Hornbill Triangle (HoT): securing a future for hornbills in large forest complexes of Southern Thailand and North Peninsular Malaysia

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Hornbills are some of the most iconic forest birds in Asia, where 32 species (out of 57 recognised globally) are known to occur. However, many hornbill species across their distributional ranges are threatened with extinction and their populations are declining (some rapidly) primarily due to the loss and/or degradation of its forest habitats, poaching and/or hunting. Within Asia, south-east Asian countries primarily Thailand, Indonesia, Malaysia, Myanmar and the Philippines collectively support the highest diversity of hornbills (10-13 species per country). The Hornbill Triangle (HoT) consists of three large forest complexes that are located contiguously or in close proximity with each other i.e. Belum-Temengor (ca. 320,000 ha) and Greater Ulu Muda Forest Complexes (ca. 160,000 ha) in north Peninsular Malaysia and Bang Lang National Park-Hala-Bala Wildlife Sanctuary (93,375 ha) in southern Thailand. Individually, these three sites have the highest diversity of hornbills *per site* globally as 10 hornbill species have been recorded to occur within its forests. Furthermore, the HoT is also the southernmost stronghold for the globally threatened Plain-pouched Hornbills *Aceros subruficollis* where up to 3,000 individuals have been counted during their non-breeding months (July-September). Therefore, it is vital that the HoT receives adequate conservation attention. On the Malaysian side, the Malaysian Nature Society (MNS) has spearheaded the call to protect and conserve the Belum-Temengor Forest Complex since the 1990s with a series of scientific expeditions. In 2004, the MNS Hornbill Conservation Project was established specifically to advocate for the protection of the forest complex through hornbill research, stakeholder engagements and collaborations and CEPA (communication, education, participation and awareness) activities. I will highlight in more detail the significance of the HoT, the achievements to date and discuss future conservation actions needed in order to maintain the integrity of the HoT and its hornbill populations.

p04-015

Where are the most important areas for Galliformes of conservation concern in the Greater Himalayas, and are they represented in the current protected area network?

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The uneven spatial distribution of both anthropogenic threats and galliform biodiversity makes site-specific prioritization of scarce conservation resources in the Greater Himalayas a necessity. However, our knowledge of species distributions is incomplete and different aspects of biodiversity can be valued in different ways, making it difficult to produce a coherent regional conservation strategy. This study combines niche modelling and a site prioritization method to identify important areas for the conservation of Galliformes in the Greater Himalayas. Maximum Entropy software was used to model the environmental niches for 23 species of Galliformes based on non-systematically collected presence-only data (2377 records from 1980 to the present day). The results of these models were used to identify high-value sites using a multi-species, complementarity-based prioritization method called 'Zonation'. In order to identify important areas for species of conservation concern, we incorporated different weighting schemes within our zonation analyses based on IUCN Red List category, endemism to the Himalayas, phylogenetic distinctiveness and a measure of range decline. We compared the results of our weighted analyses to a basic, non-weighted analysis and identified areas of overlap. Finally, we assessed how well the existing protected area network captured galliform diversity, revealing that on average the current network fails to capture 10% of this diversity in comparison to the optimal solution. Our results emphasize the importance of North West India, Central Bhutan and the North Eastern India/Southern China border for Galliformes of conservation concern regardless of conservation metric. Galliform species are reasonably well-represented within the current protected area network, which suggests that enforcing legislation within rather than expanding the network would be a better use of conservation resources.

p04-016

Importance of Chihuahuan desert grasslands in the population limitation of North American grassland birds

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Breeding populations of North American grassland birds have significantly declined during the last 60 years. Many hypotheses for these declines implicate the extensive anthropogenic transformation of breeding habitat throughout the Great Plains during the 20th century. Most grassland birds converge in the Chihuahuan Desert of northern Mexico and southwestern United States during winter. However, the ecological processes that may be driving the documented population declines during the winter have been often neglected. To address these information gaps, we conducted bird surveys in desert grasslands across the Chihuahuan Desert from 2007-2013 and characterized the abundance and distribution of migratory grassland birds during the winter. We also investigated the factors affecting overwinter survival using radiotelemetry. In addition, we measured the loss of winter habitat through remote sensing. Migratory grassland bird communities throughout the Chihuahuan Desert are characterized by the dominance of a few species although their composition can be highly variable between years. Grassland bird distribution during winter is associated to the distribution of precipitation and vegetation growth during the previous summer. Several of the most steeply declining species are strongly associated with low-slope grasslands with low amounts of shrub cover. Estimated daily winter survival of vesper sparrows (*Pooecetes gramineus*) (99.1%) suggests that only 25% of birds survive through the winter. Winter survival is positively associated with grass vegetation height, suggesting of that the prevailing tendency to overgraze the winter grounds may contribute to high winter mortality. Recent grassland conversion to farmland irrigated by newly tapped aquifers has destroyed more than 70,000 ha of grasslands in central Chihuahua since 2006, threatening the elimination of low-slope grasslands within a few decades. Decreasing habitat availability and quality and low survival rates suggest strong population limitation during the winter, which may be further exacerbated by projected increased aridity for the Chihuahuan Desert during the 21st century.

p04-017

Hotspot analysis of Taiwanese breeding birds to determine gaps in the protected areas network

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Although Taiwan is an important hotspot of avian endemism, efforts to use available distributional information for conservation analyses are so far incomplete. For the first time, we present a hotspot analysis of those Taiwanese breeding birds with sufficient sampling coverage for distribution modeling. Furthermore, we improved upon previous modeling efforts by combining several of the most reliable modeling techniques to build an ensemble model for each species. These species maps were added together to generate hotspot maps using the following criteria: total species richness, endemic species richness, threatened species richness, and rare species richness. We then proceeded to use these hotspot maps to determine the 5% most species-rich grid cells (1) within the entire island of Taiwan and (2) within the entire island of Taiwan but outside of protected areas. Almost all of the species richness and hotspot analyses revealed that mountainous regions of Taiwan hold most of Taiwan's avian biodiversity. The single substantial unprotected region which was consistently highlighted as an important avian hotspot is a large area of unprotected mountains in Taiwan's northeast (mountain regions around Nan-ao) which should become a high priority for future fieldwork and conservation efforts. In contrast, other unprotected areas of high conservation value were just spatial extensions of areas already protected in the central and southern mountains. To combine the results of our four hotspot criteria, we assessed which grid cells were the most valuable according to all four criteria. Again, we found the Nan-ao mountain regions to be important. We also showed that different hotspot criteria only partially overlapped and sometimes barely at all. Therefore, to protect areas based on only one hotspot criterion (e.g., total species richness) would not protect areas based on other hotspot criteria (e.g., endemic species richness, threatened species richness, or rare species richness) in Taiwan.

p04-018

A new atlas of Mauritanian birds pinpoints areas of high species richness, endemism and complementarity

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The last Mauritanian bird atlas was published by Bruno Lamarche in 1988. We therefore are working on a new bird atlas for Mauritania which will bring together mostly new data gathered since then, collated from publications, much unpublished data provided by various field ornithologists and birdwatchers, our own field work and Mauritania's new checklist (2010), co-authored by P. Browne. Our database now contains > 60000 locality records of almost all species mentioned in the checklist. Using the program BIOMOD (https://r-forge.r-project.org/projects/biomod/) and GIS-based environmental data layers of Mauritania, we used these records to build predictive distribution maps for all species with sample sizes > 10. Using the AUC evaluation criterion, we selected the three best models and combined them into an ensemble distribution map for each species. First, we combined these individual species maps into species richness maps which showed, as expected, areas of high species richness in southern Mauritania and along the coast, with the Banc d'Arguin being a species richness hotspot. Second, endemic hotspots are also found along the coast line, but also in the hilly interior (e.g., Hodh El Gharbi, Tiris Zemmour). Third, we selected complementarity sites for protection using MARXAN (www.uq.edu.au/marxan/), which prioritized areas other than areas selected based purely on species richness or endemism. Not all of these areas overlap with BirdLife's Important Bird Areas, which again demonstrates that different selection criteria lead to different areas being prioritized. We hope that this effort will fill a long-standing gap in African ornithology and inform local, regional and continental conservation efforts.

p04-019

Conservation prioritization improved by a measurement of fragmentation

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Endangered species occur across the world, and often due to anthropogenic threats. Conservation of species is highly determined by suitable habitat. Considering that habitat loss can be efficiently quantified, applying our knowledge of available habitat with our more limited understanding of dispersal gives an idea of connectivity necessary for long term persistence. Birds in particular can be highly mobile creatures, more able to 'connect' their landscapes to fulfill their requirements than other animals. Metapopulation capacity is a fragmentation persistence measurement that allows for the prioritization of specific species and their most important habitat patches. The measurement is particularly useful in comparing within a species or within a region of focus, but an improved understanding of movement ability can overcome this restriction. Furthermore, this can be combined with phylogenetic rarity as an additional criterion for prioritization. The incorporation of this measurement can have multiple applications for global conservation, such as through the EDGE programme or the IUCN Red List.

p04-020

The Red List of Migratory Birds of Germany – Rationale, methods and implications

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A new Red List of Migratory Birds was created, based on a classification system developed in Germany for all organismic groups. The rationale, aims, classification methodology and criteria of this Red List are outlined. It represents an extension of the existing threat assessment of breeding birds to encompass all periods of the year. The assessment is based on four main criteria, population size, short-term and long-term population trends, and "threat factors" (thus differing slightly from IUCN).
Due to insufficient data, some had to be gathered using expert opinion, either by literature research or by a Delphi procedure. All 511 German bird species were classified. Of the 279 regularly migratory species, 26 were subdivided, yielding a total of 305 taxa assessed in the red-listing process. Of these taxa, 71 were assigned a Red List category, a further 31 were declining and Near Threatened. Thus, one third of all regularly migratory bird taxa in Germany were considered threatened or of conservation concern, its proportion being particularly high in long-distance migrants and birds of agricultural areas.
Two independent threat assessments shall now be used in evaluating conservation status of birds in Germany, accounting for the manifold threats the birds are faced with throughout the year's cycle. Improving our attendance to the strong connectivity of all life-history stages will have strong implications for the prioritization of future conservation action within and beyond the boundaries of our country. We argue that the interconnectedness of habitats and ecological functions require comprehensive conservation action across many sites and regions. Thus, the classification system presented here could give further impulses to bird conservation at the level of existing (or required) international conventions, directives and treaties.

p04-021

Long-term waterfowl population monitoring of South-Eastern Russia: results, overview and conservation issues

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Most threatened taxa of migratory waterfowl are largely confined to East Asia. Many species that are experiencing severe deterioration of their habitats in the southern sectors of the East Asian-Australasian Flyway can potentially meet the natural refuges in more intact landscapes and wetlands of south-eastern Russia. Nevertheless, hydropower development on the main left tributaries of the Amur River, extensive oil and gas industry facilities in eastern Russia, and other economic activities cause the substantial reduction of wildfowl ranges both in breeding and migration seasons. The sharpest population declines during the last decades were documented for Baer's Pochard (*Aythya baeri*), Falcated Teal (*Anas falcata*), Swan Goose (*Anser cygnoides*) and Greylag Goose (*Anser anser*). The group of proliferating species includes Mandarin Duck (*Aix galericulata*), Common Pochard (*Aythya ferina)*, Great Cormorant (*Phalacrocorax carbo*), Great Crested (*Podiceps cristatus*) and Little Grebes (*Tachybaptus ruficollis*). Human use of wildfowl is paradoxical in the region as some principal species among ducks that are in fact hunted are often officially protected, such as the Baikal Teal (*Anas formosa*), Falcated Teal or Mandarin Duck. Appropriate habitats are used by waterfowl disproportionally to availability and the potential ecological capacity of the surveyed wetlands for these birds is larger than the realized one. The overview of waterfowl species conservation and study in the region entitled is a subject of our consideration and the case of 30 years of targeted waterfowl monitoring in Khingansky Nature Reserve is presented and thoroughly examined.

p04-022

Population trends of grassland birds in Hokkaido, focussing on the vanishing of Yellow-breasted Bunting

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To examine the population trends of grassland birds in Hokkaido, we conducted line transect censuses in 2002 and 2003, where avifaunal studies were performed in the 1970s and 1980s. By comparing the data of two periods, we found that populations of four species of grassland birds, Brown Shrike *Lanius cristatus*, Eurasian Skylark *Alauda arvensis*, Lanceolated Grasshopper Warbler *Locustella lanceolata*, and Yellow-breasted Bunting *Emberiza aureola*, were in decline. The declines of the Yellow-breasted Buntings and Brown Shrikes were severe, whereas the declines of the Eurasian Skylark and Lanceolated Grasshopper Warbler were less so. According to bird-watching event data, Yellow-breasted Buntings were relatively common until 1992. Its disappearance started in 1993 and has expanded gradually, and population sizes are still declining. Most census routes in this study were located in areas designated as protected before the old survey was conducted, and there were no large artificial disturbances in the breeding site. It is not clear why the populations of these four species are declining. Future research focussing on breeding behaviour, migratory pattern, including determination of wintering and stopover sites, and population trends and environmental studies on these sites are necessary to understand the decline of these populations.

p04-023

The plight of fish-eating birds: Cormorants and endangered salmonids in western North America

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In much of the world, aquatic systems have experienced substantial anthropogenic modification and native fish of ecological, economic, or cultural value have become highly imperiled. Due to ever-increasing human populations, resource managers often have few habitat-based options to enhance, or even maintain, these fish populations. In parallel, generalist cormorant species are often conspicuous consumers of juvenile fish of human interest, and cormorant population recovery from DDT-era lows has sometimes created a public perception that cormorant numbers are at unprecedented levels. Consequently, management to reduce cormorant predation on valued fish is frequently undertaken; cormorant population control or reduction is a common approach. In western North America, double-crested cormorants (*Phalacrocorax auritus*) have largely escaped such management due to a relatively small population (ca. 31,500 breeding pairs spread across the western third of the continent) and demographic isolation from the much larger and intensively managed population in eastern North America. Much of the recent recovery of this species in western North America, however, has occurred at a single, large colony in the Columbia River estuary, shared by Oregon and Washington states. Predation by cormorants from this single colony (~13,000 breeding pairs) has been documented to be a significant mortality factor for Columbia River salmonid populations listed under the U.S. Endangered Species Act, in some years inducing 15-20% mortality rates on juvenile salmonids migrating through the estuary. Consequently, resource managers are considering options to reduce predation by cormorants on salmonids at this location. Even in regions with relatively modest populations of piscivorous birds, prey fish populations are so commonly at conservation risk that piscivorous bird concentrations (e.g., large colonies) are likely to come into conflict. In this context, colonial waterbird conservation that promotes many small colonies may sustain more stable and publicly acceptable regional populations than would reliance on a few larger colonies.

p04-024

Status of 20 birds of conservation concern in US Fish & Wildlife Service Region 6

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US Fish and Wildlife Service (USFWS) Region 6 Region 6 includes the states of North Dakota, South Dakota, Montana, Wyoming, Colorado, Utah, Nebraska, and Kansas. This area is subject to multiple stressors including habitat fragmentation, conversion and destruction, energy development, and climate change that could potentially affect status and trends of the avifauna of this region. Consequently, the USFWS needs to be able to assess the population status and relative vulnerabilities of nongame bird species, particularly species of conservation concern. Twenty species from USFWS Region 6, with a diverse array of habitats and life histories, were selected and concise species accounts developed. The goal of this report was to create a synopsis on the status and relative vulnerabilities of each of these twenty species by summarizing data from the literature, as well analyzing data from the Breeding Bird Survey and the Christmas Bird Count. The resulting précis is an easy-to-follow summary of the status of twenty birds of conservation concern in USFWS Region 6 that can be used to help assess the impacts of increased direct take.

p04-026

Assessing the change in land bird abundance in Korea

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Understanding the change in abundance of species is important to develop conservation and management schemes. However, limited resources have often disabled species-specific monitoring programs, and thus country-wide surveys are more often adopted to assess the general pattern of changes in environmental conditions rather than in abundance changes. In the Republic of Korea, where the biodiversity is rapidly declining as the economy grows, no quantitative estimate on avian abundance changes, in particular on land bird changes, has been made. Due to the lack of quantitative information hampering direct abundance estimates, we used the occupancy estimation modeling to assess the change in abundance of 24 representative land bird species in the Republic of Korea based on the data of the 'Nationwide Surveys on Natural Environments' from 1997-2011. Our results identified significant changes in abundance that were previously unknown for several land bird species ; for instance, Forest Wagtails (*Dendronanthus indicus*), Brown Shrikes (*Lanius cristatus*), and Lesser Cuckoos (*Cuculus poliocephalus*) have markedly declined while Eurasian Kestrels (*Falco tinunculus*), Eurasian Hobbies (*Falco subbuteo*), and Japanese Wagtails (*Motacilla grandis*) have increased. We suggest that these results should be considered and applied to species action plan developments and to further managements for conservation.

p04-027

Ten years of Fairy Pitta monitoring in western Taiwan: population changes 2004 – 2013

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The Fairy Pitta (*Pitta nympha*) is currently listed as a vulnerable species in the IUCN red list. It is migratory, breeds in forest habitats of southern Japan, South Korea, southeastern China, and Taiwan, and resides mainly on the island of Borneo in winter. An on-going project, Hushan Reservoir, has been constructed in an important bird area specifically for the Fairy Pitta in western Taiwan. This study analyses the population changes of Fairy Pitta in and nearby Hushan Reservoir during the last ten years. The total monitoring area was 2,650 ha, with 300 ha within the Hushan Reservoir. Bird counts were performed once or twice annually with the help of playback during late April to Mid-May since 2004 in 314 permanent count points which were at least 200 m apart from each other. The trend and index of the Fairy Pitta show that its population has experienced a steep decline during 2004 to 2013. The population decline in the Hushan Reservoir site was as expected because of habitat loss, whereas the population has declined by 60% in areas with no significant habitat change in the same period of time. The results imply that the Hushan reservoir may affect not only the population in the construction site but also the population nearby. Additionally, there is an urgent need to evaluate the population status in all of the Fairy Pitta breeding grounds to clarify whether the decline is a specific case or a general situation.

p04-028

Using remote sensing for the study of the vegetation dynamics of a coastal Mediterranean wetland and its effect on the habitat availability of a threatened passerine

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Wetlands are one of the world's most threatened ecosystems, especially due to the loss or degradation of habitat and the modification of hydrological cycles. These threats drive the most specialist species that live in wetlands to unfavorable conservation status and population trends. In the present study, we examine the integrated use of GIS techniques, field based multi-season maps of habitats and high spatial resolution images (SPOT-5), together with the habitat selection models, for obtaining information about the population dynamics of threatened bird species. As a study species, we chose the Eastern Iberian Reed Bunting (*Emberiza schoeniclus witherbyi*), which has shown strong population declines over the last few decades in Spain. The study area was the Pego-Oliva Wetland, located in the Mediterranean coast of the Iberian Peninsula, where the species has been monitored from 2006 to 2009. We used training regions, based on vegetation field maps, for creating supervised vegetation classification of the SPOT images, obtaining accuracy values higher than 85% for the classification algorithm. After integrating the annual variation of the vegetation with the habitat selection patterns of the Eastern Iberian Reed Bunting and the management measures of the habitat, we observed a general reduction of reed-rush patches (positively selected habitat) and an increase in homogeneous reed patches (negatively selected) for almost all areas of the wetland, related to the abandonment of shepherding techniques and changes in hydrological regimes. These variations were statistically significant at those areas where the species disappeared as breeders. Our study shows the potential of these techniques for detailed *a posteriori* monitoring of the variation of the available habitat for threatened species, with the purpose of establishing management and conservation measures.

p04-029

The Taiwan Breeding Bird Survey

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Monitoring of species populations is crucial to biodiversity conservation. Long-term, large-scale bird monitoring projects have played an important role in bird conservation in Europe and North America, but such surveys were scarce in East Asia, making decisions of conservation strategies more challenging. Here we introduce the Taiwan Breeding Bird Survey (BBS Taiwan), a nation-wide project implemented annually since 2009, aimed at monitoring population status of common breeding birds in Taiwan. With over 300 sites surveyed per year, BBS Taiwan comprehensively covers altitudes from 0 to 4,000m and various habitat types from urban environment to primary forests. Population indices of over 60% of common breeding birds were reported each year, revealing downward population trends of montane forest birds and lowland grassland birds. Even the widely common and well known Eurasian Tree Sparrow (*Passer montanus*) is experiencing a population decline, which is surprising and only detectable by this monitoring project. BBS Taiwan operates with partnerships among non-government organizations, government agencies, and academic institutes. It is also a citizen science project, with participants recruited from birders whom were willing to spend 2 mornings a year to record birds for conservation incentives. The experience of BBS Taiwan may be of useful reference for other regions in East Asia whom were planning to set up large-scale bird monitoring projects.

p04-030

Population status of the Fairy pitta in Taiwan from 2001 to 2013

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The Fairy pitta (*Pitta nympha*) is an IUCN Red Listed vulnerable species that breeds in north-east Asia and winters on Borneo. A large proportion of its breeding population breeds on Taiwan where the species is distributed island-wide in lowland forests. To monitor distribution and population status of breeding Fairy Pitta in Taiwan, five systematic surveys using playback have been conducted from 2001 to 2013. A minimum of 3,000 points were visited for each survey. Here we show the latest 2013 survey results and the population trend for the past 14 years. We estimated a breeding population of c. 10,000 individuals in 2013; half the population size of 2001. The population trend was c. -5% per year, with different regions in Taiwan experiencing different population trends. The northern and central-western regions show the largest decline. These statistics reveal that, despite being listed both internationally and nationally as a conservation priority species, the population of Fairy Pitta remains under continuous threat. Locally, habitat destruction is thought to be the major threat on Taiwan, but the status of wintering habitats might also be of international importance. For a more comprehensive understanding of the population status of Fairy Pitta, projects to survey populations in other breeding regions (such as south-east China) and its wintering sites are recommended.

p04-031

Using distance sampling to assess population restoration methods for two raptor species in south-central England

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In a changing landscape, wild predator populations are often those most frequently at risk. In the UK expanding human populations, associated land-use changes and persecution have all resulted in significant negative impacts on raptor populations. These range from the extirpation of the Red Kite (*Milvus milvus*) from England by the mid-20th century, to a compromising of the status of the once common and widespread Eurasian Kestrel (*Falco tinnunculus*). In an attempt to resolve these issues, two markedly different approaches to population restoration have been attempted for these species in the UK: Red Kites through a series of reintroductions, and kestrels, through provision of nestboxes. Our broader, ongoing objective is to monitor raptor populations in the modified and human-dominated landscape of south-central England. Here, however, we use distance sampling methodologies to provide initial assessments of two methods of population restoration. For Red Kites we explore the seasonal variation and growth in a reintroduced population and for kestrels whether, and how, nest boxes have effected a change in population size. To allow for both of these, our 2280km^2 study area is subdivided into eight, 19 x 15km areas, four treated as 'control' areas and four as 'experimental'. Five, randomly situated 15km transect routes are located within each area and these are walked in the spring and autumn each year. All raptors encountered are recorded using standard distance sampling methodology (using compass, laser rangefinder and gps). After two years of initial surveys, kestrel nest boxes were then installed at suitable locations at ca.3km intervals within the experimental areas (25 boxes per area). Population estimates derived from these transects are then used to provide insights into the rate of population change, the impact of seasonality on generation of estimates for both species and to quantify the impact of nestbox provision on kestrel populations.

p04-032

A niche-based framework to assess current monitoring of European forest birds and guide indicator species' selection

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Concern that European forest biodiversity is depleted and declining has provoked widespread efforts to improve management practices, through mechanisms such as policy change and certification. To assess the success of resultant modifications to management practice in delivering their objectives, appropriate monitoring of forest ecosystems is paramount. Multi-species indicators, often drawn from the bird community, are frequently used to assess the state of biodiversity and its response to implemented management, but generally applicable and objective methodologies for species' selection are lacking. Here we use a niche-based approach for objective species' selection to identify species for inclusion in a pan-European forest bird indicator. This method is underpinned by coarse quantification of resource use, ensuring all resources exploited by the wider community are exploited by at least one species in the indicator. We use this framework to identify the minimum number of species required to deliver full resource coverage and the most sensitive species' combination, and go on to explore the trade-off between two key characteristics, sensitivity and redundancy, associated with indicators comprising different numbers of species. We compare our indicator to an existing forest bird indicator selected on the basis of expert opinion and show it is more representative of the wider community. We also present alternative indicators for regional and forest type specific monitoring and, by comparing indicator sets drawn from currently monitored species and the full forest bird community, use this framework to identify significant gaps in the coverage of the current monitoring scheme. We believe that adopting this niche-based framework for species' selection strongly supports the objective development of multi-species indicators and that it has good potential to be extended to a range of habitats and taxa.

p04-033

Habitat use and factors influencing detection probability of the Nightingale Reed-warbler

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Human activity most negatively affects wildlife populations that are isolated and small, and species that are territorial and behaviorally implastic. One such species is the Nightingale Reed-warbler (*Acrocephalus luscinius*), which is extant on only one island in the Western Pacific. The island, Saipan, is only 115 km^2. Most native habitats on Saipan have been reduced or greatly modified by human activities; these are ongoing and increasing in impact. Habitat modification is believed to be the primary conservation challenge for *A. luscinius*, but specific habitat requirements for the species are not well known. This study used three sources of data (island-wide surveys, surveys of a conservation area dedicated to the species' protection, and land development surveys) to characterize the distribution and compare the relative abundance of *A. luscinius* in various habitat types on Saipan. It also compared the effectiveness of different survey methodologies (visual and aural, with and without playbacks) in these contexts. Findings indicate a surprisingly high occurrence of *A. luscinius* in nonnative and disturbed habitat, and detection probability greatest using aural surveys with playbacks. These results suggest that the species is behaviorally plastic, and that traditionally used survey techniques may underestimate the actual population size. Management implications are discussed.

p04-034

Monitoring the changes in population and phenology of land birds in Japan

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In order to detect the effects of environmental and climate changes on birds, we have studied the population and seasonal activity changes in forest-grassland and Satochi-Satoyama (countryside) ecosystems as parts of "Monitoring Sites 1000" program by the Ministry of the Environment. The breeding and wintering birds have been monitored at one- to five-year intervals by a point count method in the former ecosystem since 2003 (n = 467) and by a route census method since 2008 in the latter (n = 94), respectively. Bird abundance has also been studied in residential areas in the wintering and breeding seasons annually since 2005. The results suggested that the birds of forest understory (Bush Warbler and Siberian Blue Robin) decreased due to the impact of increased deer browsing. In the residential areas, arboreal birds (Brown-eared Bulbul and Japanese White-eye) increased, whereas Large-billed Crows, omnivorous scavengers, decreased because of improved garbage management. The phenology of selected familiar species (e.g. Bush Warbler, Barn Swallow and Daurian Redstart) has been monitored since 2005 based on the initial dates of arriving or singing in their breeding or wintering grounds. The changes of the breeding period of Varied Tits have been monitored by automatic logging of nest box temperatures since 2010. The phenology of forest birds has been monitored since 2010 through automatically recording, and distributing bird songs on the Internet. The results showed that the breeding start of Varied Tits, a year-round resident, was significantly correlated with the accumulated temperature from January to May that influences insect emergence. On the other hand, the arrival date of Barn Swallows at their breeding sites and the peak singing period of Siberian Blue Robins, both of which are summer visitors, were closely correlated to the mean temperatures of the breeding seasons, respectively. The cause of this correlation needs to be determined.

p04-035

The role of citizen scientists in the study of birds in Yogyakarta

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The impact of urbanization on wild birds and other wildlife in Indonesia is little known, due to the lack of a long-term study program on the topics. The limited resources, including limited local researchers and the availability of funding, were considered as the causes of this situation. In the last two decades, bird watching clubs in Indonesia have been growing rapidly. In Jogya, as one of the centers of the growth, twelve birdwatching clubs have been founded and actively watch the wild birds of Yogyakarta. This paper reports on a study of the role of the birdwatchers in the Yogyakarta urban bird monitoring program. In total 267 bird species have been reported in Yogyakarta Special Province, 76 species out of them were urban birds. Some birds, such as Java sparrow, Barn Swallow, Chinese Starling, Barn Owl and Javan Hawk-eagle were routinely monitored using standard methods. However, the monitoring program for other birds is still in the early stage. For that reason we proposed a standarized method for the long-term bird monitoring program of Yogyakarta.

p04-037

Using mark-recapture methods to estimate avian road mortality with a single observer

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Wildlife at Gulf Islands National Seashore in Florida faces mortality due to vehicle collisions on roads running down the center of a barrier island. Opportunistic surveys by Park Service staff have documented varying numbers of carcasses each year, with most being chicks and adults of Least Terns (*Sternula antillarum*), but also beach-nesting Snowy Plovers (*Charadrius nivosus),* other shorebirds, and passerines. Developing methods for accurately quantifying wildlife road mortalities is important for targeting management actions, and for understanding potential regional demographic consequences for these species. Imperfect observer detection, and carcass scavenging and deterioration can hamper accurate counts of wildlife road kills. Most methods for estimating mortality also rely on two observers surveying the same area consecutively to estimate detection rates. We designed a single-observer method that unifies estimation of carcass loss rates and detection rates using a robust capture-mark-recapture population estimator. We supplemented our sample size for scavenging rate estimation by placing 1-day and 10-day old quail carcasses at random points along the road. We surveyed each section of road by car at 10mph twice within 4-hour primary periods to meet the model's assumption of population closure. Species, age, and condition of each carcass were recorded and all carcasses were marked using a GPS unit. During the six-week study, we found 77 shorebird carcasses. Our detection rate for both road passes during vehicle surveys was >0.9 for all weeks. We estimated that we missed four birds during surveys, and an additional 16 birds were killed and scavenged between surveys, for a total estimate of 97 carcasses. Persistence rates for large quail were consistent with those of adult shorebirds. Small quail, however, did not prove to be useful surrogates for shorebird chicks, as they persisted for significantly shorter periods. It is likely that previous non-systematic methods have underestimated road mortality at this site.

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p04-038

Long-term population monitoring and conservation of the Short-tailed Albatross on Torishima, Japan

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The Short-tailed Albatross, *Phoebastria albatrus,* once bred in huge numbers on Torishima, Japan, but feather exploitations during 1887 and 1933 diminished the population and the population was believed extinct in 1949. However, a small number of birds were rediscovered surviving in 1951. Since that time long-term population monitoring and active conservation managements have been undertaken. Because the original colony is on the narrow and steep slope of volcanic ash, it has been subject to frequent erosion and the breeding success was reduced to less than 50%. We managed the nesting habitats through erosion control and grass transplant and improved the breeding success up to around 70%. We also succeeded in establishing a new colony at the erosion-free site on the gentle and wide slope of the island with the use of decoys and sound. This new colony has been growing very rapidly from 4 pairs in 2004 to 122 pairs in 2012 by the immigration of immature birds from the original colony. With the success of these managements, the total breeding population on Torishima increased in numbers from 50 nesting pairs in 1979 to 538 pairs in 2012, almost exponentially at the annual growth rate of 7.55%. The population is predicted to reach 1000 pairs with more than 5000 individuals in 2020. Thus, it would be sure that the Short-tailed Albatross population would re-establish itself on Torishima in the future.

p04-039

Report on an 8-year study on *Spizella wortheni*: what we actually know and future needs

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For several decades it has been believed that *S. wortheni* inhabited only some portion of the Mexican Plateau, specifically small valleys between the states of Coahuila, Nuevo León and Zacatecas, with a reduced population of almost 120 individuals in small groups, with a low breeding success and high rates of predation, supposedly leading to low genetic diversity. Nevertheless, we found an unexpected high genetic diversity and high gene flow between the small studied populations (in Coahuila, Nuevo León and San Luis Potosi), suggesting high mobility in a fragmented landscape. Recent studies have demonstrated that the species is widespread inside of the already known distribution area. A model on the potential distribution in the Mexican Plateau, gives us valuable information. After eight years of investigation we have new data changing the picture of the species; in an exhaustive research on geographic distribution based on the results of a preliminary model niche study, we found a wide distribution, encompassing not only the states already mentioned, but also San Luis Potosí and Aguascalientes, with a total geographic range of approximately 87,765 km^2, and an estimate of over 300 singing males. Other ongoing studies give us novel information about ecology and plasticity of the species, and some of these will be presented.

p04-040

Ten years of water bird counts at the RAMSAR site Lac Tele Community Reserve in the Republic of Congo

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An international counting program of water birds has been conducted to follow up birds in wetland areas. This program started in 1967 under BIROE, currently known as Wetlands International. We collected data during 10 years between 1997 and 2006 at Lac Tele Community Reserve which has a high biodiversity. Positive results were gained for water bird conservation, because, i) a national network for data collection has been implemented; ii) water bird population conservation has been evaluated; iii) the counting protocol follows relevant international conventions ; iv) the program allows to identify threats to water birds in wetland areas ; v) sustainable management of water birds and their habitats can be elaborated with certain recommendations. Also, new species to Congo have been identified both for water birds and terrestrial birds. In total 300 bird species have been counted.

p04-041

Breeding Recovery of Little Egret (*Egretta garzetta*) and Cattle Egret (*Bubulcus ibis*) after the Aceh Tsunami, Indonesia

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Colonies of Little Egret (*Egretta garzetta*) and Cattle Egret (*Bubulcus ibis*) used to breed in the mangroves, near the fish ponds of Tibang village, Syiah Kuala, Banda Aceh district, Indonesia. It is located at 5° 35'5" North and 95° 21'0" East and covers approximately 2 Ha. However, on 26 December 2004 a tsunami destroyed the mangroves; only two bunches of seedlings survived. After the tsunami then, the birds stopped breeding in the area. We report the breeding recovery of these two species. In order to protect the coast, the mangroves were replanted gradually in 2005 and 2006. In 2009 the seedlings that survived the tsunami and new planted seedlings were growing to be young trees; the seedlings that survived the tsunami reached 3-4 m in height and the new planted seedlings were 2-3 m high. In December 2009, both bird species began recolonizing the area. However, bird hunters shot them. So, they stopped their early breeding activities. Soon after that, the guard of the fish ponds located near the growing mangroves chased the hunters and tried to protect the mangroves. After it settled, the colonies returned to the mangroves and began to nest again in February 2010. In April 2010, the number of nests reached 300 and increased to 700 nests in May 2010. These birds had the ability to withstand the catastrophe for 5 years (2004-2009) until the nest trees were again available. They preferred to wait, rather than to move to another place to breed; perhaps due to this preference site that had been used for longtime for breeding area.

p04-042

Effects of agro-environmental management on foraging behaviour and reproductive success of Skylarks (*Alauda arvensis*)

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Agricultural intensification has caused a number of farmland bird species to decline rapidly over the past decades, including the Eurasian skylark *Alauda arvensis*. Many European countries introduced field margin management as a way of enhancing bird populations, but data on the effectiveness of this measure is currently lacking. We studied the effect of field margins on the foraging behaviour and reproductive success of Skylarks breeding on intensively managed farmland in the Netherlands over a period of six years. Field margins were preferred as foraging habitat over all other habitat types, probably due to the higher availability of invertebrate prey. The visiting rate to field margins decreased with increasing distance to the nest, and dropped markedly when the distance between the nest and a field margin exceeded 100 m, emphasizing the importance of establishing field margins close to suitable nesting habitat. Contrary to expectations, the presence of field margins did not improve nestling body condition nor nest survival rates. However, reproductive success was strongly affected by breeding habitat. Nestling condition was poorest in cereals, probably related to the low prey densities in this crop. The main cause of nest loss was the cutting of grass for silage, causing very low nest survival rates in grassland. Reproductive success was highest in lucerne, which combines the advantages of long cutting intervals, suitable vegetation height for breeding, and relatively high prey availability. We conclude that field margins alone are not sufficient to maintain a stable Skylark population in intensively farmed areas. The provisioning of safe nesting habitat throughout the breeding season is essential to improve reproductive success and should be incorporated into the next generation of agro-environment schemes.

p04-043

Rescue programs for injured Japanese birds of prey using falconry techniques and the tracks of recovered birds with GPS-TX

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In Japan, various birds of prey are listed as endangered species. They are under government control with related laws, and there are various conservation activities to improve the situation. Rescue projects for injured birds of prey are also included in the activities. Usually, injured birds are found by the general public, and they are picked up by related authorities such as the department of wildlife in the prefectural office. Then, these birds are carried to suitable institutions that are able to treat them because most authorities do not have the specialists and facilities. The Japan Falconiformes Center (JFC, Member of IAF) has rescued birds at the request of related authorities since 1982 with a falconry technique that was developed in Japan in the 18-19C. Falconry equipment, facilities and technique are useful for the handling, feeding and rehabilitation of birds of prey without the risk of inducing tameness before they are released. Verification of hunting ability in the rehabilitation stage is also important to prevent starvation after release. Medical examination, operations and prescriptions are by the Green Animal Hospital. Recently, 69 birds were brought to the JFC over 5 years (September 2008-August 2013) from Aichi, Gifu, Osaka, and Wakayama prefectures. Nineteen of these birds (28% of birds brought in) were released after recovery. Rescued species were Northern Goshawk (*Accipiter gentilis fujiyamae*), Common Kestrel (*Falco tinnunculus*), Peregrine Falcon (*Falco peregrinus japonensis*), Eurasian Sparrowhawk (*Accipiter nisus*), Common Buzzard (*Buteo buteo*), Black kite (*Milvus migrans*), Osprey (*Pandion haliaetus*), Japanese lesser Sparrowhawk (*Accipiter gularis*) in the order of a large number of cases. If released birds were able to pair for breeding, the rescue would effectively conserve the next generation of the birds of prey. Therefore, we have confirmed the survival of released birds with a new real time GPS tracking system (GPS-TX) by the Mathematical Assist Design Laboratory Institute.

p04-044

Conservation of the critically endangered Chinese Crested Tern: Restoration of a lost breeding colony in the Jiushan Islands

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How to establish a well-protected and intensively-monitored conservation network for wide-ranging endangered species is a big concern of wildlife conservation. The Chinese Crested Tern (CCT, *Thalasseus bernsteini*) is probably the most threatened seabird species in the world. Two islands in the East China Sea are the only known breeding sites, and its total individual number is estimated less than 50. Given the widespread harvest of tern eggs and that most tern breeding colonies along the China coast are unprotected, strict protection of every breeding pair of CCTs is crucial. During April-October 2013, we conducted a crested tern restoration project in the Jiushan Islands National Nature Reserve, which is a historical breeding site for CCTs. We used social attraction techniques, a method that has been successfully used in seabird restoration projects worldwide. We aimed to: (1) test whether social attraction techniques would work on such a critically endangered species as the CCT, (2) test whether social attraction would attract breeding adult CCTs from previously unknown colony sites, and (3) restore a lost breeding colony of CCTs as a first step toward creating a conservation network of breeding sites for the CCT. During the 2013 nesting season up to 2,600 Greater Crested Terns (*T. bergii*) and 19 CCTs were attracted to the small island selected for deployment of social attraction, and many of these terns nested at the new colony site. The success of the restoration attempt, plus data from the other two extant colonies, suggested that there is a previously unknown breeding colony of CCTs somewhere in the East China Sea. Also, our results indicate that it is possible to create more CCT breeding colonies using social attraction techniques, and ultimately to establish a well-protected and intensively-monitored conservation network for CCTs and other breeding seabirds in the East China Sea.

p04-045

The effect of livestock grazing on nest survival of the common redshank (*Tringa totanus)* on Northwestern European salt marshes

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Populations of shorebirds have declined worldwide, and European populations of salt marsh breeding common redshank (*Tringa totanus*) are one such example. Historic declines in Britain were linked to intensification or cessation of grazing, and therefore conservation initiatives have encouraged low intensity grazing. However, populations have continued to decline. We focus on predation and trampling mortality across a range of low intensity grazing scenarios, and ask 'is there a relationship between both the annual intensity of grazing (LSU/ha/year) and the direct presence of cattle during the breeding season (Cattle/ha) on redshank nest mortality?'. Nest survival was recorded over a range of grazing intensities on conservation-managed salt marshes in the Ribble estuary, North-west England. The probability of nest loss to trampling and predation was estimated under a range of low intensity grazing scenarios, and daily nest mortality was calculated. Our results show that grazing increases the risk of a nest being predated from <37% at 0.03 LSU/ha/year to >90% at 0.28 LSU/ha/year. Similarly, our results show that the direct presence of cattle in the breeding season increases the risk of a nest being trampled from <16% at 0.13 cattle/ha to >99% at 0.82 cattle/ha. In conclusion, low intensity conservation grazing of salt marsh reduces nest success in redshank through high rates of nest predation and nest trampling by livestock when carried out at stocking levels considered by conservationists to be light, but trampling risk could be eliminated by commencing grazing at the end of the breeding season. Our work both describes the likely mechanisms behind population declines and suggests that conservation measures implemented on salt marshes have failed because light conservation grazing is too intensive. This work does not recommend stopping grazing on altogether, but suggests research into cattle movement in intertidal grazed landscapes, and changes to the timing and intensity of grazing.

p04-046

Effectiveness of anti-predator training in reintroduction of Greater Rheas

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Reintroduction of captive Greater Rhea can increase wild populations of the species; however, applying this strategy involves high post-release mortality due to predation. An anti-predator training of release candidates is a useful tool for them to recognize predators and be able to escape. The aim of this work was to evaluate the effectiveness of anti-predator training in captive Greater Rheas as well as post-release survival in the wild. Training involved 11 leg-banded individuals that were exposed to a stimulus representing the main wild predator (a taxidermized puma), followed by an aversive stimulus (simulated capture). The control stimulus was an object (a chair) that was harmless to the animal and not associated with the aversive stimulus. Each animal was submitted to five training sessions with each stimulus. Control Greater Rheas (nine individuals) were not exposed to either stimulus. All of the animals were exposed to the predator stimulus 30 and 60 days after the end of training. This stimulus was not paired with the aversive one so that behavioural responses could be compared. These data were collected using focal sampling with continuous recording. The aversive stimulus was unsuccessful, since there were no differences in vigilance and defense behavioural responses between groups. Eight months after release the trained animals did not show survival advantages with respect to controls, since survival was nil in both groups. Only one Greater Rhea was killed by a puma, whereas mortality of the remaining individuals was caused by predators not included in the training sessions, such as poachers and dogs (8 and 10 Greater rheas, respectively). The reasons for training inefficiency may have been the inclusion of only the principal wild predator of Greater Rheas as well as to a possible effect of habituation to humans during captivity.

p04-047

The research on reintroduction of Cabot's Tragopan

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Reintroduction is the ultimate goal of a large number of ex situ conservation projects. Cabot's Tragopan (*Tragopan caboti*) is an endangered pheasant. Reintroduction of Cabot's Tragopan from captivity had been carried out in Taoyuandong National Nature Reserve, China from 2010 to 2011. The program was composed of release area evaluation, acclimation training and post-release monitoring. On the basis of literature analysis, we surveyed the vegetation and sympatric wildlife, and confirmed that Taoyuandong Reserve is suitable for Cabot's Tragopan. We built a soft-release cage, which size is 1300 m^2, in mixed broadleaf-conifer forest at the altitude of 1370 m for acclimation training. Three batches of Cabot's Tragopan were trained in the cage from October 2010 to October 2011, respectively. The acclimation training was mainly for environment adaptation and foraging in the wild. We used instantaneous scan and fecal analysis to study changes of behavior and diet of Cabot's Tragopan. The result showed that the acclimation training ameliorated behavior of Cabot's Tragopan significantly and adapted their diet for plants in the cage. The trained tragopans were released as experimental group and untrained ones as control. By post-release monitoring, we found that the survival rate of the experimental group was rather higher than the control in one month, which was 85.7% in the experimental group while the control was 20.0%. In addition, a survey of the habitat of the experimental and control groups was carried out, and we found significant differences between the two groups. The habitat of the experimental group was similar to wild Cabot's Tragopan. These results show that the survival rate of Cabot's Tragopan is improved significantly after acclimation training.

p04-048

Ecology and conservation of the critically endangered *Cacatua sulphurea abbotti* (Oberholser, 1917) on Masalembo Islands, Indonesia

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The Critically endangered *Cacatua sulphurea abbotti* (Oberholser, 1917) is endemic to Masalembo islands, Indonesia ($5^0$42′ – $5^0$47′ South; $114^0$39′ – $114^0$45′ East). Previously, it occupied two of the Masalembo Islands, which are Masalembo Island and Masakambing Island. However, in the early 1980s the subspecies disappeared from Masalembo Island and currently a remnant population is only found on Masakambing Island. This subspecies of cockatoo is highly threatened by forest conversion and intensive capture. Most part of the islands have been converted to crop plantations, settlement and other infrastructure development. Also, live birds used to be captured for trade and as a gift from community leaders to foreigners. In late 1997, it was reported that the number of birds had decreased sharply and only 5 individuals (including breeding pairs) were left in the wild. In 2008, the Indonesian Parrot Project resurveyed and tried to save the subspecies by studying its ecology, providing awareness and capacity building to the local community, conservation education to the school children and law enforcement. After approximately five years of activities of the Indonesian Parrot Project, in early 2013 the population of this cockatoo subspecies has increased to be 17 individuals. The ability of the cockatoo subspecies to adapt to its disturbed habitat, the involvement of local community to save the bird and local laws for protecting the subspecies will be discussed.

p04-049

Breeding habitat preference and effects of mowing on hunting success of the Gray-Faced Buzzard *Butastur Indicus* in northern Japan

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The Gray-faced Buzzard (*Butastur Indicus*) is a typical migratory raptor species in East Asia. It breeds in northeastern China, the Korean Peninsula, and Japan (except Hokkaido Island) and winters in southwestern Japan and Southeast Asia. The buzzards prefer to breed in the *Satoyama* habitat, which consists of irrigated rice paddies and secondary forests. They nest in mature pines or Japanese cedars and feed on frogs, snakes, insects and a variety of other small animals. Its rapid decrease in population size is a source of concern in Japan. This study was designed to contribute to our understanding of the habitat use of this species in the northern limit of the breeding range. The study area was located in Hanamaki, Iwate Pref., Japan. The survey was conducted from early May until the middle of August, 2007. We used radio-telemetry to estimate home ranges of 4 adult male buzzards during the breeding season and categorized their foraging locations . We also investigated their land use patterns on each point in 7 control areas. Once a week we measured the grass height and vegetation cover at 7 control areas. In the first half of the nestling period, the buzzards hunted among the rice paddies and thereafter in woods mostly. Regardless of the vegetation cover, they preferred hunting in short grass areas. They also preferred cultivated rice paddies where visible prey are easily located, as opposed to abandoned paddies where weeds grow taller. The analyses indicate that vegetation condition affects foraging efficiency. This study has identified requirements for biological conservation of the buzzard as follows: (1) cultivated and weeded rice paddies, (2) woods consisted of broadleaved trees inhabited by frogs and insects, (3) coniferous trees for nesting. This work was supported by Grant-in-Aid for Scientific Research (A) (23241077) & (C) (25450506).

p04-050

Re-introduction of the Endangered Crested Ibis to Dongzhai of Henan Province, China

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The Crested Ibis (*Nipponia nippon*) is one of the most endangered species in East Asia. In the 1980's, the species was thought to be extinct in the wild. However, a small wild population of 7 individuals was found in Yangxian, Shaanxi Province of central China in 1981. With 32 years of conservation effort, the wild population has increased to over 1000 individuals and there is a captive population about 700 in China. From 2004, re-introductions of Crested Ibis were implemented in Yangxian, Ningshan and Tongchuan of Shaanxi Province, respectively. In 2013, a re-introduction was implemented in Dongzhai of Henan province, which was the first attempt outside of Shaanxi Province in China. We will review the conservation status of the species in China, with emphasis on the re-introduction in Dongzhai.

p04-051

The road to the co-existence with Great Cormorants using "Cormorant Management Phase" in accordance with the various progress situation of the damage control.

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As a consequence of the increasing Great Cormorant population, damage to vegetation and inland fisheries have become a serious social problem in Japan. The damage control, population management of cormorants, and conservation of aquatic environments in a water area are promoted according to a specific Wildlife Management Plan in each prefectures unit under the Wildlife Protection and Appropriate Hunting Law. The guideline for designing the Great Cormorant Management Plan was revised in 2013 by the Ministry of the Environment. Because the situation of the damage control of cormorants varies considerably from one region to another, the suitable measures should also be varied. Therefore, in the revised guidelines, the progress situation of the cormorant management in each prefecture is determined by the flow chart, called "Cormorant Management Phase (CMP)", which consists of Phases 1 to 6. An Administrator can easily understand the own phase using "CMP". The appropriate measures for each phase are described in detail in the Guideline. Phase 1 question is "Do you know the population size(s) of cormorants?". Phase 2 is" Do you quantify the damage by Cormorant?" Phase 3 is "Do you have a meeting to build the consensus on the issue of cormorants?". Phase 4 is "Do you have a specific Wildlife Management Plan?". Phase 5 is "Do you need a large-sized population management program?". These questions are given in each phase and if you answered "NO", your prefecture belongs to that question's phase. Especially in Phase 3, the guideline recommends to hold a workshop, called "The Cormorant world café", enabling the stakeholders to build consensus smoothly. As the Great Cormorant is a native species of Japan, Phase 6 is the final goal of this issue; we can co-exist with a moderate-sized cormorant population, which is enough to maintain the local population with an acceptable level of their damages to us.

p04-052

Nest site restoration increases the breeding density of Blue-Tailed Bee-Eaters

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For birds that excavate their own nest burrows, the availability of suitable nest sites and substrates may influence the number and density of breeding birds. However, few studies of burrow-nesting birds have experimentally manipulated nest site or substrate availability. The Blue-tailed Bee-eater (*Merops philippinus*) is a colony breeding, summer migrant that excavates nest burrows in sandy banks on Kinmen Island, 5 km east of mainland China. To test whether substrate availability influenced the density or reproductive success of breeding pairs of bee-eaters, we removed all vegetation and old nest holes on treated slopes and left control slopes unmanipulated in 2003 and 2004. Plant cover on control slopes was 37.7% (11.9–67.7%). Slope gradient, soil penetration resistance and vegetation height in front of slopes did not differ between treated and control slopes in either year. Combining data from both years, the density of active nests was significantly higher (3.1-fold) on treated slopes than on control slopes. However, the reproductive performance of bee-eaters nesting on treated and control slopes did not differ in either year. Thus, removing vegetation and old nest holes from slopes with sandy loam soil improved the breeding habitat and increased the number of breeding Blue-tailed Bee-eaters. This technique could be used to support and manage populations of this species and other burrow-nestling species with similar habitat requirements.

p04-053

How to protect celebrities from paparazzi: Discussing protection of Blakiston's fish owl and wildlife viewing

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Blakiston's Fish Owl (*Ketupa blakistoni*) is endangered throughout its range (EN by IUCN) and the Japanese population (*K. b. blakistoni*) is as low as 40 pairs. The Japanese government is concealing habitat information to prevent disturbance by wildlife viewers; however, information of nesting and feeding sites are spreading widely through the internet. Not only geographical information, but photos and movies of chicks and nests—even using strobe lights near nests—can easily be found on the web. Such viewing and photographing activities raise conservation concerns. Our analysis found that most of the photos and movies on the internet are taken in 4 sites, which are all near a hotel. Of these 4 hotels, 3 feed the owl and advertise themselves through the internet and Facebook as "owl-viewing hotel." Tour operators also use these hotels to organize owl photo-shooting tours lead by self-styled "nature guides." There are no regulations in Japan to prevent such harassment activities. In one spot, the forest agency is fencing a site to block aggressive viewers; however, this has been easily ignored even by "nature guides".

The current situation cannot be overlooked. Business advertisement using inadequate information (photos etc.) of endangered species may also need to be controlled. We are discussing legal (including amending statutes) and non-legal measures to regulate harassment and feeding activities. On the other hand wildlife viewing can be beneficial to conservation if conducted in a proper way. Conservation agencies must look for a way to facilitate proper wildlife viewing rather than just hiding it. This research is funded by Mitsui & Co., Ltd. Environment Fund.

p04-054

Microsatellite analysis of Red-crowned Cranes in Oka Crane Breeding Center and sex ratio of theirs nestlings.

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In Oka Crane Breeding center (OCBC) a breeding program of rare species of cranes is running since 1984. We have analyzed DNA of 10 breeding adult birds of Red-crowned Cranes by 7 microsatellite loci (Hasagava et all . 2000). All seven loci showed a distinct allelic variation ranging from 1–4 alleles. We defined more heterozygous birds in this group.

The analysis of the Red-crowned Crane offspring's sexes demonstrates a female-biased sex ratio; 61 males and 105 females have been obtained from 7 pairs of Red-crowned Cranes at OCBC in the period between 1984 and 2009. We have noted a difference in brood sex ratio of Red-crowned Cranes, Siberian and White -naped Cranes in OCBC. The sex ratio of Red-crowned Crane offspring (disregarding the sex of non-survived embyos) was 0, 3 ± 0,1 (p = 0,00536) while sex ratio of Siberian Crane offspring was 0,49 ± 0,1, and for White -naped Crane 0,44 ± 0,2 . This female-biased sex ratio in Red-crowned Cranes can be probably explained by the Trivers and Willard hypothesis of adaptive sexual investment (Trivers & Willard1973). Red-crowned Cranes may show a higher female chick mortality rate in nature because, as observed in OCBC, female nestlings grow slower and so they are weaker. As the level of chick aggression is notably lower in Red–crowned Cranes compared to SIBERIAN Cranes and rather lower than compared to White-naped Cranes, then the latter two species have often only the elder one chick surviving, and Red-Crowned show more female chick mortality. These observations allow to suppose the hypothesis that Red-crowned Crane have a some physiological- genetic mechanism that provides a female-biased sex ratio in the years when the food resources are abundant.

p04-055

Current status of the Okinawa Woodpecker breeding population

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The Okinawa Woodpecker (OW), one of the world's rarest woodpecker species, inhabits only a narrow area of subtropical evergreen forests called "Yambaru" located in the northern part of Okinawa Island, south-western Japan. Here, I review recent results on the conservation research of OW and report the current status of the breeding population and habitat situation. The breeding range of OW has been restricted to old-growth forests in the central mountain range of Yambaru. In the 20th Century, the area was subjected to deforestation such as due to harvesting, dam-and-road construction, and other agricultural activities. Thus survival of OW has been threatened and it is now ranked CR in IUCN Red List. The OW is a close relative of *Dendrocopos* woodpeckers which are basically arboreal. However, OW's foraging niche is to a large extent situated on the ground. Males in particular frequently forage on the ground, while females remain arboreal. The ground foraging behavior of OW appears to be responsible for the suffering from alien mammal predators (*e.g.*, mongoose and feral cats). In particular, the negative impact of mongoose intrusion into Yambaru area since 1990s seems to be crucial. In the 21st Century, although the scale of deforestation has been significantly reduced, restoration of secondary evergreen forests is still not enough for supplying nest trees for OW. In the secondary forests alien disease and pests (*e.g.*, pine wilt disease and leaf beetles) create dead trees that play an important role for constructing OWs nesting habitat. However, the advantage of the creation of such dead-tree rich forests appears to be only temporal. The government should extend adequate protection for the remnant old-growth forests and provide an effective framework for forest restoration schemes.

p04-056

Does patch-burn grazing management increase abundance and nest survival of declining populations of grassland songbirds?

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Many species of grassland songbirds are declining in population numbers in North America. Ongoing population declines are thought to be related to habitat loss, caused by land-use change and habitat fragmentation, and agricultural intensification. Songbirds often have specific habitat needs for nesting and feeding young, but common management of annual burning and intensive grazing may not meet habitat needs for grassland bird communities, leading to declines in bird diversity and abundance. Patch-burn grazing management is aimed at creating high levels of heterogeneity in vegetative structure. Recent studies have found that patch-burn grazing management increases species diversity of grassland songbirds, improves nest survival in Dickcissels (*Spiza americana*), and decreases parasitism rates by Brown-headed Cowbirds (*Molothrus ater*). It is unclear whether patch-burn grazing has similar effects on the demography of other species or under different environmental conditions.

Our study was conducted at Konza Prairie Biological Station, a tallgrass prairie reserve in northeast Kansas, USA. Between 2011 and 2013, we monitored 149 nests of eight species of declining grassland songbirds that differed in habitat requirements. We compared bird diversity and abundance, nest survival, and parasitism rates among pastures managed with a patch-burn grazing management regime and pastures managed by annual burning combined with or without grazing by cattle.

We found that both bird abundance and nest survival were higher for patch-burn grazing managed pastures, while parasitism rates were consistently high across all management regimes (0.6 - 0.8 for all treatments; 2-3 eggs per nest). Nest survival was generally low and ranged between 10 - 20% for all treatments. By increasing abundance and nest survival, patch-burn grazing management could improve demographic performance of declining populations of grassland songbirds. Moreover, results of our three-year field study help us gain insight into how different management regimes affect population dynamics of declining grassland songbirds.

p04-057

The Restoration of a Short-tailed Albatross colony on Mukojima, Ogasawara Islands Group

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Historically, breeding colonies of Short-tailed Albatross (*Phoebastria albatrus*; STAL) were broadly distributed in the northwestern Pacific islands. The species was driven to the brink of extinction by feather hunters and guano mining. Many years of conservation management activities have maintained a 7% year^{-1} population increase, but the breeding colony is still restricted to two sites, Torishima Island and the Senkaku Islands, and neither of these sites are secure due to volcanic activity or political instability. To facilitate the recovery of this species by establishing at least one additional colony, a total of 70 post-guard phase chicks were translocated from Torishima to a safe, former site, Mukojima, in February 2008-2012 and hand-reared there for 100 days until fledging. Fledging success was 99% in all these 5 years. The number of days when hand-reared STAL from previous years or naturally-reared STAL from other natal colonies visited Mukojima during the chick-rearing period increased greatly over time; 14 days in 2009, 11 days in 2010, 49 days in 2011, 75 days in 2012, 85 days in 2013. The number of individual hand- or naturally-reared STAL visiting Mukojima also increased from 3 birds in 2009 to 16 birds in 2013. During 2011 to 2013, a remarkable 17 of 35 birds hand-reared between 2008 and 2010 returned at least once to Mukojima. The results demonstrate rapid progress toward potential new colony establishment through translocation and hand-rearing of albatrosses.

p04-058

Cryptic species detected by DNA in the Violet Sabrewing *(Campylopterus hemileucurus)*

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In the course of barcoding the birds of Mexico using a 650 bp of the CO1 mitochondrial gene, we came across one specimen that differed remarkably from 2 other specimens collected in the same area of Veracruz (Los Tuxtlas, Mexico). Sequences were checked to discard mislabelling of specimens, or nuclear sequences. Blast of the odd sequence matched almost completely one sample of Violet Sabrewing in the Barcode of Life Data System from Panama. Twelve more samples of Violet Sabrewings from Veracruz have been analysed and a more robust pattern has emerged, revealing two populations in southern Veracruz of different genetic origin (7.6% genetic distance with a neighbour joining algorithm between the two groups). Because these samples show a clear-cut difference the only plausible explanation is that they belong to different lineages. Violet Sabrewings are abundant in tropical rain forest ranging from southern Mexico to Panama. Although seasonal fluctuations had been detected in Nicaragua and Costa Rica (Skutch 1967, Stiles ad Skutch 1989) they are usually recorded as resident hummingbirds. Altitudinal and intratropical migratory behavior are expected in frugivorous or nectarivorous species (Levey and Stiles 1992) due to the high spatial and temporal variation in their resource base, but patterns of movement in tropical species are basically unknown. Morphological data corroborates this result. The pattern now indicates that either the Veracruz population receives an intra-tropical migratory population from the south, or the two putative species are sympatric in this part of the range. A more detailed study throughout the species range is under way.

p04-059

Recovery of Blakiston's Fish Owl populations – a positive beginning but a long and challenging road ahead

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Blakiston's Fish Owl (*Ketupa blakistoni blakistoni*) is distributed only in Hokkaido, Japan's northernmost prefecture. Its diet mainly consists of fluvial fish, and the species uses tree cavities for nesting. Since the 1970s, the population has declined as a result of damage to its habitat. The reclamation led by government such as logging, farmland development, dam construction, and total capture of the migrating salmon caused severe nests and food shortage for Fish Owls. A conservation program that included provisioning of nest boxes and supplemental feeding was initiated in the middle 1980s. Despite these measures habitat loss and population decline continued until the 1990s. In the early 1990s only 40 pairs survived with at least 10% of the pairs being the result of inbreeding.

As a result of concerted conservation activities, the population of Fish Owls began to stabilize in the new millennium. In a 2013 survey, 54 pairs were recognized representing a population increase of 30% in a 20 year period. The provisioning of nest boxes and supplemental feeding has contributed to the recovery. 80% of the pairs use nest boxes and 25% benefit from the supplemental feeding. In addition, long term and in-depth research into the ecology and environment of Fish Owls has improved conservation efforts. Finally the downturn of the Japanese economy slowed the large scale developments and the adoption of measures to protect the environment have reduced the habitat loss. The combination of these factors has fortunately saved the Fish Owls from extinction.

Although the Fish Owl population has increased, the improvement to its habitat has not yet followed suit. However, new approaches including the conversion of conifer plantations to indigenous forest and reengineering of dams to permit fish migration will contribute to the recovery of both Fish Owl populations and ecosystems. The cumulative experience and knowledge of these conservation strategies will be important in coping with unpredictable future risk.

p04-060

Population recoveries of the Red-Headed Wood Pigeon at the Ogasawara Islands, Japan, after the control of invasive alien mammals.

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Ogasawara islands (N27,142W) are oceanic islands that consist of three inhabited islands and about 30 uninhabited small islands. After the first settlement in 1830, three species and three subspecies of endemic birds were extinct within 100 years. These extinctions were suspected to be caused by alien mammals, such as feral cats, *Felis catus* and black rats, *Rattus rattus*. An endemic island pigeon, the Red-Headed Wood Pigeon（*Columba janthina nitens*）has survived, but the population size has diminished to a low level. In 2005, the Ministry of Environment estimated that the population was around 40 birds. After the Population and Habitat Viability Assessment Workshop, the efforts to control feral cats and black rats have increased on several islands. Up to now, more than 360 feral cats have been trapped by cages and shipped to Tokyo. Rat eradication programs have been conducted at 10 islands so far. The results of a census program showed that all of the following parameters of population recovery have increased: distribution range and numbers of observed pigeons, number and behavior of young birds, annual clutch size, habitat quality of nesting sites, etc. We will discuss possible explanations for these responses of endemic islands pigeons that have evolved on oceanic islands.

p04-061

Conservation programs for the Little Tern breeding on rooftops

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One of the main causes of biodiversity loss is habitat destruction. Constructing artificial habitats may play an important role in the conservation of wildlife, especially for those organisms which live in highly developed landscapes where conflicts between human activity and wildlife frequently occur. Among these, the conservation program of the Little Tern (*Sterna albifrons*) is a fascinating example of such activity. The Little Tern is a summer migrant seabird which breeds in Japan, and forms breeding colonies of ten to several thousands of individuals. They nest on bare ground in places such as sandy coasts or gravelled riversides, and in the past their main breeding habitats in Japan were coastal areas. Because such areas are important not only as breeding habitat for Little Terns but also for industrial development, natural breeding habitats of Little Terns have been steadily destroyed over the past 50 years. As a result, the breeding population of Little Terns has been decreasing and they are now treated as a vulnerable species in the Japanese Red Data List. The Little Tern Project (LTP) has been managing an artificial colony site for Little Terns on a rooftop of the Morigasaki Water Reclamation Center, a wastewater treatment plant in Tokyo, since the first discovery of breeding Little Terns there in 2001. The conservation activities of the LTP include protecting eggs and nestlings from predators, maintaining bare ground by weeding, and attracting Little Terns using decoys. Over the last decade, 5500 nests have been found and over 3000 nestlings have been hatched at this colony site. We will introduce more detailed information on our conservation programs in our presentation.

p04-062

Diet analysis using DNA barcoding from feces of the Japanese Crested Ibis, *Nipponia Nippon*, for the habitat management of reintroduced species

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The Japanese crested ibis, *Nipponia Nippon*, became extinct in 1981. Since 2008, the ministry of environment in Japan has reintroduced the ibises onto Sado island, and in addition, various nature restoration tactics have been implemented for supporting the population of the released ibises. Paddy fields are one of the important habitats for the ibis because they mainly prey upon small animals living in paddy fields. Therefore, the restoration of paddy environments has been mainly conducted on Sado island to improve their foraging habitat. Furthermore, information of habitat selection and foraging efficiency has accumulated. However, in the study on diet contents of the Japanese Crested Ibis based on direct observation of foraging behavior, ca. 80 % of prey items were too small to identify species of captured prey. This information on diet ibis could definitely contribute to improvement of their habitat.

DNA barcoding is an approach to clarify food items by analyzing a DNA sequence collected from undigested food in feces, which is also recognized as a powerful tool for the rapid and unambiguous identification of species compared with traditional diet analysis such as the morphological identification of stomach content and the direct observation of foraging behavior. Furthermore, this method is suitable for small animals and endangered animals because it keeps their stress from capture and treatment to a minimum.

In this study, we aim to propose an effective nature restoration scenario based on foraging information of the Japanese Crested Ibis. First, the food items of ibis were clarified throughout the year using DNA barcoding from feces. Then, we calculated the foraging efficiency from their foraging behavior, DNA barcoding, caloric content of prey, and finally, we discuss an effective paddy management which is able to increase ibis foraging efficiency.

p04-063

Conservation genomics of Japanese and Hawaiian Black-footed Albatross populations using Rad-tag sequencing

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The Black-footed Albatross *Phoebastria nigripes* is an observationally philopatric species that has a breeding population of 1240 pairs in Japan and a larger, main population of 64,500 pairs in the Hawaiian Islands. The Black-footed Albatross is classified as Near-Threatened (recently downlisted from Vulnerable) on the IUCN Red List of Endangered Species. In May 2013, the Agreement on the Conservation of Albatrosses and Petrels taxonomy working group rejected a petition for the Japanese and Hawaiian populations to be considered separate subspecies: previous data was based on mitochondrial DNA and hence could have overestimated genetic differentiation between the populations. To resolve this pending issue, we used Rad-tag sequencing on a total of 47 birds to generate a genome-wide dataset with 3455 single nucleotide polymorphisms (SNPs) from individuals from one of the Bonin Islands in Japan (Izu-Torishima) and two islands in the leeward Hawaiian chain (Midway and Tern). The analysis suggests slightly lower genetic diversity in the Izu-Torishima population compared to Hawaii ($\pi_{Torishima}$=0.152, π_{Tern}=0.165, π_{Midway}=0.160) and slightly more differentiation between the Japanese and Hawaiian populations than between the Hawaiian populations ($F_{st\text{-}Torishima\text{-}Midway}$=0.039, $F_{st\text{-}Torishima\text{-}Tern}$=0.032, $F_{st\text{-}Midway\text{-}Tern}$=0.022). An analysis using the clustering software STRUCTURE detected two clusters, one containing the Japanese birds and one the Hawaiian birds. However, using Bayesian migration software (MIGRATE), we also found a significant amount of gene flow between Japan and Hawaii (Nm ≈ 2.3 birds per generation). Our results are trending in the expected directions, but our analysis suggests that the populations are only weakly differentiated, and that the Black-footed Albatross is nearly panmictic. Based on these results, we do not think that the Japanese population of the Black-footed Albatross should be considered a separate evolutionarily significant unit. Rad-tags will be a useful tool for further investigation of albatross evolutionary history as well as conservation issues throughout the Procellariiformes.

p04-064

Disastrous African Grey Parrot (*Psittacus erithacus erithacus*) Conservation Status in the Northern Republic of Congo

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In the Northern Republic of Congo, the WCS has long had buffer zone projects around the Nouabalé-Ndoki National Park and the Odzala-Kokoua National Park. Since November 2011, more than 800 live African Grey Parrots have been confiscated from poachers in these projects. With the help of WCS field veterinarians and parrot specialists, we have been maintaining them in a large cage at WCS's field project site until their wing feathers, cut or damaged by the poachers, re-grow and they can fly away. Most individuals (about 60%) died even after keeping them in a large flight cage, mainly due to the psychological shock of capture, and the poor treatment during trafficking. Less than 20% of the confiscated birds could be released after their feathers and health conditions improved. Several individuals were illegally released to local people (police, army, and the other citizens) by local forest officer. This is because the illegal international parrot trade attracts buyers willing to pay high prices. Japan is an important destination for this species as pets. These birds are listed as Vulnerable by the IUCN Red List because of the extent of the annual harvest for international trade, in combination with the rate of ongoing habitat loss. They are on Appendix II of CITES. The Congolese wildlife law lists them only as Partially Protected (can be hunted with a small game licence), but CITES removed the Congo quota in 2012 because of issues regarding transparency of exports. The two neighbouring countries of Cameroon and DRC have existing CITES export quotas of 3,000 and 5000 respectively. These encourage laundering of birds from Congo and could have serious consequences for species in the region.

p04-065

Implications of the control of the invasive alien Red-billed Leiothrix (*Leiothrix lutea*) for native bird communities impacted by Sika deer in the high mountains in Japan

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The Red-billed Leiothrix (*Leiothrix lutea*; RBL), which is an introduced species from China, has been colonizing natural beech forests in Japan since the 1980's. It was reported that some native bird species have decreased where RBL has increased. At the same time, rapid increases in the population of Sika deer (*Cervus Nippon*; SD), in most areas in Japan have caused changes in bird communities through the alteration of natural vegetation. Thus, we investigated the effect of RBL on native bird communities where the density of SD had increased recently in the Tsurugi and Chichibu Mountains, Japan. Bird censuses were carried out by the line-transect method during the breeding seasons of 2003 – 2011 in Saorigahara, Kochi Prefecture. The density of RBL decreased in 2011 after increasing from 2003 to 2007. Meanwhile, the Bush Warbler (*Cettia diphone*; BW), a native species whose nesting habitat overlaps with that of RBL, decreased significantly in 2009. Most bamboo grass *Sasamorpha purpurascens*, a super-dominant bush layer vegetation, died at this time where SD had strongly grazed. We will refer also to a tentative result of a long term banding survey at Chichibu Mountains. These results suggested that RBL and BW both had decreased due to the disappearance of the bush layer. In 2012, a non-governmental organization decided to implement a program for controlling RBL on Shikoku Island. An effective method of capturing adult birds has not yet been established; additionally, nest control by replacing eggs with a pseudo-ovum is effective but lacks utilities. Basic data on the population dynamics and dispersal of RBL in relation to SD density will be essential for conservation of native birds.

p04-066

Effect of an alien predator on the breeding performance in a pelagic seabird

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Introduced predators are one of the main threats to island avifaunas, because these avifaunas are particularly vulnerable to predation by introduced species due to the absence of native mammalian predators. In particular, invasive rats severely impact on seabirds, reducing their populations and in many cases triggering their extinction, because seabirds are social creatures that have evolved to breed on islands where terrestrial predators do not exist. This study had been carried out during 2001-2012 at the Sasudo-island, South Korea, to investigate basic information about the breeding status of a pelagic seabird, the Streaked Shearwater *Calonectris leucomelas*. This study presents data on variation in breeding population size and breeding success of the Streaked Shearwater and the magnitude of rat predation, and considers the possible causes of variation in breeding performance of the Streaked Shearwater. In this study, we found that predation by the Norway rat *Rattus norvegicus* has been the single greatest cause of egg loss and breeding failure for the breeding colony of the Streaked Shearwater, and that the variation in breeding population size and breeding success during the study period could be affected by changes in the magnitude of rat predation.

p04-067

Invasive Common Mynas (*Acridotheres tristis*) in Tutuila, Samoa: abundance, distribution, predictors, and impacts on native birds

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The Common (or Indian) Myna (*Acridotheres tristis*; hereafter "myna") is native to much of continental Asia and has been widely introduced, both deliberately and accidentally, to tropical oceanic islands. Its high degree of success as a human commensal and potential impacts on native avifauna, have contributed to the nomination of this species as one of the "world's worst" invasive species. We conducted research on mynas in Tutuila, American Samoa, where a single myna was first detected in 1980 and which now sustains a population of hundreds of thousands of birds that are the most commonly sighted species on the island. Native bird populations declined after Hurricane Val in 1991, while myna populations appeared to dramatically increase during the same period. We present research conducted in 2013 to estimate the abundance and distribution of myna populations and identify potential predictors of myna abundance. We documented myna interactions with other birds, including socialization between species and aggressive behaviors (territoriality, food theft, and harassment). We present findings on myna interactions with six native forest birds and two other invasive bird species. Myna abundance is highly positively correlated with human population density and anthropogenic disturbance. Mynas showed aggression towards every native species observed, and aggressive behavior increased with flock size; mynas sometimes socialized with other invasive species. Aggressive behavior and natural disasters may partially explain the expanding range of the mynas on Tutuila. As with other Polynesian islands, Tutuila is highly susceptible to cyclones and damage to forests resulting from such events could potentially facilitate the further expansion of mynas into forests where they may continue to displace native bird species.

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p04-068

Mixing with Mallards: Is the genetic integrity of the Australian Pacific Black Duck at risk due to hybridisation with Mallards?

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The threat of hybridisation with Mallards (*Anas platyrhynchos*) posed to many dabbling duck species is one that is commonly overlooked. Introduced Mallards have interbred with the Pacific Black Duck (*A. superciliosa*), to the extent that the New Zealand subspecies is now considered endangered. In Australia, introduced Mallards are typically of domestic origin and were originally believed to be restricted to urban areas. The degree of hybridisation between Mallard and the Pacific Black Duck is currently unknown, largely because hybrid backcrosses are difficult to visually identify. A technique using microsatellite markers was established to genetically identify hybrids. This system utilises 9 markers that were tested on putatively pure Pacific Black Ducks and domestic Mallards. Assignment tests, performed with the program Structure, had a 99% likelihood that specimens of a known species (Mallard or Black Duck) were assigned to the correct group. The marker set established was used to test the rate of hybridisation throughout Australia. Assignment tests were performed, as previous, on 372 specimens from 6 different Australian states. Overall, the proportion of hybridisation was less than 0.01, however, an increased rate was found in the states of Tasmania and Western Australia (0.03 and 0.16 respectively). This result suggests that hybrids are not common, but are increasing in the areas of Tasmania and Western Australia. Furthermore, all samples from Western Australia were collected from urban areas, whereas all other samples were from rural regions. An increased rate of hybridisation in Western Australia compared to other states supports theory that hybrids may be more prevalent in urban areas where Mallards are more common. More study of hybridisation in urban areas is required to determine whether urban ponds act as reservoirs for Mallard genes and whether these reservoirs may be a threat to the genetic integrity of the Australian Pacific Black Duck.
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p04-069

Ebbing avifaunal population *vis- a- vis* traditional practice of indigenous tribe of Arunachal Pradesh, India.

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Arunachal Pradesh, the 24th state of India is situated between 26° 40' to 29° 27' N and 91° 35' to 97° 24' E in the north-eastern part of India and lies in the Eastern Himalayan biodiversity hotspot. Its eastern edges lie at the confluence of the Eastern Himalayan, Indo-Malayan and mountains of south west China biodiversity hot spot. Consequently, Arunachal Pradesh has the richest terrestrial biodiversity in India; the animal diversity is best represented by avian diversity, 832 species having been recorded. This avian diversity is under tremendous pressure from 26 indigenous tribes that each have their own unique traditional customs and culture. Wildlife and parts of animals are used by tribal people to celebrate festival, practice rituals, decorate traditional attire, etc. So, there are rampant hunting of wildlife, particularly mammals and birds, to maintain these traditional legacies. Our study indicated that fifteen species of birds are extremely affected by aforesaid traditional hunting. Great Pied Hornbill *Buceros bicornis*, Indian Pied Hornbill *Anthracoceros albirostris*, Rufous-necked Hornbill *ceros nepalensis*, Wreathed Hornbill *Aceros undulatus*, Greater Racket-tailed Drongo *Dicrurus paradiseus*, Lesser Racket-tailed Drongo *Dicrurus remifer*, Satyr Tragopan *Tragopan satyra* , Blyth's Trogopan *Tragopan blythii*,Temmink's Tragopan *Tragopan temminckii*, Khaleej Pheasant *Lophura leucomelanos,* Scalater's Monal *Lophophorus scaletri* Himalayan Monal *Lophophorus impejanus* and Red Jungle Fowl *Gallus gallus*, Spotted Dove *Srteptopelia chinensis* and Barred Cuckoo Dove *Macropygia unchall* are the fifteen most hunted birds species. Their feather, legs, beaks and tails are used to keep alive traditional practices. We are attempting to identify the threat to each species by traditional practice and to highlight the unique threat to birds before the conservation forum for two pronged conservation intervention of the problem.

p04-070

Understanding population limitation in migrants birds: Whinchats on Salisbury Plain

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The decline of long-distance migrant birds is currently high on the conservation agenda and there is a need to understand the major ecological and demographic constraints acting on these species. The Whinchat (*Saxicola rubetra*) is a grassland-dwelling, trans-Saharan migrant that breeds in Europe and has suffered large declines in abundance and range in recent years. Through studying a large population of Whinchats on Salisbury Plain, England, which remains stable despite the declining UK trend, we hope to determine which aspects of the species breeding ecology, habitat use and demography allow this population to persist. We examined the variation in territory density and turnover, productivity and settlement choice in relation to the variation in habitat condition, resource availability and parental care. Early results point to a mismatch between habitat choice for settlement and those with the highest breeding success, suggesting an ecological trap effect. We explored the main cause of breeding failure, predation, in the light of the interacting effects of habitat and food availability. Our results point to a potential carryover effect of parental condition on breeding success. Age related return rates from an extensive program of colour ringing and re-sighting enabled the isolation of local limiting factors from those operating at other life history stages. Current data suggests that there is insufficient productivity and overwinter survival to maintain the Salisbury Plain population without immigration of first year birds from elsewhere. Both local site-based and large scale landscape level demographic factors appear important in determining overall population trends, suggesting a multi-scale approach is required for the conservation of migratory species.

p04-071

Stress in wild Greater Rhea populations: effects of agricultural activities on fecal glucocorticoid metabolite levels

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In recent years, wild populations of Greater Rhea *Rhea americana* have declined drastically, due mainly to the conversion of grassland into cropland as a result of intensive, specialized agricultural practices. In this study we evaluate potentially stressful effects of agricultural activities on this ratite by assessing their adrenocortical response. Specifically, we compared fecal glucocorticoid metabolite (FGM) levels of rheas living in two areas under very different land use: grasslands mainly devoted to cattle grazing and agro-ecosystems intensively used for crop production. Radioimmunoanalysis of fecal samples from 269 individuals indicated no significant differences in mean concentrations of FGM according to habitat type. In the agro-ecosystem we found no direct effect between agricultural practices (planting and harvesting) and the bird's FGM levels. However, FGM concentrations were significantly higher during the dry season, which may represent a stress response to the low availability of forage due to harvesting. In contrast, no increase in the FGM levels was registered during the dry season in the grassland, where ample forage was available throughout the year. In this environment the greatest increases in FGM levels coincided with the reproductive period, likely due to the frequent agonist encounters between males at this time of the year. Our findings therefore suggest that the consequences of agricultural practices may constitute a chronic environmental stressor for Greater Rhea populations living under such conditions. The present study supports earlier research showing detrimental impacts of agricultural activities on this species, whose area of distribution coincides with the most productive regions of South America.

p04-072

Feeding ecology and conservation of the endangered red-headed wood pigeon, based on diet analysis by DNA barcoding

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Knowing the diet of an endangered bird is essential for understanding its ecology and an appropriate conservation planning. Recently, DNA barcoding techniques together with next-generation sequencing (NGS) is rapidly developing and may provide more detailed information on animal diets than other conventional methods. We performed a diet analysis of critically endangered Red-headed Wood Pigeon *Columba janthina nitens* that is endemic to the Ogasawara Islands, Japan by sequencing chloroplast trnL P6 loop of plant DNA extracted from feces. The NGS approach detected a much larger number of plants than the microhistological analysis. Plants that were difficult to identify by microhistological analysis after being digested in the pigeon stomachs were frequently identified by the NGS approach, indicating the effectiveness of this approach for detailed diet analysis of the pigeon. The results of the NGS approach also indicated the frequent consumption of introduced species, in addition to several native species, by the Red-headed Wood Pigeon. The rapid eradication of specific introduced species may reduce the food resources available to this endangered bird; thus, balancing eradication efforts with the restoration of native food plants should be considered. The seasonal changes of the pigeons' diet, the food resource availability and the nutrient composition of food plants will also be presented. Using these data, food preference of the pigeons and the reason why they consume some introduced species frequently will be discussed.

p04-073

Fine-scale foraging interactions of northern royal albatross with fisheries during chick-rearing at Taiaroa Head/Pukekura, New Zealand

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Incidental death (bycatch) of apex marine predators, including albatrosses, in commercial fisheries is recognised as a key threat to marine ecosystems worldwide. Despite mitigation attempts, bycatch mortality in commercial fisheries has led to populations declines in many seabird species. Little is known about at-sea habitat use, let alone interactions with fisheries of northern royal albatross (*Diomedea sanfordi*) at Taiaroa Head/Pukekura during chick rearing period. Understanding the nature and spatio-temporal extent of interactions between fisheries and foraging albatrosses is, therefore, of important conservation concern. Here we combined GPS tracking data from the foraging trips with Vessel Monitoring System data from the entire fleet around New Zealand waters in 2012 to detect fine-scale spatio-temporal overlap between fishing vessels and albatrosses. We tracked 89 foraging trips from 7 breeding adults during chick rearing in 2012. Of the 89 foraging trips, overlap between fishing vessels and albatrosses occurred in 19 trips. Albatrosses overlapped with vessels in areas around the continental shelf edge of the eastern South Island of New Zealand, as well as around the northern and southern shelf edges of the Chatham Rise. Results of our fine-scale analysis indicated that albatrosses foraged in close association with fishing vessels on 67% of the occasions for which they were within 10km of a fishing vessel, indicating that the 33% of overlap was as a result of coincidental habitat use rather than albatrosses following fishing vessels.

p04-074

Population estimate and habitat preference of the endangered Amami thrush *Zoothera dauma major*, endemic to Amami-Oshima Island, southwestern Japan

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The scaly thrush (*Zoothera dauma*) is distributed throughout the Palearctic and Oriental ecozones. One of the subspecies, the Amami thrush (*Z. d. major*), is restricted to Amami-Oshima Island in southwestern Japan. Amami-Oshima is a small island (712 km^2), which includes rich fauna and flora with high endemism, and the natural environment of the island has been affected by human activities. The Amami thrush is categorized as one of the National Endangered Species designated by the Law for the Conservation of Endangered Species of Wild Fauna and Flora, which includes 38 avian species vulnerable to extinction in Japan. The Red Data Book published by the Ministry of the Environment in 2002 estimated the population size of the Amami thrush to be less than 100 breeding pairs. Since 1994, the Amami Ornithologists' Club has conducted a count survey for singing Amami thrush in March, supported by public participation. The results of this long-term survey showed gradual increase in population during these 20 years, with especially prominent growth in 2013. Based on the analysis of recent distribution data, the number of singing individuals was estimated to be 800–1,000 (the estimate of population size was 1,600–2,000 if the singing individuals are males). Relatively old-aged forest in higher altitudes was inferred to be the preferred habitat for the thrush. Although the gradual population recovery was recognized, preserving the regenerating evergreen forest alongside the remnants of old-aged forest is essential for the further conservation of the Amami thrush.

p04-075

Detection of vegetation types at nest sites of *Grus japonensis* in eastern Hokkaido, Japan, by using vegetation maps

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For conservation, it is very important to analyze the nesting habitat of *Grus japonensis* (Japanese or Red-crowned Cranes), an endangered species. Because cranes disperse over vast flat wetlands covered with tall grass and trees, the observers are often unable to detect the cranes and their nests from land. Consequently, researchers survey cranes from aircraft. It is impossible to record details about vegetation near the nests from the air. Since 1980, we have conducted air surveys annually of the isolated and sedentary population of *G. japonensis* in eastern Hokkaido, Japan. Recently, vegetation maps covering almost all breeding areas of these cranes were completed by the Ministry of the Environment, using Geographic Information Systems (GIS), allowing for estimation of vegetation of all nesting spots and surroundings. In the Kushiro Mire, for example, 27.8% (N=916) of nests were found in the alder (*Alnus*) communities and 23.3% in the tall reed (*Phragmites- Calamagrostis*) communities. The reliability of these results was supported by comparing maps of vegetation types from GIS with photos taken at each nest during the air surveys. Some differences in the vegetation of nesting spots were observed for the core region compared to and the peripheral region of the mire. In former years when numbers of breeding pairs were much lower, most nests were found in tall reed communities. This paper suggests that cranes accept new vegetation types for their nest sites in peripheral areas of the mire because of the high density of breeding pairs in recent years and they are able to move into other areas of Hokkaido in future.

p04-076

Birds of agricultural landscapes in the Colombian tropics: a case study of silvopastoral systems, pastures and tropical dry forest fragments in Tolima

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The Tropical Dry Forest (TDF) biome in Colombia has been jeopardized by ecosystem transformation; as a consequence, just 7% of the original cover is remaining. As a conservation alternative, more sustainable cattle production models have been proposed including arboreal components whose ecological and productive functionality improves conditions for the establishment, reproduction and conservation of resident and migratory birds in Colombia. Here we monitored birds in three landscapes (Intensive Silvopastoral Sistems –ISPS-, Low tree density pastures –LTDP- and forest patch –FP-) in Piedras, Armero-Guayabal and Venadillo municipalities, using mist nets and point counts in three one hectare-plots, during four field cycles covering dry and rainy seasons. A total of 2487 individuals from 33 families and 135 species were sampled, representing 46% of the bird species recorded in Tolima's TDF; of these, 281 showed evidence of reproductive activity. We noted the presence of 11 migratory birds and two endemic birds. The most diverse families were Tyrannidae and Thraupidae. Seventeen guilds were detected showing the highest diversity in "canopy and edge small-fruit consumers" and "small sticks and branches insectivores". The highest diversity and abundance were registered at ISPS. We found that some species prefer forest cover and avoid cattle systems. This research contributes to the understanding of avian community composition and dynamics in agro-landscapes in tropical dry forest biomes.

p04-077

The influence of communication tower attributes on the loss of migrating songbirds in Arkansas

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The loss of songbirds due to fatal collisions at tall, red-lit communication towers has been documented since the late 1940s. With recent advances in cellular, digital, and wireless technologies, the number and types of towers in North America have increased rapidly. We identified four tower attributes to investigate for impacts on migrating birds: 1) physiographic region, 2) tower height, 3) tower lighting system, and 4) guy wires. We sampled 28 randomly selected towers for bird carcasses for over a four-week sampling period coinciding with peak movement of long-distance Nearctic-Neotropical migrants during spring and fall migration from 2005 through 2008. Tower search technicians recovered 185 carcasses and 151 feather piles, for a total loss of 337 individuals comprising 70 species. Of 185 carcasses, 133 (71.9%) individuals were long-distance migrants, while 68 of identified feather piles (45.0%) represented long-distance migrants. Only tower height showed a significant different between treatments, with more bird carcasses recovered from tall towers (mean = 0.153 carcasses per day, SE = 0.036, p = 0.0237) than from short towers (mean = 0.034 carcasses per day, SE = 0.030). We also conducted searcher efficiency trials to determine negative biases to the carcass count data. Marked brown-headed cowbird (*Molothrus ater*) carcasses were placed at tower sites once during each sampling period, and the mean percent of cowbirds recovered by technicians ranged from 24.3% ± 5.1% to 43.7% ± 4.7% across all trials. Cowbirds were also used to estimate the removal of carcasses by scavengers at tower study sites, another source of negative bias to carcass count data. Less than 30% of all carcasses placed were removed within one week. We recommend restricting the height of proposed communication towers to less than 150 m to minimize negative impacts posed to migrating birds.

p04-079

Pride and desire for the local heritage is the key to conservation education: a case of an elementary school in remote areas in a Japanese village

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Conservation of endangered species requires long-term monitoring, which makes the role of local residents indispensable. Since the monitoring effort should be sustained over generations, nature education plays a leading role to bring up future generations that are able to continue the work. Although school education is one of the options, the aims of education generally differ between schools and conservation agencies. Thus partnership between these two fields of education is far from satisfactory. We present a case where this educational partnership is realized, providing details on the background, the process and the current status of the program. Nakanomata elementary school in Nagaoka city, Japan, is a small school with 15 pupils located in a snowy mountainous region. This region has natural beech forests that are home to a few nationally endangered forest birds. The residents of this small village with 180 households, take pride in the traditional culture of the region, such as tea ceremony (“Sado”) and local dance (“Kodaiji”), and are eager to preserve them. This elementary school cooperates with the residents in a project of cultural inheritance. In addition to this local heritage study, the school started a new program of environmental study asking for the assistance of the Nagaoka Municipal Science Museum. This joint program involves pupils identifying and observing the local species of wildlife, such as aquatic animals and birds, and reporting their daily observations onto a public board at school. The tradition of cooperation between the whole village community and the teachers of the school has made it possible for this program to be initiated with the assistance of the museum. We will also address the issues associated with this program.

p04-080

Behavioral responses of shorebirds to wind turbines on Wang-Gong, Chung-Hua Coast in Taiwan

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Previous studies have shown that wind turbines can cause collision mortality in certain bird species, particularly in migratory raptors. However, our understanding on how wind turbines influence movement patterns of birds is still limited. In this study, we compared local movement patterns of shorebirds during pre-construction, construction and operational periods to assess how these birds responded to the presence of wind turbines on Wang-Gong, Chung-Hua Coast in Taiwan. In our study area there are ten wind turbines, spaced irregularly along the flight path of shorebirds flying between their daily foraging and roosting grounds. We recorded the flight path, including flight height, from 1 hour before until 1.5 hours after high tide monthly. Flight paths were categorized in four sections: (1) eastern section beyond wind turbines, (2) narrow inter-turbine interval section (turbines spaced at 200m intervals), (3) wide inter-turbine interval section (spacing of 500m between turbines), and (4) southern section beyond wind turbines. Our data showed that the flight height of about 40% of all individuals was within the range of the turbine blades (40m-120m) for these three periods. The movement patterns of shorebirds was significantly different between pre-construction and operational periods (χ^2=592.12, p<0.001). The proportion of individuals using the wind turbine section to commute between the foraging and roosting area remained unchanged during these three periods. However, the usage of the narrow inter-turbine interval section decreased from 27.19% to 8.56% during the pre-construction and operational periods, respectively. The shift of flight location from narrow to wide inter-turbine interval sections indicated that inter-turbine distance could affect the local movement patterns of shorebirds. We suggest that in future the intervals between wind turbines should be cautiously incorporated into the design of wind power developments to mitigate the impacts of wind turbines on wildlife.

p04-081

Causes of migratory bird mortality at a stopover site in Korea

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Hong-do is a small island located in the SW end of Korea and is an important stopover site for migratory birds. We collected data on bird mortality at Hong-do during 2007-2011, and classified them according to the causes of mortality; Feral cats (29.3%) was the dominant cause of mortality at the study site, followed by collision with man-made structures (22.3%), oil pollution (15.0%), exhaustion (10.6%), other human-related causes (7.6%), predation by natural enemies (4.6%), traffic accident (0.1%), and cause unknown (10.6%). A total of 1338 birds of 130 species were recorded, most of them were passerines. The mortality was higher in bird migration season, but it was much higher and more concentrated in spring than in autumn. Causes of mortality showed species dependency, probably due to the differences in ecological niche such as foraging and resting places. Finding and removal of the risk factors for migratory birds at a stopover site, especially in a small and isolated island, is critical to ensure a successful migration of birds. Future studies on the mitigation of risk factors should be carried out at the study site.

p04-082

Behavioral responses of wintering Black-faced Spoonbills (*Platalea minor*) to threats and disturbances in Korea

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Behavioral responses can be used to understand the impacts of disturbance on animals and to develop management strategies. To understand the behavioral responses of endangered Black-faced Spoonbills (*Platalea minor*) to disturbance factors in winter, both the alert behaviors and flight distances of Black-faced Spoonbills were recorded at Seongsanpo Inner Bay, Jeju, in the Republic of Korea. A total of 29 factors elicited 319 alert responses by the spoonbills; of these, seven including poachers and predators such as Peregrine Falcons (*Falco peregrinus*) and feral cats (*Felis catus*) were identified as potential threats while the remaining 19 factors were identified as non-lethal disturbance factors. However, the spoonbills responded to every disturbance factor at a similar level whether it was lethal or not. Although natural factors such as predation caused some strong behavioral responses, anthropogenic disturbances caused significantly greater behavioral responses, in general, than natural stimuli did. Flight distance in relation to human approaches, which were the most common disturbances, were affected by the activeness of the spoonbills, the occurrence of other waterbird species, and the interaction of these two factors. Based on this, we suggest that Black-faced Spoonbills benefit from the presence of other waterbirds, and exploit them as an early warning system. It is necessary to secure sufficient buffer areas (more than 200 m) around key roosting areas based on the behavioral responses of sympatric waterbirds with longer flight distances as well as the typical flight distance of wintering Black-faced Spoonbills.

p04-083

The 30-year seabird population trend on Nakanokamishima, in the south Ryukyus, Japan

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Nakanokamishima is an uninhabited island located among the southern Ryukyu Islands and is the breeding site for Brown Booby (*Sula leucogaster*), Sooty Tern (*Sterna fuscata*), Bridled Tern (*S. anaethetus*), Brown Noddy (*Anous stolidus*), Streaked Shearwater (*Calonectris leucomelas*) and Bulwer's Petrel (*Bulweria bulwerii*). In 1903, large-scale commercial hunting began. It took only a few years for the seabird population to decrease and business declined. Some disturbances, mainly egg exploitation by local people from the islands surrounding Nakanokamishima and fishermen from Taiwan, occurred thereafter. This island was designated as a natural monument in 1978 and as a special wildlife protection area in 1982. Although the egg exploitation stopped in 1980, people frequently landed on the island for fishing, bird watching and photographing, and resting during diving intervals. A prohibition of landing except for academic purposes was made widely known by governmental agencies in 1986. Kohno landed on the island for the first time in 1976 and started a monitoring survey and ecological study, mainly of Sooty Tern that formed a dense colony in the center of the island and Brown Booby nesting throughout the entire island. The number of Sooty Tern adults and chicks (fledglings) was counted by taking photographs of the colony using a telephoto lens from two fixed points on nearby hills. The number of Brown Booby nests was counted along fixed routes. The Sooty Tern population increased gradually from around 4,000 adults and 2,000 chicks (fledglings) in the 1980s, to over 8,000 and 4,000, respectively, in recent years. Although the number of Brown Booby nests gradually increased from around 200 in the 1980s to around 300 in the 1990s, it has rapidly increased to over 900 in recent years. Thus, Nakanokamishima has recovered as a breeding site for mixed seabirds over the past 30 years.

p04-084

Spatial characteristics of foraging habitat and seasonal changes in potential foraging area of Golden Eagle in deciduous broadleaf forest

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Golden Eagles *Aquila chrysaetos* mainly inhabit environments with few trees, such as steppes or mountain districts above forest boundaries. A subspecies of the Golden Eagle, the Japanese Golden Eagle *Aquila chrysaetos japonica,* which is an endangered species in Japan, is an exception to this rule, being distributed in deciduous broadleaf forest belts including coniferous plantation. Seasonal changes in the spatial structure of deciduous broad-leaved forest may exert a large influence on foraging habitat selection of the Japanese Golden Eagle, which could in turn influence prey use and/or breeding success of this subspecies. In this study, we compared characteristics of foraging habitat of eagles before and after leaf out by airborne laser scanner, and estimated potential foraging area within the home-range of a certain pair for developing conservation scenarios for this species. Before tree leaf out, foraging habitat used by eagles predominantly consisted of snow fields and forest gaps, and potential foraging area was widely distributed within the home-range. After leaf out, the size and shape score of forest gaps in which eagles foraged were larger than those of gaps that were selected randomly. Eventually, potential foraging area within the home-range dramatically decreased from before leaf out to after leaf out. We propose that it is essential to conserve the forest area with large gaps after leaf out and/or to create larger forest gap in coniferous plantations by forest-thinning for increasing foraging efficacy of this endangered eagle.

p04-085

Impacts of climate change on the alpine habitat of the Rock Ptarmigan in the Hida Mountains, Central Japan

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The Rock Ptarmigan *Lagopus muta* is adapted to cool, alpine environments. The alpine zone of the mountains in central Japan is the southern limit of the global distribution of the species and the population size is small, about 3,000 birds in 1980s. In Japan, the Ptarmigan utilizes *Pinus pumila*, a dominant species of the Japanese alpine zone, as nesting sites and shelters from predators and mainly feeds in alpine fellfield and snowbed grassland. It depends heavily on the alpine habitat that is vulnerable to rapid climate change. In this study, the present and potential future distributions of the Ptarmigan were assessed in an area (about 20 x 30 km) of the Hida Mountains both with detailed vegetation maps and with ptarmigan territory records. The current potential habitats of the Ptarmigan were explained with high accuracy by the GAM model, using the occupancy of the three alpine vegetations (*Pinus pumila* community, alpine fellfield and snowbed grassland) and distance from ridge as predictor variables. The presence/absence and the occupancy of the three alpine vegetations were also explained with high accuracy by the GAM model and by the Random Forest model, using four climatic variables (warmth index, minimum temperature for the coldest month, summer precipitation and maximum snow water equivalent) and five topographical variables (slope angle, slope direction, curvature, topographic wetness index and distance from ridge) as predictor variables. The future potential habitat of the Ptarmigan was predicted by applying these models and 24 climate change scenarios for impact assessment. The suitable habitats of the Ptarmigan decreased remarkably under almost all of the 24 scenarios for 2081-2100, and they were predicted to vanish in the eastern parts of the focus area.

p04-086

Ecological value of urban riparian zones for maintenance of urban bird diversity in Taipei, Taiwan

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Urban areas have become one of the most dominant landscapes worldwide, and are expanding both in size and number. The relationship between bird diversity and urban environment is important for concerns about the negative impact of urbanization on bird diversity. However, recent studies have started to focus on the maintenance of urban bird diversity in the face of increasing human population and expanding cities, and have proposed hypotheses that could lead to an increase in urban bird diversity. Cities are typically located near large water bodies, rivers, estuaries, or along coastlines. Generally, the interface between water and land is referred to as the riparian zone. Compared with urban green spaces, riparian zones have contiguous and larger areas. In addition, habitat heterogeneity caused by irregular flood and disturbance provides various resources for birds, with many specialists living only in this area. However, there has been surprisingly little attention to conservation of urban riparian zones in Taiwan. Habitat alteration and concretization now threaten the bird diversity of urban riparian zones. Here, we highlight the value of riparian zones in the urban environment for bird diversity, and identify bird guilds that would be threatened by urbanization. Our study site is the Taipei Basin, the most populated urban zone in Taiwan, home to more than six million citizens. The Tamsui River meanders across Taipei Basin and develops a large riparian zone. By building a database of over 300 survey points from this study and the Taiwan Breeding Bird Survey, we compare bird diversity of different regions and the distribution of bird guilds in the Taipei Basin. Besides, we test the importance of area, NDVI, habitat heterogeneity and urbanization respectively for riparian bird diversity. Research results will provide conservation strategies in urban riparian zone for building a biodiversity-friendly city.

p04-087

Nest survival of Kentish Plover in the Bohai Bay of Eastern China

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Nest survival is an essential component of bird life history because it influences fitness of individual and thus population viability. Nest survival rates are varied under different environments, likely due to different factors such as climate, predators, micro-habitats and anthropogenic impacts. Understanding how factors influence nest survival is of critical importance for bird conservation and management. Over the past 30 years, mean losses of 30% intertidal areas occurred in the Yellow Sea, which harbors internationally important stopover sites for many water birds. In parallel with this, 27-33% of species of shorebirds have declined rapidly in the East Asian-Australasian Flyway. Conservation and research efforts have been cast on migratory shorebirds, but rarely focused on breeding shorebirds in the region. Thus we investigated the nest survival of the Kentish Plover (*Charadrius alexandrines*) in order to have insight into the influence of ongoing habitat losses on survival and reproduction of breeding shorebirds in Bohai Bay, China. Our study shows that apparent nest survival of Kentish Plover was 23.00% and nest daily survival rate (DSR) was 92.50% ± 0.41% (n = 413). Predation, flood and human disturbance are among the top reasons for nest failure. We further found negative correlations between DSR and nest age grew, temperature, precipitation and nest density. Interestingly, the DSR also exhibits small-scale variation with the DSR of nests in the bank of shrimp ponds being significantly smaller than those in crystallization ponds and abandoned drilling platforms. Our results demonstrate that both biotic and abiotic factors influenced nest survival in Kentish Plover in Bohai Bay, perhaps ubiquitous in East Asia. This finding highlights the negative impacts of tidal land reclamation in Bohai Bay, China on birds beyond wintering and migratory seasons.

p04-088

Climate change and its multiple impacts on the Qinghai-Tibet plateau endemic forest birds

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The effects of global climate change have attracted increasing attention, especially concerning the Arctic, and Antarctic areas. The Qinghai-Tibet plateau is considered as "The Third Pole of Earth". Many endemic species on the plateau had already been adapted to the high altitudes and low temperatures, and even more, their distributions are restricted within the plateau. Therefore, climate change might cause disastrous effects on these species as in polar species. We used Maxent software to construct species distribution models for two endemic forest birds, the Sichuan Jay (*Perisoreus internigrans*) and Chinese Grouse (*Tetrastes sewerzowi*), and then predicted and compared current and future distributions to assess the impacts. Generally, we suggest that the potential impacts should be manifold for these endemic birds. First, the potential suitable area size and suitability would decline, especially for Sichuan Jay. Second, the climate change would compel both species to shift northward and upward, but quite limited areas would be available for such compensatory extension. Finally, both the decrease and shifting of suitable habitat entail severe further habitat fragmentation in the future. Furthermore, although the size of suitable area would not change a lot in the near future for Chinese grouse, fragmentation would exacerbate. Habitat fragmentation has been proposed as one of the major causes of global biodiversity loss and local extinction, which may exacerbate the climate change impacts indirectly through slowing or halting gene flow, and therefore increasing the extinction rate of isolated local populations. Hitherto, the majority of such modeling studies on climate change were concentrated on the impacts from shifts in suitability or distribution. Therefore, our resutls also validate the importance of habitat fragmentation analysis when assessing climate change impacts using the SDM method.

p04-089

Use of rice fields by Bean Geese *Anser fabalis* and White-fronted Geese *Anser albifrons* wintering in Hangang River Estuary according to post-harvest treatment

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Foraging habitat use of Bean Geese *Anser fabalis* and White-fronted Geese *Anser albifrons* was investigated in Hangang River Estuary, one of the largest wintering grounds of waterbirds in Korea Republic, from 2011-2012 to 2013-2014. Bean Geese forage in both estuarine wetland and rice fields around Hangang River Estuary. On the other hand, White-fronted Geese use rice fields as their foraging habitat almost exclusively. The value of rice fields as habitat for waterbirds can vary according to farming method, such as harvest method, post-harvest straw treatment and the extent of flooding because the density of rice grains, which are the main food item of geese, can be influenced by how rice fields are managed. We will focus on post-harvest straw treatment and classify the type of rice fields into ‘no straw treatment’, ‘straw burned’, ‘straw chopped’ and ‘rice field plowed’, etc. and investigate the use of Bean Geese and White-fronted Geese of each type. Consequently, we expect to provide some implications for rice field management in order to contribute to conserve wintering geese populations in Hangang River Estuary.

p04-090

West coast of Kamchatka peninsula in danger of anthropogenic transformation

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The West Kamchatka coast is located in the northern part of the East Asian-Australasian flyway. Up to 1 million of shorebirds are migrating southward through this part of the flyway annually. 35 species of shorebirds are recorded in this area (more than 70 % of the total number of shorebird species of the Russian Far East). The narrow (0.1–1 km) and long (up to 1000 km) coastal line of west Kamchatka (including numerous river coastal lagoons and river estuaries) is most important as a staging point for shorebirds during migration. However till now this area is still poorly investigated. Ornithologists have visited not more than 5 % of the coastal line of west Kamchatka. We found that biotope features of the West coast of Kamchatka show significant differences between them and their efficiency of food providing for shorebirds is not equivalent. As a rule, there are one or two dominant species in every investigated region: Dunlin *Calidris alpina*, Rufous-necked Stint *Calidris ruficollis*, Great Knot *Calidris tenuirostris*, Whimbrel *Numenius phaeopus* & Bar-tailed Godwit *Limosa lapponica*. Duration of stopovers for different species on Southward migration, amount and location of base gathering, their space structure and significance in migration forming are as yet poorly investigated. Activation of fisheries and incipient development of hydrocarbon fuel on the West Kamchatka shelf will certainly lead to a gradual degradation of the natural environment and significant deterioration of shorebird habitats. In view of the impending adverse change it is extremely important to collect detailed information on the abundance and distribution of shorebirds migrating along the West coast of Kamchatka.

p04-091

The effects of landscape fragmentation on the habitat use of Woodlarks *Lullula arborea* and their invertebrate prey

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Vineyards in Switzerland are among the most intensively managed crop systems where up to 95% of the parcels do not have any ground vegetation cover. However, there has been a considerable reduction in the application of herbicides over the past decades, leading to more vegetation of higher diversity on the ground. These different management types lead to a fragmented mosaic of few parcels with ground vegetation and lots of parcels with bare ground. The Woodlark (*Lullula arborea*) is an endangered ground-nesting bird species that occurs in vineyards and here we investigate its habitat preferences on different scales and in relation to habitat fragmentation. Using the combination of radio-tracking data, field surveys and satellite images, we demonstrate the positive effects of ground vegetation on the Woodlark's habitat use and on its prey. We show that on the level of micro-habitat selection, Woodlarks favoured foraging and displaying habitats with a proportion of ground vegetation cover around 30-60% and with a higher plant and arthropod species richness. On a territory level, our results show the effects of landscape fragmentation where highly connected parcels were preferred. Our findings indicate that fragmentation directly impedes the movement of arthropod prey whereas the Woodlark adjusts its habitat use in relation to the availability and abundance of its prey. Using these findings, our project aims to give clear recommendations to winegrowers about the amount, distribution and connectivity of parcels with ground vegetation within the vineyards, which should ultimately favour biodiversity in general and Woodlarks in particular.

p04-092

The impact of sound pollution on territory defence: implications for conservation in mining areas

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Songs are used by male birds in the context of territory defense. This vocalization allows the assessment of individual fighting ability without engaging in risky and costly fights. Many studies show evidence that noise pollution has an impact on animal communication. In particular, anthropogenic noise could mask male song and then increases the probability of fights, which could have an impact on individual fitness (survival). Mining is a major economic activity in the state of Minas Gerais, Brazil and occurs in habitats of high biodiversity. This activity is known to have deleterious impacts on the environment and to produce sound pollution. However, mining noise pollution's impact on animal communication has rarely been studied. In this study, we experimentally investigated in captivity the impact of noise pollution from mining activity on territory defense in the Saffron Finch (*Sicalis flaveola*). We estimated the probability that two males would enter in physical contacts during 15 minutes following the intrusion of one male in the cage of a resident male and we recorded the vocalizations of both individuals. Each resident male confronted each intruder in three randomized conditions: (1) with mining noise; (2) with a control noise; (3) without noise. We tested seven males and conducted the tests with a total of 42 tests/condition. Because of the masking effect of vocalizations by noise, we predict that resident males enter in physical contacts with a higher probability during the tests with noise exposure and that noise exposure will affect vocalizations such as the rate at which males vocalize. The result of this study will allow us to estimate whether or not noise from mining activity can impact population viability due to an increase in costly fights by male birds and will have implications for conservation of biodiversity in mining areas.

p04-093

Using radio-telemetry to assess relative stopover habitat quality of native and anthropogenic woodlands for migrant birds in the northern Great Plains, USA

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Identification of high quality stopover habitat is important for migrant conservation, but habitat quality can be difficult to assess. Previous studies of plasma metabolites and corticosterone suggest that both native riparian corridor woodlands and anthropogenic woodlots in the northern Great Plains, USA, provide similarly suitable stopover habitat for meeting the energetic demands of migration. Movement behavior during migratory stopover is governed by the energetic condition of migrants and energetic condition, in turn, is related to the quality of stopover sites. Based on previous data, we hypothesized that stopover behaviour would be similar between the two habitat types. We measured stopover duration, movement rates, and temporary home ranges in both habitat types for fall migrant Yellow-rumped Warblers (*Setophaga coranata*) by attaching radio-transmitters and relocating birds to corridor (n = 8) or woodlot (n = 8) study sites. Upon release, we obtained GPS coordinates every 30 min for the rest of the day, and between these GPS measurements, we observed birds closely for 15 -20 min to estimate the movement distance between successive locations. On subsequent days, we located radio-tagged birds twice per day until departure. The range of stopover duration of birds was 0-13 days and birds showed statistically similar mean (± SE) stopover duration between corridors (5.1 ± 1.3 days) and woodlots (4.1 ± 0.9 days). Movement rates ranged from 0.6-8.7 m/min and were also statistically similar between corridors (3.5 ± 1.0 m/min) and woodlots (2.6 ± 0.8 m/min). The temporary home ranges also did not vary significantly between the two habitat types (corridors: 0.09 ± 0.03 km^2; woodlots: 0.06 ± 0.01 km^2) and ranged from 0.01 to 0.23 km^2. These data are in accord with plasma metabolite and corticosterone data, and suggest little difference in stopover habitat quality between native and anthropogenic woodland habitats in this region.

p04-094

An investigation of vital rates of landbird populations on Saipan, Northern Mariana Islands

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Little is known about the phenology, vital rates, population dynamics, or trends of resident landbirds on tropical oceanic islands. Filling this data gap is a critical to the conservation of these species, which typically have restricted ranges and small population sizes. Here we report on a scheme of standardized mist netting and modern capture-recapture analytical techniques to provide insights into the phenology and demography of landbirds at six sites on Saipan, Northern Marianas Islands. Of 14 species, we assessed the phenology and detailed demographic characteristics of three: Rufous Fantail (*Rhipidura rufifrons*), Bridled White-eye (*Zosterops conspicillatus*), and Golden White-eye (*Cleptornis marchei*). Between 2008 and 2012 we recorded 5,360 year-unique captures for all 14 species; 2,195 (41% of total) were Rufous Fantails, 1,274 (24%) were Bridled White-eyes, and 900 (17%) were Golden White-eyes. Sampling was concentrated during the late-dry/early-wet season in all years (Apr-Jul), except for 2010 when sampling spanned Feb-Oct. Although most breeding appeared to be concentrated in Mar-Apr, data from 2010 suggested that adults in breeding condition and young birds could be found at any time of year with the extent and timing of breeding varying among years. Adult population size estimates were variable among sites and tended to be higher during the initial two years of the study (2008 and 2009) compared to later years (2010-2012). An index of productivity based on the proportion of immature birds in the catch during Apr-Jul suggested that productivity was relatively low in the initial two years when adult population sizes were higher. Adult apparent survival was relatively variable among sites and years for Rufous Fantail, varied among sites for Golden White-eye, and was relatively low and consistent across space and time for Bridled White-eye.

p04-095

Bird communities of an oil palm plantation in East Kalimantan, Indonesia

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Despite ongoing debates on the negative impact of oil palm plantations on biodiversity, oil palm plantations are becoming an important landscape in Indonesia. The concept of High Conservation Value (HCV) Forest is adopted by Indonesian oil palm industry to retain biodiversity in oil palm plantations. This study aimed at examining bird diversity in different stages of plantations (9, 13, and 17 years old) and reserved habitat (HCV) in an oil palm plantation in Labangka Village, District of Penajam North Pasir, East Kalimantan. Our results showed that reserved habitat had the highest bird species richness, while plantations of nine years old had the lowest number of bird species. We also found that bird composition in HCV areas differs from those in oil palm plantations. High maintenance in productive plantation plots reduced lower vegetation that is important for birds, resulting in a lower number of bird species. This is in line with a previous study in Guatemala that showed a positive correlation between bird species richness and understory vegetation. We will discuss some management recommendation to improve the role of High Conservation Value areas in retaining bird diversity of oil palm plantation.

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p04-096

Detection of breeding sites of the Bryan's shearwater in the Bonin Islands, subtropical Japan

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The Bryan's Shearwater (*Puffinus bryani*) is a new species described in 2011 based on a specimen collected in Midway Atoll in 1963. It is probable that this shearwater does not regularly breed in the Northwestern Hawaiian Islands, because there has been only one additional record, in early 1990s, since the first specimen. However, six individuals of the shearwater have been found as carcasses and rescued individuals in the Bonin Islands, off Japan, since 1997. Therefore, the shearwater possibly breeds in the islands. Since this shearwater is considered to be seriously threatened or endangered because of the limited number of records, the detection and conservation of its breeding area is urgently required. In order to attempt locating breeding colonies, we conducted acoustic surveys in winter, when they are suspected to breed. We deployed a total of 18 recording units (SongMeter 2, Wildlife Acoustics Inc.) on three seabird breeding islands (uninhabited small satellite islets of Chichijima Island) in the winters of 2011 and 2012. They recorded for one minute every ten or fifteen minutes from dusk to dawn. An acoustic analysis software package (Song Scope ver. 4.1.3A, Wildlife Acoustics Inc.) was used to automatically search for calls of the shearwater, using a vocalization sample of the shearwater recorded in Midway Atoll in 1990s as a reference. The results showed the existence of the shearwater on at least two islets. The shearwater most frequently called in February and March, while the vocalizations were recorded from Dec to April. Bryan's Shearwaters actively vocalized during 19:00-22:00 and 2:00-5:00. Although a nest has not yet been found, we strongly suspect that they breed on these islets. These recordings are the first reliable evidence of the shearwater's survival. In the future we will actively seek to locate breeding individuals.

p04-097

Agricultural nature conservation for meadow bird families; food availability in grass field margins

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Agricultural intensification in grass fields has led to the decline of meadow bird populations in the Netherlands in the last 60 years, due to a negative effect on reproductive success. Meadow bird chick habitat has declined in quality and quantity, thereby reducing the food availability for meadow bird chicks. Agri-environment schemes (AES) for meadow birds to halt the decline in meadow bird numbers are up to date not sufficient. These AES are mostly on the level of whole fields while recent research suggest that grass field margins could be more suitable chick habitat than the main field. Therefore, it would be interesting to specifically target grass field margins as part of meadow bird AES. Our research examined the differences in food availability for meadow bird families in different locations on a grass field and differences in food availability between field margins with different management regimes.

We showed strong differences in food availability within fields, depending on meadow bird species. The prey species of Lapwing (*Vanellus vanellus*) chicks showed no clear pattern within fields, whereas those of Oystercatcher (*Haematopus ostralegus*) chicks were found mostly in the main part of the field. The preferred prey species of chicks of Black-Tailed Godwit (*Limosa limosa*) and Redshank (*Tringa totanus*) predominantly occurred in the field margin. Furthermore, additional management of grass field margins improved the amount of the preferred prey species of these two meadow bird species. Leaving the margin unfertilized or unmowed at first mowing of the field both positively influenced the number of large flying insects in the margin. It is concluded that food availability within a grass field differs between meadow bird species. Particularly for Black-Tailed Godwit and Redshank, grass field margins constitute an important part of the field which is even more profound with additional grass field margin management.

p04-098

Interactions between nest predation and fragmentation in tropical island pacific birds

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Habitat loss and fragmentation has occurred at unprecedented rates in the last decade, especially in tropical rainforests. The loss of forest habitat is considered one of the main causes of extinction for tropical forest birds, yet the mechanism by which habitat loss affects bird populations is poorly understood. This is particularly true on islands in the South Pacific where there is likely to be an interaction between two confounding factors, forest loss and invasive species. The present study examines the relationship between nest predation and nest predation in Samoan forests. We monitored artificial nests at two different scales: (1) the position of a bird nest within the landscape, and (2) the microhabitat in the immediate locality of the nest. Results suggested landscape scale factors, such as the proximity to plantations, affected nest depredation rates by the black rat (*Rattus rattus*). Furthermore macrohabitat factors measured at the nest site, such as the percentage of low (<15cm) ground cover surrounding the nest tree, also influenced nest depredation rates. However, our results did not show a significant variation between edge habitat away from plantations and interior forest sites (<1km from the edge). This is the first quantitative study to investigate how the spatial positioning of the nest influences invasive rat predation rates of native birds in the South Pacific. We predict that increased conversion of native habitat to plantations at the landscape scale is likely to indirectly increase nest predation rates of forest birds. Furthermore, our study suggests that purely maintaining large forest patches may not be a sufficient method for preventing rat predation on interior forest sites since they also experience high predation levels. Control of black rat numbers may be critical for maintaining sensitive bird species on South Pacific islands.

p04-099

State uncertainty models for migration stopover dynamics of an endangered short distance migrant, the Piping Plover (*Charadrius melodus*), in South Carolina, USA

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Short-distance migrant beach-nesting shorebirds contend with human disturbance and habitat development on their breeding, migratory stopover, and wintering sites. As breeding ground management has encountered diminishing returns, interest in understanding threats in nonbreeding areas has increased. Repeatable estimates of nonbreeding demographic rates (such as arrival and residency) are generally lacking, however, which hinders the study of limiting factors. We estimated fall migration demographic rates of endangered Piping Plovers at four sites in South Carolina in 2006/7 and 2007/8 using mark-recapture models, taking advantage of birds color-banded on the breeding grounds. We used a robust design state uncertainty model to account for heterogeneity in arrival and departure rates between migrants and winter residents, and classification uncertainty for those two states. Cumulative probability of arrival was >33% by August for both residents and migrants, and reached 95% for both groups by October. Estimated residence time of migrants was approximately 30-52 d in the first winter and 50-74 d in the second. Residence probabilities were lower for migrants carrying brood-specific color combinations from the Great Lakes breeding grounds (most of which were hatch year) than for those carrying unique color combinations (all of which were after hatch year). High resight probabilities allowed us to make fairly precise estimates of trends in arrival and residency rates with small sample sizes. Our results imply that habitat protection intended to benefit wintering Piping Plovers at our sites should be in effect by late summer, as many birds are resident from July through the end of winter. If banding programs on the breeding grounds continue, long term monitoring programs can permit separation of demographic variance from sampling error, which is crucial for further research into population regulation and limiting factors.

p04-100

Flight behavior of breeding Piping Plovers: implications for risk of collision with turbines

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As the focus on clean energy continues globally, collisions of birds with wind turbines in coastal areas poses a potential threat that could affect populations of imperiled or declining species. We studied flight characteristics and flight behavior of beach-nesting Piping Plovers at six study sites in Massachusetts and New Jersey, USA. Using color-banding and radio telemetry to conduct observations, non-courtship flights were mapped in 2012 and 2013. Preliminary results suggest that the center points of flight paths were clustered by territory (MRPPP<0.001 for all sites in all years). During 2012, we found differences in day-time flight frequency between three Massachusetts study sites and Stone Harbor, New Jersey (Negative Binomial Regression, $F_{4,127} = 2.69$, $P = 0.034$). We found that flight frequency of breeding Piping Plovers may be dependent upon habitat configuration, and flight paths of breeding Piping Plovers typically remain within the boundaries of their nesting and feeding territories, which has implications for population-level risks of turbine placement. Day-time flight frequency for 2013 is currently under analysis. Assessing Piping Plover flight behaviors during times of poor visibility can also help to evaluate the potential threat of turbine construction at or near breeding areas because birds may be most susceptible to collision with turbines during these occasions. During the 2013 field season, we deployed an automated telemetry receiver with the ability to detect movements over a 24-hour period, including at night and in poor weather. These data are also currently under analysis. Additionally, we collected data on flight height and flight speed, which can be input directly into existing collision-risk models, and our results may be used in future construction planning of coastal turbines.

p04-101

Variable responses of the Black Woodpecker *Dryocopus martius* to call-playbacks in the breeding season

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The Black Woodpecker *Dryocopus martius* is an endangered species in Japan, caused by a reduction in the extent of suitable habitat containing the large trees that it requires for nesting in. However, there are few studies about population estimation and dynamics of the species, while this is crucial information for conservation. Call-playback surveys have been conducted for many woodpecker species, including the Black Woodpecker, but few studies have examined the response rates of the woodpeckers to these surveys. To estimate population dynamics accurately, the response rate to call playback should be elucidated. By waiting for a Black Woodpecker near the nest, I examined their variable responses to call-playbacks in breeding season in Hokkaido, Japan. Call-playback surveys were conducted every two weeks on two breeding pairs of Black Woodpecker, one located in the Mikasa area (during two years), and one in the Makkari area (during three years). A total of 45 trials were conducted over three years. The Black Woodpecker responded to call-playback at 31 trials. Male woodpeckers appeared at 13 trials, females at 5 trials, and pairs at 3 trials. Males appeared from before the egg laying period to the nestling period, while females only responded to the call-playbacks before the egg laying period and until halfway the incubation period. The response declined from laying period to the first half of the nestling period. Thus, multiple censuses should be conducted at intervals during the breeding season. Distance from the nest and time of day had little effect on response to call-playback. The lack of effect of time of day on Black Woodpecker responses can be helpful in planning censuses because of the lack of temporal constraints. Before egg laying, woodpeckers could frequently be observed for more than 20 minutes, but the duration of this observation period decreased throughout the breeding season. Time of day and distance from the nest did not have important effects on the staying time.

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Habitat selection and female choice in polygynous Japanese Marsh Warblers

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For effective conservation of endangered bird species, it is necessary to understand how habitat selection might influence breeding success. The Japanese Marsh Warbler *Locustella pryeri* (IUCN category: Near Threatened, Japanese category: Endangered) is endemic to East Asia and has a polygynous mating system. Previous work has shown that the distribution of breeding males is related to the vegetation structure in wet grassland. Males prefer to establish territories in the specific grassland areas where reeds are less than 2.5 m tall and have abundant understory vegetation. However, their nesting environments are varied on a small scale and little is known about (1) how the nesting microhabitat affects the nesting success and (2) how breeding habitat selection by males affects their mating and breeding success. We studied this at Hotokenuma wetland (the largest breeding site in Japan) where we monitored 209 breeding males and 250 nesting attempts during the 2007-2009 breeding seasons. (1) We found that nests that were situated in the specific type of grassland were more successful (had higher rates of survival) than nests found in other microhabitats, indicating that vegetation structure is an important factor influencing the nesting success. (2) We conducted an analysis of male mating success (number of mating females and nesting attempts), which showed that males with larger structural body sizes obtained more mates and had more nesting attempts than smaller males. This suggests that female chose mates based on male body size and not territory quality (area or vegetation structure). However, we also found that the number of successful nests and total number of fledglings were unrelated to both male quality and territory quality. We discuss relationships between male breeding habitat selection and female choice or male breeding success. Our findings will provide useful information for environmental management of the species.

p04-103

Influence of microhabitat structures on waterbird communities in rice fields

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Rice fields provide temporary artificial wetlands to waterbird communities, and offer a periodic alteration between freshwater and terrestrial ecosystems. It has been established worldwide that rice fields provide a suitable habitat for waterbirds. However, only few studies have assessed the influence of seasonal heterogeneity of microhabitats within rice fields on waterbird species during the course of a year. The present study investigated the effects of seasonal microhabitat composition on the distribution and abundance of waterbirds in the rice fields of central-western Korea. The waterbirds using microhabitats were found to be more influenced by the accessibility of food resource than food abundance. Water levels in rice fields varied depending upon the irrigation intensity during the spring, and the distribution of shorebirds across microhabitats was determined by the shorebirds' foraging methods and body sizes. In the summer and autumn, when the rice fields are dense, microhabitat selection of herons was found to be influenced by food detectability and accessibility. Further, when waterfowl visited rice fields during the winter, the distribution of food initially affected their microhabitat selection; however, as the habitat changed in accordance with the straw manipulations, waterfowl preferred the microhabitat with relatively less human disturbance. These study results show that various seasonal cultivation methods play important roles in the seasonal visitation of waterbirds in rice fields.

p04-104

Does presence/absence of raptor species explain bird and plant diversity better than patch area and shape?

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It is logistically challenging to build conservation plans by revealing habitat requirements of all species in the target ecosystems. In this context, conservation planners use biodiversity surrogates such as indicator species or landscape structure to identify areas with high conservation values.
Marsh Harrier *Circus spilonotus* is one of the top predators in wetland ecosystems, and frequently invoked as an umbrella species. We examined the presence/absence of this species in relation to the area and shape of wetland patches, species richness of wetland birds and wetland plants, and abundance of wetland birds in 29 wetland patches (2-132 ha) in central Hokkaido, northern Japan.
Marsh Harriers bred in 12 wetland patches. Model selection showed that presence/absence of harriers was related to wetland bird species richness and abundance, and patch shape was of secondary importance to bird abundance. Specifically, wetland bird richness and abundance were greater in harrier breeding patches, and abundance was greater in patches with simpler shape. Patch area was not important for wetland bird species richness and abundance. These covariates did not significantly explain wetland plant richness.
Harrier breeding patches had high bird species richness and abundance, which would indicate that habitat requirements of harriers were similar with those of wetland bird species. Another possible reason is that the presence of harriers may be a cue for habitat selection of wetland birds (heterospecific attraction). On the other hand, wetland plant richness was not explained by the presence/absence of harriers and the area and shape of patches. Habitat requirements of many plant species would differ from those of harriers.
In conclusion, this study suggests that presence of raptor species can be a better indicator than patch area and shape.

p04-105

Foraging habitat selection by overwintering Middendorf's Bean Geese, *Anser fabalis middendorffii,* around Fukushima lagoon, Japan

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In many countries, a rapid decrease in the number of migratory birds has been caused by global climate change, human-induced habitat deterioration, and so on. IUCN classified 11% of migratory bird species in the world as threatened or near- threatened species on their Red List.

Middendorf's Bean Goose, *Anser fabalis middendorffii*, which is a large sized migratory waterfowl and designated as near-threatened species in Japan, overwinters in lagoons and lakes in Japan. Above all, more than 70% of Middendorf's Bean Geese flying to Japan during winter overwinter at Fukushima lagoon and in its surrounding paddy fields. These geese use the lagoon as roost at night, and paddy fields around the lagoon as foraging habitats during the daytime. Therefore, paddy fields play an important role as a habitat for making up energy requirement for overwintering and migration. Recently, however, the environment around the lagoon was remarkably changed by expansion of the lagoon and farmland consolidation in paddy fields, which might pressure overwintering goose population. Loss and deterioration of foraging sites could cause poorer energy intake, decrease survival rate, and eventually lead to a reduction of overwintering population size. In order to conserve the wintering goose population, it is essential to demonstrate which areas are to be preserved around Fukushima lagoon, based on features of suitable foraging habitats for geese.

This study aims to build an optimal model for predicting suitable foraging habitat, based on foraging site data, and to extrapolate the optimal model to the paddy environment around Fukushima lagoon, to map potentially suitable foraging areas, and finally to detect a candidate area in which to push for effective habitat restoration, for the geese.

p04-106

Energy requirement of Middendorf's Bean Geese and carrying capacity in Fukushima lagoon and the surrounding paddy fields

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Migratory birds are known to move seasonally over long distances between breeding and wintering grounds. Deterioration and/or loss of either area used by migratory birds have a huge impact on their survival. Fukushima lagoon, which is located in Niigata Prefecture, Japan, is an important overwintering site for many migratory wildfowl species. Middendorf's Bean Goose, *Anser fabalis middendorffii*, which is one of migratory wildfowl designated as a near-threatened species by the ministry of environment, migrates to the lagoon every winter. And, more than 70 % of the geese migrating to Japan in winter overwinter in Fukushima lagoon. They mainly use the lagoon as roost and paddy fields around the lagoon as foraging site. Therefore, paddy fields have been considered as an important overwintering habitat for this species. In recent years, however, the paddy environment around the lagoon has remarkably changed by expansion of the lagoon and farmland consolidation in paddy fields, which might pressure overwintering goose populations. Loss and deterioration of foraging sites could cause poorer energy intake, decrease survival rate, and eventually lead to a reduction in overwintering population size. To maintain the population size of bean goose in Fukushima lagoon, it is necessary to understand the amount of resources needed to fulfill the energy requirement of geese during overwintering.

In this study, we first clarify its food items and diet contribution of each food using DNA barcoding and stable isotope analyses. Then, we compare energy requirements of geese during winter with the total amount of energy estimated by both the biomass and the caloric content of food items available within the foraging area. Finally, we discuss management scenario to conserve goose populations overwintering in Fukushima lagoon.

p04-107

Quality or quantity? - large-scale and small-scale factors shaping distribution of forest bird species in Polish Carpathian mountains.

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Habitat features acting both at a small and large scale are known to influence the distribution of many bird species. However the impact of habitat structure on bird presence has been rarely studied at a wide geographical range, especially in montane areas. Here, based on extensive bird surveys carried out in the Polish part of the Carpathian mountains (ca. 20 000 km^2) we assess the importance of factors acting at different scales in shaping the distribution of forest birds. Bird surveys covered ca. 250 plots, with more than 2 200 observation points in which both data on bird abundance and on habitat structure was gathered. The study revealed that factors operating both at a small-scale (stand level) and large-scale (landscape) level have a significant influence on the presence of birds, both for whole forest bird assemblages and individual species. Stand-level factors were of particular importance for some rare or threatened bird species, like White-backed Woodpecker, Stock Dove, Collared Flycatcher and Red-breasted Flycatcher. Such studies, besides scientific interest, might have significant protection implications, allowing to infer the optimal habitat structure for specific species and in consequence are crucial for planning appropriate conservation measures.

p04-108

Foraging site selection and conservation of the Baikal Teal in rice fields around Katano-kamoike, Kaga City, Japan

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The Baikal Teal *Anas formosa* is a dabbling duck distributed in the Far Eastern region of Asia. The world population size is estimated at about 500,000 individuals. The duck mainly winters in wetlands of South Korea, and, in Japan, 5,000-10,000 individuals also winter. The Ministry of the Environment of Japan designated the Baikal Teal as a vulnerable species (VU). The Katano-kamoike Pond in Kaga City is one of the main wintering sites of the Baikal Teal in Japan. The wintering flocks roost at the pond in the daytime, fly away in the evening and forage on agricultural lands during night. In 2011-2012, we examined the foraging behaviour of Baikal Teal flocks in the wintering season, to support conservation of this species. By radiotracking of 20 individuals, we confirmed 256 nocturnal foraging sites, which were almost all rice fields. Using the data and spatial data for land use, we estimated the probability of occurrence of foraging Baikal Teals in mesh units (500 m x 500 m) by construction of generalized linear models. GLM model selection showed that the area of rice fields, the area of rice fields in eight meshes around each mesh, the average angle of slope and the area of lakes and rivers had positive effects on the occurrence of foraging ducks, whereas the distance from the Katano-kamoike to each foraging mesh had a negative effect. Applying this model, we can make suggestions for conservation of Baikal Teals wintering in rice fields around Katano-kamoike.

p04-109

Wintering farmland bird assemblages in Hungary, Central Europe

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The decline of farmland bird populations is probably the most important challenge for bird conservation in Europe. As winter period is the „bottleneck" for the survival of populations, it is crucial to understand bird population sizes and habitat use. This need is even more pronounced due to the ongoing climate change. Wintering farmland birds have received little attention in Central Europe, although differences between West and Central-East European farmland bird communities are well known. In this study we intend to find direct correlations between bird assemblages and winter seed food supply. Our study area was the Trans-Danubian Mezőföld, an intensively farmed region of Hungary. We censused wintering birds in semi-natural grasslands, seeded meadows, ploughed fields and autumn sown wheat fields three times in the wintering period. The available winter food (i.e. seed) was estimated in the top soil layer and on shoots. During the three censuses we recorded 346 individuals of 10 granivorous species, 191 individuals of 14 resident species, 652 individuals of 10 short-distance migrants. Semi-natural grasslands showed the highest and sown grasslands the second highest total species richness and abundance values, also for granivorous species richness. Higher seed mass was found on semi-natural and sown grasslands than on ploughed sites and winter wheat fields. There was a positive correlation between bird species richness and seed mass only for the December census. If the CAP reform is to support intensification (including the conversion of grassland to arable fields), decline of winter food supply is expected. We propose maintenance of multifunctional and heterogeneous landscape structure and better understanding of wintering bird communities and the role of food needs surveys at the landscape level, and monitoring of both birds and resources during the non-breeding season.

p04-111

Changes in the numbers of four species of birds, the House Sparrow, the Cape Glossy Starling, the Laughing Dove, and the Cape Turtle Dove in two provinces of South Africa

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Of the ~9,920 extant bird species, 1,253 of them are threatened. The decline of birds, particularly the House Sparrow and the starlings, over about the last three decades have been well-documented. In Great Britain, the numbers of House Sparrows have declined by as much as 60%, the starlings by 41% and the Turtle Doves by 71% while in South Africa, the numbers of Cape Turtle Dove and the Laughing Dove have declined by 10%. In this study, the density index of four bird species in two provinces of South Africa, a generally urbanized one (Gauteng) and a fairly rural one (Limpopo) were determined. Data obtained from the Avian Demographic Unit (ADU) of the University of Cape Town for two national counts, SABAP1 (1987-1992) and SABAP2 (2007-2012), were analysed. The House Sparrows and the Laughing Doves showed declines in both provinces: for the House Sparrows, the decline was significant ($P < 0.001$) while for the Laughing Doves it was not at $P > 0.3$ and $P > 0.4$, respectively. For the Cape Turtle Doves, the decline was significant ($P < 0.02$) in Gauteng but not in Limpopo ($P > 0.4$); the increase in the numbers of the Cape Glossy Starlings was significant ($P < 0.01$) in Gauteng but not in Limpopo ($P > 0.6$). The reasons for the declines between the periods of the counts can be attributed to a number of well-documented factors which including climate change, change in land use, increase in air pollution and introduction of alien bird species, leading to interspecific competition for resources. Changes in the density indices of birds in South Africa appear to follow the world trends.

p04-112

An application of IUCN categories and criteria to the birds of Iran; a case study of Anatidae

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Carrying out conservation programs requires a thorough knowledge on the threat status of species. While birds in Iran are facing serious threats and population declines, conservation efforts are hampered by a lack of knowledge on their threat status. IUCN Red List categories and criteria are the most widely used method for determining the extinction risk of species at national and global levels. With an aim to determine whether this method is suitable for producing the national Red List of birds in Iran, we used IUCN categories and criteria along with IUCN regional guidelines to determine the national threat status of Anatidae species, including 29 non-breeding migrant populations and 14 breeding populations. A variety of data on population, geographic distribution, and threats were collected and analyzed. Each species was then assessed against as many Red List criteria as the available data allowed. Criteria D and A were the most commonly used for assessment of the non-breeding populations while criterion B was the only criteria which allowed categorization of the breeding populations. In 30% of the assessments, due to the lack of suitable data, populations were categorized as Data Deficient. In the final national Red List, 25 of the non-breeding and 4 of the breeding populations were placed in the threatened categories. Due to the shortage of high-quality data on trends, population size, and distribution of birds in Iran, in order to use the IUCN method on other species, we suggest focusing on criteria B and D, which call for determining the current population size and distribution of species.

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Survival of the White-naped Crane requires larger international efforts in East Asia

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Focusing conservation actions on a culturally significant and long-distance migratory species such as the White-naped Crane *Grus vipio* offers a tremendous opportunity for multi-national collaboration on conservation issues which will be critical for the survival of this species and other threatened migratory waterbirds. We have started an international project for this species in East Asia focusing on urgent research and conservation needs. Initial assessment indicates that the threats confronting this species cover a broad spectrum from localized issues associated with grazing and agricultural conversion to global issues related to climate change, melting permafrost, and dramatic changes in hydrology affecting entire ecosystems. The survival of the species will require larger international efforts because the target species is migratory; current knowledge of ecological factors is limited; the main breeding area includes the border region between Mongolia, Russia, and China; and its migration flyway lies along one of the most rapidly changing human developed regions on earth - East China. In 2013 we started tracking White-naped Cranes that breed in Mongolia via satellite and cell phone telemetry. As of April 2014 we identified three sites that were used both for spring and fall migration, and considered important for migratory connectivity of this species. These sites include 1) an unprotected area near Duolun in Inner Mongolia which is facing tourist development, 2) Cangzhou/Beidagang near Bohai Bay with limited protection and undergoing rapid coastal economic development, and 3) the Miyun Reservoir affected by disturbance from farming and facing potential new water development projects. Our data were collected during a wet year in these regions. Additional tracking data are needed, not only to reinforce what we have obtained on stop-overs and migration routes, but also to identify and protect alternate stopover sites used under different hydrologic conditions such as drought.

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Recent status of Steller's Sea Eagle *Haliaeetus pelagicus* in Southeastern Hokkaido

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For the past 30 years, the wintering range of Steller's Sea Eagles (*Haliaeetus pelagicus*; SSE) has been changing within Hokkaido. High concentrations of SSEs were originally seen in northeastern Hokkaido (around Shiretoko peninsula), however, in the past 20 years, they are starting to disperse and the concentration in southeastern Hokkaido (Kushiro and Nemuro peninsula) has been increasing. Two distinctive studies were done to support the importance of southeastern Hokkaido for conserving SSE.

In the first research, SSEs were radio tracked in southeastern part of Hokkaido. Radio tracking was conducted in an approximately 150 km range in Kushiro and Nemuro area for 15 non-sequential days from Jan.17th to Mar.27th, 2014 using both vehicle-mounted and Yagi antennas. Six SSEs were found and tracked for a total of 13 days. These SSEs were born in Sakhalin Island and tagged with VHF transmitters as fledglings. A total of 37 fledglings were tagged in the same area from the year 2008 to 2010.

Also, adult mortality is a critical factor for the conservation of this specie. In the second study, cause and location of death of adult SSEs were investigated for the past 5 years. Forty-five dead SSEs including adult, immature and juvenile were collected throughout Hokkaido from Apr. 2009 to Mar. 2014. Twenty-seven out of 45 (60%) dead SSEs were adult birds. The most common causes of mortality in adult SSE death were road kill (n=8), lead poisoning (n=6), and railroad kill (n=5). Of the 27 dead adult birds, 9 were found in northeastern Hokkaido and 7 were found in southeastern Hokkaido. It was confirmed that a comparable number of SSEs died in both north and southeastern Hokkaido.

From the results shown above, southeastern Hokkaido was suggested to be an essential area for conserving SSEs. Thus, continuous research on the population and mortality risks in southeastern Hokkaido is needed.

p04-115

A tentative analysis of genetic differences between wild and laboratory populations of Japanese Quails using Microsatellite DNA Markers

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The draft genome assembly of the Japanese Quail (*Coturnix japonica*) was deposited last year. It enhances the importance of this species as an experimental animal model. However, wild populations of the Japanese Quail are threatened with extinction and their population sizes have been declined throughout East Asia in decades. Besides, genetic introgression of domestic quails into local wild quail populations is becoming a matter of concern in conservation of this species. In Europe, introgressive hybridization of domestic Japanese Quails and wild populations of their related species, the Common Quail (*C. coturnix*) has been reported in the past years. Thus, genetic assessment for wild populations is an essential approach to constitute an appropriate conservation program of this species. Here, we used 50 microsatellite DNA markers, which were developed based on the draft genome assembly of this species in our previous study, to assess genetic differences between 15 laboratory lines including one commercial line and 21 wild individuals collected from Honshu and Tsushima island of Japanese archipelago, and Liaodong Peninsula of China. The fragment of mitochondrial D loop region (252 bp in length) was also analyzed to infer their breeding history. The mitochondrial D-loop sequences exhibited three major haplotypes in laboratory lines, and two of them were shared with wild quails. A neighbor-joining phylogenetic tree revealed that a few unique haplotypes of wild quails differently branched off from basal nodes of the three haplotypes of laboratory lines. This result suggested different maternal origins of laboratory lines. Microsatellite markers revealed high levels of genetic differences not only among laboratory lines but also between laboratory and wild quail populations. We conclude that these microsatellite markers are more effective for genetic assessment of wild and domestic quail populations than the mitochondrial D loop.

p05-001

Response of Bush Warblers (*Cettia dipone*) in a highly contaminated area near the Fukushima-Daiichi nuclear power accident

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The four reactors of the Fukushima-daiichi Nuclear Power Plant (F1-NPP) were severely damaged by a huge earthquake and tsunami waves on March 11, 2011. An area greater than 900 square km northwest of F1-NPP was highly contaminated by radioactive material, which originated mainly due to the deliberate venting of the reactors on March 15 and afterwards. The radioactive fallout was more than 6 x 10^5 Bq/m^2 around the area. The main radioactive molecules recorded have been ^{134}Cs and ^{137}Cs. The radioactivity was around 30 to 100 μSv/hr 1m above the ground in this area. I have investigated birds and other wildlife at this highly contaminated area since mid-July 2011. I have been capturing bush warblers there since August 2011 and found severe contamination on their feathers, levels of which depend on the radioactivity at each site (Ishida 2012). Automatic multiple recording surveys proved that male Bush Warblers came to this area in late March, when some snow accumulation remained, and started singing actively through mid-August. Thus the detected feather contamination resulted from the accumulation of five months' contact with the radioactivity, which had decreased to about one fifth of its original level in the summer of 2012 compared to 2011. The area studied, located about 10 to 40 km from the F1-NPP, is complex and has higher biodiversity in the highlands, with paddies and other agricultural fields, natural and plantation forests, and streams. Variation in the bird community was not directly related to the variation in radioactivity, and several different kinds of NPP accident effects may play roles, both positive and negative, according to the point count and multiple IC-recording survey results. Since the accident, the Bush Warbler was recorded throughout the area and may have overcome radioactivity-related stresses at the population level.

p05-002

Functional Morphology of the Vocal Organ in a Phylogenetically Basal Bird

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In most bird species, acoustic communication is crucial for many social behaviours, including reproduction and predator avoidance. However, the evolution of the underlying sound production mechanisms is not well understood. The Tinamiformes are among the most ancient groups of extant birds, appearing first in the fossil record of the Miocene Epoch. We describe the vocal behaviour, anatomy and functional morphology of the syrinx in the elegant-crested tinamou, *Eudromia elegans,* a grass- and scrubland species from southern Argentina and Chile. The calls of this species are varied and represent two vocal modes, a mode with low fundamental frequencies (300-600 Hz), and a higher mode with fundamentals between 1-2 kHz. Like the other extant group of paleognaths, the Struthioniformes, the syringes in tinamous are tracheobronchial, involving modifications of both the trachea and bronchi. However, we discovered that unlike in the Struthioniformes, which have no intrinsic syringeal muscles, the tinamous have ventral syringeal muscles, which insert cranially near the interclavicular air sac membrane and caudally on the two primary bronchi and the interbronchial ligament. We show in an in vitro preparation that muscle shortening lowers the phonation onset pressure, and that phonation can also occur in the absence of muscle activity when the air sac pressure is higher than bronchial pressure. Histological preparations revealed previously undescribed, tendon-like collagen bands situated along the lateral walls of the cranial portion of the primary bronchi and attaching to vibratory tissue masses inside trachea. Using endoscopic high-speed imaging in combination with syringeal muscle stimulation, both in-situ and in-vitro, we describe how this collagen band may function during phonation. We quantified the parameters required for phonation in both the low-frequency and high-frequency modes in this species.

p05-003

On the methodological limitations of detecting oxidative stress: effects of paraquat on measures of oxidative status in Greenfinches

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Oxidative stress (OS) is widely believed to be responsible for the generation of trade-offs in evolutionary ecology by means of constraining investment into a number of components of fitness. Yet, progress in understanding the true role of OS in ecology and evolution has remained elusive. Interpretation of current findings is particularly hampered by the scarcity of experiments demonstrating which of the many available parameters of oxidative status respond most sensitively to and are relevant for measuring OS. We addressed these questions in wild-caught captive Greenfinches (*Carduelis chloris*) by experimental induction of OS by administration of the pro-oxidant compound paraquat with drinking water. Treatment induced 50% mortality, a significant drop in body mass and an increase in oxidative DNA damage and glutathione levels in erythrocytes among the survivors of the high paraquat (0.2 g/l over 7 days) group. Samples taken 3 days after the end of paraquat treatment showed no effect on the peroxidation of lipids (plasma malondialdehyde), carbonylation of proteins (in erythrocytes), parameters of plasma antioxidant protection (total antioxidant capacity and oxygen radical absorbance), uric acid or carotenoids. These findings of an increase in one marker of damage and one marker of protection from the multitude of measured variables indicate that detection of OS is difficult even under the most stringent experimental induction of oxidative insult. Therefore I would discuss the need for reconsideration of over-simplistic models of OS and draw attention to the limitations of detection of OS due to time-lagged and hormetic upregulation of protective mechanisms and highlight the diagnostic value of measurement of oxidative damage to DNA bases and assessment of erythrocyte glutathione levels.

p05-004

Haemosporidians in Iberian *Alcedo atthis*

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The Common Kingfisher, *Alcedo atthis* (Fam. Alcedinidae) is widely distributed over Europe, Asia, and North Africa. In the Iberian Peninsula the breeding population is sedentary, although Kingfishers from Northern and Central Europe arrive every year, either on passage towards Africa or to winter in Iberia. In temperate regions, the typical habitat of the Kingfisher includes clear, slow-flowing streams and rivers, and lakes with well-vegetated banks. Common Kingfishers are important members of ecosystems and good indicators of freshwater community health.

Haemosporidian parasites (genera *Haemoproteus*, *Plasmodium* and *Leucocytozoon*) can cause alterations in the physiological status of birds and in their breeding. They are transmitted from infected to uninfected birds by a variety of biting flies. The host habitat choice can affect the frequency of contact with flying vectors of hematozoan parasites, which are mainly associated with wetlands and rivers.

Few studies have been carried out on the infection of Kingfishers by haemosporidian parasites. Previously, three species of *Haemoproteus* and three species of *Leucocytozoon* have been recorded in the Alcidinidae family. In order to study the presence of haemosporidians, a total of 50 Common Kingfishers were captured and analysed for blood parasites by molecular analyses, along of Central Spain. The Kingfishers were caught with mist-nets during 2005-2008 in seven rivers (Adaja, Barbellido, Cea, Cega, Duero, Eresma, Tormes) along Valladolid and Avila provinces, at an altitude between 640 and 1427 m asl. The prevalence of infection was 40% (15% only with *Haemoproteus*, 10% with *Plasmodium*, 55% with *Leucocytozoon,* 20% with multiple infections). In these multiples infections one bird was found to be infected with *Haemoproteus-Haemoproteus-Leucocytozoon* and three with *Haemoproteus-Haemoproteus*. No significant differences were found in the parasite frequencies by sex ($\chi^2_1 = 0.012$, $P = 0.909$) or season during the breeding (May-July) and post-breeding (August-October) periods ($\chi^2_1 = 0.205$, $P = 0.650$).

We isolated six lineages of *Haemoproteus*, four of them described above (MW1, RW1, ROBIN1, HLSV06) and two have been identified in this study for the first time (hATT6 y hATT7). We found two lineages of *Plasmodium* (DELABUR4 and GRW06), none have been described so far. A single lineage of *Leucocytozoon* (CIAE02) has been found. Some of these lineages are restricted to one host, while in others the distribution is bound to the geographic conditions.

p05-005

Continental-scale variation in habitat suitability for House Finches *Haemorhous mexicanus* and evolution of virulence in a bacterial pathogen

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In the mid-1990s roughly 50% of the House Finches *Haemorhous mexicanus* in eastern North America died following the emergence of a disease caused by a species of bacterium previously known only regularly to infect galliform birds. In less than 10 years the lineage of the bacterium *Mycoplasma gallisepticum* that was first detected in House Finches spread from the eastern to western side of North America. However, the bacterium's impact on House Finch populations has been minimal through the central and western parts of North America, at least partially because the bacteria reaching the west coast of North America were less virulent --- producing less severe disease in the finches. We hypothesize that lower numbers of House Finches in the grassland interior of North America is the cause of the evolved lower virulence of the bacteria, because bacterial strains causing severe disease and thus limiting mobility of the finches are likely to have a low probability of dispersing across a region of low host availability. By quantifying variation in distribution and abundance of House Finches across North America using habitat-suitability (niche) models, we show that the evolution of virulence in dispersing bacteria is likely to have been driven directly by variation distribution and abundance of House Finches across North America, and indirectly by continent-wide variation in suitability of habitat for the finches.

p05-006

Potential risk map for avian influenza A virus invading Japan

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Global pandemics of avian influenza have become a threat to poultry production. Spatial risk assessment is one of the important techniques in order to decide priority-monitoring locations. We created a potential risk map for the spread of avian influenza by migratory birds using the occurrence of the influenza A virus in wild birds in Japan. Our modelling included a consideration of the multi-collinearity and spatial autocorrelation of environmental variables and an examination of the reproducibility of the model results. Maximum entropy approach was used to generate potential distribution models from presence-only data. Independent variables in the model included environmental factors such as winter temperature and precipitation, host factors such as duck population size and habitat abundance, and artificial factors such as size of urban areas and poultry density. We used eigenvector-based spatial filters to alleviate spatial autocorrelation. To explore the reliability of the model we compared the risk indices of localities positive in past winters for the influenza A virus in wild birds with those of all localities. Our results suggested that the dabbling duck population in an area appeared to be the best indicator of high risk for the introduction of avian influenza from abroad. Priority monitoring localities for avian influenza carried by wild birds should be designated in western Japan and along the Pacific coast, which we estimated to be high-risk areas. When we used the frequency of occurrence of the influenza A virus in 5 recent years in localities where wild birds were infected to estimate the repeatability of the high-risk indices, the potential risk indices for avian influenza in wild birds were high in localities where wild birds were infected in past.

p05-007

Infectious and parasitic diseases or their agents recorded from Japanese bird species: a review

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Outbreaks of infectious or parasitic disease have not yet significantly impacted populations of birds in Japan. Because effective conservation requires an understanding of the infectious avian disease organisms that are present in Japan, as well as their ecology, transmission, and symptoms, we previously reviewed the literature in this field (Asakawa et al., 2002). Here we update this review with new literature published in the past decade. We provide an overview of the diseases and/or their responsible agents (e.g., virus, bacteria, fungi, protozoa, helminthes and arthropods) based on our own research and that of others (Asakawa et al., 2013; Hirayama et al., in press; Ushiyama et al., in press; Yoshino et al., 2013). In the present session, we will give an outline of the reviewed papers, and briefly discuss potential strategies for risk reduction.

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p05-008

Molecular and morphological diagnostics of avian malaria and related haemosporidian parasites, with remarks on the parasite detrimental effects

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Avian malaria and related haemosporidian parasites (Haemosporida) are widely used model in studies of host-parasite interactions, particularly because they include agents of malaria (*Plasmodium* spp.), which cause severe diseases in animals and humans. Additionally, these parasites are widespread, easy to sample and show a diversity of pathogenic potential, including influence on bird fitness, breeding success, phenology, and lifespan. However, the currently used diagnostic methods of these pathogens have shortcomings.

We provide results of comparison of molecular screening and microscopic detection of haemosporidian parasites from Bulgarian birds. In all, 506 birds of 47 species (mainly passerines) were sampled. We applied the most often used nested PCR protocol and light microscopy to examine these samples. Overall infection prevalence was 63.6% by molecular screening, and 58.7% by microscopic examination ($P > 0.1$). Interestingly, 9.6% of examined birds were positive by microscopic examination, but negative according to the PCR-based diagnostics. On the other hand, 15.2% of birds were considered negative for haemosporidians according to microscopy, but positive by PCR screening. Hence, the combined prevalence is 73.7%, which is significantly higher ($P = 0.001$) than the estimate by each single approach. We conclude that implementation of both methods is important for diagnostics of haemosporidian parasites in bird communities, particularly parasite biodiversity. Both diagnostic methods have shortcomings: microscopy sometimes does not read light parasitemias, but PCR sometimes does not read co-infections. Both methods can be used separately in determining general trends of haemosporidian infection in birds. However, due to complicated haemosporidian life cycles, we recommend avoiding using single diagnostic methods when inferring patterns about phylogeography, co-evolution, biodiversity and detrimental effects on the birds.

We discuss our data in regard of haemosporidian parasites' sites of geographical transmission and effect on avian host. The study was supported by European Union Structural Funds project "Postdoctoral Fellowship Implementation in Lithuania".

p05-009

A Research Coordination Network in Ecological Immunology (RCNE)

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Ecological immunology, or eco-immunology, is a rapidly growing field, and in 2010, the National Science Foundation funded a Research Coordination to foster its conceptual and technical development of the field. Since funding, the RCNE has flourished, including: the spawning of several collaborations; the convening of topical workshops in Florida, Scotland, Michigan, and Germany; establishing an email list-serv; supporting trainee research exchanges; and producing a website. We present this poster to increase the visibility and membership of the RCNE, present results of a recent meta-analysis on costs of immunity, and encourage researchers to take advantage of RCNE-sponsored research exchanges. RCNE-sponsored research on the evolutionary ecology of host-parasite interactions from molecular to landscape scales will be highlighted.

p05-010

Avian malaria and its consequences for reproductive investments in Blue Tits *(Cyanistes caeruleus)*

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Haemosporidian infections are widespread among wild birds and have become a popular model system to study host-parasite co-evolution. Parasites usually impose fitness costs to their hosts by reducing their survival, fecundity, or mating success. Unfortunately, previous studies do not give a clear answer on the impact of these parasites on the host. Some of them show a negative effect of infection, while others suggest a positive relationship between the presence of parasites and reproductive success.

Here, we studied whether infection with malaria parasites is associated with reproductive investments. The magnitude of investment was assessed with measures of offspring quality: body mass, tarsus length and cell-mediated immune response. We also take into account the mating success by verifying whether the occurrence of extra-pair offspring in the brood is related to infection status with avian malaria parasites of the social father in a wild Blue Tit (*Cyanistes caeruleus*) population characterized by a relatively high frequency of extra-pair matings (40% of nests contain at least 1 extra-pair offspring) and approximately 60% infection rate with malaria parasites among adult males and females. Our results suggest that infection of the parents positively affected offspring performance but only in harsh environmental conditions. Parasitic infection had also an effect on the female's decision about engaging in extra-pair copulations but these decisions were dependent on her infection status, not only the male's infection. We will discuss possible explanations for these results.

p05-011

Avian influenza virus dynamics in a waterbird community in Australia

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For Northern Hemisphere waterbird communities it has been well established that the prevalence of low pathogenic Avian Influenza Virus (AIV) can seasonally fluctuate dramatically, showing peak prevalence in autumn. Whether this is a global phenomenon driven by common ecological and environmental drivers has so far remained uninvestigated. To investigate this in the southern hemisphere, we undertook studies at the Western Treatment Plant of Melbourne, a key (Ramsar) site for waterbirds in southeast Australia. We examined (1) for signs of periodicity in AIV infection dynamics; (2) the interactions between bird density, bird diversity and climatic conditions on viral prevalence, and (3) the potential relationships between individual resident times and infection risks in a waterbird community. For our examinations we collected and analysed fresh faecal samples from waterfowl for viral prevalence from 2006-2012. Of the 3295 fresh faecal samples collected and analysed, 179 (5.43 %) tested positive for AIV. No annual AIV periodicity was apparent, sharply contrasting with findings in the Northern Hemisphere where strong annual trends were found. Secondly, we obtained waterbird counts and rainfall data from 2006-2012 and found that AIV prevalence was positively correlated with rainfall, with AIV levels increasing in the months following heavy rainfall. This pattern may be related to (opportunistically) breeding waterfowl and the presence of immunologically naïve individuals in the population. Thirdly, we collected red blood cells and feather samples for stable isotope analyses and cloacal and oropharyngeal swabs for viral analyses (2011-2013) for a range of waterfowl species. Whether local birds are more or less susceptible to infection than new arrivals to the area and whether bird origin thus plays a role in determining AIV prevalence (as seemingly is the case in Northern Hemisphere studies) are pending and will be presented; preliminary carbon and nitrogen stable isotope analyses indicate that residence status of birds can be assessed.

p05-012

Avian malaria affects survival in the Great Snipe

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Malaria parasites can infect birds and prevalence can vary among species and populations. In addition to prevalence studies, parasites are often used to investigate effects on life history traits. Findings from these studies are not unambiguous, as correlations with many life history traits are absent, although common findings include relationships with survival and body condition. We investigated prevalence of the blood parasites, pigmented haemosporidians (PH) and *Leucocytozoon*, in eleven populations of Great Snipe (*Gallinago media*), a lekking shore bird, and their effect on survival using a PCR approach. Moreover, we explore the effect of parasites on arrival time.

We found the overall adult prevalence to be 29.9% with an 28.6% prevalence for PH, 4.9% for *Leucocytozoon* and 3.5% for mixed infections. The prevalences we report are very high compared to other shorebirds are somewhat intermediate compared to those found for other bird species. We found variation in prevalence among the sample years in our main study population, Gåvålia, Norway. To find among-year differences, long-term are often needed. At the main study site we found differences in prevalence between different leks. Also, we found a decrease in PH prevalence with age, and infected birds had a lower mean age. Two not mutually exclusive alternative explanations are that infected young birds may have a higher mortality and/or that individual birds can purge the infection.

p05-013

Bird-mediated tick movements in an urbanized landscape

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The northeastern United States of America has high rates of tick-borne zoonoses among its human population. Lyme disease, one such tick-borne disease, is the most commonly reported vector-borne disease in North America, and the state of Delaware, in particular, has the highest per capita Lyme disease rate of any state in the USA. The incidence rate across the country continues to rise, and the ranges of the tick vector (*Ixodes scapularis*) and disease-causing bacteria (*Borrelia burgdorferi*) are expanding. Ticks are reliant upon their hosts' movements to disperse and colonize new areas. As such, migratory birds have been implicated as a group of important hosts contributing to the range expansion of ticks and pathogens. At a local scale in human-dominated landscapes, hosts likely disperse ticks among forest fragments. We investigated the capacity of breeding forest birds to host and distribute ticks among a network of forest fragments surrounded by human development in Newark, Delaware, USA. From May–August, 2013, we captured 214 birds across ten forest fragments and removed 137 larval and nymphal ticks from those birds. We identified ticks and screened them for pathogens. We will present our results on the summer phenology of tick loads and pathogen prevalence. To understand the potential for birds to move ticks within and among forest fragments, we used radio telemetry to track the movements of juveniles of two ground-foraging bird species that are expected to be important tick hosts, Gray Catbirds (*Dumetella carolinensis*) and Wood Thrush (*Hylocichla mustelina*). During 2012 and 2013, we tracked 45 Wood Thrush and 56 Gray Catbirds. Both species exhibited inter-fragment movements, but catbirds were more likely to move from forests into residential areas. Our evidence indicates that bird species are differentially capable of hosting ticks infected with Lyme and moving them among forest fragments in an urban environment.

p05-014

Host sex and age dependent transmission strategies of avian lice in a colonial raptor.

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The effect of parasites on their hosts has been widely studied, however how host traits affect parasite decisions is less often addressed. Avian lice (Insecta: Phthiraptera) are permanent obligatory ectoparasites that need direct contact of hosts for transmission. Here we reveal the colonization strategies of various louse species during vertical transmission parasitizing on colonial Red-footed falcon (*Falco vespertinus*) fledglings. We collected samples from a total of 95 nestlings from 14 different artificial falcon colonies in southeast Hungary. We sampled a presumed male and a female from each nest with administering pyrethrin powder to the plumage. The birds were kept over a cardboard for 5 minutes and all fallen lice specimens collected. Two lice species dominated in the samples; *Colpocephalum subzerafae* (n=498) that feeds on contour feathers, skin and blood, and *Degeeriella rufa* (n=271) that typically forages on the material of larger feathers. Both species had relatively high prevalenc (~78%). The abundance of *C. rufa* varied significantly with host sex, while *D. rufa* abundance was significantly influenced by host wing length. Red-footed falcons are sexually dimorphic, but the sexes have identical plumage as nestlings. The female-biased abundance of *C. subzerafae* indicates that this species presumably has a previously unidentified sex detecting mechanism. We hypothesize that from the lice perspective, it is adaptive to choose females over males because a) females will moult less melanised feathers, providing more favourable future habitats, b) their contact rates with future offspring will be higher due to the different roles the sexes play in parental care. *D. rufa* is less mobile and has highly adapted locomotive organs that only allow these animals to move on feather. Therefore, selection may favour individuals whom colonize nestlings as late as possible, waiting for the new host to develop as mature plumage as possible.

p05-015

Helminths and arthropod parasites of Red-Crowned Crane (*Grus japonensis*) in Hokkaido, Japan

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Although several biological and ecological studies on the Red-crowned Crane (*Grus japonensis*) have been conducted, so far little information has been recorded regarding disease causing agents such as parasites of the crane . In the present paper, ten helminth species including six nematode (*Baruscapillaria* sp., *Syncuaria* sp., *Viktorocara* sp., *Paraucuaria adunca, Contracaecum* sp. and *Cyathostoma (Hovorkonema)* sp.), three trematode (*Echinostoma gotoi*, *Echinochasmus* sp. and *Apatemon gracilis*), one cestode (*Ligula* sp.), and five arthropod parasites including two louse-flies (*Ornithoica momiyamai* and *Ornithomya avicularia aobatonis*), one chewing lice (*Gruimenopon* sp.), one ixodid tick (*Ixodes* sp.) and one feather mite (*Geranolichus* sp.) were obtained and identified from free-ranging and captive cranes. Among the above parasites, *Echinochasmus* sp., *Ligula* sp., *O. momiyamai*, *O. a. aobatonis*, *Gruimenopon* sp., *Ixodes* sp. and *Geranolichus* sp. are the first host records and *Gruimenopon* sp. and *Geranolichus* sp. are the first geographical records from Japan. The nematode genera *Syncuaria*, *Viktorocara*, *Paracuaria* and *Cyathostoma* are regarded as disease causing agents sometimes causing severe enteritis, ulcerative ventriculitis, pneumonia and/or air sacculitis including fatal cases in various wild and captive birds. The lesions caused by these nematode species including a fatal cyathostomiasis were observed in some of the examined cranes. Hence, the infestation of these parasite species should be taken into account in conservation activities.

p06-001

A trade-off between pigmentation and overheating in avian eggs

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Many bird species like shorebirds (Charadrii) nest on the ground in sites with no vegetative cover. When incubating adults are disturbed, they depart from nests, and then the eggs may remain exposed to direct solar radiation, reaching temperatures that may be critical for embryos. The eggshells of shorebirds are pigmented and spotted. More pigmented and spotted eggs may suffer a quicker overheating than less pigmented and spotted eggs when exposed to direct solar radiation. Using eggs of Japanese Quail *Coturnix japonica*, we determined whether egg pigmentation and spottedness affected rates of overheating in eggs exposed to direct solar radiation. We conducted the study at temperate (Spain) and tropical (Costa Rica) sites. More pigmented and spotted eggs overheated more than less pigmented and spotted eggs, in both temperate and tropical sites. However, for the same ambient temperature, eggs overheated more in the tropics than in temperate sites, which may be due to more intense solar radiation in the tropics. Thus, the risks of overheating may affect pigmentation and spottedness of eggs of birds nesting in open sites.

p06-002

Evolutionary potential of arrival date on breeding grounds: selection, heritability and microevolution

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In migratory species, timing of arrival on the breeding grounds in spring is crucial for the reproductive success. Thus, in the face of a changing environment, it is important to be able to adjust the timing accordingly. However, little is known about the genetic background and hence evolutionary potential of arrival date. We have used a multi-level approach to investigate the evolutionary potential of arrival date combining data from a multigenerational pedigree and novel migration tracking techniques of a natural population of Great Reed Warblers (*Acrocephalus arundinaceus*). We found that selection favours early arrival both in male and female Great Reed Warblers, and that the trait is both repeatable and heritable. Further, arrival date in the population has advanced during the two decades of this study, a pattern that is in accordance with the response attributed to climate change reported in other migrant birds but also in accordance to the directional selection acting on the trait. Tracking the full migratory annual cycle of individual Great Reed Warblers show that departure date from the wintering site determines arrival date and that spring migration is faster than autumn migration, corroborating the selection for earlier arrival. Our study is a first step towards dissecting the genetic and environmental factors that contribute to shape arrival date in long-distance migrant birds. Such analyses are essential if we want to understand how migratory species are able to cope with a rapidly changing environment.

p06-003

Detecting selection on phenotype by approximate Bayesian computation (ABC) in phylogenetic comparative methods: examples in birds

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Phylogenetic comparative methods (PCMs) have been used to test hypotheses on adaptive evolution. The evolutionary modes commonly included in PCMs are Brownian motion (genetic drift) and the Ornstein–Uhlenbeck process (stabilizing selection), whose likelihood functions are mathematically tractable. More complicated models of evolutionary modes, such as branch-specific directional selection, have not been used because calculations of likelihood and parameter estimates in the maximum-likelihood framework are not straightforward. Here, we present a fundamental structure and advantages of our new PCM method using the approximate Bayesian computation (ABC) algorithm (Kutsukake and Innan, 2013, Evolution, 67: 355-367). The ABC estimates unknown parameters as follows: (i) simulated data are generated under a suite of parameters randomly chosen from their prior distributions; (ii) the simulated data are compared with empirical data; (iii) parameters are accepted when the distance between the simulated and empirical data is small; and (iv) by repeating steps (i) to (iii), posterior distributions of parameters will be gained. Because the ABC does not necessitate mathematical expression or analytic solution of a likelihood function, the ABC is particularly useful when a maximum-likelihood estimation is difficult to conduct (a common situation when testing complex evolutionary models and/or models with many parameters in PCMs). As application, we analysed trait evolution in which a specific species exhibits an extraordinary trait value relative to others in birds. The ABC approach detected the occurrence of branch-specific directional selection and estimated ancestral states of internal nodes under this evolutionary model. The ABC will be a promising approach for broad topics of PCMs, particularly for testing complex evolutionary models that deviate from the standard evolutionary models based on Brownian motion.

p06-005

Toll-like receptor (TLR) evolution in wild birds

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Continuously evolving pathogens and parasites, usually leading emerging infectious diseases, pose strong selective forces on the immune systems of their animal hosts. These consequently drive adaptive genetic variation at functionally important genes involved in the development of immune defense. Therefore patterns of pathogen-mediated selection acting on immune-defense genes in animals have been the focus of considerable interests for evolutionary biologists. Members of the Toll-like receptor (TLR) gene family play an important role in pathogen recognition and the initiation of innate and adaptive immune responses. However, their role in host-parasite interactions and adaptation has rarely been investigated in an eco-evolutionary context, and little is known about the selective pressures that have shaped TLR evolution across species and populations. Being natural reservoirs and probably potential vector species of several avian-borne diseases, long-distance migratory Anatidae birds, i.e. geese, swans and ducks, are one of important groups to study adaptive evolution of animal immune systems. Investigating molecular evolution across several Anatidae species (ducks and geese), we show that TLRs are evolutionarily dynamic and a target of parasite-mediated selection in birds. The findings of our study contribute to a better understanding of evolutionary processes in multigene families other than the MHC, as well as important implications for host-pathogen coevolution.

p06-006

Complex song evolution and stress hormone in Bengalese finch: neural and evolutionary mechanisms

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The Bengalese Finch is a domesticated strain of the White-rumped Munia and exhibits more complex song sequences, which may have evolved due to domestication. Much evidence suggests that the song complexity is used as an indicator of male quality. Because songbirds learn their song during the juvenile stage, development of the song system is affected by developmental stress. We compared the level of the stress hormone corticosterone, fear and aggressive behaviour between Bengalese Finches and White-rumped Munias. Bengalese finches had lower corticosterone levels, lower fearfulness and aggressiveness than White-rumped Munias. Two subtypes of corticosterone receptors, the glucocorticoid receptor and mineralocorticoid receptor, showed expression in song nuclei and regions for emotion processing of the Bengalese finch brain. These results suggest that song development and emotional control are regulated by corticosterone via binding to the corticoid receptors. Bengalese finch might have been able to increase the investment of energy to reproduction in exchange for reducing the costs for predation coping. Our results suggest that decreased stress hormone levels secondary to domestication might account for one reason why songs became complex in Bengalese finches.

p06-007

Modeling the evolution of delayed plumage maturation in birds

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Delayed plumage maturation (DPM) describes the phenomenon of delayed acquisition of a certain plumage color and pattern until after the first potential breeding season in birds. This phenomenon has been studied for more than four decades. Many passerine species were demonstrated to exhibit DPM, and scientists are still finding new examples of DPM in nature. A profusion of hypotheses has already been proposed to explain the adaptive significance of DPM. We suggest that the DPM can be considered as a certain life history strategy, which should balance the trade-off between survival and reproduction. As far as we know, there is still no game theoretic modeling study to describe the basic logic and mechanisms of DPM and different hypothesis. Therefore, here we applied an age-dependent game theoretic model to explore the evolution of the DPM phenomenon. We found that the ESS of the strategy of investment on plumage in the first year is strongly determined by the available resources and predation risks. Either increasing maximum survival rate (i.e. determined by available resources) or predation risks can promote the evolution of DPM. Furthermore, we supported the cryptic hypothesis through including the cryptic effect in the survival rate equation. Since both the mimicry hypothesis and status signaling hypothesis assume that the subadults may gain advantages from reduced aggression from adults and easier access to food or other resources, we also supported these two hypotheses based on an assumption that the total resources gained by the subadults are negatively related to the plumage investment. Finally, we found that parental care investment between male and female had a strong influence on the evolutionary results. If the male investment constitutes a larger proportion of total parental care or the available male investment is more strongly related to the physical condition, the DPM strategy will be more preferred.

p06-008

Evolution of eggshell structure in tropical birds

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Breeding biology and how birds are responding to different nesting conditions, is not well understood in tropical areas while such understanding could help us to elucidate constraints imposed on species range limits, such as elevation distribution. It is known that the eggshell has allowed birds to colonize novel environments by preventing desiccation and thus permitting bird embryonic development in pretty much any environment. However, not much is known about eggshell structure variation among bird species, especially in tropical areas. Since egg pores are responsible for gas exchange between the embryo and the external environment, it has been proposed that birds have to modify the size and/or number of pore according to their nesting environment to avoid embryonic mortality. For example, to reduce water loss and gas exchange in dry and cold environments such as high elevations, egg shells should be thicker and have fewer pores in order to avoid embryonic desiccation, when compared to bird species inhabiting warmer and humid areas, such as low elevations. Because humidity, barometric pressure and temperature change with elevation, the Andes is a great area to test the hypothesis of thicker shells and fewer pores in tropical birds inhabiting high elevations. In this study, we evaluated differences in eggshell structure, and in the rate of gas conductance from eggs collected in Colombia and Peru. Then we tested the hypothesis of adaptation of eggshell structure to conditions varying with elevation, using (1) phylogenetic comparative methods involving cross-species analyses and (2) within-species examination of patterns of variation along elevational gradients. We examined whether this prediction holds interspecifically (comparing species from highlands and lowlands) and intraspecifically (comparing populations of single species distributed along an elevational gradient), focusing on Thraupidae, Turdidae, Furnariidae and Tyrannidae; families that have a distribution across the elevation gradient.

p06-009

Evolution of nest-building behavior in antbirds (Thamnophilidae)

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Recently, different authors have suggested and provided evidence on the usefulness of behavioral characters in phylogenetic systematics. In birds it has been demonstrated that behavioral characters, such as breeding biology traits are historically informative and reflect phylogenetic relationships of lineages, but such studies are scarce. The neotropical antbirds (Thamnophilidae) form a morphologically and ecologically diverse radiation of insectivorous birds that exhibit an extraordinary diversity in nest architecture and placement. To explore the evolution of this diversity and evaluate phylogenetic signals of nesting characters, I analyzed the wide variety of nest architecture in antbirds, combining novel field observations and a comprehensive literature search. I proposed hypotheses on homology and compared nest architecture characters as shape, materials, support type, attachment, among others. The analysis included 38 genera and 102 species (ca. 78% and 43% of all genera and species in the family). In addition, I mapped different nesting traits onto an independent molecular phylogeny. Our findings suggest a remarkably evolutionary conservatism for nest architecture and support type, but no phylogenetic signal was found for other traits. It is also suggested that cup-nesting was the ancestral condition in Thamnophilidae, with cavity-nesting, dome-nesting and globular-nesting arising once during the evolution of these species. Our phylogenetic results support both traditional and novel phylogenetic groupings, and suggest that some genera (e.g. *Myrmeciza*, *Thamnomanes* and *Myrmotherula*) could be non-monophyletic groups. Construction of domed nests appears to be a clear unique trait for a diverse group of species that exhibit large differences in morphology, song and ecology. This study suggests that nesting strategies are tightly linked to the inferred evolutionary history of Thamnophilidae, as well as provide support to recent splits and taxonomic arrangements in the family. We also report novel data on nesting biology of poorly known species

p06-010

Structure, function, evolution and development of amorphous photonic nanostructures from avian feather barbs: a comparative small angle X-ray scattering (SAXS) analysis of 230 bird species

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Non-iridescent structural colours of feathers are a diverse and an important part of the phenotype of many birds. These colours are generally produced by three-dimensional, amorphous (or quasi-ordered) spongy beta-keratin and air nanostructures found in the medullary cells of feather barbs. Two main classes of three-dimensional barb nanostructures are known, characterized by a tortuous network of air channels or a close packing of spheroidal air cavities. Using synchrotron small angle X-ray scattering (SAXS) and optical spectrophotometry, we characterized the nanostructure and optical function of nearly 300 distinctly coloured feathers from 230 species belonging to 52 avian families. The SAXS data provided quantitative diagnoses of the channel- and sphere-type nanostructures, and confirmed the presence of a predominant, isotropic length scale of variation in refractive index that produces strong reinforcement of a narrow band of scattered wavelengths. The SAXS structural data identified a new class of rudimentary or weakly nanostructured feathers responsible for slate-grey, and blue-grey structural colours in addition to a previously identified instance of 2D quasi-ordered bundles of keratin nanofibres in the medullary barb cells of Blue Penguin (*Eudyptula minor*, Spheniscidae). SAXS structural data provided good predictions of the single-scattering peak of the optical reflectance of the feathers. The SAXS structural measurements of channel- and sphere-type nanostructures are also similar to experimental scattering data from synthetic polymers that self-assemble by phase separation processes. These results support the hypothesis that numerous lineages of birds (at least 52) have independently evolved self-assembled, quasi-ordered, colour-producing nanostructures in feather barbs that develop via arrested phase separation of polymerizing beta-keratin from the cytoplasm of medullary cells. Such self-assembled avian amorphous photonic nanostructures with isotropic optical properties may provide biomimetic inspiration for next-generation photonic technology.

p06-011

The phylogenetic distance analysis between the Great and Rhinoceros Hornbills and between Austen's and Tickell's Brown Hornbills

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Since the relationship of 13 species of Bucerotiformes (Asian hornbills) of Thailand were generated by 1143 bp cytochrome b phylogenetic tree, we focused on the classification of birds with similar casque sizes . The phylogenetic distance between two larger species (Great and Rhinoceros Hornbills, *Buceros bicornis* and *Buceros rhinoceros*) but having a distinct morphology of an enlarged solid casque is narrow to 0.02 nucleotide substitution per site. However, the smaller birds having a reduced casque (Austen's and Tickell's Brown hornbills; *Ptilolaemus austeni* and *Ptilolaemus tickelli*) render a wider phylogenetic distance of 0.03 nucleotide substitution per site. With this different distance value, we postulated that the divergence of *Buceros bicornis* and *Buceros rhinoceros* occurred sooner than the brown hornbills resulting in a closer speciation time among the solid casque. We also hypothesized that the Austen's and Tickell' s Brown Hornbills were separated geographically long enough to maintain their speciation time. The genetic analysis of those 4 species are discussed.

p06-012

Does incorporation of alarm calls into avian song increase rates of signal divergence across species?

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Signals involved in mate choice often diverge due to fixation of different stimulating features in different populations. This process is thought to be especially rapid when mate-choice signals are learned. For example, in many songbird species, imperfect learning introduces variation in the song features that arise in different populations, leading to rapid cultural evolution. In contrast to songs, alarm calls are thought to diverge much more slowly, because they are subject to a distinct set of selection pressures. However, the songs of many bird species incorporate alarm calls either between successive song bouts or incorporated directly into song syntax, suggesting that the stimulating function of calls in alarm contexts can be co-opted into sexually selected signals. What are the consequences of alarm call incorporation for signal divergence across species? To address this question, we have compiled >300 alarm call and song recordings from >50 species in a single songbird genus, the *Phylloscopus* warblers, for which we have both a complete phylogeny and detailed range and habitat information. Song is a critical component of mate recognition and preference in these species and their songs often incorporate alarm calls. We will estimate the evolutionary rates of songs and calls in these species and compare the acoustic similarity of calls and song components to evaluate whether call incorporation is related to increased divergence rates of calls and/or songs. We expect our findings to provide insight into the consequences of call incorporation for signal divergence across species and, therefore, the evolution of song itself.

p06-013

Testing an accelerated directional evolution model in brood parasite cowbirds by a ABC-based phylogenetic comparative approach

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Cowbirds constitute a monophyletic group in which all five species are brood parasites. The number of host species varies among species (ranging from 1 to 216), with recently diverged species having a larger number of host species. Because species in their sister clade are not brood parasites, a likely evolutionary scenario is that (1) the most recent common ancestor (MRCA) of cowbirds was a specialist, and (2) cowbirds were under an accelerated directional selection toward increasing the number of host species. Phylogenetic comparative methods (PCMs) such as phylogenetic generalized least squares (PGLS) have been commonly used for testing models of trait evolution on a phylogeny. However, PGLS is not suited for testing such complex models because it basically assumes that evolutionary changes follow Brownian motion (neutral evolution) model in which trait variance correlates to branch length. In this study, we estimated different selective pressure for each branch and the ancestral states of host numbers in cowbirds by a recently developed PCM using approximate Bayesian computation (ABC). This ABC-PCM supports an accelerated directional evolution model because (1) the MRCA was estimated as a specialist species, and (2) the increases of trait changes were larger in short branches. In contrast, PGLS estimated the MRCA as generalist species. Our study indicates that ABC-PCM is effective and powerful tool for testing a complex evolution model compared to PGLS.

p06-015

Nesting success of grassland birds: aA comparison between tropical and temperate larks

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Life-history strategies differ in many respects between temperate and tropical regions. However, there are also life-history traits that are similar across latitudes. For example, related species from tropical and temperate regions show very similar rates of ontogenetic development despite the very different environmental and physiological conditions. Analyzing nest success and chick growth of two related species from different climate zones may give insights in the evolution of different pathways to maximize reproductive output. We compare nest success of Skylarks *Alauda arvensis* from a temperate grassland in the Netherlands and Red-capped Lark *Calandrella cinerea* from tropical grasslands in Kenya. To quantify nest success, nests were visited once every three days to determine the nest fate (successful nesting or nesting failure). We distinguished between nests that produced at least one fledgling, nest predation and nest desertion. We calculated nesting success using a modified Mayfield Method and the program Contrast. We discuss our results in light of the evolution of different reproductive strategies under contrasting biotic and abiotic constraints, including weather effects and predator abundance.

p06-016

What creates differences in brightness in ultraviolet-blue plumage colours in the Blue-and-white Flycatcher (*Cyanoptila cyanomelana*)

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Non-iridescent structural colours are commonly produced by coherent scattering of light wave by nanostructures of medullary β-keratin in feather barbs. Previous research has investigated the effect of the nanostructure of feathers barbs or barbules on colour production for various hues with brightness in structural plumage colours. Here, we focused on the effect of the nanostructure in making the difference in plumage colours in several body regions of the Blue-and-white Flycatcher (*Cyanoptila cyanomelana*), which show different brightness among similar hue values. A male Blue-and-white Flycatcher has ultraviolet-blue structural plumage colours which covers the plumage from head to back including wing and tail feathers. We used full-spectrum spectrometry to show hue values and brightness of ultraviolet-blue plumage colours of a male flycatcher. Reflectance spectra of ultraviolet-blue plumage colours of a male Blue-and-white Flycatcher showed that head, back and wing covert feathers reflected similar ranges of hue values whereas brightness of these plumages showed significant differences. Head feathers reflected much more strongly in the UV-blue regions of the spectrum than wing covert or back feathers. Furthermore, using scanning electron microscopy and transmission electron microscopy, we observed nanostructures of feather barbs to investigate the effect of the nanostructure on producing hue values and brightness in ultraviolet-blue plumage colours. Our results showed t significant differences of brightness in ultraviolet-blue plumages in an individual male Blue-and-white Flycatcher. Also we assume that the difference in spongy medullary β-keratin layer in feather barbs produces different brightness in structural plumage colours. In this species, a male inflates his head feathers to attract a female. We propose that brightness of head feathers of a male may have a possible role for mate choice in the Blue-and-white Flycatcher which is a topic for further research.

p06-017

Allochronic and geographic reproductive isolation in an African songbird

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Speciation involves reproductive isolation between populations. Such evolutionary dynamics are mainly driven by natural and sexual selection. However, research on the interaction of both evolutionary processes leading towards genetic diversification is scarce. In particular, consequences of reproductive timing on isolation mechanisms have received less attention. We studied genetic, song, and morphology divergence of geographically close populations of African Stonechats which breed six months apart from each other. Genotypes and phenotypes of geographically or allochronically separated populations showed similar patterns of diversification forming three distinct genetic clusters. Our results indicate that gene flow between populations is restricted through geographic and allochronic reproductive isolation barriers. Moreover, song and morphology divergence is strongly concordant with patterns of genetic structure. Additional experiments show that African Stonechats can discriminate between different song and morphological traits with females preferring mates with synchronised reproductive timing. Determining potential reproductive barriers and the ecological forces that shape them is crucial for understanding the multidimensionality involved in speciation.

p06-018

How latitude affects song traits in the leaf-warblers (Phylloscopidae)

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We applied a comparative phylogenetic approach to identify mechanisms shaping the evolution of territorial song in 80 taxa of Old World leaf-warblers (Phylloscopidae: *Phylloscopus*, *Seicercus*). The effects of body size, horizontal and elevational distribution, habitat and migratory behavior on 20 song parameters were tested via simple and multiple regressions. A multi-locus phylogeny was compiled to account for the confounding effect of phylogenetic history on the regression analyses. Most song features were driven by various selective forces leading to fast and irregular trait evolution across the tree. In accordance with previous studies, body size had a large effect on overall frequency parameters, being generally higher pitched in smaller birds due to morphological constraints of the vocal apparatus. Surprisingly, almost no adaptations to the acoustic properties of the habitat were detected. Similarly, effects of migratory behavior were small. In contrast, numerous relationships with measures of horizontal and vertical distribution were indicated many of which remain difficult to link to a specific underlying causation. On this poster, we want to focus on the effect of latitude on song features such as verse duration, frequency and song complexity and illustrate them with sonagrams of exemplary songs from over 300 males investigated.

p06-019

The rise and fall of family living and cooperative breeding in birds

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In birds, comparative analyses so far came to contrasting conclusions regarding the role of ecological and life-history factors that facilitate the evolution of cooperative breeding. However, all these studies contrasted cooperative breeders with all other species, which is an erroneous approach. Using life-history and ecological data on over 3000 bird species, we show that social evolution in birds is a step-wise sequential process between pair living, family living and cooperative families. Family living and cooperative breeding species are primarily found in stable, predictable environments while pair breeding species are more abundant in unpredictable environments. However, pair breeders and cooperative breeders are more similar in their reproductive decisions than family living species. We argue that this discrepancy in the response to ecological and life-history factors between the different social system is a consequence of that both family living and most cooperative breeding birds live in environments that allow the prolonged association of offspring with their parents. However, cooperative breeding modifies the reproductive investment decisions, allowing females to invest more in reproduction than family living species, since helpers reduce their reproductive costs. As a consequence, cooperative breeders are more similar to pair breeders in their reproductive investment, while family living species generally are more conservative in their reproductive investment. Thus, our study elucidates the factors that drive evolution of avian social systems.

p06-020

B10K Project: A Plan to Sequence the Genomes of nearly all 10,000 Bird Species and Development of a Database for Interrogating Trait Evolution Including Neurobehavioral Traits

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Here we announce our goal and progress on an international collaborative effort to generate representative draft genome sequences of all living bird species (>10,400), and some extinct ones, called the B10K project. Among the leaders of this effort are BGI, Copenhagen University, Duke University, the Smithsonian Museum, the Chinese Academy of Sciences and Louisiana State University. This goal is now achievable due to advances in next generation sequencing technology, reduced cost of sequencing genomes, a rapidly evolving computational biology field, and, a comprehensive availability of high quality avian tissue samples from museums and other institutions around the world. We have organized the project for sequencing in three phases representing the species of: (i) the 230+ avian families; (ii) the 2250+ genera of birds; and (iii) as many of the remaining 8,000+ extant species as possible. We are creating a database of traits that can be useful interrogating trait associations for differences across species. In a proof-of-principle, international Genome10K-BGI effort, the motivation for the B10K project, the genomes of 48 bird species, representing all Neoaves, both Neognathae, and two Palaeognathe orders, assembled or collected. Phylogenetic analyses revealed a highly resolved avian tree. The tree supports the evolution of vocal learning multiple independent times, and suggests that the common ancestor of core landbirds may have been an apex predator, and that this trait was lost two independent times. Based on this initial experience, we envision the B10K effort will provide a public resource that we hope will benefit many scientists, facilitating the study of a myriad of questions in genome biology and evolution that would otherwise be difficult to address. This includes fostering the development of novel computational tools and algorithms, identify genetic differences underlying biogeographical patterns of species ranges and richness, and attain a greater understanding of speciation in the tree of life. We hope this project will also be useful for studying avian pathogenic infections of interest to public health, and for gaining insights into genes controlling complex avian traits such as flight, vocal learning, cognition, and social, mating, and predatory behavior. We envision B10K to also serve as a model for future lineage comprehensive genome projects.

p07-001

The diet of antbirds (Thamnophilidae; Passeriformes) from stomach content analyses

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The family Thamnophilidae, known as antbirds, comprises around 209 species in 45 genera distributed in the Neotropics and off-shore islands. Most thamnophilids occur in humid lowland forests with the highest diversity in the Amazon basin; the number of species diminishes with increasing altitude in montane areas. Many members of the family are arboreal, inhabiting the understory to canopy levels, although some are terrestrial. Antbirds feed on arthropods, but occasionally eat small vertebrates. Many species are obligatory ant-swarm followers, and they also form mixed flocks in the understory and to a lesser extent in the canopy. Using inventories from various surveys in the Amazon region, the objective of this study was to determine the diet of representatives of the Thamnophilidae, including the number of prey and the total biomass consumed. We analyzed the stomach contents of 280 specimens representing 32 species and 17 genera. Most of the species were followers of ant swarms, of which 50% were occasional, 15.6% regular and 6.25% obligatory. Diet items with the highest frequency of occurrence were Coleoptera and Orthoptera (22,7% and 20,2%, respectively), and these were responsible for more than 80% of the biomass consumed, with the Orthoptera contributing 52.8% and the Coleoptera 29.2%. Other arthropods identified as food were Araneae, Chilopoda, Hemiptera, Hymenoptera, Isoptera, Diptera, Odonata, Blattodea, Dermaptera, larvae and eggs. Small vertebrates were eaten by two species, *Percnostola leucostigma* (n = 1) and *Hylophylax poecilinotus* (n = 4). Financial support was given by CAPES and CNPq.

p07-002

Does diet influence time of breeding and molting in Neotropical birds?

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Assuming that food supply for birds is directly related to environmental variables such as rainfall and temperature, this can lead to distinct, diet-related periods of breeding and molting. We tested this hypothesis by mist-netting, fecal sampling and scoring of molt and brood-patch presence in birds in an Atlantic Forest in southeastern Brazil. Sampled species were grouped into omnivores, insectivores and nectarivores-insectivores, and the results were compared using Friedman's Anova and Chi-square tests. We found no significant differences in periods of molting ($F = 2.0417$, df: 2, $p = 0.1314$) and breeding ($F = 1.5417$, df: 2, $p = 0.3258$) among the analyzed foraging guilds, suggesting that species of distinct guilds perform these tasks at the same time of the year (November to May and August to February, respectively). These observations can be explained by a generally higher abundance of food resources during the hot and wet season. We also found little overlap between molt and breeding cycles, with overlaps of just 7.1% in insectivores ($\chi^2 = 3.0124$, $p = 0.2222$), 13.6% in nectarivores-insectivores ($\chi^2 = 3.0124$, $p = 0.2222$) and 5.1% in omnivores ($\chi^2 = 0.1126$, $p = 0.9155$). This can be explained by the high energy costs involved in these life-history stages, regardless of feeding habits. In general, there were no temporal differences in the studied cycles for the distinct trophic guilds studied and we thus reject our initial hypothesis.

p07-003

Diet composition of Cerulean Warbler (*Setophaga cerulea*) nestlings

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The Cerulean Warbler (*Setophaga cerulea*), once common in eastern North American hardwood forests, is one of the fastest declining Nearctic-Neotropical wood warblers, decreasing at a rate of approximately 3% per year. It is listed as vulnerable by the IUCN, as a species of concern in the United States and as endangered in Canada. Population declines are primarily attributed to habitat loss in the eastern U.S. and at wintering grounds in South America. Despite a substantial increase in research during the past decade, Cerulean Warbler offspring diet has not been studied. We determined the prey types (insects and arachnids) that Cerulean Warbler parents fed their young over the 2011-2013 breeding seasons and compared the proportions of different prey types to prey availability. We identified a total of 351 prey items (n=34 in 2011, n=17 in 2012, and n=300 in 2013) at 24 nests. Although the proportion of Lepidoptera larvae (caterpillars) deliveries varied annually and seasonally, caterpillars were the most frequently delivered prey item. Caterpillar availability decreased and non-caterpillar prey deliveries increased proportionally during the latter part of the breeding season. Non-caterpillar prey items included Orthoptera, Diptera, Neuroptera, Arachnida, Coleoptera, Hemiptera and Phasmida. Many songbirds rely on an abundant supply of caterpillars to raise their young, and their nesting phenology has evolved to coincide with peaks in abundance of caterpillars. These species may be particularly prone to the effects that changes in vegetation composition and climate likely have on the life cycle and abundance of their food source and these effects may negatively influence those songbirds' reproductive success.

p07-004

Temporal and spatial change in the diet of Black-faced Spoonbill chicks revealed by stable isotope analysis

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The endangered Black-faced Spoonbill (*Platalea minor*) breeds mainly on uninhabited coastal and offshore islets in the western Korean Peninsula. Because the nasal salt glands of their hatchlings may not be fully functional, it has been suggested that adults with young possibly switch feeding sites from freshwater wetlands to brackish and coastal mudflats over the nestling growth period. We investigated the change in diet of Black-faced Spoonbill chicks, using stable isotopes ($\delta^{13}C$, $\delta^{15}N$) in the primary feathers of chicks raised in Incheon (Suha Islet, Namdong Reservoir) and in Jeonnam Province (Chilsan Island). The tip (grown at the age of 10 days) and middle (grown at the age of 22 days) portions of each primary were collected and analysed to examine potential diet change over the early chick growth period. $\delta^{13}C$ of the middle portions was significantly higher than that of tips regardless of breeding site, suggesting that the ratio of marine foods increased over time as expected. According to the two-source $\delta^{13}C$ diet mixing model, the estimated contributions of marine foods to the chicks' diet changed from 59.78% to 68.71% in Incheon and from 60.52% to 70.18% on Chilsan Island as chicks grew. However, the $\delta^{15}N$ value did not change significantly in Incheon whereas it significantly decreased on Chilsan Island. The latter result indicates that the trophic level of the Incheon chicks remained unchanged during the brooding period, whereas the trophic level of the chicks on Chilsan Island was reduced over time. Our results provide the first evidence of a temporal change in the diet of the chicks in this species, showing a declining reliance on freshwater foodwebs with age, as well as a spatial variation in diet related to breeding site.

p07-005

Spatial, foraging behaviour and dietary overlap between two similarly-sized avian herbivores wintering in China

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Competition may occur when two species with similar feeding ecologies share limited resources. Understanding both the mechanisms of competition and their impacts are crucial for predicting population dynamics and developing conservation and management strategies. In recent years, two wintering goose species, Eastern Tundra Bean Geese *Anser fabalis serrirostris* and Greater White-fronted Geese *Anser albifrons frontalis* have increased at Shengjin Lake, China. To examine the potential occurrence of inter-specific competition and possible avoidance strategies, we studied their 1) seasonal abundance; 2) habitat use and 3) foraging behaviour and diet of geese foraging in mixed and single species flocks, in the sedge meadows that they used simultaneously. During the main wintering season, numbers of both species were inversely correlated, suggesting avoidance. Both species extensively exploited sedge meadows, where they showed considerable overlap in spatial distribution and diet. However, the percentage of time feeding and diet by both species were unaffected by the presence of the other species. Greater White-fronted Geese appeared to be diurnal sedge meadow specialists, almost never feeding in other habitats. In contrast, Bean Geese were less selective, shifting from the shared sedge meadow to alternative habitats and increasingly fed at night in mid-winter. This exploitation of alternative habitats and night feeding potentially ameliorated the potential for inter-specific competition between the two species. The specialised feeding ecology of Greater White-fronted Goose may make them particularly vulnerable to sedge meadow habitat shortage. Bean Geese probably perform better in the face of sedge meadow shortage by proactively exploring alternative habitats and changing their feeding ecology.

p07-006

Diet variation of the Southern Grey Shrike in Algeria

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The diet of sixteen Southern Grey Shrikes (*Lanius meridionalis*) was studied in three Algerian sites: Algiers (North-central), Tlemcen (North-west) and Biskra (South-east). Between 2006 and 2010, 370 pellets were collected at shrike roosting sites throughout the year. The aim of this study is to analyze diet variation and relate this to environmental factors. In the laboratory, pellets were disaggregated carefully and a quantitative study of their composition was conducted with a binocular stereomicroscope. Nine of the 83 fragments of plants studied in the pellets collected in the region of Algiers were identified as autochthonous species; 4 of the 15 fragments of plants analyzed in the Tlemcen-site pellets were identified as autochthonous species; and 3 of the 22 fragments of plants studied from the pellets collected in the region of Biskra, near the Sahara desert, were identified as autochthonous plant species. The most abundant species identified in this study is, however, an unidentified plant (found in 58 fragments from Algiers and in 20 from Biskra), followed by Poaceae species (7 fragments from Algiers and 3 from Biskra). Previous studies show that plant residues found in shrikes (Fam. *Laniidae*) were part of the diet of other primary vertebrate preyed upon. Results of this study demonstrate that the Southern Grey Shrike is able to accommodate diet variation under environmental restrictions.

p07-007

Hunting habitat selection by Eastern Marsh Harriers *Circus spilonotus* in agricultural areas: a case study in the Hachiro-gata polder

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Breeding habitats of Eastern Marsh Harriers (*Circus spilonotus*) are not only primal wetlands. In Japan, they breed in agricultural areas as well and Hachiro-gata polder, Akita prefecture, is typical. This polder is a vast lowland (north-south 18km, east-west 12km) surrounded by a lake. Although most of the polder is composed of paddy fields, there are also soybean fields, wheat fields, pastures, waterways and windbreaks. The Harriers breed in reed beds along waterways or on vacant land that are scattered among the polder. From May to July 2013, we observed nesting of the Harriers at 2 study sites. We defined hunting flights as low-altitude flights in which gliding and flapping alternate while the bird scans the ground surface. We timed hunting flights for each type of land cover and calculated Manly's Selectivity Index (MSI) that is the ratio of hunting flight time and land cover area. MSI indicates degree of each land cover preferred by the Harriers as hunting habitat. While we observed each Harrier, we recorded vegetation structure and surveyed densities of small animals (voles, frogs and birds), which are the birds' major prey in the study area. In one study site, where pasture was the land cover, we recorded the longest hunting flight times. The MSI of pasture was larger than other land cover types. On the other site with no pasture, the longest hunting flights were over reed beds, and the MSI of reed beds was the largest. Thus, pastures and reed beds are important hunting habitats for the Harriers in Hachiro-gata polder. While there was positive correlation between MSI and density of voles, there were no correlations between MSI and other elements including vegetation structure. These results suggest that the Harriers would select hunting sites with an emphasis on abundance of voles. This work was supported by Grant-in-Aid for Scientific Research (C) (25450506).

p07-008

Foraging habits of Gentoo and Chinstrap Penguins revealed by stable isotope analysis on King George Island, Antarctica

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The ecology of diving seabirds is largely affected by the abundance and distribution of their marine prey. The intent of this study was to investigate intra- and inter-specific differences at the trophic level and geographical origin of the penguin diet. We used two stable isotopes, ^{13}C and ^{15}N, in the whole blood of Chinstrap (*Pygoscelis antarctica*) and Gentoo Penguins (*P. papua*). Whole blood samples were collected for stable isotope analysis from the 13th of January until the 6th of February, 2013. During this period, the penguin chicks were in the late guarding and early crèching stage. As a result, Chinstrap and Gentoo Penguins showed similar trophic level having similar $\delta^{15}N$ values, but Chinstrap Penguins appeared to forage in more pelagic areas than Gentoo penguins by having higher $\delta^{13}C$ values. The males showed a higher trophic level than females for both species, but there was no significant difference in foraging areas between males and females as indicated by $\delta^{13}C$. According to the isotope comparisons for age, chicks showed lower $\delta^{15}N$ values than the adults for both species. The finding suggests that adults feed their chicks with prey in the lower trophic level (krills) in comparison to their own diet. Chicks also had lower $\delta^{13}C$ values suggesting that adults utilize prey from more offshore areas for their chicks.

p07-009

Hummingbirds and their flowers at dryland vegetation in Chapada Diamantina, northeast Brazil

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We investigated the relationship between hummingbirds and their floral resources in an area of altitudinal dryland vegetation in Chapada Diamantina, Caatinga biome, northeastern Brazil. It is a region regarded as having a high priority for conservation due to its high floristic diversity and endemic species. During bimonthly expeditions from April 2012 to August 2013 we documented the seasonality and foraging strategies of the hummingbird species, as well as floral characteristics and flowering patterns of plant species explored by these birds. We recorded eight species of hummingbirds, five of which were considered resident species. *Anopetia gounellei* and *Phaethornis pretrei* displayed a trapline foraging strategy, visiting species with more specialized ornithophilous flowers. *Chlorostilbon lucidus*, *Eupetomena macroura* and *Amazilia fimbriata* displayed a territorial behavior, defending areas with concentrations of floral resources. The remaining species made occasional visits, acting as low reward trapliners or generalists. Hummingbirds foraged in 28 species of plants belonging to 15 families of which the Cactaceae was the most representative, followed by Bromeliaceae. Among the plant species visited, 57% are ornithophilous. Most of the plant species have tubular corolla and the average concentration of nectar of the community was 21.1%. Ten species flowered exclusively during the dry season, one species only during the rainy season, and 17 during both seasons, so that floral resources were available throughout the year. The network of mutualistic interactions between hummingbirds and plants had a nested pattern, with a level of connectance of 25%. In this pattern, most of the interactions are focused on a small number of species. The different foraging strategies used by these hummingbirds promote lower niche overlap, which, combined with the continuous flowering of species in the plant community, enable the coexistence of hummingbird species in the area.

p07-010

Influence of thermodynamic costs on daily movement decisions and habitat use of the Brolga (*Grus rubicunda*)

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Endotherms produce heat as a result of internal metabolic processes. The core temperature of endotherms is independent of external temperatures within the thermoneutral zone. When external temperatures exceed the upper critical temperature of an animal, it needs to lose heat, which is associated with increased rate of water loss. To maintain core temperature within non-lethal limits, animals may change their behaviour to increase evaporative cooling or shift their location to habitats that provide a thermal environment with lower metabolic costs and reduced water loss. Brolgas (*Grus rubicunda*) forage in open, exposed paddocks and are therefore subjected to external environmental conditions that can result in individuals experiencing heat stress and water loss. These factors are likely to constrain the amount of time available for foraging and influence decisions on when and where to move to maintain water balance and reduce metabolic costs. Daily patterns of habitat use and movements are thus likely to be driven by environmental conditions. We investigated these patterns of behaviour by utilising GPS tracking data to study daily habitat use of Brolgas. We then combined location data on habitat use with detailed behavioural observations, weather data and a biophysical model to understand mechanisms behind daily movement decisions of Brolgas. Preliminary results indicate that Brolgas foraged in paddocks during the cooler part of the day and roosted in wetlands during the hottest part of the day. Movements between the two habitats were triggered by biophysical requirements to reduce heat loss and metabolic costs and to maintain water balance.

p07-011

Body size differences in a brood of nestlings of Daito Scops Owl is related to the diversity of provisioned food

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Female Daito Scops Owls (*Otus elegans interpositus*) which lay eggs every 3–4 days, start incubation before their clutch is complete, so eggs hatch asynchronously. In general, nestlings of asynchronously hatching broods vary in body size and these differences may affect the survival of fledglings. The aims of this study were: 1) to determine whether body sizes differed between nestlings of this owl, and 2) to understand mechanisms leading to nestling size differences through the analysis of food provisioned by the parents. We monitored owls breeding in 2012–2013, recording the food provisioned by the parents with charged-coupled device cameras and measuring body sizes of nestlings every 5 days. We only analysed data from three egg clutches. Hatching was asynchronous with an average hatching span from first till third egg of 3.5 ± 1.0 days (N = 6). Both the first and second-hatched nestlings spent on average of 29.1 days in the nest while the third-hatched nestling (C03) stayed an average 27.5 days in the nest. Thus C03s fledged earlier than the other siblings. Body mass, natural wing and tarsus length of C03s at 10 days before fledging were significantly smaller than those of their siblings. The provisioning rate and growth rate of all siblings was indistinguishable. The relative differences in nestling mass (index of body mass difference within a brood; i.e. index of within clutch variation in body mass) were positively correlated with provisioning rate of cockroaches by both parents and negatively correlated with Simpson's diversity index of the provisioned food by the male parent. We found body size to vary in relation to hatching date, but found no evidence that size differences were escalated by competition between siblings over food resources. Most likely, size differences were affected by the quality of the food the chicks received, and especially by the diversity of types of food provisioned by the parents. Therefore, parents may tend to compensate for nestling size differences by modifying their food provisioning efforts.

p07-012

Sexual size dimorphism and foraging behaviors of the Crested Ibis (*Nipponia nippon*)

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Size differences between male and female Crested Ibises are sometimes perceivable in casual observations, but functions of sexual size dimorphism remain unknown. This mysterious species was once extinct in the wild and is now on the way of reintroduction in Japan. We examined whether sexual size dimorphism was related to differences in foraging of male and female Crested Ibises. First, we measured the lengths of the tarsus and culmen of birds captive-bred prior to release to the wild, and found that the mean lengths of males were longer than those of females for 8% and 11%, respectively (p<0.01 for both, Wilcoxon rank sum test). In 2012 and 2013, we observed behaviors of breeding birds that had previously been released. We used the scan-sampling method to determine microhabitat selection of foraging birds, and conducted 3-minute focal animal tracking to examine whether use of searching behaviors was different between sexes. A "submerged" searching behavior was defined, a case where the bird submerged its head until its eyes were hidden under mud water at least once within a tracking session; "normal" surface searching meant the bird didn't use "submerged" searching within a session. Males foraged on mud water of rice paddies for more than 53%; females foraged for more than 34% on levees (narrow embankments around paddies) and less on mud water. Males and females selected microhabitats differently (p<0.05, chi-square test). Males exploited submerged foraging in 23.5% of tracking sessions (n=68) while females did not (n=14); the sexes adopted different foraging behaviors (p<0.05, Fisher's exact test). Males caught more loaches per unit time in rearing periods, than females did (p>0.05 for 2012, p<0.01 for 2013, Wilcoxon rank sum test). These results supported our hypothesis and suggested that males, with longer tarsi and culmens, can forage frequently and deeply on mud water.

p07-013

Foraging ecology of an Oriental White Stork in Toyooka city, Hyogo Prefecture, Japan

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The Oriental White Stork (*Ciconia boyciana*) is a large wading bird and an endangered species in Japan as well as in the world. The storks have become extinct about forty years ago in Japan, because of habitat loss and decrease of their prey. A reintroduction program which released storks in the wild for restoration of the species was started in 2005 in Toyooka, Japan. Toyooka is a city which was the last habitat of the storks. In order to provide information on the species' foraging ecology in the wild, I studied the daily active time, foraging time, foraging habitat and prey of the species in Toyooka in March and June 2008. I pursued the stork by car from flying out of the roost to roosting, and recorded its foraging behavior by video camera. The time between leaving the roost and coming back for roosting was 12 hours 39 minutes in March, and 15 hours 5 minutes in June. The proportion of time spent foraging was 42.6% in March, and 48.3% in June. The stork mainly used paddy fields (51.1%) and ditches (38.0%) in March, and paddy fields (93.8%) in June as foraging sites. Prey identification from recorded videotapes showed that the stork mainly consumed loaches and red swamp crayfishes in March, and tadpoles in June. I also estimated the daily total weight of its food in March and June. I will discuss the significance of their foraging ecology for the restoration of the species.

p07-015

The possibility of endozoochorous seed dispersal by waterbirds in Mongolia

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Waterbirds may play an important role in the maintenance of aquatic vegetation by transporting plant seeds between wetlands. However, field data and information on the occurrence of waterbird-mediated transport is limited. Moreover, most studies have extensively focused on non-breeding sites. We believe that the information from breeding sites is important with respect to seed dispersal. Waterbirds forage on seeds at their breeding sites before undertaking long-distance migrations to the south. We examined their feces for intact seeds in Mongolia. Twenty-three species of geese and ducks breed in Mongolia and most leave their breeding sites by August–September, although a few species of waterbirds overwinter in unfrozen open waters. We collected fecal samples from locations of feeding and roosting waterbirds. Ninety-three samples were collected at 8 sites in Hövsgöl and Arkhangai in August 2007, and 44 samples at 3 sites in Gobi-Altai in August 2009. We observed mainly Whooper Swan *Cygnus cygnus*, Bar-headed Goose *Anser indicus*, Swan Goose *Anser cygnoides* and Ruddy Shelduck *Tadorna ferruginea* at the sampling sites. However, we could not identify the feces at species level due to several reasons. We additionally collected 22 fecal samples (Ruddy Shelduck and Mallard *Anas platyrhynchos*) at 2 wintering sites in Ulaanbaatar in February 2009. Samples were washed through a 0.5-mm or 1 × 2-mm sieve and the residues examined. Intact seeds occurred in 0–33% of samples in August 2007, 7–67% in August 2009, and 43–60% in February 2009. Seeds found in summer were from at least 2 plant genera (*Potamogeton* and *Persicaria*). Seeds found in winter were mainly *Persicaria* spp. Our results confirm the papers reporting that waterbirds potentially carry seeds at long distances during their migration. We found plant seeds not only in summer feces but also in winter feces. It suggests the possibility of seed dispersal throughout the year, at least at local wetlands.

p07-016

The cost of long distance adult foraging movement during reproduction: an inter-population study of Streaked Shearwaters

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In Procellariiformes such as shearwaters and albatrosses, chick-rearing-adults make trips to predictably rich waters that are surprisingly far from their nests. An explanatory hypothesis was suggested, namely that the parents need to efficiently replace energy that was lost while provisioning chicks, even though the long trips impose a cost on the parents and chicks, by reducing parental nest attendance and provisioning rate which determine chick growth. Therefore the long trips may affect the inclusive cost in reproduction for this pelagic group. Using Streaked Shearwaters (*Calonectris leucomelas*), we compared inclusive cost and benefit of parents' foraging trips in reproduction by studying parental foraging behavior and morphological traits, and chick growth rates among populations of the western North Pacific (Mikura and Sangan) and a population of the Sea of Japan (Awa) that are neighboring populations along eastern Honshu, Japan, in the Far East Asia. Tracking by satellite telemetry, we found that the parental birds of the three populations make foraging trips to the wide area of waters off south-eastern Hokkaido. Destinations of foraging trips varied in distance from their nests, being a maximum of 1,184km from Mikura, 749 km from Awa and 540 km from Sangan. Mikura birds spent most of the foraging days on the long distant trips (i.e. >500 km from nests), by contrast, birds from the other two islands spent most days on the short distant trips (i.e. <250km from nests). The parent body mass and chick growth rate of Mikura birds were the lightest and the slowest, respectively, among the three populations, while those of Sangan birds were the heaviest and the fastest, with moderate values for Awa birds. Our comparative study among the three populations, thus, indicates that the Mikura population incurs a cost of long distant parental foraging movements in reproduction compared to the other two populations.

p07-017

Roost population and foraging behaviour of the Malabar Pied Hornbill in Western Ghats of India

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Roost populations and foraging behaviour of Malabar Pied Hornbills were observed from April, 1984 to February, 2013 in the Hornbill Conservation Reserve, Western Ghats of Karnataka, India. The roosting place is located on the right bank of river Kali amidst human habitation. In 1980s and 90s the study area was under tremendous disturbance from the construction of a Dam for hydro-electric power. The study revealed that there is a steady increase in the population of hornbills from 44 in 1985 to 69 in 2013 at the roost, and that the same roosting and foraging sites have been used by Malabar Pied Hornbills over a period of 29 years. However, seasonal changes in foraging route and distance have been noticed.

The increase in hornbill population at the roost is due to decreased human activity and predation pressure in the study area. The protection of roost, food plants, and decreased predation pressure in the Hornbill Conservation Reserve are the possible reasons for their fidelity to roost and foraging sites.

p07-018

Social facilitation of foraging behaviour in domestic chicks; a possible role of dopaminergic reward system

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Social facilitation occurs when an animal behaves in the presence of one or more conspecifics, often resulting in an enhanced performance and a behavioural synchronization leading to swarm formation. Common biological backgrounds have often been assumed, because the social facilitation is reported in a variety of animals including human (Zajonc 1965, Clayton 1978). In this study, we investigated facilitation of foraging behaviour in week-old domestic chicks. Single or paired chicks foraged in an I-shaped maze equipped with a pair of millet feeders on both ends, and each feeder distributed one or two grains at variable intervals without any cues. Chicks actively ran back and forth between the two feeders (shuttling). (1) The shuttles were not synchronized with the food dispensing, (2) amount of shuttles was higher in paired chicks than in single chicks, (3) shuttles of paired chicks were partially synchronized, and (4) the effects occurred immediately after the pairing. We further examined the social facilitation by dividing the I-maze into two parallel lanes separated by a transparent wall, so that kleptoparasitic interference (food competition) did not occur. Again, (5) the social facilitation of shuttles and their synchronization occurred, indicating that the competition was not responsible. As the next step, we searched for the neural substrate of social facilitation by using selective lesion of dopamine (DA) transmission by micro-infusion of 6-OHDA to basal ganglia and midbrain dopaminergic nuclei. Results of the lesion experiments suggest that (6) medial striatum is critical for keeping foraging efforts, but is not required for social facilitation to occur. Instead, (7) substantia nigra (lateral group of DA neurons) is involved in the social facilitation. It is suggested that a subset of dopaminergic reward system is activated by visual exposure to foraging conspecifics, and its activation could cause the social facilitation and swarm formation.

p07-019

Seasonal and annual variation in foraging strategies of Little Penguins (*Eudyptula minor*)

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Seabirds must alter their foraging strategies throughout the year in order to cope with variation in prey availability and the demands of breeding. We sampled foraging locations and diving behaviour of breeding Little Penguins (*Eudyptula minor*) at Oamaru, New Zealand, using Global Positioning System and time-depth recording devices. We attached the devices during pre-egg, incubation and chick-rearing stages over three breeding seasons (2010, 2011, and 2012). We aimed to determine how Little Penguins adjust their foraging in response to different stages of breeding and to determine if variation in foraging relates to reproductive performance. Foraging variables were related to the duration since the start of the breeding season rather than the stage: distance travelled increased, and dive depth decreased, as the season progressed. In all seasons there was no difference in the distance travelled and the total diving duration during incubation compared to chick-rearing. Among seasons, differences were found in the diving activity during the rearing of second broods (of double-brooding pairs). An increase in the total diving duration per day paralleled a reduction in breeding success during 2010. The reduction in breeding success was attributable to the occurrence of a storm event during the 2010-11 austral summer, however during the same period the total diving duration was already high. We conclude that extrinsic factors were more important than stage-related demands of breeding in influencing Little Penguin foraging strategies at Oamaru.

p07-020

Applicability of a single-sample doubly labelled water method to the Streaked Shearwater (*Calonectris leucomelas*)

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Doubly labelled water (DLW) method is a common approach to investigate CO_2 production rate (rCO_2) (i.e. field metabolic rate) of free-ranging animals by injecting oxygen and hydrogen isotopes. The two-sample protocol (TS) of DLW method requires taking two blood samples both before and after an experimental period (i.e. initial and final isotope enrichment, respectively). Alternatively, a single-sample protocol (SS), which includes the estimation of initial isotope enrichment, has been developed as a less invasive means with lower impact on the behaviour of study subjects. However, little information is available on the accuracy and precision of SS protocol. Therefore, we studied the validity of SS protocols in the Streaked Shearwater *Calonectris leucomelas*. We developed equations for the SS protocol based on the measured initial isotope enrichments, the amount of injected isotopes and body mass collected from 21 shearwaters. Then, for six shearwaters subjected to the TS protocol we calculated the turnover rates of oxygen and hydrogen isotopes (ko and kd), and rCO_2 using the two-pool model with both measured and initial isotope enrichments. The arithmetic and absolute errors were 0.02% and 0.90% for the estimated initial enrichments in oxygen isotope and 0.24% and 3.15% for hydrogen isotope. rCO_2 calculated by TS and SS protocols showed a linear relationship although the SS protocol overestimated rCO_2 by 15.0% in comparison to the TS protocol. ko and kd derived from the SS protocol had a discrepancy of -2.6% and -11.8%, respectively. We could reliably estimate the initial enrichments of both isotopes and apply the two-pool model in the calculation of rCO_2. The overestimated rCO_2 by the SS protocol may be caused by the lower accuracy and precision of the estimated initial enrichment in hydrogen isotope. The choice of sampling protocol may depend on the trade-off between the need for both accuracy and precision, and the behavioural impacts on the study species.

p07-021

Crisis for males: the failure of sexual niche separation when food resources changed

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Sexual segregation in foraging has been reported in animals, especially in those with gender dimorphism. Different foraging strategies of males and females have been explained by niche separation or dominance hypothesis but it is usually difficulty to distinguish the ecological causes and consequences. We investigated the foraging behaviours of Bar-tailed Godwits *Limosa lapponica*, a shorebird with conspicuous dimorphism in body size and bill in Yalu Jiang, China, an important staging site for northward migration. We collected behavioural observations and benthos samples in several areas with different benthos composition and density and we repeated this at the same places while the food resources changed over time. We found that males tended to be tide followers and they pecked quickly to feed on bivalves even when the densities of bivalves were very low or bivalves were too big for them. Fewer females followed the waterline and they consumed more polychaetes and shrimps than males. The frequency of aggression was very high when the birds were foraging together along the waterline and females frequently involved and won more aggressive interactions than males. Pecking for and swallowing small benthos quickly could be a strategy developed by males to avoid competition with females while a huge number of birds foraging in staging sites and niche separation have been fixed by evolution. However, this foraging habit can bring males into unfavourable condition when the number of bivalves declines sharply.

p08-001

Climatic conditions on migration and annual survival of a neotropical migrant, the Yellow Warbler

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Populations of migratory songbirds are influenced by climatic condition at all stages of their annual cycle. However, recent work on western neotropical migrants suggests that ENSO-related climate conditions on migration have a greater influence on annual apparent survival than conditions on the wintering grounds or breeding grounds. Here, we examine how El Nino Southern Oscillation effects on westerly wind speeds during the migration period, storms on migration, and dry season precipitation in the southwestern region of the migratory flyway influence the apparent annual survival of Yellow Warblers (*Setophaga petechia*) breeding in western Canada using data collected from 2004-2014. We show that westerly windspeeds during a two month period (April-May) explain more of the variation in annual apparent survival than conditions over a longer or shorter migratory period. Wind-speed effects on apparent survival are not explained by increases in the prevalence of wind or rain-storms during this migratory period. We compare the level of support for survival models including ENSO effects on wind speed at elevations used by neotropical migrants, and dry season precipitation that will influence conditions at stopover sites, and contrast our results with previous studies on neotropical and palearctic-African migrants.

p08-002

How timed is the timing of migrants?

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The timing of reproduction and survival in relation to migration are generally believed to be crucial in determining fitness of migrants. Several studies have investigated how timing of breeding is related to reproduction, but the consequences on survival of migration and arrival timing have not received much attention. The proximate control of timing of individuals is presumably a result of a combination of genetic, phenotypic and environmental factors as well as some degree of randomness. Here, we investigate the effect of timing on individual survival, by modelling survival rates as a function of ringing date. In all cases, we incorporated species, season and migration distance effects. In spring, long-distance migrants tended to show low survival for early and late birds whereas for short-distance migrants, survival generally decreased during the season. In autumn, the pattern of survival was much less clear with apparent differences between species. Overall, migration in spring passed was before the maximum survival. For the species showing protandry, the migration peak of females coincided with maximum survival, whereas males arrived before that. This supports the prediction that competition for territories can lead to suboptimal arrival times in migrants.

p08-003

Plasticity and repeatability of migration timing of American White Pelicans

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Endogenous and exogenous mechanisms control the timing of avian migration. The onset of spring migration is likely controlled by endogenous mechanisms because of fitness benefits of timely arrivals in nesting habitat. Likewise, dates of autumn departure from the southern boundary of a species nesting range are also critically important for winter survival (e.g., avoidance of northern winter conditions). Therefore, the two dates may express high repeatability, particularly in a short-distance migrant. However, phenotypic plasticity or individuality of migration timing allows for microevolution and adaptation to fluctuating environments in both wintering and nesting ranges. The timing of autumn migration may have greater individuality than that of spring migration. We used the GPS relocation data on 33 American White Pelicans (*Pelecanus erythrorhynchos*) wintering in Louisiana, Mississippi, and Alabama, USA from 2002 to 2011 to test the predictions: 1) the timing of spring and autumn migration changes over years, expressing either microevolution or phenotypic plasticity of migration timing; 2) the onset of spring migration and autumn departure dates from the southern boundary of *P. erythrorhynchos* nesting range have greater repeatability than the dates of spring and winter arrivals; and 3) dates of spring arrival are influenced by winter and spring temperatures in wintering habitat. Spring departure and arrival dates became earlier from 2002 to 2011, whereas arrivals in wintering habitat were delayed over years. Repeatability of spring departure dates and autumn departure dates from the southern boundary of the nesting range was 0.76 and 0.63, respectively, greater than that of spring and winter arrivals. Furthermore, spring departure and arrival dates became earlier with increasing spring and winter temperatures of winter range, respectively. Therefore, the timing of the spring and autumn migration of *P. erythrorhynchos* exhibits both phenotypic plasticity and repeatability.

p08-004

Weather effects on roosting ecology of Barn Swallows at an East Asian stopover site in the spring migration season

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Weather during migration affects body heat loss, migration speed, and food availability, thus it may affect not only migration schedules but also stopover of individuals or populations. We investigated whether meteorological conditions at a stopover site in the spring migration season affected roosting ecology of the Barn Swallow, which is known to be sensitive to environmental conditions during migration. We marked 73 roosting Barn Swallows on Heuksan-do Island, which is located at the south-western end of Korea, and monitored their roosting period (days observed in the roost) and size (number of individuals in the roost) in spring 2013. Multiple regression on the meteorological factors and roosting period showed that the roosting period increased with wind velocity at the arrival date. Second, a later arrival date and low mean lowest temperature during the roosting period were related to a shorter roosting period. Fluctuations in weather parameters such as wind velocity, precipitation, and lowest temperature during the roosting period were also significantly related to the roosting period. Third, meteorological conditions at the time of roosting formation were negatively related to roosting size. With these results, we confirmed that weather conditions in the stopover site affect the roosting period and roost size in Barn Swallows. Bad weather and its effects on the replenishment of fuel at stopover sites may be somewhat compensated by making communal roosts and by decreasing heat loss at night in this species.

p08-005

Local habitat selection and its implications for stopover patterns of fall migratory songbirds at an inland site of the northern Gulf of Mexico, USA

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Migration is one of the most hazardous periods in a migratory bird's life with high levels of mortality occurring during and just after migration. Many songbird migrants do not fly nonstop between breeding and wintering grounds, but alternate between flights and rests. The selection of stopover sites and the habitats at a stopover site is scale dependent. We studied local habitat selection and microhabitat association of songbird migrants at an inland site ~600 km north of Gulf of Mexico during fall migration. We examined 1) if species showed variation in their use of different habitats, (2) how microhabitat features affected the use, (3) how stopover parameters such as timing of use, mass change, and recapture rate varied by habitat, and (4) how experience (age) affected these patterns. Habitat selection was species specific: we identified two major groups, forest-understory and fruit-consuming birds that were more often associated with the forest, and another group more associated with edge habitat and open site. The habitat selection was affected by the body condition of these birds, and it in turn influenced condition change during stopover of these birds. Hooded Warblers (*Setophaga citrine*) had better overall body condition in the wetland site, with higher fat, body mass, and a significant increase in condition index compared to those of the same species using the forest site, while Common Yellowthroats (*Geothlypis trichas*), Magnolia Warblers (*Dendroica magnolia*), and Blue-winged Warblers (*Vermivora cyanoptera*) from the forest site had greater fat and body mass. All thrush species were found more frequently and most had better conditions and daily increase in condition index in the forest site. Habitat selection was affected by age in some species: adults were more habitat specialist associated with particular habitat features. Adults of eight species also showed positive mass change in one site and negative in the other.

p08-006

Stopover habitat preferences of Wood Sandpipers and Common Snipes in lotus and rice fields

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It is well-known that flooded rice field is an important habitat alternative to decreasing natural wetlands for waders. In East Asia there also exists another type of flooded agricultural fields, i.e. lotus fields, which are saturated with water all year round like natural swamps. However, few studies have focused on the availability of lotus fields as stopover sites by waders. During the spring migration season in lotus and rice fields in central Japan we studied the habitat preferences of two wader species: Wood Sandpipers (*Tringa glareola*) and Common Snipes (*Gallinago gallinago*). These two species were common in the study area and expected to show different habitat preferences due to conspicuous differences in morphological traits such as bill shape and body size. In late April, when more than one fourth of rice fields still remained unflooded, both species used lotus fields. After all rice fields were flooded to plant rice, Common Snipes preferred rice fields to lotus fields, whereas Wood Sandpipers remained in lotus fields. Our findings suggest that for both species the presence of lotus fields and for Common Snipes the timing of flooding rice fields play a prominent role. On the basis of these results we discuss the function of lotus fields as suitable stopover sites for waders in inland wetlands.

p08-008

Geolocators reveal that a migratory woodpecker uses tree cavities throughout the entire annual cycle

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One resource that may be limited in human-altered landscapes is tree cavities for roosting, but it is challenging to monitor the frequency with which non-breeding birds use cavities, especially during migration. Numerous studies have addressed the use of cavities for breeding but they may also function as roosting sites that provide protection from the elements and predators during the non-breeding season. Thus, the availability of cavities during the non-breeding season may be a critical resource for migratory cavity nesting birds. Using data from light-level geolocators collected over four years (n = 20 geolocators), we provide the first documentation of the frequency of cavity use throughout the entire annual cycle. We studied a migratory woodpecker, the Northern Flicker *Colaptes auratus*, in British Columbia, Canada. Flickers migrated along the west coast of North America but there was considerable individual variation in migratory distances, movements and wintering locations. Some flickers made more than two large-scale movements within the non-breeding period. Throughout the year, flickers spent on average 87% (range: 79 − 99%) of nights roosting in cavities. However, periods of the annual cycle (breeding, post-breeding, migration and wintering) varied, with cavities used less frequently during the post-breeding, fall migratory and winter periods. Remarkably, during migration flickers spent on average 83% (range: 59 – 95%) of nights roosting in cavities. The frequent use of cavities during migration emphasizes that access to tree holes during migration, a potentially scarce resource for roosting, may be important for individual survival and maintenance during the annual cycle and hence may have consequences for maintaining stable populations of cavity nesting birds.

p08-009

The use of radar for "observing" bird behavior

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During the last decades there has been a growing number of radar applications for ornithology. In addition to the traditional use for monitoring migrating birds, radars have been used in airports to reduce the potential risk of bird collision with aircrafts and along power lines and wind mills for assessing the collision risk with these manmade structures. Radars are useful to detect birds movements beyond the range of binoculars and with low visibility (i.e. at night) and these can be quantified exactly, both at the individual and group level. Here we present four case studies gathered in different Italian areas during the last two years: (i) the daily activity of aquatic birds in Venice lagoon; (ii) departure directions during the spring migration of several raptors species from an island in the central Mediterranean; (iii) the transit of passerine birds over a Mediterranean Island at different times of day and night; and (iv) the daily entrance of shearwaters to their colony and their departure in relation to the moon phase. In all these cases the radar has proved to be a reliable tool for revealing aspects of bird behaviour that could not have been detected by traditional observation methods. The behavior revealed by the radar in the four case studies was in line with what has been hypothesized, although never directly observed. From the recordings gathered it was possible to obtain detailed quantification of the movements. In the future, such recordings can be used to analyse data more deeply using new analytical tools.

p08-010

Australia-Asia Little Tern *Sterna albifrons* geolocator project

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The Little Tern *Sterna albifrons* migrates to Japan to breed. From May to August they form colonies on beaches, along the sandbanks of rivers, and on developed lands etc. However, the natural environment that they favor for breeding is decreasing and they are deterred from breeding on most developed lands and airports (due to bird strikes). Their breeding sites the terns are using are damaged from natural disasters and predators. The Ministry of the Environment has put the Little Tern on the red list as Endangered II. Their breeding sites are protected by volunteers, NPO and other groups as much as possible. The staging areas on their migratory routes and their wintering grounds are also in need of protection. These areas are very important sites for the terns and the loss of them would be devastating.

Up to now, research on these birds and their sites could not be done due to their small size. However, development of geolocators has made it possible to conduct research on their sites and movements. We chose the MK5090 model geolocator for this purpose. The total weight including the flag is 1.2 grams and is 1.0 - 1.3 cm in length.

In 2013 we attached these geolocators to 100 Little Terns. They were captured in Osaka, Shizuoka, Tokyo, Chiba and Ibaraki. We will report on the methods used and some of the results.

p08-011

Migratory behaviors in free-flying passerines tracked by radio telemetry

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During migration birds are highly dependent on a number of decisions in order to successfully reach their wintering area and to return to their breeding grounds. Several of those decisions are made on stop-over sites and include duration of stop-over, departure direction and departure time in relation to weather and availability of orientation cues. Situated in the most southwesterly point of Scandinavia, Falsterbo is a strategic stop-over site for the about 500 million birds heading back and forth between their breeding areas and their wintering habitats at more southerly latitudes every year. We use an automatic radio telemetry system in order to study behaviors in free-flying migratory passerines on stop-over in Falsterbo. To be able to study flight behaviors and the decisions that make a bird fly a specific way, we have an additional radio telemetry tower situated offshore, 50 km southeast from Falsterbo. We track both long and short distance as day and night migrants and have observed that they stay in the area up to several weeks. The birds that passed the offshore tower southeast of Falsterbo all left the peninsula during early night and under certain wind conditions. The wind also affected the time it took for them to fly to the offshore station, which also was affected by how clear the sky was at departure and fat score at release.

p08-012

Regional Doppler radar network and eBird observation database reveal trans-Atlantic departures of nocturnally migrating birds

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Bird migrations occur at global scales, at which monitoring is challenging. Yet large-scale monitoring is crucial for understanding movements of bird populations, particularly relative to potentially rapid changes in landscapes and climate. One such global-scale movement occurs over the western Atlantic Ocean between the Northeast US coast and the Caribbean and South America. Radar and direct visual studies have confirmed that many species, including songbirds, use these routes. However, no studies have characterized geographic and seasonal extents of these departures or flight directions relative to species composition. We characterized migration phenology from 1 August – 30 November in 2010 and 2011 from archived weather surveillance radar and eBird observational data. We quantified density, direction, and speed of nocturnal bird movements in 40,000 hourly scans from 13 Northeast US radar stations. We created daily distribution maps and changes in frequency of occurrence for species in this region from eBird data. Distinct differences in density and direction of movements corresponded in time and space to changes in species distribution and frequency of occurrence, with trans-Atlantic radar headings matching changes in species' arrivals and departures. Results highlight a shift in migrant headings in coastal Massachusetts from trans-Atlantic flights in August and September to coastal flights in October and November; more trans-Atlantic flights originating from Massachusetts in August and September than from Maine; and a trend toward more over-water flights earlier in the fall season, in contrast to more coastal and trans-continental flights later. Results also suggest that complementary radar and observational data can detect in space and time when trans-Atlantic flights are occurring and what species are involved in the flights. This has value for examining how these flights have changed in the last two decades and predicting how birds might respond in a rapidly changing climate.

p08-013

A call for large-scale isotopic assessment of feathers to rapidly delineate patterns of migratory connectivity

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There is an overdue and urgent need to establish patterns of migratory connectivity linking breeding, stopover, and wintering grounds of migratory birds. Such information allows the more effective application of conservation efforts by applying focused actions along movement trajectories at the population level. Stable isotope methods, especially those involving the use of the measurement of stable hydrogen isotope abundance in feathers (δ^2H_f) of birds combined with Bayesian assignment techniques producing continuous probability surfaces and the use of prior information such as relative abundance of breeding birds, now provides a fast and reliable means of establishing migratory connectivity, especially for those migrants that molt prior to autumn migration. Despite advances, the ornithological community has failed to realize the full potential of this approach for rapid flyway-level assessements and there is still much misunderstanding regarding the use of this technique compared with other innovations, including the use of light-level geolocators. We outline key assumptions, advantages and a best practices approach for the isotope technique and provide several examples of large-scale connectivity assignments involving the Palearctic-Afrotropical, Neacrtic-Neotropical and East-Asian-Australasian flyways. We further make the case for a coordinated large-scale network to create an isotopic migratory atlas.

p08-014

Establishing migratory connectivity of Siberian rubythroats using stable isotope (δ^2H) analyses

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Seasonal migrations are an essential part of the annual cycle in most songbird species that breed in temperate and northern latitudes. Establishing connections between breeding, stopover, and wintering sites in songbirds is crucial for understanding their ecology and evolution, as well for effective conservation and forecasting the spread of diseases. Ringing has been the principal technique used to study songbird migration. Despite over a century of ringing effort, relatively little information has been garnered on migratory linkages in most flyways especially, in the Asia-Pacific Region. We therefore applied analysis of stable-hydrogen isotope ratios (δ^2H) of claw keratin and models of precipitation of δ^2H to depict wintering grounds of Siberian rubythroats (*Luscinia calliope*) from central Amurland (n=22) and South of Sakhalin Island (n=18), Russian Far East, captured at stopovers soon after their arrival from wintering grounds. Values of claw δ^2H indicated two large spatial clusters where rubythroats from Amurland and Sakhalin most likely over-wintered: one on the mainland from the Western Bengali in India through eastern Myanmar, another one is likely the Philippine Islands. This result suggests a possible migration divide between Amurland and Sakhalin birds. However this spatial assignment could not separate these two possible wintering grounds since the two regions are predicted to be isotopically similar. We will also analyze additional samples from the winter grounds in Thailand in order to validate migration links of species under study. Preliminary results suggest that the isotopic method may provide a useful addition to traditional band recovery efforts along the East Asian Flyway.

p08-015

Combining stable isotope analysis and geolocator data to investigate migratory connectivity in a long-distance Eurasian-African migrant, the Red-backed Shrike (*Lanius collurio*)

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During the last half-century long-distance migratory bird populations have been declining across Europe. In order to identify the factors controlling population dynamics and improve conservation strategies for these species we need to increase our understanding of how populations are linked in time and space. Despite advances in the development of tracking technologies (e.g. geolocators), quantifying migratory connectivity – the extent to which migratory bird populations are spatially linked during different stages of the annual cycle – remains a challenge; mainly due to low sample sizes. Here we use stable isotope analysis of carbon, nitrogen and hydrogen in bird feathers to investigate migratory connectivity between two European populations of the Red-backed Shrike (*Lanius collurio*) breeding in Denmark and Spain respectively. By determining wintering locations based on geolocator data we are able to validate the data from stable isotope analysis and make more robust inferences regarding migratory connectivity. Our preliminary analyses show no distinct patterns in the isotopic signatures of individuals from the two populations; whereas data from geolocators show that the populations are wintering in two geographically distinct locations of Sub-Saharan Africa. This suggests that individuals of this species are wintering in specific habitats, and calls for caution in using stable isotope analysis alone to determine wintering locations of species with specific habitat preferences.

p08-016

Revealing the migratory connectivity of Terek Sandpiper *Xenus cinereus* by mitochondrial DNA and stable isotope analysis

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Revealing the migratory connectivity of a bird is important for planning a conservation strategy to protect the bird at a population level in a specific site. The Republic of Korea (ROK) plays a major role in the East Asian-Australasian Flyway (EAAF) by providing stopover sites especially for long-distance migratory shorebirds. However, currently there is not enough information on the breeding grounds and wintering sites of the shorebirds which stopover in ROK. Therefore, this study was conducted to reveal the migratory connectivity of Terek Sandpiper *Xenus cinereus* which stopover on the west coast of ROK. We analysed the stable isotope signatures collected from feathers in two distant study sites to estimate the wintering origins. Additionally, the genetic structure was analysed using mtDNA to reveal the migration patterns between populations of the two sites. This study will shed more light on the migration pattern as well as the origins of *X. cinereus* which is not well studied in the EAAF and will be applied in conservation planning for the species.

p08-018

The elusive White-winged Flufftail *Sarothrura ayresi*; stable isotope analyses determine diet and migratory origins

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The White-winged Flufftail *Sarothrura ayresi* (family Rallidae) is a small (25-35g), elusive, wetland bird whose biology is poorly known, such that even its call is unconfirmed. The species has recently been uplisted to Globally Critically Endangered (previously Endangered). It is known from two disjunct populations some 4,000 km apart, one in Ethiopia (c. 9°-10°N) where it breeds in two seasonally flooded wetlands and another in South Africa (c. 25°-31°S) where breeding is unconfirmed. The migratory link between these two countries has largely been inferred and very little is recorded on the birds behaviour, diet, and feeding biology. Stable light isotope (δ^2H, $\delta^{18}O$, $\delta^{13}C$, $\delta^{15}N$) of feather and faecal samples from birds in Ethiopia and South Africa were analysed to, i) delineate the relationship between these two populations with respect to migratory connectivity, and ii) understand more about the diet of this elusive species. Results of these findings will be presented.

p08-019

Attracting wild birds to a terrace in Barcelona

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Feeding wild birds in gardens is a popular activity in many European countries, but not in Spain. This is the first Spanish survey with the aim to attract wild birds to a terrace. It was conducted on a 50 m^2 terrace in a densely urbanized area of Barcelona. Bird baths, bird tables and ground feeding stations were placed to attract a diverse range of birds. The birds were observed at the study area from a window, on average 215 days a year, from January 1st 2010 until July 31st 2013. There were in total 32 different species flying or occasionally perching in the study area. However, only 11 visited the feeding facilities. *Turdus merula* and *Sylvia melanocephala* were observed throughout the year; *Parus major, Cyanistes caeruleus* and *Carduelis carduelis* only occasionally. *Sylvia atricapilla* and *Sturnus vulgaris* visited the terrace as a stopover during the prenuptial migration. *Phylloscopus collybita, Erithacus rubecula, Phoenicurus ochruros* and *Motacilla cinerea* visited the terrace as a wintering ground. Additionally, a scan sampling was done to examine behaviour patterns. Dominant individuals controlled the best feeders, and subordinates fed in less favourable places. In addition to dominance relations, other variations in feeding efficiency between individuals result from experience (or age) and from sexual and individual differences in morphology. The most crucial habitat for travelling migrants is presumably that which lies adjacent to an ocean or other barrier, and forms the last possible feeding place before the barrier, or the first encountered after it. The success of this study was mainly due to the coastal location of Barcelona. In particular supplementary food was crucial to individuals who had suffered injuries on their migratory route.

p08-020

Bird species migration ratio in East Asia, Australia, and surrounding islands

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Abstract

Bird migration and its relationship with the contemporary environment have attracted long-term discussion. We calculated the avian migration ratio (the proportion of breeding species that migrate) in the areas from 70°E to 180°E and examined its relationship with the annual ranges of ambient temperature, primary productivity (estimated by the Enhanced Vegetation Index), and precipitation, along with island isolation and elevational range. The avian migration ratio increased with increasing latitude in general but varied greatly between the two hemispheres. Furthermore, it showed minimal differences between continents and islands. Our analyses revealed that the seasonality of ambient temperature, which represents the energy expenditure of birds, is the dominant factor in determining bird species migration. Seasonality in primary productivity and other environmental factors play an indirect or limited role in bird species migration. The lower avian migration ratio in the Southern Hemisphere can be attributed to its paleogeographical isolation, stable paleoclimate, and warm contemporary environment. Under current trends of global warming, our findings should lead to further studies of the impact of warming on bird migration.

p08-021

Main results of 15 years of bird migration monitoring by long-term ringing at the south of the Russian Far East

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Our Russian-Japanese project has been running since 1998. During those 15 years more than 145000 birds of 170 species were ringed. The ringing database consists of 180120 capture stories, and includes information about the age and sex structure of populations, body conditions, recapture, and length of stopover. We traced the long-term dynamic intensity of spring and autumn migrations, identified population trends of some species (including negative ones), and accumulated information on small species. Regular and accidental records on the mainland coast were found for passerines migrating at the Pacific islands.

We recorded the return of four passerines between Japan and southeast of Primorye, thus confirming the existence of the flyway through the Sea of Japan (*Emberiza rustica, Phoenicurus auroreus*). Birds ringed in Sakhalin were recaptured in Japan (11) and Taiwan (1), and those ringed in Primorye were recaptured in China (19).

It was revealed for the first time that some transit migrant passerines of the East Palearctic (*Ocyris rutilus, Locustella lanceolata*) had a specific migration strategy – the interruption of autumn migration for moult at long stopovers.

We studied the moult features of first-year birds (some *Sylviidae* and *Emberizidae*) with primary moult prior to the start of migration. By considering the length of the East Asian flyway for polytypic species, we have successfully started to study the migration characteristics of several sub-species using genetic methods.

p08-022

Body mass variation of the arctic warbler along a northern section of the east Asian flyway during fall migration

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One of the major approaches to studying migration strategies of most small songbird species is still through trapping, banding, and measurement of the biometrical variables at migratory stopover sites. The East Asian Flyway is one of the major global migration routes for many songbird migrants, but with limited research on the stopover ecology of these birds. Here we examined the body mass variations of the arctic warbler (*Phylloscopus borealis*) along this flyway during its fall migration with the goal of having a better understanding of the migration strategy of this species. The data were from two sites in central and southern parts of Kamchatka (Russia), two sites in the north and south of Sakhalin (Russia), one site at Honshu (Japan), two inland sites (northeast China and Amurland, Russian Far East), and two island sites in the Republic of Korea. We detected that arctic warblers migrated with substantial subcutaneous fat stores, but showed no trend of increasing body mass (and hence fuel stores) from the north to the south, otherwise known for many European-African and Neotropical migrants. Birds from Amurland and Korea were significantly lighter than those of other sites, but corrections for the individual sizes of birds made the difference less evident. Arctic warblers gain moderate fuel reserves at the onset of fall migration, but appear to maintain them along the route, showing rather low between-site variation. This might be an adaptation for dealing with unpredictable weather and for crossing large water bodies such as the Sea of Okhotsk. This conclusion is supported by the slightly smaller size-corrected body mass of birds from inland sites and Korean islands, where birds move for longer periods of time without crossing barriers and face smaller barriers such as the Yellow Sea.

p08-023

Migration patterns of birds in the southernmost forests of the world

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The UNESCO Cape Horn Biosphere Reserve (CHBR) at the austral end of the Americas hosts the world's southernmost forests. Dominated by the evergreen broadleaf *Nothofagus betuloides*, the sub-Antarctic forests in Cape Horn also include deciduous patches of *N. pumilio* and *N. antarctica*, as well as a mosaic of moorland, high-Andean, coastal, and wetland habitats embedded in a landscape of archipelagoes, fjords, and channels. Using 12 years of standardized monthly mist netting at the Omora Ethnobotanical Park, Chile (55^{o}S), combined with bird censuses in summer and late fall/winter at 61 sites broadly distributed throughout the CHBR, we analyzed variation in the abundance of forest birds at different seasons of the year, and in different habitat types and zones of the CHBR. We hypothesize that a significant fraction of the forest birds are migratory, and that populations in the more exposed western zones of the CHBR will have more migratory movements.

A total of 11012 birds belonging to 26 species were captured with mist-nets, including 6 orders and 15 families. Nineteen species (79%) were passerines and other small forest birds. Three species (*Phrygilus patagonicus, Aphrastura spinicauda,* and *Elaenia albiceps*) accounted for 75% of all captures, and 8 species for >95% of the captured birds. In the CHBR 15 species were residents, 3 local migrants and 7 regional migrants. We detected 3 partially migratory species. Of the 19 species detected on the more exposed islands on the West, 12 were residents, 5 were regional migrants, and 2 presented only local migrations to sheltered sites. *E. albiceps* was the only species that presents long-distance migration to tropical forests of South America during winter. Our results detected a remarkable contrast of the seasonal dynamics of sub-Antarctic forest bird assemblages with those reported for temperate and boreal forests in the Northern Hemisphere.

p08-024

High altitude New Zealand record for a Long-tailed Skua (*Stercorarius longicaudus*)

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On 5 November 2010, an in-bound passenger aircraft to Auckland Airport, New Zealand, collided with a Long-tailed Skua (*Stercorarius longicaudus*) at an altitude of 4084m (13400ft). Although fragmentary, the bird's remains allowed specific morphological identification that was subsequently confirmed by DNA analysis. The record was accepted by the Ornithological Society of New Zealand's Record Appraisal Committee, and the specimen is preserved in the Museum of New Zealand Te Papa Tongarewa, Wellington. The Long-tailed Skua is a northern hemisphere breeder that migrates to areas including the SW Pacific in the austral summer. It is considered a rare visitor to New Zealand, though it is recorded as a regular visitor to SE Australia. Little is known of the migratory patterns of the species in the Pacific as most records tend to be of dead specimens retrieved from beaches. Known wintering areas for the Long-tailed Skua are in the southern Atlantic, but wintering areas close to Australia and New Zealand are also suspected. Our record is consistent with the current understanding of high altitude migration by skuas. High altitude migration is associated with long-distance flights, in which birds utilise favourable weather patterns, selecting tailwinds generated more frequently in high pressure weather systems. The timing of the record, however, is outside of the recognised migration periods for the species. The record location on the eastern margin of the non-breeding distribution centered on SE Australia suggests that the skua may have been moving laterally within this western Pacific non-breeding 'cell', using the high altitude conditions to assist the movement. This record is of significance as, not only does it provide further evidence of the Long-tailed Skua as a high-altitude flyer, but also provides additional data for the non-breeding distribution for the species and a further record of a species rarely reported in New Zealand.

p08-026

Long-distance migration patterns of New Zealand's endemic Long-tailed Cuckoo (*Eudynamys taitensis*)

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Long-tailed Cuckoos are a long-distance migrant, breeding only in New Zealand during the Austral summer and migrating north to spend the non-breeding season in an arc of South Pacific islands spanning an east-west range of 11,000 km. Previously, their non-breeding distribution was known from sighting and museum records, but migration routes were unknown. Two hypotheses have been suggested about their annual movements: 1) they undertake a loop migration, moving anti-clockwise around the South Pacific, or 2) they follow a fan migration, with breeding based in New Zealand and then fanning out across the South Pacific for the winter (and converging back). It was also unknown if site-specific migration routes would be apparent, with birds from disparate breeding locations in New Zealand undertaking different and specific migration routes. To answer these questions we attached 5g PTT satellite transmitters to adult Long-tailed Cuckoos during the Austral summer. Northward migrations took place during March/April and tracking results supported the fan migration hypothesis as well as the existence of breeding-site-specific migration routes. The implications of these findings will be discussed in context of both the conservation of this species and its brood parasitic life history.

p08-027

Difference in home range between male and female juvenile Black-faced Spoonbill as shown by PTTs

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The Black-faced Spoonbill (*Platalea minor*) is one of the 50 rarest birds of the world. In an international winter census in 2012, only 2693 individuals were counted worldwide. Previously, most studies regarding the Black-faced Spoonbill focused on the habitat use of wintering site, foraging behaviors and breeding biology. Information related to migration and home range, however, is rare. The home ranges of juvenile Black-faced Spoonbills during post-fledging were studied using platform transmitter terminals (PTTs). Two juvenile birds were equipped with PTT (ID 67938, 79593) and engraved color rings (E37, E44) at their breeding sites (Suha island, Gaksi island) in early July 2011. Sex identification of juveniles was confirmed using their feathers, with E37 being male and E44 female. During the early post-fledging period there was no significant difference between male and female juveniles in the home range, and then E37 moved to the coastal area of North Korea. After one month, the home range of E37 (male) was significantly larger than the home range of E44 (female) before long-distance migration. Then, they successfully migrated to Taiwan (wintering area) and used the same habitat area. Although they used similar habitat, the home range of E37 (male) at the wintering area was significantly larger than for E37 (female). E44 (female) consistently used one place. On the other hand, E37 (male) used several places by moving often. They stayed at the wintering site for 2 years. Then, E37 (male) returned to the coast of North Korea and mainly used three sites. E44 (female) returned to the natal site and used the habitat nearby. Thus, two years after fleding, the home range of E37 was significantly larger than E44.

p08-028

Classifying mudflats using Landsat TM imagery in investigating the distribution of Eurasian Curlew in Chang-hua, Taiwan.

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Eurasian Curlew (*Numenius arquata*) is an IUCN Red-listed near-threated species. Before 1986, a population of more than 3,000 individuals wintered at the coastal mudflats at Chung-hua, Taiwan. In recent years, the wintering population has declined to 600 – 1,000 individuals and shifted their distribution 30 km southwards, from Ta-tu estuary to south of Fang-yuan. The distribution change of water birds is thought to be due to shifts of food resources in mudflats (*e.g.* benthos). Since the '90s, industrial developments including reclamations and thermal power plant construction have largely changed the landscape of the Chung-hua coastline. Mudflats may have been changed by such large scale habitat alteration, which redistributed marine benthos, and eventually resulting in the change in population status of Eurasian Curlew. Benthos population and distribution have been proven to be strongly connected with water bird densities, and mudflat properties affect benthos existence. We hypothesized that there was a synchronized distribution shift between the curlews and certain types of mudflat. We use Landsat satellite images to classify mudflats into different categories. Observations of foraging curlews were then plotted on digitized maps to attain the association between curlews and certain mudflat categories. Classifications of mudflat types are verified by ground truth sampling data. The result of this research will evaluate the possibility that the distribution change of Eurasian Curlew is owing to mudflat change, which is disturbed by industrial development. In addition, for conservation purposes, the research will identify potential foraging areas for Eurasian Curlew, which is under future threats such as wind farm plantations.

p08-029

Changes in the migratory pattern of cranes to Izumi

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Izumi city in Kagoshima prefecture is located at the southern end of Kyushu. It is the largest wintering site of cranes in Japan with a wintering population of about 10,000 Hooded Cranes (*Grus monacha*) and 3,000 White-naped Cranes (*Grus vipio*). Autumn migration to Izumi starts in mid October and the wintering population peaks from December to January. The results of crane counts during the season show that almost all the wintering population of Hooded Cranes migrate to Izumi by the beginning of November whereas the number of White-naped Cranes increases gradually towards the end of December. The changes in the migratory pattern of cranes have been observed over the past 10 years. The number of White-naped Cranes reached 1,000 by mid November before 2002, but since then there has been a 2-3 week delay in reaching 1,000. To help to understand the changes in migratory pattern of White-naped Cranes, simultaneous counts in Korea and Japan were conducted during 2012-2013. The results show that about 4,500-5,000 White-naped Cranes move between Korea and Japan during winter. As for Hooded Cranes, their migration at the end of October has intensified in recent years, growing rapidly to a large wintering population of 6,000-7,000. We will report on these changes in autumn migratory pattern of Hooded Cranes and White-naped Cranes to Izumi.

p08-030

Control of bird migration in common cuckoos *Cuculus canorus*

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The innate programme guiding inexperienced avian migrants to their appropriate wintering grounds has proved very difficult to study. We aim at understanding how inexperienced Common Cuckoos are able to find appropriate staging, wintering, and breeding grounds and separate the components of the inherited programme and external factors. Mapping the migration of young cuckoos using satellite telemetry enables us to compare timing of migration, migration routes, and length of time at stopovers with that of adult cuckoos. In addition, tracks can aid in pinpointing the critical stages affecting juvenile survival in Common Cuckoos.

p08-031

Home-range of wintering Mallards (*Anas platyrhynchos*) in Korea

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The Mallard (*Anas platyrhynchos*) is an abundant winter visitor in South Korea. Mallards migrate long distances between Russian Siberia and Korea. This species prefers rice paddy areas as their winter habitat. This species is also known as a potential carrier of HPAI (highly pathogenic avian influenza) H5N1 virus. Thus, we tracked their daily and wintering activity to know the relationship of HPAI outbreak to waterfowl migration.

We tracked eight mallards using WT-200 (GPS WCDMA based Telemetry), a newly invented telemetry device by the KoEco Inc. The WT-200 is a new telemetry device based on the GPS (Global Positioning System) combined with WCDMA (Wideband Code Division Multiple Access) mobile phone system. This device when attached on wild animals will record the GPS coordinates at a given time interval and transmit the geographic coordinates at the pre-set time of day using the public network of mobile phone system. Researchers can acquire the location data of tracking individual by accessing the tracking website.

We captured birds using cannon-net, and attached the WT-200 on eight Mallards in the winter of 2011-2013. We analyzed the tracking location data using ArcGIS 9.0 and calculated Kernel Density Estimation (KDE) and Minimum Convex Polygon (MCP).

The average home-range at the wintering grounds by MCP was 114.1 Km^2 (SD=66.3, n=8) and the maximum home-range was 221.8 Km^2 and the minimum was 27.7 Km^2. Extents of home-range by KDE were 100.7 Km^2 (KDE 90%), 45.7 Km^2 (KDE 70%) and 24.5 Km^2 (KDE 50%).

p09-001

Physical traits of male Japanese Bush Warblers in summer and winter

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The Japanese Bush Warbler (*Cettia diphone*) has a very distinctive song, shows marked sexual size dimorphism, and has a polygynous mating system. However, the physical traits of males and seasonal variation in those traits remain unknown. Physical traits (25 anatomical measurements including body size, mass of skeletal muscles, and visceral organs) of males in the breeding (summer, n=5) and non-breeding (winter, n=5) seasons were compared statistically. Clear differences were found between summer and winter ($p < 0.05$, *t* test) in the following seven items: body mass (19.8 ± 0.7 g *vs* 15.6 ± 1.2 g [mean ± SD]), mass of male reproductive organs (184.0 ± 25.7 mg *vs* 6.0 ± 1.4 mg), hind limb (3,789.2 ± 346.2 mg *vs* 3,003.4 ± 226.8 mg), leg muscles (883.0 ± 63.5 mg vs 581.4 ± 33.2 mg in either side), skin around the neck/throat (1,280 ± 34.9 mg *vs* 287.2 ± 84.7 mg), syrinx (35.8 ± 2.39 mg *vs* 25.0 ± 3.24 mg), and circumference of the neck/throat (52.1 ± 2.3 mm *vs* 38.3 ± 2.6 mm). In contrast to winter males, summer males had thickened flabby skin prominently in the neck/throat area and an inflatable oesophagus, perhaps a morphological basis for the elaboration of the throat sac as a vocal resonator. Also, the remarkable development of the flexor muscles of the legs of summer males suggests that perching and movement using the legs increases during the breeding season. These characteristics of summer males may have evolved as adaptations associated with the polygynous mating system, probably under sexual selection.

p09-002

Sexual dimorphism and sex-differential migration ecology of Little Buntings (*Emberiza pusilla*) at a stopover site

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The Little Bunting (*Emberiza pusilla*) breeds from northern Scandinavia across the northern Eurasian continent, and winters in eastern Nepal, northern and eastern India to northern South-East Asia, southern China, and Taiwan. It is an uncommon passage migrant in Korea and a few winter in the Korean Peninsula. Of the 16 bunting species recorded at the study site, the sex of Little Buntings is the most difficult to identify because its plumage characteristics are considerably similar between the sexes. Therefore, we aimed to find morphological and color differences by sex, in order to help understand their migration ecology and mating behavior. We caught 103 Little Buntings at a constant-effort banding station in Korea (Heuksan-do Island, Jeonnam) in spring and autumn migration season of 2012. We measured six parts of the head plumage and seven morphological characteristics, and sex was verified by molecular sexing using known universal primers. Male Little Buntings arrived earlier than females, as in other sexually distinctive dichromatic species at the study site. The first principal component, mainly explained by wing, tail, and total length, was significantly greater in males than in females. Males had more reddish and saturated colors than females. We also found that bigger individuals had more reddish and saturated plumage color regardless of sex and season. Our results indicate that the Little Bunting has sexual size dimorphism and cryptic sexual dichromatism, and plumage color may indicate individual quality.

p09-003

Dimorphisms and delayed plumage maturation in Japanese Paradise Flycatchers

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Fifteen of the 16 species of Paradise Flycatchers in the genus *Terpsiphone* generally have two color morphs in males with long central rectrixes (ca. 30 cm); however this dimorphism has not been detected in Japanese Paradise Flycatchers. Some have suggested that plumage coloration matures in three years along with the development of long rectrixes. This species experiences a typical form of delayed plumage maturation, although this has not been examined scientifically. We investigated variations of plumage of summer resident male Japanese Paradise Flycatchers from April to July in 2013 on Miyako-jima in the Nansei Islands, southwestern Japan. We caught and individually marked 44 males with mist-nets. We inspected their plumage color and measured external morphological traits. Sex of short-tailed individuals can be determined by incubating behavior. We confirmed the presence of three distinct types of plumage in breeding males, i.e. blackish-purple with a long tail (BPL), blackish-purple with a short tail (BPS), and brownish with a short tail (BS). BS should be considered yearlings as suggested by Yamashina (1941). The ratio of BPL, BPS, and BS were 68.2%, 9.1%, and 22.7%, respectively. We believe the yearling males develop blackish-purple plumage at the end of the first breeding season because we caught four yearling males who were in the process of molting from brownish to blackish-purple plumages in July. Although it has been suggested that males exhibit an intermediate color between blackish purple and brownish plumages during second year, we did not find such a morph. We concluded that plumage maturation was delayed in young males. It is inferred that the low ratio of BPS males indicates the existence of dimorphism in tail length in Japanese Paradise Flycatchers. We plan to continue to inspect the changes of plumage in the marked males annually.

p09-004

Analysis of colour variability in the Bluethroat subspecies *Luscinia svecica volgae (Z)*

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The Bluethroat is a polytypic and polymorphic passerine bird distributed in the North Palaearctic. Males have a variable colour throat patch on the bright blue bib. The colour of the spot varies according to the subspecies: chestnut (*svecica)*, white (*cyanecula)*, chestnut and white mix *(volgae)* or absence of the spot. It is supposed that the colour of the spot plays an important role in the mating system. Sexual selection is believed to be strong for this species, considering the variance in this secondary sexual male trait, the strong mate guarding by males of this species, and mating behaviour - when the male demonstrates his spot to the female. The distribution of the subspecies *volgae* is located between the *cyanecula* and *svecica* zones of distribution. Both colour morphs and all possible intermediate combinations of bib colours can be found here. Genetic investigations showed that the *volgae* subspecies manifests itself as an intermediate form. Analysis of sperm morphology in the Bluethroat also revealed its intermediate position between *cyanecula* and *svecica*. It is expected that the original forms (*svecica* and *cyanecula*) are also present in small numbers in the population. However significant differences in measurements were not detected. Some specific preferences in biotopes for red and white morphs were found. We revealed that evident sexual selection is absent in the population of the *volgae* subspecies. Females can choose males with different spot colour in different years. High levels of polygamy and extra-pair paternity were found in the studied population. All these forward the process of intergradation between different colour forms.

p09-005

Sexual dimorphism in moult and morphology of the Pale-winged Starling *Onychognathus nabouroup*

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Unlike other members of the African starling genus *Onychognathus*, Pale-winged Starlings are not sexually dimorphic in plumage. Field studies of vocal behaviour show that both birds in established pairs sing the same songs. At Augrabies Falls National Park, South Africa, over two successive visits in 2011 and 2012, experienced bird-ringers measured and ringed 66 birds, which were sexed subsequently by genetic methods from feather samples. Since rapid assessment of the sex of the birds during behavioural field work is preferable, we used these morphometric data (body mass, wing, tail, tarsus and culmen length) in a Discriminant Function Analysis to investigate if the sexes can be separated reliably. There were no significant differences between samples from different years, but marked differences related to both sex of the bird, and the identity of the ringer. DFA could separate males and females with a high degree of confidence (100% accuracy for one ringer, 76% for another), but clearly measurements by different individuals can differ significantly, and should not be pooled without careful assessment. A combination of measurements is required, and no single measure is a reliable indicator of sex. Wing moult overlaps with breeding in both sexes, but in both seasons there was a clear trend for moult to be more advanced in females than in males. This may relate to differences in parental care, but further investigation will be required.

p09-006

Effect of hatching asynchrony on variation in biometry of Hooded Crow *Corvus cornix* nestlings in a wetland population (W Poland)

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This study examines how flooded river valley conditions affect the variation in biometry of asynchronously hatched nestlings in a Hooded Crow population. The goals of this study were to compare: a) the differences in the dimensions of nestlings in individual nests and their variability during the period of growth between broods consisting of 3, 4 or 5 nestlings; b) the measurements of nestlings from individual broods, which died or survived during the chick-rearing period. All of the studied biometric parameters increased in the same way in broods consisting of 3, 4 or 5 nestlings. Furthermore, in a nest, the variation of all dimensions depended on the nestling's age and decreased during the period of growth. In addition, there were no differences in the dimensions between nestlings which died or finally fledged from the nests. All these facts show that food is not a severely limited resource in the study area. Parents are able to compensate for the detrimental effects of asynchronous hatching being a by-product of the earlier onset of incubation. They invest slightly more in smaller rather than bigger nestlings in the brood during the chick-rearing period, systematically decreasing initial differences between offspring. The study was funded by the grant NCN NN305076140.

p09-007

Establishment of double-contrast radiography of the air sac and simultaneous measurement of intratracheal pressure and air sac pressure in chickens

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As birds have no diaphragm, expansion and reduction of air sacs play an important role in causing expiration and inspiration, respectively. The root of each air sac is histologically characterized by tracheal cartilage, etiologically reflecting the air sac to be branched from the trachea. The avian lung has low tissue compliance and is only minimally expanded; thus, expiratory and inspiratory airflow is not delayed within the lung tissue. In this study, we scientifically investigated the sequential order of airflow within the air sac. The crop located under the esophagus was surgically removed in chickens under spontaneous-breathing inhalational anesthesia with isoflurane. A 2-mm silicone tube was then inserted into the intraclavicular air sac under direct vision. Then a 19-G needle was punctured through the skin into an individual air sac (upper or lower chest or abdominal air sac). A pressure sensor was applied to each air sac for simultaneous measurement of air pressure of each air sac and intratracheal pressure. Eight female chickens were used as experimental subjects. Measurement conditions were as follows: 100/sec, 14-bit grating, and 16 ch data logging.
For double-contrast radiography, a small amount of Urografin was infused into the air sac, and the movement of the air sac was recorded in real time moving images under X-ray fluoroscopy. The results revealed that abdominal muscle attached to the lower part of the rib cage and muscle ending at the pelvis contracted, thereby increasing the volumes of the chest and abdomen. That is, the increased volume served as a suction pump, leading to the occurrence of inspiration. The filling of the abdominal air sac resulted in an elevation of pressure. Double-contrast radiography of the air sac showed that expiratory airflow enters the abdominal air sac, then moves into the chest air sac at the time of non-lifting. It is thus unlikely that the airflow of the air sac moves in one direction.

p09-008

Comparative morphology and syrinx evolution in Brazilian caprimulgids (Aves, Caprimulgiformes)

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The study of internal anatomy in birds, particularly the morphology of the syrinx, has proved to be informative and effective in delimiting taxonomic groups. Nevertheless, considering the order Caprimulgiformes, there is a scarcity of studies focusing on this issue. This order is currently composed of five families: Aegothelidae, Podargidae, Steatornithidae, Nyctibiidae and Caprimulgidae, the latter three with representatives in South America. A recent molecular study divided the New World nightjars (Caprimulgidae) into three groups: New World 1, New World 2 and New World 3, with the latter two groups containing most of the Brazilian species of the family. This study aims to analyse the evolution of the syrinx in Brazilian species of nightjars, considering the latest available phylogeny for the family, and to verify the degree of intraspecific variation regarding this structure. The syringes of around 16 species of nightjars and 3 species of potoos (Nyctibiidae), used as an outgroup, were extracted, double-stained for cartilage and bone, analysed and illustrated. Preliminary results point to a certain similarity between the species scissor-tailed nightjar (*Hydropsalis torquata*), sickle-winged nightjar (*Eleothreptus anomalus*), long-trained nightjar (*Macropsalis* forcipata) and band-winged nightjar (*Caprimulgus longirostris*), which is consistent with molecular phylogenies, since most of these species are often placed in the same group. Furthermore, the genus *Caprimulgus* presented high polymorphism, and the subfamilies Chordeilinae and Caprimulginae seem to be paraphyletic, similar to molecular studies. We intend to increase the number of specimens and taxa analysed in order to achieve results regarding intraspecific variation and syrinx evolution.

p09-009

Musculus sternotrachealis and Musculus costosternalis pars minor: morphological variation and interaction between syringeal and trunk muscles in the Furnariida (Passeriformes: Tyrannides)

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Only a few studies concerning syringeal morphology have presented clearly and in detail the origin point of Musculus sternotrachealis, the most common extrinsic muscle of the syrinx. Among the species of Furnariida, a highly diverse parvorder of Neotropical passerines, two origin points for this muscle were described: on the Processus craniolateralis sterni and on the vertebral element of the first rib of the Costae completae verae. However, the close interaction of this muscular origin with Musculus costosternalis pars minor – a trunk muscle extending from Proc. craniolateralis to the first rib – has never been reported. Our aim was to describe the great morphological variation of this interaction in Furnariida by dissecting 133 specimens, including 59 species included in 50 genera representing the 10 families, 12 subfamilies and seven tribes of this parvorder. We found different degrees of muscular association in both origin points of M. sternotrachealis: 1- on the Proc. craniolateralis origin a- muscles completely independent, without any contact (Grallariidae), b- muscles contacting each other, but remaining independent without any overlap (Thamnophilidae, except Thamnophilini), c- few fibers of M. sternotrachealis inserting on the proximal tendinous band of M. costosternalis for a short extension (Thamnophilini), d- some fibers of M. sternotrachealis inserting on the proximal tendinous band of M. costosternalis for a long extension, almost half of the M. costosternalis length (Conopophagidae); 2- on the rib origin a- muscles completely independent, both inserting directly on the rib (Synallaxinae, Philydorinae, *Scytalopus* and *Sclerurus rufigularis*), b- M. sternotrachealis inserting both on the rib and on the aponeurosis of M. costosternalis connected to the rib (Rhinocryptidae except *Scytalopus*, Pygarrhichinae and *Furnarius*), c- M. sternotrachealis inserting on the aponeurosis of M. costosternalis (Dendrocolaptidae, Formicariidae, Melanopareiidae, Xenopidae, Berlepschiinae, *Lochmias nematura* and *Sclerurus scansor*). These results point to a promising source of potential phylogenetically informative characters.

p09-010

Systolic and diastolic measurement of the avian heart using an esophageal catheter

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We developed an esophageal catheter for recording the avian electrocardiogram (ECG), heart sound, and ventricular acceleration (ejection power) to substantiate the theory that there are no abnormal findings or symptoms in birds infected with low pathogenic avian influenza virus. Asymptomatic viral infection is uncommon in humans, and is associated with certain abnormalities at the genetic, cellular, and organ levels.
The avian heart has an extremely thick left ventricular wall. Electron microscopy reveals that myocardial myofibers are shorter in birds than in mammals, suggesting a higher ejection power. This observation corresponds to macroscopically hypertrophic myocarditis-like histology in humans. As birds have no diaphragm, chest and abdominal skeletal muscles operate continuously to control the air sac, thus birds cannot take rests. Therefore, ECGs acquired via electrodes placed over the body surface show constant electromyographic activity. The path of the esophagus in chickens and pheasants, as in other birds, is considered to be anatomically adjacent to the back of the heart, thus ECG findings and ejection power can be evaluated by inserting a catheter into the esophagus. We collected ECG data, heart sound, and ventricular ejection power using an in-house designed esophageal catheter from 10 chickens and 6 pheasants under spontaneous-breathing inhalational anesthesia. Excellent results were obtained by eliminating electromyographic activity from the ECG data collected, measuring the vibration of the closed aortic valve using an accelerometer, and determining systolic and diastolic ventricular properties. We herein report the favorable results of the present study. This work was supported by a Grant-in-Aid for Scientific Research from the Ministry of Education, Culture, Sports, Science, and Technology, Japan.

p09-011

A bony support structure in the penguin flipper

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Penguins are well adapted to aquatic life, and can 'fly' underwater by beating their flippers dorsoventrally. In such an oscillatory propulsion, a paddle-like appendage must be large, broad, and stiff enough to withstand hydrodynamic drag without muscular effort. Previous studies noted that penguins possess a wide ulna like a humerus and a unique triangular ulnar carpal bone, and that these bones contribute to form a rigid flipper adapted to diving by increasing a ratio of a skeletal element within the flipper. However, little is known about the 3-dimensional distribution of the bones in the flipper. We observed the internal structure of the flipper and viewed the spatial positioning of wing bones within the flipper by using CT scan. We also calculated the percentage of bone in the flipper by the cross-section images made from CT scan images to examine a distribution of bony support structure in the flipper. CT scan images revealed that the triangular bone was positioned in a notch made by the carpometacarpal bone and ulna, and that the posterior contour of arm bones was nearly parallel to the posterior edge of the flipper. The ratio of anteroposterior width of arm bone complex divided by flipper anteroposterior width was almost constant throughout the proximodistal profile from elbow to the tip of digit. The result showed that arm bones were distributed equally over the flipper. The triangular carpal bone contributes to maintain the ratio of skeletal elements in the wrist, suggesting that the bone plays an important role in increasing the strength of penguin flippers by occupying the wrist notch We concluded that penguins achieve a rigid flipper, which is advantageous for oscillatory propulsion, by the evenly expanded arm bones and triangular carpal bone.

p09-012

Structure of blood vessels penetrating the flight muscles (*Mm. pectorales superficiales*) of diving birds

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Morphological and physiological adaptations for thermoregulation have been studied in many species of birds. Seabirds and waterfowl are particularly well adapted to live in water in severe cold climates. For preventing heat radiation in extreme cold environment, these birds are considered to have evolved peculiar modifications of the blood vessels in the legs and other body parts. Among aquatic birds, body shapes show considerable variation depending on the usage of the wings or legs when diving and swimming in water for catching prey. The adaptation of the blood vascular system to cold is also considered to related to differences in body shape. Preliminary observations have revealed that blood vessels penetrate the flight muscle (*Mm. pectorales superficiales*) in some aquatic birds, such as Alcidae, Gaviidae and Anatidae. In the present study we examined modifications of blood vessels for cold adaptation in wing-propelled and leg-propelled diving birds. The specimens, Tufted Puffin, *Fratercula cirrhata*, and White-billed Diver, *Gavia adamsii*, were collected as carcasses of fishery by-catch. They were injected intravascularly with the contrast medium, and observed using X-ray CT scanning. The tri-dimensional figures were reconstructed and analyzed. Results show that the Tufted Puffin, known as a wing-propelled diving bird, has a highly developed blood vessel passing through the pectoral muscles. On the other hand, the White-billed Diver, known as a leg-propelled diver, has many more penetrating blood vessels than the puffin. We hypothesize that the difference in blood vessels between these two aquatic birds reflects adaptations to coldness associated with different diving behaviours. In addition, adaptations of other blood vessels are also discussed.

p09-013

Why aren't they hatching? Genetic causes of embryo mortality in zebra finches

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Embryo mortality and hatching failure are surprisingly common phenomena given that natural selection is constantly acting against them. Across bird species about 12% of eggs fail to hatch, and wild zebra finches (*Taeniopygia guttata*) exhibit about 17% hatching failure. Despite this evolutionary puzzle, we feel that there is a lack of studies investigating the causes of embryo mortality, and the scientific literature usually names either inbreeding or environmental effects as likely causes for early mortality.

Our captive population of zebra finches held at the Max-Planck-Institute in Seewiesen (Germany) consistently shows about 30% of embryo mortality. Cross-fostering of individual eggs revealed that this mortality was mainly caused by the genetic parents rather than the foster parents. Analyzing the fates of 4,159 eggs from 529 breeding pairs showed no significant male parent and only a moderate female parent contribution to embryo mortality, but a strong female-male-interaction. However, inbreeding depression, as estimated from our eight-generation pedigree, was only a minor cause.

We identified a second captive zebra finch population that on average had only 10% embryo mortality in Krakow (Poland). We exchanged breeding pairs between both locations to (1) rule out direct environmental effects on embryo viability and (2) produce hybrids for QTL mapping of the genetic loci contributing to this mortality. These reciprocal common garden experiments lent no support for direct environmental effects causing the difference in embryo mortality rate between the two populations. QTL mapping in F2 hybrids located some genomic regions contributing to embryo mortality that need further investigation.

Embryo mortality is a striking evolutionary puzzle that may be due to more than just trivial inbreeding and environmental effects. We will discuss possible scenarios under which genetic variation for mortality may be maintained.

p09-014

New moult pattern in raptors: primary moult pattern of the Japanese Sparrowhawk (*Accipiter gularis*)

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In the Accipitridae, the primary feathers are moulted sequentially from pl outwards to p10, whereas in the Falconidae, the primaries are moulted divergently, starting at p4 (sometimes with p5), and then simultaneously proceeding both ascending towards p1 and descending towards p10. We found a new pattern of primary feather moulting in the Japanese Sparrowhawk. We examined 114 museum specimens and photographs of 48 individuals taken in the spring and autumn migration seasons. Among these, 76 were juveniles and 86 were young adults in their second calendar year, or adults. Two types of moult pattern were observed during a single moult season: normal-type moult (14%) and the "new-type" moult (64%). During the first stage of the normal-type moult, the primaries were generally moulted descending, starting from p1 and most ended at p8 (although sometimes at p3, p5, or p7). During the first stage of the new-type of moult, the pattern of primary feather moulting varied among individuals, with the primaries being shed from p3 to p10. The percentages of moulted primary feathers were as follows: p4 (16%), p5 (21%), p6 (21%), p7 (20%) and p8 (14%). During the second stage of moulting, there were three waves of primary feather moulting. The second wave started from the inner retained feather (p1) and progressed descending until meeting the first wave, which stopped at p3, p4, p5, or p6; whereas the third wave progressed towards p10 from retained feathers (p6, p7, p8, or p9) that were not shed during the first stage. It appears that the first stage of moulting, after which moulting is temporally suspended, is completed before the beginning of spring migration from the wintering grounds. During this first-stage moult from p3 to p10, the inner feathers are more worn and faded than the outer feathers. Consequently, we presume that the first stage of moulting starts from the innermost feathers and proceeds descending towards p10, which is the same as the pattern seen in the normal moult sequence.

p09-015

Morphofunctional aspects of the frugivorous specialization in the *Calyptomena* broadbills (Passeriformes, Eurylaimidae).

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The Old World suboscine passerines birds, as opposed to the numerous and diverse New World suboscines, are represented by few families with a small number of species. Within each group, birds have very similar trophic characteristics. Most species of the Old World suboscines are carnivorous, feeding on a variety of invertebrates and small vertebrate animals. Among them stands out the genus *Calyptomena* (family Eurylaimidae), which are almost exclusively frugivorous birds. Our objective was, by using morphofunctional analysis, to reveal the depth of the adaptation of the jaw apparatus of the genus *Calyptomena* to feeding on fruits. We investigated morphological features of the jaw and hypoglossal apparatus in 13 species of the family Eurylaimidae, 2 species (*Philepitta*) of the family Philepittidae and 10 species of the family Pittidae. We found that the *Calyptomena* are adapted to consume the widest variety of fruits. This adaptation was formed on the basis of the primary ability of broadbills to eat large food items of animal origin. Specific features of the jaw apparatus of *Calyptomena* may be interpreted biomechanically as a part of this adaptation to frugivory.

p09-016

Alula functions as a vortex generator

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The alula is a small structure located at the joint between handwing and armwing of birds, which is used in slow flights with high angles of attack such as landing. It has been assumed that the alula functions as a leading-edge slat that increases the lift and delays the stall. However, in spite of the universal presence of the alula in flying birds, it is still not clearly understood how the alula aids the flight of birds. In this study, we elucidate the mechanisms that are involved in the function of the alula and the effect of the alula on the aerodynamic performance of birds based on the data collected from free flight and wind tunnel experiments. With the alula, birds performed steeper descending flights with greater lateral angle changes. Force measurements conducted on dried magpie wings in a landing posture confirmed the stall-delaying effect of the alula, although the magnitude of the effect varied depending on the camber in the dried wing. Through digital particle image velocimetry, we show that a vortex is created at the tip of the alula, and the separation over the wing surface is suppressed due to the presence of the alula tip vortex. Consequently, separation is less pronounced at the location where the alula is located. We suggest that the alula functions as a vortex generator that induces greater lift and endows greater flight manoeuvrability to the birds.

p09-017

Patterns of morphological evolution during the evolution of wing-propelled diving in penguins: Insights into the evolution of form and function in birds

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Modern birds display varied patterns of locomotion that can be linked to ecological diversity, as in the many lineages of aquatic birds. However, close examination of the evolution of locomotion in birds and its relationship to anatomical form and function has been primarily associated with one particular evolutionary event–the origin of flight. The evolution of wing-propelled diving in penguins represents a similar significant shift in ecology and morphology in birds, involving movement through a medium hundreds of times denser than air. This factor, in combination with robust fossil record and well-constrained phylogeny, makes the evolution of penguins an ideal framework for examining the relationships between form, function, and adaptation in birds. New discrete morphological characters developed through study of fossil penguins and dissection of extant penguins were combined with previously developed character matrices to form the most complete dataset of penguin osteological characters to date. Patterns of discrete character change in the forelimb and hind limb of penguins were assessed in parsimony and Bayesian frameworks to infer relative rates of evolutionary change in each anatomical region across penguin phylogeny. We also incorporated morphometric data on waterbird limb elements in order to examine the evolution of limb "morphospace" in penguins and outgroup taxa. In contrast to hypotheses of sequential modification for forelimb and hind limb morphology, we find similar rates of character change early in penguin evolution. Our results emphasize the importance of examining whole-organism patterns of change rather than approaches only based on single character complexes or key innovations. These data, when combined with further anatomical and functional data obtained from extant penguins, will provide greater insight into the evolution of ecological and morphological diversification within birds.

p09-018

Comparison of morphological traits in two subspecies of Ashy Minivet (*Pericrocotus divaricatus*) specimens

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Wing morphology directly impacts flight ability and migratory behavior and is thus likely to be under strong selective pressure. Longer wings are expected to be more adaptive to long distance journeys than shorter ones. Two subspecies of the Ashy Minivet (*Pericrocotus divaricatus*) have different migratory ecologies; *P. d. tegimae* is sedentary, whereas *P. d. divaricatus* is a summer breeder in Japan. The morphological data of the two subspecies may therefore provide a good example of the evolution of wing morphology and migratory ecology. Moreover, recently, the distribution of *P. d. tegimae* has been expanding, whereas the *P. d. divaricatus* population is in decline and has been designated as an endangered (sub)species. Thus, studying the morphology of these two subspecies is also worthwhile from a conservation perspective. I measured and compared morphological traits from 109 museum specimens of the two subspecies. As expected, wing lengths of *P. d. divaricatus* were significantly longer than those of *P. d. tegimae*. No difference was found in other traits between the subspecies. However, my study revealed considerable geographic variation within the subspecies. In *P. d. tegimae*, the wing length of Kyushu specimens was significantly longer than that found in populations on Amami, Okinawa, and Sakishima islands, suggesting that *P. d. tegimae* from Kyushu had a comparatively higher long-distance flight ability. For *P. d. divaricatus*, specimens collected around the Korean peninsula had smaller bodies than those in other populations. Rather than the result of a latitudinal cline, this geographic difference may relate to the differences in vegetation and therewith feeding behavior of the Korean peninsula birds compared to the birds found in Japan.

p09-019

How can alcids dive so long? A biomechanical approach

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For breath-hold diving animals, longer dive duration allows longer foraging time. Moreover, since the limiting oxygen storing capacity increases faster than oxygen consumption with body mass, larger animals are capable of longer dive duration. Thereby, penguins, which are relatively heavy birds (up to 40 kg), are specialists of diving. On the other hand, alcids, which are capable of both aerial flight and diving, show restricted body mass by demands of aerial flight (0.1-1kg). However, alcids exhibit a maximum dive duration 2.5 times longer than that of penguins with similar body mass. Previous studies failed to explain such relatively longer dive capacity in alcids. In the present study, I show a lower energy consumption rate (i.e. lower oxygen consumption) by mass unit in alcids versus penguins, based on a biomechanical model. Swimming speed is the dominant component of energy consumption rate (proportional to speed^3), and alcids swim slower than penguins with normalized body mass. I here suggest that slower swimming speed in alcids allows a lower oxygen consumption compared to penguins, which will in turn enable alcids to dive longer.

p09-020

Macro- and nano-structural contributions to rainbow-like iridescence in Common Bronzewing *Phaps chalcoptera* feathers

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Color display is a critical function of feathers. Iridescent colors are not caused by pigments or dyes, but by nanostructured arrays of melanosomes (melanin-containing organelles), providing advantages like enhanced color variations over pigmented colors. Generally single feathers contain only one structural color, but those of the Common Bronzewing contain a gradient from blue to red over the proximo-distal gradient of individual barbs. We used Optical Microscopy and Micro spectrophotometry to quantitatively characterize this color gradient, and Scanning and Transmission Electron Microscopy to investigate their macro- and nanostructure. Barbules of all colors contained multilayers of melanosomes that varied in both the size of melanosomes and the spacing between them. Interestingly, barbule orientation also varied from $\sim 0^{\circ}$ - 90° relative to the feather plane. Combining optical modeling and experimental results, we argue that the rainbow color is caused by the synergetic effects of variation in the size of melanosomes, space between melanosome layers and barbule orientation. This result illustrates how slight modifications can produce large changes in structural color, and may provide inspiration for biomimetic multi-colored materials.

p09-021

Measuring the eye size of mist-netted birds: a comparison of two non-invasive methods

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The amount of visual information captured by an animal depends on its eye size. Birds are characterized by particularly large eyes which may be partly interpreted as adaptation to rapid flight. Moreover eye size is determined by selection arising from required visual skills related to communication with conspecifics, interactions with heterospecifics, foraging for food and anti-predator behavior. Relating eye size to different aspects of ecology and species' life history features will certainly offer more interesting views on selective forces shaping eye size. However, data on eye size is hardly available. So far several methods were used to measure the eye size of birds: measuring the eye balls of fresh dead birds, measuring the orbital cavity of fleshless skulls and measuring the diameter of the exposed eye surface of live birds. Although the eye shape is not necessarily spherical and can differ between diurnal and nocturnal birds, the maximum corneal diameter may provide a sufficient eye size measure for many studies on factors shaping eye size in birds. Using an electronic vernier calipers and photographs of birds' heads with a linear scale, we analyzed the accuracy of these two methods for measuring the eye diameter of mist-netted birds. As non-invasive methods they have the advantage that they can be applied without killing the bird. Compared with published data of a limited number of bird species, our results indicate that measurements based on photographs are more accurate than the direct measurement of eye size diameters, with the additional advantage of minimizing the risk of injuring the birds' eyes.

p09-022

Moult in African Birds

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Moult timing and duration was measured in 15 passerine bird species in the guinea savannah zone of Nigeria using the Underhill-Zucchini model. Moult started between August and December. In all species moult duration was much longer than equivalent north temperate resident passerines and species were found to moult seasonally, with most granivorous species moulting at the end of the rainy season and the beginning of the dry season. General seasonal patterns in granivorores and insectivores were not clear. Although there was no firm evidence that body mass was affected by moult, there was a negative relationship between the extent of moult and body mass in some species. These results are discussed in the context of other important aspects of the annual cycle and life history of tropical birds such as breeding.

p09-023

Facial skin provides thermoregulation in Stresemann's Bush-crow *Zavattariornis stresemanni*

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Stresemann's Bush-crow *Zavattariornis stresemanni* is an extremely range-restricted Ethiopian endemic that is confined to dry south Ethiopian acacia savannah habitats. It has been assumed that the specific temperature conditions in these areas might reflect a temperature optimum to which these social birds have adapted. With non-tropical magpies *Pica* and ground-jays *Podoces* being among their closest relatives, bush-crows might have developed particular adaptive traits to persist under the hot and dry tropical conditions of the south Ethiopian plains. However, this thermal adaptation hypothesis has not been tested so far. Using an infrared thermography system we investigated if bush-crows are able to regulate their body temperature by emitting heat. Bush-crows have a characteristic naked blue skin around the eye which extends further to an uncoloured skin patch behind the eye. This area is often exposed deliberately, possibly in the context of social signalling. However, our results suggest that the bare area behind the eye can also be used for thermoregulation: the surface temperature of about 42°C on this skin patch is equal to body temperature. In contrast, the skin of the constantly uncovered blue eye-rings does not show substantial heat emission. Because the structure and density of the feathers behind the eyes are less tight than the rest of the head plumage, we presume that body heat can be disposed even if the bare skin patches are not fully exposed. Both these morphological features and the possible active control of heat emission apparently serve to prevent overheating of the brain which is unknown in any other bird species yet.

p09-024

Morphoecological explanations of sexual differences in bill shape of bowerbirds (Ptylorhynchidae: Passeriformes)

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Comparison of bill outlines, drawn from the photographs of live and museum specimens of more than 200 species of birds, revealed sexual differences which turned out to be an effective tool in sex identification in monomorphic species. Most of these differences have a functional explanation. Bowerbirds, renowned for the unique courtship behavior of males, show one such example. Males of *Ptilonorhynchus violaceus, Chlamydera nuchalis, Ch. guttata, Ch. cerviniventris, Prionodura newtoniana*, *Sericulus chrysocephalus, S. aureus* and *Scenopooetes dentirostris,* who build a bower of vertically placed sticks or erect piles of sticks, have proportionally higher mandibles, than females. Males of *Amblyornis macgregoriae, A. flavifrons* and *A. inornatus*, building bowers from the layers of thin sticks, show mandibles only slightly higher than females. Males of *Archboldia sanfordi*, who do not build a bower and simply manipulate attractive objects, have mandibles similar in height with that of females. Finally, males of *Ailuroedus melanotis, A. buccoides, A. crassirostris* and *Archboldia papuensis*, who do not build bowers and rarely manipulate objects, have mandibles lower than females. These differences are obviously related to the extent in which the bill is used by males for building bowers and manipulating objects. Males of *Amblyornis macgregoriae* stay slightly aside of this tendency. Despite their lesser activity in building the bower and manipulating objects in comparison with males of *A. flavifrons*, they have relatively higher mandibles. More field observations are necessary to explain this phenomenon.

p09-025

Shape similarities and differences in the skull of scavenging raptors

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Feeding adaptations are a conspicuous feature of avian evolution. Bill and cranial shape as well as the jaw muscles are closely related to diet choice and feeding behaviors. Diurnal raptors of Falconiformes exhibit a wide range of foraging behaviors and prey preferences, and were assigned to seven dietary groups in this study. Skulls of 156 species are compared from the dorsal, lateral and ventral views, by using geometric morphometric techniques with the landmarks capturing as much information as possible on the overall shape of cranium, bill, orbits, nostrils and attachment area for different jaw muscles. The morphometric data showed that the skull shape of scavengers differed significantly from other raptors, primarily because of different feeding adaptations. As a result of convergent evolution, different scavengers shared generalized common morphology, possessing relatively slender and lower skulls, longer bills, smaller and more sideward orbits, and more caudally positioned quadrates. Significant phylogenetic signals suggested that phylogeny also played important role in shape variation within scavengers. New World vultures can be distinguished by their large nostrils, narrow crania and small orbits; Caracaras typically show large palatines, crania and orbits, as well as short, deep and sharp bills.

p09-026

Sex differences in growth and its genetic regulation in the early Zebra Finch embryos

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Sex-specific gene expression before the onset of morphological differences between the sexes has been documented in the chicken embryos. Here we asked whether specific genes regulating embryonic growth prior to gonadogenesis, and embryo size itself are also sex-dimorphic in a passerine bird showing a contrasting mode of reproduction. We used captive Zebra Finches (*Taeniopygia guttata*). We collected freshly laid eggs and incubated them for 36-40 hours. Embryo size and the expression of 17 genes involved in cell cycle regulation, growth, metabolic activity, steroidogenic pathway and stress modulation was measured using RT-PCR. Analyses controlling for the exact time of incubation of 87 embryos revealed that males were consistently larger than females in terms of Hamburger and Hamilton stage and number of somites. Gene expression level was assessed in 5 male and 5 female embryos incubated for exactly 36 h. We found significant overexpression of 4 cell-cycle control genes, 3 of them being located in the Z chromosome and one of unknown location. The faster growth of male embryos is most likely achieved by the overexpression of the growth hormone receptor gene. Growth hormone gene transcripts were detected in both sexes, but at equal levels, similarly to other 11 autosomal genes and one gene located on the Z chromosome, which did not show sex-specific expression. Steroidogenic factor 1, the key operator of gonad and adrenal formation was expressed only in female embryos. Our study confirms previous findings on overexpression of genes located on the Z chromosome in the chicken long before gonadogenesis, but to our knowledge is the first one to report sexual size dimorphism at such an early stage of development in birds. It suggests that faster growth of early male embryos is conserved through the mammalian and bird phyla, irrespective of their differential sex chromosome systems.

p10-001

Stress does not increase blood glucose in foraging wild House Sparrows

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Glucocorticoids and epinephrine, the prime hormones mediating the stress response, are thought to increase blood glucose concentrations and mobilize fats to help the animal cope with a stressor. This dogma primarily derives from fasted laboratory animals and growing laboratory evidence suggests that regulation of glucose during stress is far more complicated in fed animals. We captured free-living House Sparrows (*Passer domesticus*) feeding at bird feeders during three times of year (winter, spring, and during the autumn molt) and measured initial glucose and triglyceride titers. Both glucose and triglycerides varied seasonally, with glucose being lower and triglycerides higher during the winter. Contrary to expectations, the stress of capture, handling, and restraint, did not alter these titers. When we examined the sensitivity to the stress hormones, neither injection of exogenous corticosterone or epinephrine altered glucose or triglyceride titers. Furthermore, injecting phentolamine and propranolol (alpha and beta adrenergic receptor antagonists, respectively) alone or in conjunction with epinephrine did not alter glucose or triglyceride titers. These data indicate that actively foraging House Sparrows are resistant to the classic effects of corticosterone and epinephrine on plasma glucose and triglycerides. The data further suggest that the stress physiology of fed birds, likely indicative of many if not most birds in the wild, is different than what is commonly assumed.

p10-002

Variation in basal metabolic rate in wild-caught tropical birds of Southern Vietnam

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There are many differences between tropical and temperate birds in life-history traits. Limitations associated with physiological features may be considered as main constraints on divergence of life histories. Basal metabolic rate (BMR) is the most studied physiological trait, but the number of studies on avian energetics in the tropics is very limited. Using the largest existing data-set on metabolic rates of Old World free-living tropical birds (372 individuals belonging to 59 species from Southern Vietnam), we compared BMR in different ecological and taxonomical groups of birds (passerines and non-passerines, oscines and suboscines, tropical and temperate birds, residents and long-distance migrants, males and females, foragers in the sun and shade). The result is discussed within the frame of an energetic model. According to the model the high BMR was acquired by migrant passerines, which then occupied the forest zone of temperate and high latitudes.

p10-003

Basal metabolic rate, parasite prevalence and blood variables in different taxonomic and ecological avian groups of Southern Vietnam

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The main goal of the study was to perform correlative analysis of interrelations between energetic and other physiological variables in different taxonomic and ecological groups of tropical birds from Southern Vietnam. We evaluated basal metabolic rate (BMR), blood leukocyte indexes (WBC and H/L), prevalence of blood parasites and ectoparasite infestation in free-living birds. The pressure of ectoparasites was higher on Suboscine passerines than on Oscine and Non-passerine birds. Suboscine passerines were characterized by the highest level of interaction between three physiological variables, namely BMR, blood indexes and infestation by different forms of ectoparasites. In this group, mass-independent BMR was positively related to both leukocyte index and the degree of infestation by ectoparasites. The latter indicator, in turn, was positively correlated with hematological characteristics. Oscine passerines did not show any links between mass-independent BMR and other physiological indicators, but similarly to the previous group, they demonstrated a positive correlation between ectoparasite pressure and hematological characteristics. According to the structure of relationships between physiological variables, the non-passerine birds were similar to Suboscine birds, but the correlation between hematological features and the degree of ectoparasite infestation was not found in the former group. Moreover, non-passerines and Suboscine birds showed alternative relationships between the degree of ectoparasite infestation and body mass. Being indirect by definition, the above outlined correlative approach provided the opportunity for future causal analysis based on a detailed study of the physiological processes. Assuming trade-offs between the physiological indicators measured, the patterns observed in Suboscine birds probably reflect their increased susceptibility to parasite load and lowered resistance.

p10-004

Seasonal variation in basal metabolic rate, respiratory quotient and evaporative water loss in the Cape White-eye, *Zosterops pallidus*

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One way in which birds in the northern hemisphere generally cope with extreme winter conditions is by elevating their basal metabolic rates (BMRs). In southern Africa however, winters are generally milder than at higher latitudes, although there are still unpredictable periods of extreme cold, and so it is expected that small Afrotropical birds would conserve energy by lowering their winter BMRs. Open flow respirometry was used to record oxygen consumption, carbon dioxide production and evaporative water loss (EWL) in twelve wild-caught Cape White-eyes *Zosterops pallidus*, in summer and winter, at a range of temperatures. In winter, Cape White-eyes significantly reduced their BMRs and dropped their lower critical limits. Mean respiratory quotient was lower in summer than in winter, indicating greater catabolism of lipids in summer than in winter. There was no seasonal difference in EWL, but at 35°C, EWL was higher in winter than in summer. Overall, these results are indicative of energy conservation during winter, and are consistent with those of other small southern hemisphere birds for which such seasonal differences have been investigated. However, similar studies on Afrotropical species are relatively few, and more work is needed to confirm these trends.

p10-005

The impact of urbanization on oxidative stress and telomere length: experimental disentangling of genetic and environmental effects in Great Tits (*Parus major*)

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Urbanization is a fast growing recent process permanently changing the native habitats and a major global threat to biodiversity. Nonetheless, many forest living species have and are in the process of extending their distribution into the urban environments where parks and gardens provide alternative habitats. In addition to ecological adaptions to these new habitats, the traffic-related air pollutants, mainly nanoparticles and nitric oxides are other challenges that species have to cope with. The effects of these components could be harmful if the organism is unable to up-regulate the detoxifying system. Some of these damages, which include damage to DNA and lipids, are involved in cellular ageing and cancer, ultimately, affecting individual to population-level fitness. Therefore, understanding how the detoxifying antioxidant system and degree of damage are affected by the urban environment can give some clues about the influence of the environmental stressors that urban birds are facing. During spring of 2013 a cross-fostering experiment was conducted between an urban (high traffic-load) and a rural (low traffic-load) population of Great Tits (*Parus major*) in the South of Sweden. At the age of 12 days a blood sample was taken from each nestling for measuring different red blood cell antioxidant biomarkers and oxidative damage. In addition to the oxidative-antioxidant system, we measured telomere length by qPCR. This experiment will allow us to disentangle the direct environmental effects on physiology and telomere shortening from non-genetic and genetic inheritance, i.e. evolutionary adaptation to environmental stress. Our results provide useful information about the physiological status of birds in relation to traffic pollution. Nevertheless, future long term research will provide a better understanding of how urbanization is affecting bird populations and if birds themselves are being able to cope via plastic responses or if evolutionary adaptation has taken place.

p10-006

Circulating hormone pattern of obligate brood parasites during the breeding season

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During the breeding season, birds providing parental care experience diverse behavioral stages, from finding partners to provisioning chicks, and hormonal regulation is known to be a proximate cue underlying these breeding-related changes of behavior. In particular, plasma levels of three hormones (testosterone, prolactin and corticosterone) are well known to play a key role in regulating breeding behavior. Many free-living birds show early elevation of testosterone levels to secure a breeding partner and resources for reproduction, which is followed by an increase of prolactin levels and degradation of testosterone levels when providing parental care. However, little is known about the reproductive hormone profiles of brood parasitic birds such as cuckoo (*Cuculus*) species, which transfer parental duties to the host species and do not themselves provide parental care. In this study, we examined the temporal pattern of hormone levels in two *Cuculus* species, the Common Cuckoo (*C. canorus*) and the Lesser Cuckoo (*C. poliocephalus*) and compared these to other species exhibiting parental behavior. The adaptive significance of hormonal regulation of these brood parasites will be discussed in terms of a coevolutionary arms race.

p10-007

Changes in stress hormone receptors across the breeding season: an adaptation to breeding at high latitude?

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Every spring, migratory songbirds leave their wintering grounds to travel to breeding grounds where they can encounter demanding situations such as intense storms, food shortages, predation and social disputes. During such times, songbirds are reliant upon the hypothalamic pituitary adrenal (HPA) axis and the production of the stress hormone, corticosterone (CORT), to induce changes in behavior and physiology to promote survival. In many high latitude breeding songbirds, the stress response is higher during arrival on their breeding territories compared to the parental phase. The reduction in the stress response is critical for preventing nest abandonment and ensuring parental investment but little is known about the neural regulation of this adaptation. This study investigated changes in the expression of mRNA for the two CORT receptors termed the mineralocorticoid receptor (MR) and the glucocorticoid receptor (GR) in the brain of male Gambel's White-crowned Sparrows using *in situ* hybridization. There was significantly lower expression of MR mRNA in the hippocampus when birds at the pre-parental phase were compared to those during the parental phase. No significant change was found in GR in the paraventricular nucleus. Changes in MR and/or GR expression may be critical for regulating negative feedback and thus controlling both baseline and stress induced levels of CORT. These data suggest that changes in MR sensitivity may be important for regulating the stress response in birds that have very short breeding seasons at high latitude.

p10-008

Changes in gonadal activity associated with rearing condition, egg laying and molting in captive Svalbard Rock Ptarmigan (*Lagopus muta hyperboreus*)

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The Japanese rock ptarmigan (*Lagopus muta japonica*) is one of the bird species threatened with extinction in Japan. This species is categorized as Endangered on the Japanese Red List and is an object of the Conservation Program of the Ministry of Environment in Government of Japan. In preparation for *ex situ* conservation of this subspecies, Japanese zoos have embarked on the development of a good husbandry technique and collection of biological data by keeping a related subspecies, the Svalbard Rock Ptarmigan (*L. m. hyperboreus*). Understanding the physiology of egg laying and aspects of endocrine secretion are important for husbandry and the fostering of reproduction. We monitored sex steroid hormone dynamics in the captive Svalbard subspecies non-invasively. We also investigated the relationships among hormonal changes and rearing condition, egg lying and molting.
Feces were collected from 4 male and 4 female Svalbard Rock Ptarmigans kept at two institutes. The light in cages changed gradually throughout the year. The lighting was continuous in June to July (0D: 24L) and shortest from December to January (13D: 11L or 15D: 8L). The fecal concentrations of testosterone of males and progesterone and estradiol-17β of females were determined by enzyme immunoassay. The cecal feces hormonal concentration was higher than that of rectal feces, but its dynamics were similar. Fecal sex steroid hormone concentrations in male and female rectal feces increased with ambient temperature and light time and were highest levels during 24 hours of light. At this time, mating and egg laying were observed. During the second half of the continuous light term, hormonal concentrations decreased. Increasing light length may activate the hormonal secretion or gonadal activity. Molting occurred earlier in females than males and it progressed with hormonal increase in female; however it progressed after the start of hormonal decrease in males.

p10-009

Seasonal changes of fecal sex steroids in Kagu, *Rhynochetos jubatus*, in captivity

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The Kagu (*Rhynochetos jubatus*) is an endangered bird species endemic to New Caledonia. In this study, changes in levels of secreted sex steroids were measured to acquire fundamental data necessary for Japanese efforts to successfully breed captive Kagus. Three male–female pairs were kept under natural daylight conditions at the Preservation and Research Center of Yokohama City and observed. Levels of fecal testosterone (T), estradiol (E2), and progesterone (P4) were measured in periodically collected feces. Measurements were conducted from August 2000 to July 2001, and changes throughout the year were analyzed. Eggs were laid between October and May of the following year, corresponding to the breeding period in New Caledonia, which is from June to November. All pairs proceeded to brood, but abandoned eggs after a short period. Egg-laying, brooding, and abandonment was then repeated, resulting in a total of 16 eggs laid among the three pairs. A possible explanation for this abandonment of eggs may be the absence of helper birds. Fecal T and E2 increased with egg-laying, although high concentrations were measured during only a brief period. The changes in levels of these two steroids did not always correspond to each other. Twelve of the eggs were laid after fecal E2 decreased from a high level (1–3 ng/g) to below 0.1 ng/g. This may a characteristic trait of the Kagu, which has a clutch size of one. Secretion of P4 was expected to increase during the brooding period; however, no clear changes in fecal P4 levels were observed.

p10-010

Labile regulation of nocturnal activity during pre-migratory life stage

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For seasonal animals like long distance migrants, the transition to the next annual stage undoubtedly means a transfer from a relatively sedentary stage (like breeding or moulting) to an active migratory stage, and vice versa. The early development of life history stages may be hidden, and this is especially true for the beginning of migration in nocturnal migrants. This change to nocturnality is believed to be governed by endogenous programs. Recent findings show that the mechanism underlying the development of nocturnal flight is based on the phase relationship between diurnal and nocturnal circadian oscillators. Nevertheless, neat graphs of locomotory rhythm drift obtained from captive birds during the development of migratory disposition are difficult to obtain from free-living birds. Our study was designed to test how environmental cues can trigger nocturnal flights in previously relatively sedentary breeding reed warblers (*Acrocephalus scirpaceus*). RWs were captured on their nests and housed in outdoor and indoor conditions. Locomotory rhythm drift was registered in all tested groups (near in all 45 individuals), and reached it maximum on the 5th-6th day. Significant differences in nocturnal flight performance were revealed after radio-tagged RWs were released into the wild (7-8 days after capturing): none of the birds kept in captivity close to their nests departed, and all but one bird displaced from their nests (>20 km) departed. Here we showed that (1) nocturnal activity in caged birds is indeed a reflection of real night flights in nature; (2) environmental cues that lead to the interruption of normal annual stage indeed cause nocturnal flight activity that develops as a gradual nocturnal rhythm drift; and (3) return to the appropriate life history stage can block this nocturnality within several days. All of this allows us to conclude that avian nocturnal activity is under rather labile regulation and can be triggered by either endogenous or environmental stimuli.

p10-011

Molecular cloning and expression of PGC-1α in Eurasian Tree Sparrows (*Passer montanus*)

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In animals, phenotypic flexibility of adaptive strategies may promote to maximize fitness in a changing environment. Although there are a few studies focusing on investigation of metabolic flexible response to environmental variability in birds, little information is known on the flexibility of related functional genes. In animals, peroxisome proliferator-activated receptor gamma coactivator 1 alpha (PGC-1α) are also involved in many biological responses including adaptive thermogenesis, mitochondrial biogenesis, glucose-fatty acid metabolism, and muscle fiber specialization. In present study, we successfully cloned the 2, 388 bp of full-length of open reading frame (ORF) PGC-1α cDNA in Eurasian Tree Sparrows (*Passer montanus*), which encodes 795 amino acids (aa). The phylogenetic analysis showed that the PGC-1α aa sequences are most similar to those of *Taeniopygia guttata* (98%), *Geospiza fortis* (98%), *Zonotrchia albicollis* (98%), *Falco cherrug* (97%), *Pseudopodoces humilis* (97%), *Gallus gallus* (95%), and *Chrysemys picta* (91%), but they exhibit lower identity to *Homo sapiens* (87%), *Bos Taurus* (85%), *Rattus norvegicus* (85%), and *Mus musculus* (84%). The real-time PCR results showed the expression of PGC-1α mRNA were significantly higher in the liver, brain, kidney, and heart than those from the lung and gonads. Our results indicate the gene of PGC-1α is highly conserved in the clade of amniotes, and provide the molecular basis for better understanding the phenotypic flexibility of metabolism in response to environmental variability in the future at an integrated approach.

p10-012

Fluid mechanical consideration of the airsacculitis: effects of thickening and hardening of air sacs on a respiratory flow

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Airsacculitis is a pathological condition of air sacs caused by bacteria and virus infections. The birds with airsaccultis exhibit respiratory distress. Histological studies have demonstrated that the air sacs of birds with airsacculitis have pronounced epithelial cell hyperplasia and a six to ten fold thickening of the air sac walls. In addition, we observed an increased synthesis of the extracellular matrix and collagen, producing a strong increase in tissue stiffness. We speculated that these observations of a thickening and hardening of the air sac tissue have an unfavourable effect on functioning of the avian respiratory system. The aim of the present study was to examine what effects changes in the mechanical characteristics of air sac tissue have on the air flow in the avian lung. An avian respiratory system was modeled in a lumped parameter model. Resistance and inductance of each airway were expressed by a resistor and an inductor under the assumption that the flow is laminar and can be described by the Hagen-Poiseulle law. The mechanical behavior of air sacs was modeled as spheres of linearly elastic rubber, and incorporated in the lumped parameter circuit as a pressure source. The results demonstrated that thickening of the air sac wall induces a harmonic mismatch between the inflating and deflating behavior of the air sac and the intra-pleural pressure, causing impaired expansion of air sacs during inspiration. As a consequence, the volume of air passing though the parabronchi, where gas exchange takes place, decreases. It was also found that the volume of air going through the parabronchi further decreased with hardening of the air sac wall. These results suggest that the respiratory distress of birds with airsacculitis results from a phasic imbalance of the flow dynamics in the lung.

p10-013

DNA extraction from avian feces for species identification and sex determination

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DNA extraction from birds is performed in advanced molecular ecological studies and PCR (polymerase chain reaction) is a rapid and reliable method for the species identification and sex determination of a bird. The PCR procedure requires template DNA that can be obtained from a drop of blood or a few feathers. To avoid inflicting pain on birds, feces can also be used as a source of DNA. However, avian feces contain inhibitors of the enzyme used in PCR in quantities sufficient to inhibit reactions. In this study, flow-through columns with silica membranes were used for DNA purification to effectively remove these *Taq* DNA polymerase inhibitors. We used this technique to purify mitochondrial and genomic DNA to allow PCR amplification of the genes encoding cytochrome oxidase I (COI) and chromo-helicase-DNA binding protein-1 (chd1), which are located on the avian mitochondrial DNA and on the W and Z sex chromosomes, respectively. Using this technique we successfully isolated both mitochondrial and chromosomal DNA from avian feces of sufficient quality and quantity to allow PCR amplification. Extracting DNA from feces, opposed to extraction from blood or feathers, avoids exposing birds to harm or danger. This method thus respects the welfare of the bird, making it particularly valuable when studying endangered avian species. This method provides a simple, rapid, reliable, and accurate procedure for the species identification and sex determination of birds using DNA extracted from fecal samples.

p10-015

Light intensity alters the stimulatory effects of long photoperiod, but does not alter critical photoperiod in the Indian Weaver Bird *(Ploceus philippinus)*

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Day length regulates annual reproductive cycles in many birds including subtropical Indian Weaverbirds. We investigated whether light intensity modulates the effects of the duration of photoperiods in inducing the testicular recrudescence, and whether such effects are influenced by season. In two experiments we exposed weavers to near threshold and long photoperiods (11.5L:12.5D, 12L:12D and 13L:11D) at different light intensities during two time periods of the year. In experiment 1, birds were exposed to 12 and 1200 lux for 24 to 40 weeks. Experiment 2 was similar to experiment 1, except that it included two different phases of the annual reproductive cycle and involved light intensities at a different order of magnitude. During the pre-breeding (April) and post-breeding (September) seasons, birds were exposed for 24 weeks to 11.5L:12.5D, 12L:12D and 13L:11D at 20 and 800 lux light intensity.The observations on testis size and wing primary molt were periodically recorded (testis size = 4 weeks; molt = every week). There was a significant effect of light intensity in birds exposed to long days, but not in those exposed to 11.5L and 12L. Further, birds showed faster recrudescence in response to stimulatory photoperiods during the pre-breeding than in post-breeding phase. Light intensity influenced the rate of testicular maturation and molt under long days, but did not affect the critical day length for photoperiodic induction in weaver birds. This may be adaptive, since birds may use the light intensity to modulate the rates of physiological process as per the demand of the surrounding environment.

p10-016

Physiological and immunological consequences of differential stopover habitat use in fall migrating landbirds

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Migrating birds experience high energetic demands and immunomodulation, and recent studies show that successful refueling during stopover is important in restoring reduced physiological and immunological condition. However, stopover habitat is being altered by land-use change such as introductions of exotic shrubs. These exotic shrubs offer fruits that differ in nutrient composition compared to native shrubs, but knowledge is lacking on how that difference impacts the health status of fall migrating landbirds. We tested whether measures of energetic and immunological condition vary as a function of habitat use in Gray Catbirds (*Dumetella carolinensis*) and Swainson's Thrushes (*Catharus ustulatus*) captured in native and exotic shrublands in central Michigan, USA during fall migration. Preliminary results from radio telemetry and capture-recapture data show that (1) birds initially captured in the exotic shrubland were more likely to switch to and stay in the native shrubland, (2) stopover length of individuals was significantly greater in the native shrubland, and (3) birds occupying the native shrubland trended toward greater mass gain in recaptured individuals compared to conspecifics captured in the exotic shrubland. The latter finding contradicts plasma metabolite profiles, which indicate no difference in short-term refuel rate. Measures of constitutive immune function (total and differential leucocyte counts, natural antibodies and complement cascade) did not differ significantly between habitat types. However, Swainson's Thrushes captured in the native shrubland had significantly greater levels of total circulating carotenoids, and carotenoid levels were positively correlated to the activities of complement cascade. These results suggest that while these bird species may prefer native shrublands as stopover habitat, individuals using exotic shrubs may not experience negative physiological or immunological consequences.

p10-017

Does adult neurogenesis shape the true navigator?

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In the animal world, birds are the supreme navigators with unparalleled orientation skill. Many previous studies showed that birds develop their navigational skill in the first months after fledgling and they update the memorized environmental information needed for navigation also later in life. We studied the extent of adult neurogenesis that could provide such age-related plasticity. Brains of homing pigeons, *Columba livia*, at ages of 1, 2, 6, 12, 30, 80 and 156 months were subjected to systematic quantification of both newly generated (DCX+) and overall neuron subpopulations. Firstly, 2 brain regions, the piriform cortex, an associative cortex primarily related to olfactory navigation hypothesis, and the hippocampus, a well-known region in creating and maintaining large-scale cognitive navigational maps, displayed high, over 2.5% neurogenesis rate during the first 12 months. This high rate dropped subsequently by half, but was then sustained at that level through later years of life. Remarkably, in these regions, the piriform cortex and the triangular area of the hippocampus, overall neuronal numbers increased in a linear fashion from 0.24 and 0.77 mln at 2 months to 0.68 mln (280%) and 1.68 mln (215%) at age of 13 years, respectively, indicating that adult born neurons were not involved in cellular recycling process but were recruited to expand the circuitry of these regions. Such newly built circuit could serve learning of new information without interfering with old stable memories by using different neurons for the new events, as was previously postulated in spatial pattern separation hypothesis. Secondly, we observed a cytoarchitectonic restructuring of the aging avian pallium, which we view as maturational efficiency of the neuronal circuit.
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p10-018

Response to distance calls is affected by lesions of nucleus taeniae of the amygdala in birds.

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Many bird species utter a special call in case of visual separation from conspecifics, the distance call (DC). Conspecifics are often responding to distance call by calling back. Although appearing simple at the first glance, the bird behaviour which utters the DC to conspecifics can be seen as a complex social behaviour because the decision to answer may depend on the information transmitted by the call and also on the actual situation, e.g. the predation risk. We and others have previously shown that the avian homologue of the mammalian medial amygdala, the nucleus taeniae of the amygdala (TnA) is important for the control of a variety of social and emotional behaviour. In the present experiments, we investigated whether it is also involved in the control of uttering the DC. For this purpose, we performed amygdala lesions in young Bengalese Finch males. For a control group, birds were sham operated. As adults, each male was two times exposed in a sound proof chamber to DCs' of conspecific females. The male's behaviour was videotaped and the number of vocalizations after a female DC was counted. Our results show that TnA lesioned birds uttered significantly less distance calls after hearing the female DCs. Similarly to other complex social behaviours, TnA may also play an important role in the control of using DC.

p10-019

Differences in the reproductive hormone rhythm of Tree Sparrows (*Passer montanus*) from urban and rural sites in Beijing: The effect of anthropogenic light sources

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The pervasiveness of anthropogenic light in urban environments has changed the normal day length (photoperiod) of many animals. Since photoperiod is a regulator of the timing of reproduction in most temperate region birds, such light sources could potentially change the timing of reproduction. We compared the luteinizing hormone (LH), testosterone and estradiol levels of Tree Sparrow (*Passer montanus*) populations sampled at two urban and two rural sites in China, and also performed a controlled photoperiod experiment to determine the influence of artificial light on the endocrine rhythm of these populations. LH levels of urban Tree Sparrows increased earlier than those of rural ones, but rural populations had significantly higher LH peaks. The results of the controlled photoperiod experiment showed that Tree Sparrows that were exposed to 6 lux light during the dark phase of the artificial photoperiod began to secrete LH earlier, and had lower peak LH levels, than control birds. Although urban Tree Sparrows began to secrete LH earlier than their rural counterparts, we found no corresponding advance in testosterone and estradiol secretion. On the contrary, peak testosterone and estradiol levels of urban birds were significantly lower than those of rural birds. These results suggest that although anthropogenic light sources appear to advance the onset of LH secretion in urban Tree Sparrow populations, they also lower peak LH, and consequently levels of testosterone and estradiol. A possible explanation for these observations is that greater exposure to anthropogenic light in urban environments both stimulates LH secretion and accelerates photorefractoriness.

p10-020

Comparative genomic analysis for identification of polymorphisms associated with the chicken broodiness trait

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Broodiness trait has been observed in most breeds of domestic fowl. However, as it is no longer required in modern poultry production, some layer (egg-producing) chicken strains have lost it during long-term artificial selection. Molecular mechanisms for occurrence of this trait have not been clarified yet although there are several genetic explanations for the broodiness. In this study, we performed comparative genomic analysis using NGS to identify candidate mutations that have associated with the chicken broodiness trait. We sequenced the genome sequence of three strains of chicken: the White Leghorn (WL), which have a long history of selection against broodiness, the silkie, which have strong broodiness, and the Gifujidori (Japanese native chicken), which also have broodiness traits. Three individuals in each strain were used for sequencing and 30Gb of sequence data were generated in each sample. We constructed a WL genome sequence by mapping the WL sequences to the published red jungle fowl genome sequence and replacing the polymorphic positions of the reference sequence with those of WL. Using the constructed WL genome sequence as a reference, we mapped the silkie and Gifujidori genome sequences, respectively, to identify polymorphisms between the strain which has lost the broodiness trait and those have keep the trait. As a result, we found more than 200M single nucleotide polymorphisms, which are exist in 4142 genes. The obtained list of the candidate polymorphisms and genes would provide valuable information for investigating the molecular mechanisms for occurrence of broodiness trait. This study was funded by a MEXT-Supported Program for the Strategic Research Foundation at Private Universities (S0801025).

p10-021

Variation in early-life telomere dynamics in a long-lived bird: links to environmental conditions and survival

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Conditions experienced in early life can have profound consequences for both short and long-term fitness. Variation in the natal environment has been shown to influence survival and reproductive performance of entire cohorts in wild vertebrate populations. Telomere dynamics potentially provide a mechanistic link between the early environment and fitness outcomes, yet we know little about how the environment can influence telomere dynamics in early life. We found that environmental conditions during growth play an important role in early-life telomere length (TL) and attrition in nestlings of a long-lived bird, the European Storm Petrel *Hydrobates pelagicus*. Nestlings reared under unfavourable environmental conditions experienced significantly greater telomere loss during postnatal development and had shorter telomeres at fledging, compared with nestlings reared under more favourable natal conditions, which displayed a negligible change in TL. Given an increasing body of evidence linking short telomeres and accelerated rate of telomere attrition to reduced longevity and lower reproductive success, entire cohorts of storm petrels reared in poor conditions may suffer detrimental consequences for fitness. Early-life TL was found to be a good predictor of survival during the nestling phase, providing further evidence for a link between variation in TL and individual fitness. To what extent the effect of early-life TL on mortality is a consequence of genetic, parental and environmental factors is a priority for future research. The results add to accumulating evidence that telomere dynamics play a role in mediating the effects of the early-life environment on later-life performance.

p11-001

Identification of current and historical hybrid zones of the oriental magpie-robin (*Copsychus saularis*) and the white-rumped shama (*Copsychus malabaricus*) on Borneo and Java through morphological and genetic analyses.

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Biogeographers have deduced that during glacial times a collection of events--including low sea levels, reduced temperatures, and moderated oceanic effects--altered the distribution of vegetation on the Sunda continental shelf in Southeast Asia. As a result of these events, populations of rainforest animals were periodically isolated in refugia in eastern and western Sundaland. One outcome of these refugia was the production of morphologically and genetically distinct populations in eastern and western Sundaland. We have studied the interaction of these east-west populations in two species on Borneo and Java: the oriental magpie-robin (*Copsychus saularis*) and the white-rumped shama (*C. malabaricus*). In the magpie-robin, comparisons suggest that the white-bellied subspecies *musicus* from western Sundaland (Sumatra and Malay Peninsula) invaded and hybridized with the eastern black-bellied subspecies *adamsi* and *pluto* on Borneo and *amoenus* on Java. The locations where the white- and black-bellied forms come together and hybridize in northern Borneo is reasonably well known, but where they hybridize in central Borneo is still unclear. Little is known about the extent of crossing between populations in any part of Java. An analogous situation occurs in the shama involving the western black-capped (*suavis*) and eastern white-capped (*stricklandii*) subspecies. Several studies have assessed the general situation in both species using traditional morphological and modern molecular techniques, but have not worked out the details of interaction between the forms. To solve this problem, we have undertaken comprehensive molecular comparisons and combined these with morphological analysis of skin specimen data. Our goals are to resolve the position of contact zones and extent of hybridization between the subspecies, to determine whether the contact zones are moving, and to assess whether the subspecies actually represent distinct species by virtue of their age and reproductive isolation.

p11-002

Complex analysis of population structure in a small planktivorous seabird, Crested Auklet (*Aethia cristatella*, Alcidae, Charadriiformes).

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The study of population structure in seabirds could clarify the information about migration paths, dispersal of young, isolation between colonies *etc*. Here we conducted a population analysis of the Crested Auklet (CA), a small auk with bright plumage ornamentation and complex social behavior that breed in the north Pacific. Outside the breeding season, auklets spend time at the sea, and nothing is known about fidelity to the native colony of young as well as about isolation between different colonies. We tested morphometric, acoustic and genetic variability of birds from different colonies. We measured body weight, size and main ornamental traits (totally 509 CA from five sites). We analysed two main call types, the Bark (50 calls per site, totally 200 calls from four sites, 4 temporal-frequency variables measured) and the Trumpet call of CA (25 calls per site, totally 100 calls from four sites, 20 temporal-frequency variables measured). Finally, we analysed intra- and inter-population variability of the control region fragment (408 b.p.) of mitochondrial DNA (totally 128 samples from five sites) and of four microsatellite loci (totally 183 samples from five sites). One-way ANOVA with post-hoc Tukey test shows a negligible effect of "population" on morphometric traits ($p>0.05$ for most of comparisons). We also found a small effect of "site" on temporal-frequency variables of the Bark ($p<0.001$) and no significant effect on those of the Trumpet call ($p>0.05$). Besides, no genetic differentiation was found neither within one colony nor between colonies ($p>0.05$ for all F_{ST} and R_{ST}). A high haplotypic (H=0.994+/-0.002) and relatively low nucleotide diversity (0.013+/-0.007) were noted for all sites. All analyses show a high level of similarity between CA from different colonies, so we suppose that birds from different colonies could spend winters in mixed flocks, and the gene flow between colonies could be very intense. Supported by President Grant (MK-1781-2012.4) and RFBR (12-04-00414a).

p11-003

Morphometric variation and genetic structure (or the lack of it) of the Azores Common Chaffinches

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Until recently, knowledge on the taxonomy and systematic of the Macaronesian Common Chaffinches (i.e. in the Azores, Madeira and Canary Islands), was based solely on phenotypic characters such as plumage patterns and biometrics. Only in the last years a few studies based on molecular markers have been developed, providing new insights into the colonization and genetic structure of this species in this Atlantic group of islands. Our work presents new insights into the genetic diversity and phylogeography of the Common Chaffinch *Fringilla coelebs* from the Azores archipelago based on sequences of mitochondrial and nuclear genes and on the analysis of morphometric characters. The results revealed the existence of two lineages of Common Chaffinch in most of the Azorean islands and a low level of genetic differentiation among the islands of this archipelago, suggesting the occurrence of gene flow among the island populations. This lack of genetic structure in the Azores is in contrast to the marked structure seen on the Canary Islands, where Common Chaffinches had a high level of differentiation among islands. Despite this lack of genetic structure, the existence of morphological differentiation among the Common Chaffinches of the Azores indicates a rapid adaptation and reflects the environmental plasticity of this species in the archipelago, since this differentiation seems to be related to ecological features instead of island isolation. Based on genetic differentiation among all the Macaronesian populations and between these archipelagos and the ones from the Continental Western Palearctic, it is suggest that the Atlantic Common Chaffinch needs to be re-evaluated taxonomically, since the alpha taxonomy, based solely on the phenotypic traits, may not represent the current phylogenetic situation.

p11-004

Current status of the Gray-faced Buzzard (*Butastur indicus*) based on mitochondrial DNA

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The Grey-faced Buzzard (*Butastur indicus*) is an extensive Accipitridae species of East Asia but endangered in Japan. We therefore investigated both its genetic diversity and population structure. The purpose of this study is to evaluate the current status of *B. indicus* using sequences of the mitochondrial DNA control region and its variation among individuals. DNA was obtained from feathers and eggshells from some breeding regions in Japan. We sequenced and determined 555 bp of the mitochondrial DNA control region of 90 individuals. 22 haplotypes were detected, and haplotype diversity and nucleotide diversity were 0.857±0.028SD and 0.00343, respectively. Comparing these results with those of other species, we conclude that *B. indicus* might escape the possibility of becoming extinct. Significant genetic distance was not detected among individuals. Network analysis suggested that the genetic structure of *B. indicus* tended to comprise two groups. Additionally, although results indicated nationwide gene flow of *B. indicus* across Japan, some characteristic haplotypes were detected only in West Japan, on the Sea of Japan side. We suppose that the difference in migration routes (Continent route or South-West Islands route) has caused this gene divergence.
There are four species of Eurasian buzzard comprising the genus *Butastur*: Grasshopper (*B. rufipennis),* White-eyed (*B. teesa*), Rufous-winged (*B. liventer*), and Grey-faced Buzzard. Little is known about the intrageneric relationships within *Butastur*, which we clarified using a partial mitochondrial DNA sequence. The phylogenetic tree showed that genus *Butastur* is a monophyletic group. We conclude that *B. rufipennis* is an ancestral species, from which *B. indicus* diverged, and that *B. liventer* and *B. teesa* represent a recent split in the genus.

p11-005

Evolutionary islands in the Eastern Himalaya: long-term isolation and stability explain high genetic diversity in a global biodiversity hotspot

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The Southwest Mountainous Region in the Eastern Himalaya is a "biodiversity hotspot" of global interest for conservation. Yet, little is known on what has driven this unique diversity. The dramatic topography of the region resulted from the tectonic uplift during the Miocene, leading to dramatic ecological stratification, which shaped islands of suitable habitats where organisms have been genetically isolated. Consequently, the phylogeographic patterns in four selected species of birds (*Alcippe morrisonia*, *Stachyridopsis ruficeps*, *Parus monticolus* and *Aegithalos concinnus*) from this region are characterized by deep splits between lineages that coalesce between 6 and 12 Mya. Unlike other regions at this latitude, the Southwest Mountainous Region was largely unaffected by the Pleistocene glaciations. In the rather stable "evolutionary islands" these genetically isolated lineages were thus maintained during the Pleistocene. In comparison, we found radically different phylogeographic patterns in populations of the same four species distributed in the adjacent lowland, the Central China region. This region has a geological history drastically different from the Southwest Mountainous Region, experiencing dramatic climate-induced vegetation shifts during the Pleistocene. As a result, we found considerably less geographic structure in the genetic variation and a much younger coalescence time (2.5-5.5 Mya) for these four species. We also found evidence of genetic bottlenecks during the glacial periods and gene flow during the interglacial expansions. We conclude that the high genetic diversity in the Southwest Mountainous Region is the result of a long-term *in situ* diversification within these evolutionary isolated and environmentally stable island habitats.

p11-006

Genetic variation in Mexican populations of *Habia rubica* (Cardinalidae: Cardinalini)

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Habia rubica is distributed from central Mexico to northeastern Argentina and southeastern Brazil. This species is divided in 17 subspecies and, depending on the authors, between two and five of them occur in Mexico (Howell and Webb 1995, Del Hoyo et al. 2011). We used mitochondrial and nuclear gene DNA sequences to investigate genetic variation in the Mexican subspecies. Maximum parsimony, Maximum Likelihood, and Bayesian Inference analyses supported the hypothesis that there is a clear separation between the populations of the eastern and western parts of their distribution. This separation is consistent with morphology, since males from eastern populations are red or pink from top of the head and back to the bottom body, while males from western populations have dark reddish plumage from top of the head and back.

p11-007

Mitochondrial genetic diversity and population genetic structure of Japanese Murrelet, *Synthliboramphus wumizusume*

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The Japanese Murrelet, *Synthliboramphus wumizusume,* is an endangered small seabird endemic to East Asia. This species is listed as Vulnerable in IUCN Red List. However, the numbers of individuals are thought to be decreasing rapidly as a result of predation by introduced mammals, mortality from drift-net fisheries and human disturbance at breeding sites. Conservation activities on this species are ongoing in some regions without any considerations of genetic structure and diversity, although such procedures may lead to underestimation of actual biodiversity. In the present study, we investigated genetic variations in a part of mitochondrial control region (487 bp) among 69 murrelets from 10 breeding sites in coastal areas of Japan. Results revealed 31 haplotypes, showing a relatively low genetic divergence among them. Our results also suggested significant genetic differentiations between some combinations of populations although three geological assemblages (i.e., coastal areas of the Pacific, Japan Sea and East China Sea) did not constitute monophyletic clusters exclusively. Five haplotypes were shared by populations from both side of the Japan Archipelago (Pacific and Japan Sea), which suggested gene flow between these two areas despite the presence of a physical barrier by high mountains of the archipelago. Of the five shared haplotypes, one is also found in a population from the East China Sea. The complicated genetic structure around Japan might have originated in the Pleistocene as a result of temporal changes in land configuration by sea level fluctuations.

p11-008

Cross-species characterisation of polymorphic microsatellite loci in the remnant populations of the endangered Java Sparrow (*Padda oryzativa*)

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Three microsatellite loci developed for Village Indigobird (*Vidua chalybeata*) and two loci for Bengalese Finches (*Lonchura striata* var *domestica*) were used to amplify and genotype Java Sparrow (*Padda oryzativa*) samples. I used 141 Java Sparrow samples obtained from six wild populations and two presumed wild populations derived from the bird markets. These samples were collected from Magelang (n=14), Yogyakarta (n=24), Gunungkidul (n=11), Lamongan (n=20), Malang (n=17), Madura (n=21), Bali (n=13), and Kalimantan (n=21). In addition 51 samples from a museum collection were also included. All 5 loci were polymorphic in all populations. A total of 59 alleles were observed across the 5 loci and 141 individuals from contemporary populations. There was an average of 11.8 alleles per locus, ranging from 6 alleles to 16 alleles. The mean number of alleles per locus per population ranged from 5.8 (SE=1.4) to 8.4 (SE=1.5). The non-parametric Friedman test indicated that both allelic richness and observed heterozygosity were not significantly different among remnant contemporary populations (X^2= 9.905, *df*=7, *P*=0.194; X^2= 3.139, *df*=7, *P*=0.872, respectively). However, only 4 loci consistently amplified in the historical samples; in total 45 alleles were found at 4 loci, with an average of 1.25 alleles per locus, ranging from 6 to 18. For the historical populations the non-parametric Friedman test also indicated that both allelic richness and observed heterozygosity did not differ significantly among populations (X^2= 3.235, *df*=4, P=0.519; X^2= 3.68, *df*=4, *P*=0.451, respectively).

p11-009

Phylogeography and evolutionary history of a cosmopolitan raptor, the Osprey *Pandion haliaetus*, revealed by mitochondrial DNA: implications for conservation.

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Despite wide differences in ecology and habitats across a world-wide distributional range, Osprey populations appear to be poorly differentiated from a morphological point of view. The most widely accepted taxonomic arrangement recognises a single species, *Pandion haliaetus*, with four subspecies classified on the basis of morphometric and plumage characteristics: *P. h. haliaetus* in the Palearctic and Africa, *P. h. carolinensis* in North America, *P. h. ridgwayi* in the Carribeans, and *P. h. cristatus* in the Indo-Pacific and Oceania. Despite this, the taxonomic status is still controversial and the evolutionary history of the species is not well understood. Here we present an extensive phylogeographic study based on mitochondrial DNA sequence (cytochrome b) extracted from >200 samples (both fresh tissues and ancient museum specimens) covering the totality of the world distribution for this species. The greatest genetic divergence was found between the Americas (combining spp *carolinensis* and *ridgwayi*) and all other populations. In the Old World, the phylogenetic analysis revealed three different branches for birds from Palearctic-Africa, Oceania and some birds from Indonesia. These results suggest at least 3 or 4 possible Evolutionary Significant Units (ESU). Contrary to current taxonomy, North American *carolinensis* Osprey did not differ from *ridgwayi* birds from the Caribbean. In the Western Palearctic, no genetic structure was detected between the most distant populations, from Finland to Mediterranean and the Atlantic islands. On the other hand, the existence of a previously unknown lineage and ESU from Indonesia remains to be confirmed by further studies. Finally, we discuss hypothetical evolutionary scenario explaining how species distribution and differentiation took place during the past. This work has implications for conservation strategies, not only by defining important areas for conservation, but also by helping prevent exchanges or introductions of individuals originating from different lineages.

p11-010

Phylogeography and population structure of the garnet-throated hummingbird (*Lamprolaima rhami*) based on molecular data.

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To understand how the environment and biogeographic history have shaped biodiversity, it is necessary to study species at the intraspecific level and to evaluate the different evolutionary forces which generate genetic variation. Here we analysed the population structure of the garnet-throated hummingbird (*Lamprolaima rhami*), which inhabits cloud forest, forest edge, pine-oak forest, upper tropical forest and scrub at 1200-3000 m. Some proposals have described three different groups based on subtle morphological differences: 1) *L. r. rhami* (described as subspecies) distributed in restricted highlands from México (Puebla, Veracruz, Oaxaca, Chiapas and Guatemala), 2) *L. r. occidentalis* (described as race) distributed in Guerrero, 3) *L. r. saturatior* (ssp) distributed in the highlands from Honduras and El Salvador. As a preliminary analysis, we used mitochondrial DNA to infer the general phylogeographic pattern of *L. rhami*, specifically Control Region and ATPase 6 and 8 (1402 bp). We obtained a haplotype network that shows a high level of geographic structure at both sides of the Isthmus of Tehuantepec. This pattern of spatial separation could be explained by considering the Isthmus of Tehuantepec as a long-term barrier to gene flow for these two haplogroups. In addition, the individuals from Guerrero showed the presence of unique haplotypes that could be explained in terms of geographic isolation.

p11-011

Phylogeography of mtDNA haplotypes and range settling in the Siberian rubythroat

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The analysis of the *cyt b* gene of mtDNA in the Siberian rubythroat (*Luscinia c. calliope*) migrating across Southern Primorye (Russian Far East) has revealed two well-differentiated phylogroups, which we call "western" and "eastern". In our further study of breeding birds (n = 121) from 15 localities, 82 haplotypes were identified, 42.7% of which belonged to the western phylogroup (uniting *L.c. calliope* populations), and the remaining 57.3% to the eastern phylogroup. The latter in turn is separated into 2 genetic pools, about two third from which was formed from birds of the *sachalinensis* subspecies only, and the other group united individuals belonging to races *anadyrensis*, *camtschatkensis* and Sakhalin birds. A phylogenetic network of mtDNA haplotypes of *L. calliope* shows distribution of haplotypes in different taxa of *L. calliope* on various parts of the habitat. Genetic structure of populations at the north-eastern part of the habitat and Sakhalin revealed intermixture of haplotypes belonging to the western and eastern phylogroups in various proportions, while the island populations of Hokkaido and Iturup, as the most remote populations from the spatial contact with *L.c. calliope*, were represented only by haplotypes of the eastern groups. The study revealed not only different pattern of taxon-specific haplotypes distribution in the western and eastern parts of the habitat, but also showed a link between both phylogroups through *L.c. sachalinensis*. Thus, we suggested a hypothetical scheme of spreading of the Siberian rubythroat first from Siberia to Sakhalin, then to Kamchatka, to the basins of the Penzhin and Anadyr rivers with their adjacent areas of the Koryak Highlands. Further it gradually spread from Kamchatka over the Kuril Islands, eventually reaching Hokkaido. It should be emphasized that the Sakhalin subspecies, being probably the first one among all forms of the eastern phylogroup to separate, had no direct relation to the formation of populations at the Kuril Islands and Hokkaido.

p11-012

Phylogeography of an Atlantic Forest montane passerine: recent divergence and demographic history of *Hemitriccus diops*

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Phylogeographical studies suggest that past climatic cycles exerted strong influence on the diversification of some forest-dependent Atlantic Forest bird species, shrinking or splitting their distributions during glacial periods. However, cold-tolerant species are expected to be less sensitive to these changes. To test this hypothesis, we conducted a phylogeographic study of the drab-breasted pygmy tyrant (*Hemitriccus diops*), a montane bird that reaches up to *ca.* 1300 m a.s.l.. We sequenced 910 bp of the mitochondrial ND2, 323 bp of intron 11 of the nuclear G3PDH, and 434 bp of introns 7 and 8 of the nuclear ODC for 82 individuals collected along the range of this species. The ND2 based haplotype network showed a phylogeographical break in the central region of the Atlantic Forest, dated on the late Pleistocene. No genetic structure was observed based on the nuclear data. The demographic tests applied (Fu's *Fs*, Ramos-Onsins & Rozas' R_2, Tajima's *D*, and extended Bayesian skyline plot) did not yield congruent results; some of them indicated population expansion while others suggested reduction. Ecological niche models for the last glacial maximum indicated that this species had a wider distribution than that observed today, which is congruent with the cold tolerance of this species. This is the first study that suggests recent diversification of an Atlantic Forest montane taxa. This study is co-funded by FAPESP (2009/12989-1, BIOTA, 2013/50297-0), NSF (DOB 1343578), NASA, CAPES, CNPq, and NAP BioComp.

p11-013

Molecular phylogeny based on mitochondrial DNA sequences of Eurasian and Oriental Skylarks

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There are three subspecies of Eurasian Skylark *Alauda arvensis* in Japan, including *A. a. japonica* which breeds almost throughout Japan and *A. a. pekinensis* and *lonnbergi* which are both winter visitors (The Ornithological Society of Japan 2012). Meanwhile, Sibley & Monroe (1990) categorized the skylark breeding in Japan as a full species *A. japonica.* In addition, Vaurie (1959) stated the possibility that *A. japonica* was a race of the Oriental Skylark *A. gulgula* on the basis of morphological comparisons. Against this background, a re-evaluation of the taxonomic status of the skylark breeding in Japan is required. Molecular phylogenetic analyses based on mitochondrial DNA sequences of skylarks have been carried out in this study. Blood, feather, and tissue samples of skylarks were collected from the breeding populations in various parts of Japan and in Sakhalin and Primorye of Far East Russia. Some tissue samples from *A. gulgula* in Taiwan were also collected but it was not known whether they belonged to the breeding population. We extracted DNAs from these samples and determined the base sequences for both ND2 (1041bp) and COI (649bp) genes within mitochondrial DNA. The homologous sequences of *Alauda* larks from INDC were also used in our analysis. From the results of the analyses so far, three distinct clades with high bootstrap support were identified on the phylogenetic trees based on the neighbor-joining method with both sequence data of ND2 and COI genes. Each clade consisted of individuals mostly from Japan, from eastern part of Russia, and from western Eurasia region, respectively. Large (4.6-8.3%) pairwise genetic distances (K2P) between clades were shown for all pairs with both genes. On the other hand, *A. gulgula* from both Taiwan and China were clustered into the same clade as the skylarks breeding in Japan, indicating that the Japanese species is a closer relative of *A. gulgula* than *A. arvensis*.

p11-014

The *Emberiza spodocephala* subspecies complex: new insights into taxonomy and phylogeography

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The phylogenetic relationships in the family Emberizidae are generally well resolved, but below the species level, there are few studies addressing the genetic structure and phylogenetic history of populations. For the eastern Palearctic Black‐faced Bunting *Emberiza spodocephala* three subspecies have been described: *E. s. spodocephala* (the nominate form), *E. s. personata* and *E. s. sordida*. Male breeding plumage differs between subspecies, females however are mostly indistinguishable. In this study, we use an integrative approach incorporating morphometric and genetic analysis to determine the degree of differentiation between the subspecies and investigate the phylogeographic history of these taxa. 138 individuals of *E. spodocephala* were captured with mist-nets during ringing projects in Lazovski Zapovednik and Muraviovka Park in eastern Russia. All birds were measured (longest primary, bill, tarsus) and a DNA-sample was taken. Additional data was gained at the Bird Collection of the Natural History Museum in Tring. Differences in DNA were examined by sequencing the subunit I of the mitochondrial cytochrome-oxidase gene and the nuclear sex-linked CHD1Z gene. We found significant differences between the subspecies for all measurements, but due to the great extent of overlapping, their value for subspecies discrimination is very limited. Data from mitochondrial DNA showed a deep divergence between *E. s. spodocephala* and *E. s. personata* and suggests a separation between 1.5 to 3 million years ago. The one case of a mismatch in morphologic and genetic subspecies assignment might be a cue for introgressive hybridization. The third subspecies *E. s. sordida* did not form a separate clade but exhibited unique haplotypes. In nuclear DNA, population divergence was significant but shallow and the monophyly of clades seen in mitochondrial DNA was not supported. In conclusion, our data suggest that *E. s. spodocephala* and *E. s. personata* represent two evolutionary distinct units and justify their classification as two separate taxa.

p11-015

Phylogeographic patterns in three passerine birds in eastern China

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The east of China covers two biogeographic realms and preserves a rich biodiversity. Current phylogeographical studies are far from adequate to illustrate speciation process and evolution history of the region's avifauna. Here we summarize a comparative phylogeography of three passerine birds: Grey-cheeked Fulvetta (*Alcippe morrisonia*), Light-vented Bulbul (*Pycnonotus sinensis*), and Long-tailed Tit (*Aegithalos caudatus*). Results show seven geographically separated clades in *A. morrisonia*. The time of the most recent common ancestor (TMRCA) of all lineages was rather early (11.6 Mya). In *A. caudatus* two major lineages (northeast China vs central and south China) were identified and the divergence time dated back to 0.7 Mya. *P. sinensis*, which is undergoing a rapid distribution expansion, showed no apparent population structure despite obvious plumage differences between subspecies. For this species TMRCA was estimated at the beginning of the late Pleistocene (0.47 Mya). The results demonstrate that climate impacts on avian species in eastern China happened prior to the last glacial maximum (LGM) and identify the possible enhancement of genetic structuring by ice age refuges and geographic barriers. The results also indicate that population structures and demographic histories differ among species with different ecological traits. The patterns we observed in these three species may be detectable in other organisms in east China.

p11-016

Biogeography of catbirds (Passeriformes: *Ailuroedus*) manifests zoogeographical disjunctions on New Guinea

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New Guinea is the largest and highest tropical island in the world and is estimated to host the third-largest "high biodiversity" wilderness in the world. The fauna in New Guinea is characterised by complex distribution patterns where species and subspecies often are replaced by sister-taxa in adjacent regions. One such pattern is that widely distributed lowland species are morphologically variable with distinct, geographically disjunct populations, but in spite of that there are few apparent barriers in the lowland. Today we know that New Guinea has a complicated geological history and that these patterns may reflect past geographical disjunctions.

The avifauna of New Guinea is renowned for its diversity and includes families such as the birds-of-paradise and the bowerbirds. In this study we use catbirds of the bowerbird genus *Ailuroedus* to investigate past vicariance patterns in the lowlands and lower mountains. Catbirds were chosen as model group since the two species inhabiting New Guinea are found at slightly different altitudes and may thus have responded differently to past vicariance events.

By examining molecular data within a spatio-temporal framework we found three deep genetically divergent populations in the lowland species that corroborate the presence of ancient lowland barriers. In the lower mountain taxa we found a different and more complex population structure. The result supports the hypothesis that taxa inhabiting lowland and lower mountains, respectively, have responded differently to past geological and ecological events in New Guinea. By using integrative taxonomy based on both molecular and morphological data we argue that several subspecies of *Ailuroedus* catbirds should be upgraded to species rank.

p11-017

Speciation in the Andes: contrasting phylogeography of the treerunners *Margarornis* and *Pseudocolaptes* in the Northern Andes

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Species with similar geographic distributions have been proposed as probably having a shared evolutionary history. Birds in the Treecreeper's genera *Margarornis* (*rubiginosus, bellulus, stellatus* and *squamigera*) and *Pseudocolaptes* (*lawrencii-johnsoni* and *boissonneautii*) have similar geographic distributions in the Andes of South America and south Central America, both being insectivores and catching prey in a similar way. Co-estimation of relationships and divergence times from mitochondrial genes *Cyt-b* and *ND2* for all members in these two genera with Bayesian analysis (StarBeast) suggenst the two clades have non-concordant typologies. The phylogenetic trees and divergence show the relationships inside each group are different with respect to geographic location and time since divergence. The Central American groups are the oldest inside each group, but its relationships and divergence time's change with respect to the Andean groups of the Northern Andes. *Margarornis* has divergence times between 0.7-0.14 MY while *Pseudocolaptes* between 2-1.4 MY. *M. rubiginosus* only in Central America, and *M. bellulus* and *M. stellatus* being the most recent, distributed in the Serranía del Darién (Panama-Colombia border) and the Pacific region, followed by *M. squamigera* along the Andes. *P. lawrencii* of Central America splits first, then *P. lawrencii johnsoni* (which could be considered a separate species), found on the Pacific slopes of the Western Andes (West Colombia and NW Ecuador) and some individuals of *P. boissonneautii* found on the Pacific which represent separate lineages from other *P. boissonneautii* east of the Andes, but with little morphological differentiation. The species in these two groups are not the result of one only event, but of recurrent events (repeated climatic changes), separating allopatrically the species in different times. Some Glacial/Interglacial cycles affected the distributions and divergence in the same geographical locations, but sorted differently the geographical populations even though having similar ecologies.

p11-018

Microsatellite DNA analysis divided Japanese Rock Ptarmigan into four genetic clusters

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The Japanese Rock Ptarmigan *Lagopus muta japonica* is the most southern population of this species and is supposed to be a relict population since the last glacial period. It is listed as an endangered subspecies in the Red List of the Ministry of Environment, Japan. The population size is estimated to be less than 2,000. The habitat is restricted to several high mountain top regions higher than 2,200m. The major threats to its survival are habitat fragmentation and habitat degradation mainly caused by mountain tourism and possibly caused by global warming. Some populations have been already extinct and others are critically threatened. We analyzed five loci of microsatellite DNA of ca. 200 individuals from almost the entire range of this subspecies in order to investigate genetic diversity and genetic divergence among fragmented populations. Very low genetic diversity was found in comparison with those of European populations, but Mt. Hiuchi population, the smallest breeding population in Japan (only 20-30 adults) does not have a low genetic diversity related to the other Japanese populations. Population structure inferred by Structure 2.3.3 suggested that Japanese Rock Ptarmigan are divided into four genetic clusters, Mts. Hiuchi and Yakeyama, North Japan Alps, Mts. Norikura and Ontake, and South Japan Alps. The gene tree among populations based on Fst by the Neighbor Joining method suggested that the Hiuchi and Yakeyama population is an ancestral population and genetically connects the South Japan Alps and North Japan Alps populations. These results imply that the four populations should be conserved each as different ones, and that the population structure seems to reflect historical influence more strongly than gene flow at the present age.

p11-019

Phylogeography of Oriental Greenfinch: species-level divergence on oceanic islands

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The Oriental Greenfinch *Chloris sinica* is a passerine bird distributed only in East Asia. Five to eight subspecies are usually recognized: *sinica* in SE China; *kawarahiba* in Kamchatka to Kril Is. ; *sitchitoensis* in Sakhalin; *ussuriensis* in NE China, Ussuriland to the Korean Peninsula (*chaborovi* in Amurland is usually lumped with *ussuriensis*); *clarki* in Ulleungdo Is. in Korea; *minor* in mainland Japan; *kittlitzi* in Ogasawara Is. (1,000 km south of Tokyo). Our preliminary genetic analysis using DNA barcode region (COI, 650 bp) with a few samples showed that the population of *kittlitzi* is distinctly separated from other populations. To confirm this, we analyzed partial ND6 to cyt *b* and Control region (CR) sequences of mtDNA through its breeding range (n = 86), and other closely related species. As a result of cyt *b* analysis, and the same of CR, all populations of *C. sinica* formed a monophyletic group against other relatives (*C. chloris*, *C. spinoides* and *C. ambigua*). Within *C. sinica,* the population was split into 2 groups, *kittlitzi* and the remaining populations (subspecies) with strong bootstrap support. In contrast, relationships among the remainder were unclear. To clarify this relationship, further analysis using a higher rate genetic marker (e.g., microsatellite) is needed.

The uniqueness of *kittlitzi* was also supported by its morphometrics and plumage. It has a short wing length, large beak and different wing color pattern as compared with other subspecies. We conclude that *kittlitzi* might be treated as a distinct species, because it has been separated from other subspecies for a considerable time, probably the Pleistocene, and accumulated differences in genome and external features.

This species has very limited distribution range and inhabits only part of Ogasawara Is. The estimated population size is 200 to 400 individuals, and specified as Critically Endangered in the Japanese Red list. Immediate conservation activities are required for this species.

p11-020

The role of riverine barriers as drivers of diversification in Amazonia: using the DNA barcodes with dense sampling to assess Amazonian diversity

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The Amazon basin is the largest sedimentary basin in the world, and is mainly covered by dense tropical forest. This moist broadleaf forest comprises the largest and most diverse region of tropical rainforest. More than 1800 species of birds are recognized, and yet a bigger diversity may be hidden. In the last years, the influence of Amazonian history in generating this high diversity has been proposed. Several studies are showing the influence of the uplift of the Andes, and the subsequent reconfiguration of the drainage in the Amazon basin, acting as possible triggers of diversification. Drainage reconfiguration and establishment of current courses of main Amazonian rivers (Negro, Solimões/Amazonas, Madeira, Tapajós, Xingu and Tocantins Rivers), may have isolated contiguous populations, and then, by preventing gene flow through time, new lineages have been formed. However, the role of secondary rivers is still unknown. These rivers may act as barriers to gene flow for sedentary understory birds, but have no effect on canopy species, so that the same river has distinct effects on different species. Furthermore, not only the width of river is important, the geomorphological history of the region may be equal in importance. Thus, to access the importance of rivers of different sizes on population structure of avian taxa in Amazonia, this study sampled, for each species, 5 individuals from each margin of two main Amazonian rivers (Negro and Tapajós) and two secondary Amazonia rivers (Jatapu and Purus). To access the population structure for each species or clade, the mtDNA gene Cytochrome Oxidase I (COI) is being sequenced. Haplotype networks, and genetic distances will be used to identify the influence of each river in preventing gene flow. Data obtained so far shows a strong influence of river barriers on intraspecific genetic diversity for most species.

p11-021

A genome-wide assessment of gene flow in elevationally parapatric congeners in Borneo

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High regional diversity and species rich communities in Asia require that diversifying lineages repeatedly came into secondary contact. In areas of topographic complexity, this contact often results in a parapatric replacement of congeners along elevational gradients. Indeed, one hypothesis for species accumulation is that recently differentiated lineages might coexist via elevational displacement upon secondary contact. However, the taxonomic distinctiveness and nature of interaction between these recently diverged populations are unknown. We assessed single nucleotide polymorphisms (SNPs) from across the genomes of pairs of elevationally stratified populations of three species in Borneo (*Enicurus leschenaulti*, *Chloropsis cochinchinensis*, and *Arachnothera modesta*). The population pairs in each species are slightly differentiated morphologically, and at times each had been considered conspecific.

The data indicated that each population was evolutionarily cohesive, with little or no gene flow among parapatric populations since separation. Based on mitochondrial divergence as a rough measure, the divergence between each population in a pair occurred in the Early Pleistocene, indicating a likely role for climatic and sea level fluctuation. The data not only reaffirm the species status of each population, they also corroborate the hypothesis of a refugia-based species pump in the Sunda region. Most likely, the populations were isolated by climate/habitat change, and then came into secondary contact causing elevational parapatry through competition.

p12-001

Ontogenetic color change in caterpillars as a defensive strategy against bird predation

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Bird predation provides a selective force for the evolution of body coloration in prey animals because birds have excellent color vision. In many species of *Papilio* butterflies, larvae show an interesting pattern of body color change during their development: the early instars resemble bird droppings, while the last instars match their coloration with their host plants. The two morphs represent different defensive strategies against avian predators; the former is known as masquerade that makes predators mis-recognize prey as an inedible object (i.e. bird droppings), while the latter is known as crypsis that reduces the probability of being detected by predators. However, why do the larvae shift between these two defensive strategies during their ontogeny? We addressed this question by conducting a field experiment: four types of pastry caterpillars that differed in both color (bird-dropping or leaf) and size (15mm or 30mm) were placed on leaves of their host plants, and their survival rate was examined. Bird dropping colored pastries had lower probabilities of bird attacks than leaf- colored pastries when pastry size was 15mm, which is a range of earlier instars (11-25mm) and real bird droppings (6-16mm). In contrast, leaf colored pastries sustained lower rates of attack than bird dropping colored pastries when pastry size was 30mm, which is a range of the last instars (18-44mm) and larger than real bird droppings. Our results show that masquerade as a bird dropping has a greater survival than crypsis only when the body size of prey is similar to the model object (e.g. bird droppings). This study suggests that the cognitive ability of birds promotes the evolution of elaborate masquerades of prey animals.

p12-002

The effect of a colonising superpredator (Northern Goshawk *Accipiter gentilis*) on mesopredator (Tawny owl *Strix aluco*) survival & reproductive strategies under declining food availability.

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Superpredators - predators which kill smaller predators - can exert 'top-down' control on mesopredator population dynamics and the addition of large superpredators into a community can have far reaching effects on the established species. At a time of global change when food resources for many vole-eating raptors are declining at a continental scale throughout Europe, understanding how other factors like superpredation, affect mesopredator survival is important from a conservation management perspective. We used mark-recapture data from a 30 year raptor monitoring program, to investigate the effect of a colonising superpredator population of Northern Goshawks on mesopredator (Tawny owl) survival. We investigated whether goshawk abundance, distance to the nearest goshawk territory and connectivity to known goshawk territories affected Tawny owl survival; as well as examining the effect of a declining food resource, field voles, the main prey for owls in our study site. In addition, we examined how different reproductive strategies affected survival under increasing superpredator abundance. As predicted, distance to the nearest goshawk territory, connectivity to goshawks and superpredator abundance influenced owl survival. Survival appeared to be highest for individuals living further way from goshawks and in territories less connected to goshawk nest sites. Additionally, owls which refrained from breeding in the previous year(s) and those which spent on average 30% or more of their adult life after becoming reproductively active without breeding had the highest survival. This result is consistent with the hypothesis that the additional flight feathers (up to 5 times as many) an owl can renew in a non-breeding year improves an individual's ability to escape predation. This suggests superpredators should be taken into account when understanding life history trade-offs and formulating mesopredator management programmes as both their abundance and relative spatial distribution is likely to affect both mesopredator survival and could impose a selective pressure on mesopredator reproductive strategies.

p12-003

Philopatry and breeding site fidelity of the Long-billed Plover *Charadrius placidus*.

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The Long-billed Plover occurs in East Asia, and is seen there commonly throughout the year. The plovers inhabit the flood-plains of rivers, and are usually monogamous. I investigated their ecology by individual identification for six years from 1988 and for three years from 2011, in a study area along Toki River in Saitama Prefecture, central Honshu. This area is located inland about 70 km from the river mouth. Thirty three per cent of the breeding individuals remained at the breeding site, 24% moved in summer and returned in fall, 30% were seen only during the breeding season, 7% disappeared, and the other 5% became winter visitors. Thus, observed individuals were divided into those with and without philopatric tendencies. In the study area, there were about 30 breeding territories in 1988-1993, but the number was14 in 2011-2013, the population being reduced by half. The survival rate of adults to the following year was 56-74% in 1988-1993 and 71-82% in 2011-2012, although the difference was not statistically significant. However, there was a significant difference between the survival rate of males and females. On average, the return rate was 75% for males and 59% for females. Of the breeders, 69% of males and 39% of females returned to the same breeding sites in the following year. The results indicate that males have strong breeding site fidelity, while females may change the breeding sites depending on the breeding success, suggesting a sexual difference in the breeding strategies in this plover species.

p12-004

Long-term study on natal dispersal and breeding-site fidelity of Streaked Shearwater *Calonectris leucomelas*

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Natal dispersal and breeding-site fidelity of the Streaked Shearwater in a breeding colony on Kanmurijima Island (E 135 26', N 35 40') in the Sea of Japan was analysed using a 34-year set of banding data from 1977 to 2010. We set two sites (A and B) in this colony, and banded chicks and adults. Most individuals were returned to their original sites for release. Banded chicks were found only in site A. Return rates of banded adults were low (0.007% and 0.002%) in the other study sites. Breeding-site fidelity was further analysed using a 10 m x 10 m grid system in Site A. The return rate within 10 meter of the release site among the total was defined as a fidelity index. The higher the index, the greater is the likelihood that the individual will return to the releasing place. Based on a total returning number of 4,154 banded adults recorded in this study, the fidelity index was 0.73. Based on a total returning number of 232 banded chicks, the fidelity index was 0.48. Banded chicks were found only 1.3% by 3 years. The total number of returning chicks decreased every ten years. However, the chick's fidelity index increased with age year by year. 0.41(n=170) from year 1st to 10th, 0.62(n=50) from yr 11th to 20th, 0.92(n=12) from yr 21st to 31st.

p12-005

Reconstructing networks between winter roosts and summer colonies in Ardeidae species

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Obligate colonial birds like herons and egrets form colonies in the breeding and communal roosts in the non-breeding seasons. In northern temperate regions, heron colonies are formed by resident and migrant species, but roosts are formed by resident species only. Heron colonies may grow up to several thousands of individuals, but those of roosts are a couple of hundreds at most. Although roosts and colonies are thus quite different, they are connected by flows of individuals. At the beginning of the breeding season, winter roosts suddenly disappear and individuals from those roosts move to colonies. At the end of the breeding season, colonies gradually collapse and migrant individuals fly away to the south, with residents remaining and forming roosts. The flows of individuals from roosts to colonies and *vice versa* are hardly recorded because it involves the identification of tremendous numbers of individuals. Here we propose a method for estimating the flow of individuals between roosts and colonies based on 10 years of census data of herons and egrets around Ibaraki Prefecture, Japan. We reconstructed connections between roosts in year t and colonies in year t+1 as bipartite binary adjacency matrices (A). Each adjacency matrix was estimated so as to make Bonacich's power centrality (BPC) of AA^T (roost-roost) and A^TA (colony-colony) proportional to the population sizes of roosts and colonies, respectively. The exponent parameter of BPC represents positive and negative effects of an element against others connected with it in the adjacent matrix. A simple genetic algorithm was applied for reconstructing network matrices weighted by distances between roosts and colonies. Networks among roosts were easier to reconstruct than those among colonies. Power exponents of BPC were both negative and positive; population sizes of highly connected colonies and roosts were not always large.

p12-006

Collective philopatry in heron colonies

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Many birds are faithful to their natal sites; they return to breed at the same locations every year. For example, seabirds often form their breeding colonies on the same cliffs or islands for many years. However, the availability of potential breeding sites is often restricted, and seabirds may be forced to reuse the same breeding sites. In contrast, herons and egrets form their colonies on comparatively unrestricted resources such as trees or bamboo thickets. Here we examined whether heron colonies also show site fidelity even though returning to their natal sites is facultative for herons. From 1963 to 2013, a total of 61 colonies were formed around Ibaraki prefecture, Japan. Ten colonies were formed for a duration of one year only; the herons did not show site fidelity. Twenty-five colonies persisted for a number of years, herons reusing exactly the same locations; here herons showed site fidelity. The remaining 26 colonies persisted for a number of years but changed their locations several times within the neighborhood. We examined the degree to which colonies remained within the same area or moved away by measuring the distance between the focal point and the last location of each colony. The distance in 16 out of 26 colonies was shorter than null expectations; they were not located at exactly the same sites as in the previous year(s), but still showed site fidelity in a broader sense. Consequently, 41 out of 61 colonies (67%) showed site fidelity. Even though breeding sites are widely available, heron colonies are likely to be located at exactly the same or around the same sites as in the previous year(s). We consider their facultative site fidelity at the colony level as collective philopatry. The philopatry of heron species at the individual level is known to be low and 40% at most. High collective philopatry might be realized by a few faithful pioneer individuals that are subsequently followed by others individuals.

p12-007

Granivore movement in a savanna landscape: A case study of the Black-throated Finch (Poephila cincta cincta) in north–eastern Queensland, Australia

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Granivorous birds are a common functional group in savanna landscapes however they have been prominent in lists of threatened Australian bird taxa, suggesting broad-scale declines. Their movement patterns and home range sizes are poorly known, particularly for the Black-throated Finch southern subspecies, *Poephila cincta cincta* (BTF). BTF have had a range contraction of 80% since the 1970s and now are listed as endangered under federal and state lists. Understanding movement patterns and spatial distribution of a species is critical to the ecological management of populations and habitats. This study was conducted south of Townsville, Queensland, in private and public properties surrounding Ross River Dam catchment area. Black-throated Finch colonies have been regularly monitored since 2011 and birds have been captured with mist nets. Captured BTFs are metal and colour banded and selected birds are fitted with a 0.3g radio transmitter (ATS model A2414). To date, 92 BTFs have been colour banded (5 sites) and 10 have been radio-tracked in two different sites. One bird was recaptured 12 months after banding in the same locale it was first banded. Tracked birds seem to be largely sedentary. A summary of our findings and updated results will be presented at the conference.

p12-008

The multi-scale aggregative response of cormorants to the mass stocking of fish in rivers

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In Japanese rivers, there is a serious conflict between the Great Cormorant (*Phalacrocorax carbo hanedae*) and fisheries. The basis of this conflict is that the cormorants feed on ayu (*Plecoglossus altivelis*), a commercially important fish that is stocked primarily for recreational fishing. To understand how cormorants alter their foraging habitats in relation to the stocked fish and fishing activities, we examined the relationship between cormorant abundance and ayu biomass during the cormorant breeding season (from April to July) using two approaches that differ in spatial scale. First, we compared cormorant numbers in different river sections that were defined based on ayu stocking. The cormorant numbers in the sections stocked with ayu increased during the ayu release period, whereas the cormorant numbers in other sections showed no clear seasonal patterns. Second, we tested whether cormorant numbers were correlated with the biomass of ayu caught with cast nets. Positive correlations were observed between the biomass of ayu and the number of cormorants that were within 900 m, 1 km, or 2 km of fish sampling points; however, such correlations were not observed within 100–800 m of the sampling points. The biomass of ayu caught with cast nets increased steadily from April to June despite predation by cormorants; however, this biomass decreased sharply in July when the fishing season opened. This study indicates that although cormorants altered their feeding areas in accordance with the mass stocking of ayu in a Japanese river, sufficient numbers of ayu were still maintained for anglers.

p12-009

Origin of breeding individuals in two populations of the Long-tailed Tit

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The Long-tailed Tit (*Aegithalos c. caudatus*) is a small insectivorous bird that demonstrates different patterns of seasonal movements. In the east of its wide breeding range the species shows irregular outbreaks of numbers as an irruptive migrant, while in the west it is considered to be a regular migrant. At the same time, it is known that resident individuals are present throughout the range. We attempted to explore the origin of breeding individuals in two populations with presumably different pattern of movements. The data on long-term trapping of Long-tailed Tits at two extreme field sites in NW Russia and Russian Far East were analysed. It was found that both locally born and first-year Long-tailed Tits caught on autumn migration contribute to the breeding population. In both field sites Long-tailed Tits, ringed in late September and in October, were controlled in the following year. We suggest that such individuals may finish their autumn migration at the study area. The relatedness among breeding individuals for western population will also be discussed. The study was supported by RFBR grants 12-04-31858 and 13-04-01474.

p12-010

Breeding in the temperate zone or in the tropics: a comparison of home ranges in the Common Cuckoo *Cuculus canorus* and The African Cuckoo *Cuculus gularis*

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The Common Cuckoo *Cuculus canorus* and the African Cuckoo *C. gularis* are closely related species migrating at different spatial scales. Although the Common Cuckoo potentially occurs alongside the African Cuckoo during the northern winter, their breeding grounds are in separate climatic zones. We used satellite telemetry to investigate possible differences in the breeding season home range of the two species. The mean home range of male and female Common Cuckoos from South Scandinavia was significantly larger than that of male African Cuckoos, which was also the case when considering Common Cuckoo males only. The large average overall overlap index in male African Cuckoos suggests that they do not defend territories during the breeding season. We conclude that in males of both species the core of the home range may be similar in size but differences exist in how far individuals roam. Differences in the mean home range size between the species may be due to differences in the distribution of host species as well as in availability of suitable habitats for foraging.

p12-011

To stay or not to stay on isolated islets?: Identifying the migratory status of robins based on the year-long operation logs of automatic photo and sound recording systems

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The Ryukyu Robin *Luscinia komadori* is endemic to the subtropical Asian islands. The robin is well differentiated among populations in terms of morphology and migratory behavior, and also by the genetic composition within its narrow habitat range. On the basis of phylogeographical analyses, different migratory behaviors of the robin have been inferred to play a role in maintaining such a genetic structure. On two small islets located between migratory and sedentary populations (60 km northwest of the sedentary Amami population and 90 km southwest of the migratory Tokara population), a small number of singing individuals have recently been observed during the late breeding season. Although the migratory habit and genetic origin of this (probably) breeding population is of biogeographical interest, the offshore islets are too isolated for making frequent observations. I accordingly installed infrared-triggered cameras and timer-programmed sound recording systems to collect year-round records of birds. Only the sound recordings provided continuous records of the singing individuals throughout the breeding season, which gives us a reliable basis for identifying the breeding species, including the robin. During winter, the robin has never been detected by either type of recorder, and thus it is inferred to be migratory there. The mtDNA haplotypes of two captured individuals were assigned to the branch of the Tokara group in spite of the islets being located closer to the Amami Islands. These migratory and sedentary populations inhabiting locations only 40 km apart in latitude might help us to identify the key factors promoting a migratory life history. Further, such automatic photo and sound recorders are useful tools for avian inventory data collection in remote sites.

p12-012

The importance of conspecifics during settlement: an experimental approach

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Conspecific attraction via location cues appears to be important in the settlement process of many bird species and has mostly been investigated using playbacks to mimic the presence of conspecifics. Song is of central importance for territory defense and mate attraction in many birds, while at the same time providing readily available evidence of conspecific presence. Focusing on pre-breeding cues, settling behavior of Wood Warblers on 5-ha experimental plots with playbacks of Wood Warbler songs (n=15) was compared to 5-ha control plots (n = 14). Territory establishment differed significantly ($p < 0.01$) between song plots (n=18) and control plots (n=5), with pairing rates of 33% and 60%, respectively. Settling in places where other Wood Warblers are present may increase mating opportunities (i.e. social pairing and/or extra-pair parentage). Knowledge of the fitness consequences for individuals attracted by conspecific playbacks is one of the largest knowledge gaps in our understanding of conspecific attraction in songbirds. Individuals settling in response to conspecific playbacks were also closely monitored to assess reproductive performance, which, however, did not significantly differ between song and control plots. The experiment raises new questions, but we experimentally show how important conspecific cues are for choosing a territory.

p12-013

Effects of Edge on the Understory Insectivorous Birds in a Fragmented Tropical Rainforest

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Understory insectivorous birds are found to be one of the most sensitive groups to changes in environmental conditions in tropical rainforests. Therefore, edge effects may have great impacts on the persistence of these species in a fragmented forest. We examined the abundance of insectivorous birds along the edge-interior gradient in an isolated lowland tropical rainforest in Peninsular Malaysia. The study was conducted between May 2007 and April 2008 using the Distance Sampling Point Count method. Results showed that the most striking changes on the understory bird community (i.e. relative abundance, density, diversity, and composition) occurred within 25 m to 400 m of the forest edge to the interior. The association between the birds and the micro-environmental factors separated two completely different groups of birds: (1) forest interior-specialist species such as the short-tailed babbler (*Malacocincla malaccensis*) and black-capped babbler (*Pellorneum capistratum*), which used the forest interior habitats discriminately, and tended to avoid the microclimatic fluctuations close to the edge; and (2) forest edge-specialist species such as the yellow-vented bulbul (*Pycnonotus goiavier*) and cream-vented bulbul (*Pycnonotus simplex*), which preferentially used the edge. In terms of feeding guilds, interior-specialist guilds such as terrestrial insectivores and sallying insectivores, and the edge-specialist guilds such as arboreal foliage-gleaning insectivores and terrestrial insectivores-frugivores were separated based on their sensitivity to the edge effects. The environmental conditions, vegetation structure, and composition along the edge-interior gradient resulted in different responses of the understory birds. The forest edge-specialist species were associated with the high light intensity and shrub cover, and they could be the best indicators of the edge habitat condition. The forest interior-specialist species were associated with high relative humidity and leaf litter cover and thus, could be the best indicators of the forest interior habitat condition.

p12-015

Change of habitat preferences of the Common Kestrel: dynamic of the process, possible causes, benefits

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Common Kestrel (*Falco tinninculus*) is a widespread species, the most abundant falcon in the south of European Russia. During the breeding season it can be found in rookeries located in the artificial forest shelterbelts in the steppe zone. The nesting density in this wood habitat is relatively high. In recent years, the species has actively penetrated reed habitat, initially sporadic, then regular, breeding successfully in artificial shelters for ducks. In the reed habitat egg laying starts two weeks earlier than in the rookeries. This may be due to a high availability of nest sites for breeding, as the population of ducks steadily declines. There are differences between kestrels breeding in the reed habitat from those breeding in the rookeries in wood habitats. For example there is a difference in egg shape, which is determined by differences in the size of the females in the two habitats. Differences in egg volume and clutch size between birds breeding in woodland and reed do not correlate with breeding success suggesting that the reed and wood habitat at this time in the reproductive cycle are equally suitable. The benefit of breeding in the reed habitat could be decreased competition for nest sites since aggressive behavior directed on con-specific and competitor species requires additional energetic resources. Another potential profit might be the earlier onset of breeding in the reed habitat. Penetration of the Kestrel in the new breeding habitat could be explained by different causes: an increase in the local Kestrel population, degradation of wood habitats linked to a dry period in the climatic cycle, and elevation of interspecific competition in the earlier inhabited breeding habitats.

p12-016

Temporal sharing of floral resources among hummingbirds (Trochilidae) in inflorescences of *Dahlstedtia pinnata* (Benth.) Malme. (Fabaceae) in the Atlantic Forest

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The purpose of this study was to investigate the phenology and reproductive biology of *Dahlstedtia pinnata* (Benth.) Malme. (Fabaceae), and its interaction with hummingbirds. For the phenology, we looked at the presence of reproductive structures in the plants, and for the reproductive biology we examined the frequency of potential pollinators and foraging behaviors. This study was conducted in Pedra Branca State Park, Rio de Janeiro state, in dense ombrophilous forest, between August 2010 and August 2011. Flowering occurred between December 2010 and March 2011, and fruiting between April and June 2011. Hummingbirds' foraging schedules differed significantly, with legitimate visits to the flowers occurring in the morning and illegitimate visits during late morning and the afternoon. Five hummingbirds visited flowers, three of which were legitimate visitors: *Phaethornis ruber*, *P. pretrei,* and *Ramphodon naevius*. *Amazilia fimbriata* and *Thalurania glaucopis* females only visited illegitimately. *Phaethornis ruber* robbed nectar (78% of illegitimate visits, *n*=337). *Ramphodon naevius*, with a territorial foraging behavior and a body size bigger than that of other hummingbird species observed, dominated the floral visits, which suggests that *D. pinnata* is an important nourishing resource for this endemic bird.

p12-017

Relationship between stream habitat types and annual fecundity of Brown Dipper *Cinclus pallasii* in Taiwan.

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A central question in ecology is what regulates population size. In this issue, annual fecundity plays a great role in short-lived species. Examining what factors influence annual fecundity is also a crucial topic. Dippers from the genus *Cinclus* are ideal model species because they are highly specialized predators on aquatic invertebrates, and occupy linear territories along rivers. Previous study has shown that the most preferred prey item of Brown Dippers (*Cinclus pallasii*) is Trichopterans due to the group's relatively large body size. In addition, their territory lengths were negatively related to proportion of riffles because Trichopterans are more abundant in such habitat. Accordingly, we expect that stream habitat types can reflect food abundance and influence annual fecundity of Brown Dipper. Our study area is in Cijiawan Stream, at 1700 m elevation in central Taiwan. We used depth and benthic substrate to sort stream habitat into three types: 1) deep water area is where water depth exceeds 50 cm, which Dippers rarely use; 2) riffle and 3) glide are shallow waters (depth < 50 cm) where the primary substrate is pebbles and sand, respectively. Aquatic invertebrates in the latter two types of habitat were sampled to compare prey abundance. We investigated Dipper reproduction in the spring of 2013. Excluding breeding failure by predation and weather, we estimated the proportion of the three habitat types and stream width every 50 m from 200 m upstream of a Dipper's nest to 200 m downstream. Invertebrate sampling showed that Trichopterans were more abundant in riffle than in glide. In addition, Dipper annual fecundity was positively related to the area of riffle in the investigated length. We concluded that the amount of riffle area reflects food abundance and thus is an important factor affecting the annual fecundity of Brown Dippers.

p12-018

Rice fields as an important habitat for Intermediate and Cattle Egrets in Korea: distribution and feeding activity

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Rice fields are a unique man-made seasonally flooded wetland and they play a significant role as alternative habitats for waterbirds, including herons and egrets. The objective of this study was to investigate the feeding activity of Intermediate Egrets (*Egretta intermedia*) and Cattle Egrets (*Bubulcus ibis*) in rice fields and to evaluate the effect of rice fields on the distribution of breeding colonies of two species in Korea. The Intermediate Egret and Cattle Egret were the most rice-field-dependent species compared to other ardeids. As the rice crop developed and fields became densely vegetated, both species changed to rice banks or edge areas as feeding sites and avoided the inner parts of rice fields. Also, the two species might respond to changes in the condition of rice fields by changing their feeding methods and prey types. As a result, although their feeding efficiency in rice fields varies across stages of the rice culture, they could meet their energy needs from rice field habitats. Especially, the plowing of flooded fields by tractors in May (the early breeding stages of both species) provided high feeding efficiency by higher capture rates and/or larger preys. Rice fields were the dominant feeding habitat type surrounding breeding colonies. Although both species are common throughout the Korea peninsula, their breeding colonies were concentrated mainly in the mid-western parts. There were significant positive correlations between nest abundance of two species and the area of rice fields. Also, the number of other colonies within 20 km radius was positively related to the total area of rice fields. This result shows that rice fields support a large population of egrets in Korea. Consequently, rice fields provide an important feeding habitat for both species during the breeding season. The recent population increases of Cattle Egrets, and stable or moderately increasing Intermediate Egret populations were possibly mainly driven by availability of rice fields.

p12-019

One scale does not fit all: habitat effects on the breeding success of three forest-dwelling hawks

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Anthropogenic environmental changes have reduced populations of many species. In the European boreal zone, intensive forestry is one suspected cause for a decline of forest-dwelling raptors, but the association between habitat features and breeding performance is deficiently understood. We studied the boreal breeding habitat and habitat-associated breeding performance of the Northern Goshawk (*Accipiter gentilis*), Common Buzzard (*Buteo buteo*) and Honey Buzzard (*Pernis apivorus*), which are possible competitors for territories and nest sites. We used nationwide and long-term Finnish birds of prey data combined with multi-source national forest inventory data from different distances (100–4000 m) around the nests. Breeding success of Goshawk was best explained by habitat within radius of 2000 m around nests. Goshawk breeding was more successful with increasing proportion of old spruce forest and water, and decreasing proportion of young thinning forest in a territory. The proportion of old spruce forest, the preferred breeding habitat, decreased in Goshawk and Common Buzzard territories and in the whole of Southern Finland during the study period (1992–2010). Proportion of other old forest increased in Goshawk and Common Buzzard territories although its area decreased in Southern Finland. Instead, young forests increased in Southern Finland but not in hawk territories. Habitat at nest-site scale (100 m) best explained the breeding success of Common Buzzard and Honey Buzzard, but none of the habitat variables were significantly associated with their breeding success or brood size of any of the species. We found no indication that habitat differences would explain previously observed differences in breeding success between natural and artificial hawk nests. We emphasize the importance of studying habitats in several spatial and temporal scales in order to find the most relevant scale for each species and to detect environmental changes which can occur in a nationwide scale within only few decades.

p12-020

Dynamics of Steller's Sea Eagle population in the southern part of breeding range in relation to drastic changes in habitats

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No less than 30% of the Steller's Sea Eagle (*Haliaeetus pelagicus*) population of the world inhabits Sakhalin Island and the Lower Amur Region. The total abundance of the population in both regions is about 2200 individuals. Eleven years of radiotelemetry results confirmed that at least 36% of the birds from Sakhalin spend the winter in Hokkaido. 300 territories in NE Sakhalin and 280 territories in Amur Region have been subject to complex monitoring. Currently, reference populations of sea eagles show a decreased proportion of immature birds. From the early 1990s to 2012, the proportion of immatures in Sakhalin reduced from 30.8-38.4% to 14 %. In the Amur region it decreased from 28% to 17 %. During the last 20 years, the proportion of inhabited territories in both regions remained at almost the same level, at about 70 %. However, the portion of active territories (where birds produced offspring) significantly decreased: in Sakhalin from 68 to 54% and in the Amur region from 60 to 45%. The productivity of sea eagles per territorial pair also gradually decreased from 0.79 to 0.58 fledglings in Sakhalin and from 0.87 to 0.64 fledglings in the Amur region. This is primarily due to a decrease in the number of breeding pairs. According to the results of Leslie matrix population modeling, the population decreased at a rate of 1.6% and 1.0% per year in Sakhalin and the Amur region, respectively, which may lead to a twofold reduction in population size within a period of 44–70 years. The annual mortality of immatures in their first year and mature birds was 83-85 and 4.8%, respectively. A stochastic model confirms the negative trend in both populations. Large-scale development of oil fields on the Sakhalin coast causes transformation of habitats of sea eagles. The impact of changes in habitat quality, the state of food resources, previous breeding experience, and brown bear predation is discussed.

p12-021

Flock composition and fluctuations of numbers in two populations of the Long-tailed Tit

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The Long-tailed Tit *(Aegithalos caudatus)* is a small passerine bird that has a broad distribution range stretching from Western Europe to Japan. In NW Europe it is a partial migrant that demonstrates irruptive autumn movements, when numbers of migrating individuals may vary over hundredfold between years. The birds from the Far East are believed to be regular migrants, although little is known about the rate of fluctuations of their numbers. Our previous studies show that Long-tailed Tits from NW Europe have physiologically determined periods of migratory activity (Babushkina, Bojarinova, 2011). Consequently, the role of overpopulation and food availability as triggers of their movements must have been overestimated. We suggest that social interactions may play a role in fluctuations of numbers in the Long-tailed Tit. Our study was carried out on two extreme populations of the Long-tailed Tit: in NW Russia and the Russian Far East. We conducted genetic analysis with 8 known microsatellites (Simeoni et al., 2009) to assess kinship within groups of migrating Long-tailed Tits. Additionally sex ratio and age of birds within these groups were examined and annual variation of numbers of migrating individuals was compared in two populations. The results will be discussed. This study was supported by Russian Foundation for basic Research grant no. 12-04-31858.

p12-022

Using birding reports to reveal broad-scale spatio-temporal dynamics of bird distribution: Case of altitudinal distribution of alpine bird species in Taiwan from 1972 to 2010

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Anthropogenic disturbances, such as climate change and habitat destruction, have changed the distributed range of birds. In particular, climate seriously threatens birds that inhabit high mountains. The spatio-temperal dynamic of bird distribution in the past is critical for planning conservation strategies. However, historical records of bird distribution, if available, are often patchy, uneven over time, imprecise on location, and unstandardized in method. We used generalized linear models to analyze the birding reports database of the Chinese Wild Bird Federation, voluntarily submitted by bird watchers (75,844 reports from 1972 to 2010) to detect the altitudinal distribution shift of alpine bird species in Taiwan. Due to the spatial imprecision of birding reports, we classified the location of each records into five altitudinal intervals: 1000-1500 m, 1500-2000 m, 2000-2500 m, 2500-3000 m, and above 3000 m. We found the proportion of presence records of yellowish-bellied bush-warbler (*Cettia acanthizoides*), Taiwan bush-warbler (*Bradypterus alishanensis*), collared bush-robin (*Tarsiger johnstoniae*), and Taiwan rosefinch (*Carpodacus formosanus*) decreased significantly in lower altitudinal intervals, and increased significantly in higher altitudinal intervals. Eurasian wren (*Troglodytes troglodytes*), a species inhibiting the highest altitude in Taiwan, decreased significantly in all altitudinal intervals. In recent decades, there was no serious habitat loss or degradation in the high mountains of Taiwan. These results support the prediction that alpine bird species will shift to higher areas due to global warming. We propose that, with proper analyses, some broad-scale spatio-temporal dynamics of bird distribution can be revealed by using imperfect data submitted by bird watchers.

p12-024

Energy and nitrogen budgets contribute to explaining the distributions and activity budgets of wintering herbivorous geese in China

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Food supply is regarded as a critical determinant of animal distributions because it affects energy and nutrient budgets of consumers, both of which can further modify their activity budgets by influencing foraging time allocation. Interspecific differences in consumer body size can affect food selection as a result of size-related differential abilities to ingest and digest food. In the Yangtze River floodplain, we estimated the energy and nitrogen budgets, and compiled activity budgets, of the Lesser White-fronted Goose *Anser erythropus* feeding in rare seasonal heterogeneous grasslands and in widespread *Carex* beds, based on field observations and chemical analyses of food and faeces. We also estimated energy budgets of the larger-sized Bean Goose *Anser fabalis serrirostris* and Greater White-fronted Goose *Anser albifrons* feeding on *Carex*. Throughout all wintering months, Lesser White-fronted Geese gained higher and overall positive energy and nitrogen budgets by feeding on high quality but less abundant food in rare seasonal heterogeneous grasslands, than by feeding on low quality but abundant *Carex*. In contrast, the larger Bean and Greater White-fronted Geese could generally maintain positive energy budgets by utilizing *Carex*. These differences in energetic benefits from the same foods conform to the different distribution patterns shown by the three species, with respect to food distributions. We also found that Lesser White-fronted Geese counter-intuitively foraged longer when feeding on high quality, energy-beneficial food compared to *Carex*. Our results imply that (1) the food energy content is more likely than nitrogen to determine wintering herbivorous goose distributions, (2) body-size-induced interspecific physiological differences do play a role in affecting food selection, (3) autumn fat deposits are critical for wintering herbivorous geese, (4) appropriate water regimes are important to maintain heterogeneous seasonal grasslands and therefore Lesser White-fronted Goose populations, and (5) food can affect activity budgets by inducing ingestion or digestion constraints.

p12-025

Breeding distribution of Pleske's Warbler in Kagoshima

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Pleske's Warbler (*Locustella pleskei)* breeds on small islands off the extreme south of far eastern Russia, islands off South Korea, nearby eastern Chinese coast, and western Japan. In Japan, its breeding has been recorded on the Izu Islands, the coasts of Mie prefecture, Wakayama prefecture, Shimane prefecture, Tokushima prefecture and the coasts and islands off Kyushu. In Kagoshima prefecture, located at the southern tip of Kyushu, its breeding has been recorded on islands nearby Koshiki Island, Okojima in Kinko Bay, Niijima, and islands off southern Tanegashima as reported by Mizoguchi in 2010. Breeding on Okikojima of Hayato in Kinko Bay, southern Osumi Peninsula, and Okinoshima in Kushikino has been confirmed since 2010.
Kagoshima prefecture is the most southern range of breeding for Pleske's Warbler. We will report on the distribution of the breeding and estimated population of Pleske's Warbler in Kagoshima prefecture.

p12-026

Expanding wintering distribution of Rooks in Japan

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Over the last 20 years, the wintering distribution of the Rook *Corvus frugilegus* in Japan has been expanding. Records of Rook observations have been documented showing the expanding front line of their range. However, the process and causes for the range expansion of the Rook in Japan have not been discussed in the literature. A questionnaire survey as well as a literature study was conducted to collect information on their wintering range in Japan. The results provided a time-line of the first sightings of Rooks in 19 prefectures. This information helped outline the process of how the Rooks wintering range has expanded in Japan. The wintering distribution of Rooks contracted during the late 1970's on the island of Kyushu, Yamaguchi and Shimane Prefecture. The wintering range of the Rook began expansion in the mid 1980s, and had extended considerably eastward along the Sea of Japan by the late 1980s. During the 1990s Rooks spread southwards from northern Japan as well, and by December 2006 they were confirmed to winter throughout Japan, except for Tokyo. The decrease of snow cover in Eastern and Northern Japan is probably responsible for the range expansion of Rooks wintering in those regions. However, there is not a strong correlation between annual snow coverage and the range expansion of Rooks throughout the remainder of the range. Rooks were exposed to high levels of chemical compounds, such as organochlorines and organomercury in the past. The increase of the Rook population throughout East Asia due to decreased organochlorines and organomercury compounds is likely a key factor in winter range expansion of Rooks in Japan.

p12-027

Comparison of two different "nesting strategies" and nesting success of Water Rail and Little Crake

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The Water Rail *Rallus aquaticus* and the Little Crake *Porzana parva* are secretive species which belong to the family *Rallidae*. Both species inhabit a wide spectrum of marshy sites with littoral vegetation. In the Mazurian Lake District (NE Poland), these two species often choose the same, small, midfield water-bodies as breeding sites. Previous studies have shown that the Water Rail prefers shallower places than does the Little Crake, but there are no detailed studies describing their micro-habitat nest site preferences. Results of this research revealed that while the nesting preferences of these species may show some similarities, generally they try to avoid predators and achieve breeding success in different ways. The Water Rails build nests in shallower places, but in dense littoral vegetation which provides very good protection, especially against raptors. The water level at Little Crake nest sites is significantly deeper, but vegetation around the nests is much looser, than it is around Water Rail nests. To decrease the risk of detection by predators, the Little Crake has cryptic buff eggs with brown spots, in contrast to the white eggs of the Water Rail. Little Crakes also seem to be build their nests higher above the water surface than do Water Rails. Such adaptations may protect clutches from flooding as a result of changes in water level.

The three-year long study (2011-2013) showed that the Little Crake had greater nest success than did the Water Rail (respectively 63% and 47%). The main predator of both species' broods was the Marsh Harrier *Circus aeruginosus*. We will discuss possible explanations of this marked difference and try to explain which factors are crucial to achieve a high breeding success.

p12-028

Breeding ecology of Siberian and Sandhill Cranes in Yakutia subarctic tundra

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The Siberian Crane *Grus leucogeranus* and Sandhill Crane *Grus canadensis canadensis* inhabit the northernmost regions of the subarctic tundra in the lowlands between the Yana and Kolyma rivers. The Siberian Crane, which ranks third in rarity among the world's Crane species, is noted for its nesting conservatism. Territorial pairs occupy home ranges during the entire period of their stay in the breeding area, regardless of their involvement in reproduction. A reproductive pair's home range size, including its nesting and feeding areas, is 7.3-16.5 or 10.6 km^2 on average. Numbers in the eastern population have been reported to increase since the late 1990s, particularly in the Indigirka river basin. So, numbers of Crane pairs have grown from 52 to 56 within a 1314-km^2 study area. The rate of the population growth (reproduction efficiency i.e. the percent of pairs that are successful, varies from 4.3-8.7 to 65-83.3%) allows us to assume the absence of separate generations of birds that did not survive to maturity. Sandhill Cranes continue to settle in the western tundra region and increase their numbers. At present, the range of this species almost completely coincides with that of the Siberian Crane (approximately 82 km^2). The number of Sandhill Cranes has grown tenfold and reached 56 pairs over the recent 20 years on the study site in the tundra of the Indigirka basin. We are carefully monitoring the interrelation between the two crane species to reveal whether competition or other negative ecological influences on the Siberian Crane population might be related to the increase of the Sandhill Crane. In addition, the breeding area suffers from increasing water levels because of destruction and defrosting of tundra soils and this causes a reduction in the best habitats for the Siberian Crane population.

p12-029

Breeding performance of the European Starling *Sturnus vulgaris* during a period of long-term decline in Sweden

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During the period 1975–2012, the breeding population of the European Starling *Sturnus vulgaris* declined by about 2.5% per year in Sweden. A current estimate of population size is about 600,000 pairs. This means that about one million pairs have been lost since the mid 1970s. During a considerable part of this period, namely from 1981, monitoring of date of egg-laying, number of eggs and number of fledged young has been recorded in nestbox groups distributed all over the country. Only about 10% of the decline can be explained by afforestation of farmland. An unknown percentage is accounted for by the decline of the number of farms with grazing cattle. An additional cause of decline is supposed to be intensification of farming practices in the main crop and grassland areas that are the stronghold of the species. However, in such habitats it is still possible to increase local population size through the provision of more nestboxes, meaning that the resources are not exhausted. Breeding performance in terms of the average number of eggs or average number of fledglings has changed very little during the period in spite of declining populations in several of the nestbox areas. The conclusion is therefore that Starlings tend to refrain from breeding attempts rather than to perform badly. Starlings arrive early in their breeding area in Sweden and have plenty of time, up to 2 months, to assess the profitability of a site. Amelioration of climate has so far had no positive effect on the population size although there has been a close correlation between the start of breeding and spring temperature; second clutches are still exceptional.

p12-030

Feather growth and skeletal size of juvenile Cliff Swallows (*Petrochelidon pyrrhonota*) are affected by climatic conditions during rearing

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We investigated how seasonal variation in climatic variables (summer temperature and total precipitation) that influence food availability in turn affect growth of wing, tail, skeletal traits, and body mass in Cliff Swallows (*Petrochelidon pyrrhonota*). Cliff Swallows are colonial, insectivorous birds that regularly experience brief periods of food deprivation during the nesting season. Birds were caught as juveniles soon after fledging and morphometric measurements taken. Average wing and tail length increased significantly with yearly June mean temperature. Skeletal traits generally increased with temperature and decreased with yearly June rainfall. Body mass and extent of fluctuating asymmetry in wing, tail, and tarsus were unrelated to climatic variables. Cliff Swallows allocate less growth to wing and tail feathers and skeletal size while maintaining normal levels of body mass during periods of food scarcity. Because adult and juvenile feather lengths were positively correlated, changes in juvenile feather growth in response to rearing conditions persist into a bird's first breeding season. The results show that body size in this species is phenotypically plastic and influenced by climatic variables.

p12-031

Avian reproduction dynamics in a Canadian boreal forest

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Canada's boreal forests are famous for their role as breeding grounds for billions of songbirds. Yet, we know very little about the basics of avian reproduction in this vast ecosystem, let alone the mechanisms behind avian reproduction dynamics, mostly because of difficulties in getting reliable fitness data over extensive areas and for entire species communities. However, recent work from our lab suggests that forest fragmentation may have strong enough fitness consequences to exert significant selective pressure on forest songbird dispersal abilities. Here, we present links between forest landscape attributes and songbird demographic responses at the community level in an eastern Canadian boreal forest, Forêt Montmorency. We measured forest landscape structure at two spatial scales (landscape and local) with standard GIS tools. We measured songbird parental status through a novel combination of repeated measures of parental behaviour and hierarchical modelling accounting for imperfect detection. In most years, the proportion of adult songbirds with broods exceeded 70% in peak nesting season. But nesting success appeared to decline from 1995 to 2013. Adults with broods were more likely in years of low red squirrel abundance (a nest predator), and when ambient temperatures in the preceding weeks were high. Adults with broods were also more likely in older and less fragmented forests. Despite these significant influences on parental status, our study area appears to exhibit a much higher nesting songbird performance than most ecoregions of North America studied so far.

p12-032

Direct and indirect effects of temperatures on egg mass in rockhopper penguins

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Energy trade-offs largely affect variation in reproductive efforts, especially in bird species that start their reproductive processes before arrival at their breeding sites. We tested whether temperatures (i.e. thermoregulation costs) influence the mass of the eggs and of their three major components (yolk, albumen and shell) in a population of Southern Rockhopper Penguins (*Eudyptes chrysocome*) breeding on New Island, Falkland Islands (Malvinas). Egg formation starts during migration and ends in the colony. In four breeding seasons, we weighed 878 eggs from 273 different females and collected 301 eggs for analyses.

Sea surface temperatures (SST) positively influenced yolk mass, with stronger effects on the first egg to be laid (A-egg) compared to the second egg (B-egg). By contrast, SST negatively influenced albumen mass and egg mass. These results imply a direct positive influence of warm temperatures (energy trade-off between self-maintenance and egg formation) on the yolk, which is partially formed at sea, especially for the A-egg. They also suggest an indirect negative influence of warm temperatures (via food availability and female body reserves) on the albumen, which is formed in the colony for both egg categories. Furthermore, air temperatures positively influence the different components of egg mass but again to a greater extent for A-eggs than for B-eggs. Shell mass was not significantly influenced by SST or air temperature.

Altogether, these results corroborate the idea that females faced a trade-off between self-maintenance and reproduction during egg formation. The fact that B-eggs were less sensitive to temperature variations than A-eggs also shows that the trade-off is asymmetrically directed towards A-eggs. This has important implications for crested penguin (*Eudyptes*) species that rarely raise chicks from A-eggs and for which the degree of the initial size hierarchy between siblings largely determines the survival of twins in the Falkland Island populations.

p12-034

The dynamics of prey biomass and breeding performance of sedentary and migrant hole-nesting species

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Two hole-nesting insectivorous species, Great Tit (*Parus major*, GT) and Pied Flycatcher (*Ficedula hypoleuca*, PF), have similar diets during the breeding season. GT is mainly a sedentary species, while PF is a long-distant migrant. The populations of both species were monitored over 25 years in the Moscow region. During the breeding season, caterpillars in canopies of birch trees appeared to be the main food resource for both species in the study area. Abundance of these insects, as surveyed during the last decade, depended on weather conditions at the end of April and in May. Breeding dates of GT were influenced by weather conditions in March and April, while breeding timing of PF correlated with the temperature regime of May. As resident species, GT started to breed earlier than PF. The differences between species were 3 weeks for mean laying dates and 2 weeks for mean dates of fledgling. Breeding dates of GT and PF widely overlapped in some years, when cold March and/or April temperatures were followed by warm conditions in May. On average, GT started to breed one day before leafing of birch trees and long before the mass appearance of caterpillars. PF laid their first eggs 19 days after leafing and just before the date of mass appearance of insects. PF laid eggs earlier in the years with high maximal insect biomass. Breeding dates of GT were more tightly coordinated with the features of prey biomass dynamics than those of PF. For example, the timing of chick rearing was much closer to the timing of peak caterpillar abundance in GT than in PF. In spite of the large differences in phenology, the indicators of fecundity and offspring quality in both species were mainly dependent on the value of maximal insect biomass in birch canopies.

p12-035

The global climate changes and bird populations' survival

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Global climate change not only impacts the total warming of the biosphere, but also results in a global alteration and redistribution of heat and moisture. All this impacts the state of all biota, including their bird populations. In an analysis of bird spring arrival data to Kiev city (since 1900, about 100 bird species) and the Ukraine as a whole (since 1975) and an analysis of bird distribution and their status across these areas it was shown that radical changes in bird population have occured during the last decades. Several species have started to arrive earlier than in previous years, whereas others –contrastingly – have started to arrive later. There are species that did not change their phenology of migration. Some species became rare and yet others increased in numbers. Some species changed their status and distribution. These results show us that during any climate changes ornithocenosis will exist due to species for which these changes are suitable.

p12-036

Breeding biology of White-rumped Shama (*Copsychus malabaricus*) in southern Vietnam: the avoidance of high predation pressure

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South-East Asian forest-bird ecology is studied insufficiently, and limited to only a few works related to hole-nesting passerines, which are very uncommon in lowland monsoon forests. From 2008–2013 we studied the biology of White-rumped Shama (*Copsychus malabaricus*) nesting in nestboxes (105–209 per breeding season) and in natural nest cavities in Cat Tien National Park, southern Vietnam. This species is mostly common in forest and forest edges of Cat Tien and the only species using nestboxes. During 6 breeding seasons, between 56.5 and 11.5% of the nestboxes were occupied. A total of 331 active nests were thus studied and 744 birds were marked with color and metal rings. Habitats, population density, territorial behavior, the annual cycle and breeding biology were described. We observed a high level of nest predation within the study area for several species of passerines birds, as well as a strong competition for natural nest cavities involving more than 45 species of other animals. In these circumstances White-rumped Shama successfully exploited its niche of a small cavity-nester in the lower storey of the vegetation. Nesting failure was 17.8% (n=59) for couples breeding in nestboxes and 62.9% (n=17) for natural cavities. Our observational data and experiments with nestboxes demonstrated that males show a strong preference for previously unused nest cavities as these are unknown to predators and not containing parasites. They also prefer recently formed cavities. The White-rumped Shama is a sedentary bird with a very small home range (about 0.3 ha). Therefore it can find fresh cavities easily. Additionally, this species is characterized by a high level of plasticity when choosing a place for nest building. Thus, we postulate that its nest-site selection strategy assists the White-rumped Shama in being a high density representative of a guild of otherwise highly uncommon hole-nesting passerines in the rich tropical lowland forests of South-East Asia.

p12-037

Maximum recorded longevity of birds in the southernmost forests of the world

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The ecology of southern forest birds is little known, and even less is known on their longevity. Here, based on monthly mist netting data of more than 12 years we report on the maximum longevity of forest passerine birds and we model the relationship of longevity with body mass, month of the first capture, and migratory status. Between March 2000 to August 2013, in a mixture of deciduous and evergreen forests at the Omora Ethnobotanical Park (56°S), on Navarino Island, southern Chile, we caught 1,026 individuals at least twice from the 10 most abundant bird species. We estimated longevity based on the time period between the first and last capture of each individual in the mist nets. To evaluate the effects of variables on longevity we ran a generalized linear model. Our results show that the longest lived species were the migrant tyrannid White-crested Elaenia (*Elaenia albiceps*, 15g, 8.15 years), the resident emberizid Patagonian Sierra-finch (*Phrygilus patagonicus*, 23g, 7.60 years), and the resident furnarid Thorn-tailed Rayadito (*Aphrastura spinicauda*, 12g, 6.85). However, mean longevity for these species was 1.27 (n=123), 0.89 (n=318), and 0.80 (n=427) years, respectively. The results of the Generalized Linear Model indicate that the date of first capture, the body mass, and the month when a bird was captured were the factors that best explained the longevity of the birds. Although the three migratory species were twice as small (14.08g) as the 6 resident species (28.97g), there was no effect of body mass on longevity. The estimated longevities are conservative values of how long each bird species can live as most of these birds were banded as adults and they still lived after their last recapture.

p12-038

The *wild* Jungle Crow: most familiar in Japan, yet mysterious

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For foreign ornithologists visiting Tokyo, the hordes of large, black and fearless crows all around make up one of the most impressive scenes. These are Jungle Crows (*Corvus macrorhynchos*). The Jungle Crow's distribution ranges from Afghanistan to far eastern Russia. Interestingly, the species does not occur in urban areas except in Japan. In Japan, where Jungle Crows can be easily observed, there are many studies on crows in cities or in a captive situation. On the other hand, we have almost no study on wild Jungle Crows, and therefore little is known about their life in a natural environment. Here, as a first step towards elucidating their mysterious life, we report the results of a preliminary study on Jungle Crows in Japanese forests. We searched for Jungle Crows by applying fixed-point observations and play-back experiments in an uninhabited forest environment. We indeed found crows in these forests proving that they are literally 'Jungle Crows'. Results of play-backs in 12 study sites (evergreen artificial coniferous forest or deciduous broadleaved forests) showed that the crows' density was significantly higher in coniferous forests than in deciduous forest. In addition we conducted fixed-point observations in uninhabited forests at various altitudes on Yakushima Island. Results showed that crows are evenly distributed between evergreen broadleaved forests and evergreen coniferous forests. In conclusion, our data prove that Jungle Crows also occur in uninhabited mountainous areas. They prefer evergreen forests to deciduous forest, but do not make distinction between coniferous and broad-leaf evergreen forests. A possible explanation may be that Jungle Crows prefer evergreen trees as nest sites to avoid predation, as shown in former studies. However, their food habits in dense and dark coniferous forests remain unknown. This still makes them mysterious wild Crows.

p12-039

Differences in breeding ecology of Great Tits between Japanese and European populations

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Comparative studies of inter- and intra-specific variation in breeding biology of birds have been conducted over a century. They have provided significant insights into the current understanding of the evolution and ecology of natural populations. Among them variations in breeding biology of tits (Paridae) are well documented because of their abundance and readily use of nest boxes for breeding. The Great Tit (*Parus major*) is the most widely-distributed species in this family and ranges throughout Eurasia from northern Europe and northern Africa to Japan and southern Indonesia. However, most ecological studies have been concentrated in Europe, the western end of its distribution, and very few have been done in the eastern end of the distribution. In the present study, we compared breeding ecology in Great Tit populations between Europe and Japan focusing on laying date and clutch size, which are two of the most studied life history traits in birds. We found that Japanese populations have later laying date and larger clutch size compared with populations at the same European latitude. We also found a latitudinal gradient in laying date and clutch size within Japanese populations. A possible explanation for the late laying date and larger clutch size in Japanese populations is the more seasonal environment typical in eastern continental regions. In this poster presentation we also compare species composition, predator species and some other breeding traits and discuss the differences in breeding ecology of eastern and western Great Tit populations.

p12-040

Cuckoo parasitism to sympatric closely related hosts, Brown and Bull-headed Shrikes

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Common Cuckoos *Cuculus canorus* are obligate brood parasites that make other species (hosts) incubate eggs and rear their nestlings. The hosts that accepted cuckoo parasitism lose their own brood because cuckoo nestling evict all host's eggs and/or nestlings from the nest. As a result, many host species evolve the anti-parasitism behaviour, and it is known that the anti-parasitism behaviour varies by hosts or host populations. I studied the difference in responses to cuckoo parasitism between two sympatric closely related host species, Brown and Bull-headed Shrike *Lanius cristatus* and *L. bucephalus.* The study was conducted during 1990−1998 for Brown Shrike and during 1990−2013 for Bull-headed Shrike in Nobeyama plateau, Central Japan. Brown Shrike is smaller than Bull-headed Shrike in body size, egg size and the breeding population size. The base colour of Brown Shrike's egg is whitish or pinkish, while that of Bull-headed Shrike's is mainly brown. The Brown Shrike has higher return rate than the Bull-headed Shrike. Multi-parasitism and ejection rate in the Brown Shrike was higher than those in the Bull-headed Shrike. The Brown Shrike tended to be more aggressive against parasitizing cuckoos than the Bull-headed Shrike. However there were no difference between two species in following variables; parasitism rate, duration of cuckoo parasitism regardless of with and without attack by host(s), sojourn time of hosts in their nests in laying periods, parasitized breeding stage and time by cuckoo, size of cuckoo egg parasitized, length of incubation and brood period, eviction period by cuckoo nestling. The differences in multi-parasitism rate could result from differences in the number of available nests for the cuckoo to parasitize. Other differences could result from the history of parasitism and/or the difference of traits between two shrikes, e.g. return rate and/or base colour of eggs.

p12-041

Identifying nest predators using interval-shooting function of waterproof digital cameras

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The Red-billed Leiothrix is a babbler native to southern China and the Himalayan region and has invaded to the Hawaiian Islands, Japan and some areas in Europe. Despite its success in invasion, leiothrix seems to suffer a relatively high nest predation rate in Japan. Recent studies have suggested that high breeding density of leiothrix may cause an increase of predation on sympatric native bird species that share nest predators (apparent competition). However, nest predators of these species have not been explored, because identifying them is difficult, especially in dwarf bamboo *Sasamorpha borealis* thickets in which leiothrix nests. In order to identify nest predators of leiothrix and native Japanese Bush Warbler *Cettia diphone*, we used interval-shooting function of waterproof compact digital cameras during 2008 - 2013 on Mt. Tsukuba (877 m a.s.l.), central Japan. The camera system recorded that mammals, birds and reptiles were mainly responsible for the nest predation and that jays and snakes were the main nest predators. We will discuss their possible effects on the demography of the two bird species.

p12-042

Review of aging techniques in birds and other vertebrates: most are not sufficiently accurate to deduce mortality rate from age distributions

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Mortality rate is a key population dynamic parameter providing crucial insight into animal population performance. For the estimation of mortality rates, mark-recapture data are most frequently used, but these require extensive, long-term datasets. Alternatively, population age distributions could be used to the same effect. Most studies and models estimating mortality rate from age distribution are based on the assumption that individual age is determined accurately, which is often violated as few aging techniques are capable of determining error-free age estimates. We examined the consequences of inaccuracy in age estimation for the assessment of population mortality rates. To this end we first developed a simple *mortality rate from age-distribution model* that we used to assess the propagation of age-estimation errors to errors in mortality rate. Next, we reviewed the accuracy of a series of aging techniques popularly employed in vertebrate ecology, including avian ecology. These included measurement of telomere length and racemization. The results suggested that these aging techniques are not sufficiently accurate to provide reliable estimates of mortality rate, greatly limiting the applicability of mortality rate estimates from population age distributions.

p12-043

Comparison of breeding parameters in Eurasian Tree Sparrow between urban and rural areas.

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The Eurasian Tree Sparrow *Passer montanus* mainly lives on the edge of cultivated and lightly wooded areas in much of Europe, while the species is resident and breeds in a wide range of environments from agricultural to urban and lives close to humans in Japan where House Sparrow *Passer domesticus* (larger species) is absent. Population declines of the Eurasian Tree Sparrow has been a concern in recent years. Some factors such as a shortage of suitable nest site and food due to urbanization has been suggested as cause of population decline. Mikami (2009) and Mikami et al. (2011) found that the number of fledglings cared for by parent(s) was lower in urban than rural areas. In order to understand the factors that lead to low reproductive success in urban areas, we compared breeding parameter between urban and rural areas. In our study, we put up nest boxes in urban and rural areas in the 2011 and 2012 breeding seasons, and we compared 7 breeding parameters in both areas: 1) clutch size, 2) hatchability, 3) fledging success, 4) length of egg incubation and 5) nestling periods, 6) nestling's body mass on brood day 6 and 7) that on brood day 11. As results, we detected that nestling body mass on both day 6 and day 11 were lower in urban than rural areas. Fledging success also tended to be lower in urban than rural areas. Other parameters such as clutch size did not differ between the areas. These results suggest that food availability and/or quality during nestling periods was low in urban environments.

p12-044

Nest placement of Varied Tit *Parus varius* and Great Tit *P. major* in an urban environment, Korea

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Nest placement has an impact on the probability of breeding success. Therefore, evaluation of the attributes of nest placement is important to understand bird breeding strategies. However, few studies of nest placement have been conducted in urban environments. Here, we studied whether Varied Tit and Great Tit considered vegetation ratios and distance from forests when selecting nest sites in an urban environment. We set up 89 nest boxes at Gwanak Campus of Seoul National University with 100 m spacing. The campus had 40% vegetation cover and was surrounded with forests. We measured vegetation ratios and straight-line distances from neighbouring forests. Multiple logistic regression was used to determine nest placement attributes. Varied Tits used nest boxes close to neighbouring forests ($p = 0.044$), but Great Tits tended to use nest boxes with high vegetation ($p = 0.055$). In general Varied Tit is regarded as a forest interior, so some breeding pairs of Varied Tits might immigrate from forests to use nest boxes on the campus. Great Tits are regarded as forest generalists and seemed to select nest boxes of high vegetated areas (high quality) to increase breeding success.

p12-045

Long-term trends in nest success of waders in the Russian Arctic

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Nest success of Arctic-breeding waders (Charadrii) is known to depend on abundance of lemmings as an alternative prey to predators and to impacts of adverse weather events during incubation. Lemming cycles are believed to "fade out" during the last decades and many tundra areas are subject to warming which can influence nest success of waders. We studied long-term trends in nest success of waders and in abundance of rodents across the Russian Arctic using data accumulated in the framework of the "Arctic Birds Breeding Conditions Survey" (http://www.arcticbirds.net). The dataset contained 295 records of nest success and rodent abundance measured in the period 1988-2012 on an ordinal scale (low, average, high), while abiotic conditions were accounted for by inclusion of mean June temperatures, interpolated for the study sites from weather station data. Summer temperatures increased significantly in the study period in all bioclimatic zones of the Russian Arctic. Response variables were ordinal and we used logistic regression as a principal modeling technique. Nest success increased significantly in 1988-2012 which was mostly attributed to increase in number of sites with average nest success on behalf of sites with low nest success, while the abundance of rodents did not change significantly. Nest success was strongly related to both mean June temperatures and the abundance of rodents. Given that mean June temperatures increased in 1988-2012 and rodent abundance did not, we explain the long-term trend in nest success of waders by increasing temperatures during incubation.

p12-048

Monitoring avian productivity, recruitment, and survival in American Samoa, Polynesia

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Very few data currently exist on the demographic rates (productivity, recruitment, and survival) of birds in American Samoa, Polynesia. Application of standardized constant-effort mist-netting and modern capture-recapture analytical techniques is an effective means of monitoring demographic rates of many landbird species. We have developed a “Tropical Monitoring Avian Productivity and Survivorship” (TMAPS) program on the islands of Tutuila and Ta'u, American Samoa. TMAPS stations were operated on three consecutive days (representing a "pulse"), once per month. Each station consisted of a 200-ha sampling area within which 10 mist nets were erected and operated in a standardized manner. Birds captured were identified to species, aged and sexed as permitted by visual means, and banded with numbered aluminum leg bands. Detailed molt data and photographs were obtained to investigate molt seasonality and criteria for age determination using a molt-cycle based age-coding system. Here we describe results based on data collected during 13 consecutive pulses from August 2012 to August 2013 (Tutuila only) and four pulses during December 2013 to March 2014 (Tutuila and Ta'u). Capture rates for six species (Collared Kingfisher, Samoan [Fiji] Shrikebill, Cardinal Honeyeater, Polynesian Starling, and Samoan Starling) were sufficiently high to effectively monitor demographic rates. Capture rates were much higher on Ta'u than on Tutuila. Based on results from the 13 consecutive pulses in 2012-2013, breeding for most species peaked in November-February, though in some species breeding occurred at other times as well. Based on these seasonal results we focused mist-netting effort to the austral summer period in 2013-2014 and will do so in future years. In 2014-2015 we plan to train Samoan biologists on mist-net monitoring techniques so they will be able to operate the stations

p12-049

Effects of environmental variability during breeding and non-breeding period on population dynamics of Black-tailed Gulls in the northwestern Pacific

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In long-lived seabirds, parameters of population dynamics, such as reproductive performance and adult survival, are sensitive to changing environmental conditions, therefore are important for modeling population dynamics and managing populations. Approximately 30,000-35,000 Black-tailed Gulls (*Larus crassirostris*) are estimated to breed on Kabu Island (40°32' N, 141°33' E), Hachinohe, northeastern Japan. Chicks have been ringed before fledging (760-2,523 chicks/year), and recaptures of marked adults have been carried out every year since 1973 on the island by the Ministry of Environment and Yamashina Institute for Ornithology. In this study, we examined relationships between the return rate of each cohort to the island and environmental variability of the breeding and non-breeding period within a year after hatching. Cohort differences in the return rate were related to air temperatures in June (chick-rearing period) in Hachinohe and sea surface temperatures (SST) from January to March off the eastern coast of Japan between the Kuroshio Extension and the Oyashio Front (i.e. the Kuroshio/Oyashio Transition Zone). The return rates were high in cohorts of warm air temperatures during the chick-rearing period and cold SST during the wintering period. It was suggested that northeasterly winds, called the "*Yamase*," which usually brings cold and cloudy summers over northeastern Japan, reduced survival rates of chicks until fledgling. In addition, a decrease in the cold water current to south, called the Oyashio, may reduce the abundance of major prey species (e.g. pelagic fish and zooplankton) for the gulls during the wintering period in the Kuroshio/Oyashio Transition Zone and may reduce survival of young gulls from fledging to next year.

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p12-050

Costs of nest building in the Great Tit

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The avian „costs of reproduction" in many aspects are still poorly understood. Out of the three main nesting stages - nest building, incubation and nestling feeding - the two latter ones received the most attention, while nest building was largely neglected as being considered to be less costly. Here, we experimentally manipulated the investment into the nest building stage in a hole-nesting passerine – the Great Tit *Parus major* (species with female-only nest building), and investigated the consequences of different levels of investment for body and health condition as well as for reproductive performance. We predicted that birds forced to build heavier nests would pay the costs of the elevated investment into nest building in terms of deterioration of body and health condition as well as reproductive performance. Health condition was assessed at the end of the nesting period with hemoglobin concentration, white blood cells profile, the status and intensity of infection with malaria parasites and the level of oxidative stress, and reproductive performance with the number and size of eggs, the incubation and nestling feeding pattern and the ability to commence a second brood.
The experimental nests were significantly heavier than nests from the unmanipulated group, suggesting that birds from the experimental group had increased their nest building expenditures. The manipulation did not influence the mass and the number of laid eggs nor was there a relationship between nest mass and female condition. Neither infection status nor infection intensity differed between females and males from unmanipulated and manipulated treatments. Although during the second brood more birds were observed from the control than the experimental group (21% vs 4%), the differences were not significant.
The preliminary results indicate that in the Great Tit the nest building stage is not associated with pronounced costs, that could be observed in adult condition or breeding performance.

p12-053

Colony development and density-dependent processes in breeding Grey Herons

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The density-dependent processes that limit the colony size of colonially breeding birds such as herons and egrets remain unclear, because it is difficult to monitor colonies from the first year of their establishment, and most previous studies have considered mixed-species colonies. In the present study, single-species colonies of Grey Heron (*Ardea cinerea*) were observed from the first year of their establishment for 16 years in suburban Tokyo. Colony size increased after establishment, illustrating a saturation curve. The breeding duration (days from nest building to fledging by a pair) increased, but the number of fledglings per nest decreased, with colony size. The reproductive season in each year began earlier, and there was greater variation in the timing of individual breeding when the colony size was larger. The prolonged duration until nestling feeding by early breeders of the colony suggests that herons at the beginning of the new breeding season exist in an unsteady state due to the presence of frequent intense interactions with one another, likely owing to interactions with immigrant individuals. Such density-dependent interference may affect reproductive success and limit the colony size of Grey Herons.

p12-054

Changes in numbers of Mute Swan *Cygnus olor* in the internal areas of Ukraine for the last decades

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In the 19th and 20th centuries Mute Swan numbers changed and the breeding area was reduced in Ukraine. In the second half of the 19th century this species was common in lower parts of the Dniester, Danube and Dnieper rivers, and in the first half of the 20th century only on the Dniester and Danube rivers. For the internal regions of the country it was mentioned as a rare species. Beginning from the second half of the 20th century due to suitable factors (climate change, hunt limitation since 1935, eutrophication of reservoirs, adaptation to human activities) the swans' numbers began to grow. Until the 1960s the lower part of the Dnieper River was considered as the northern border of its breeding area in Ukraine. The first records of its nests in the internal areas are dated in 1966-1968 on the Shatsk lakes in Volyn region (north-west of Ukraine). In the 1970s swans began to nest on the Dnieper River reservoirs and its tributaries. Approximately at this time birds appeared nesting in the east and central regions of Ukraine. Numbers of Swans and their distribution range started to increase in the 1990s and this has continued in our time. Records of large groups of vagrant birds have been reported in the summer period in the different regions of Ukraine. The first such accumulations were noted in 2013 while this was very rare before. Probably it is a result of its overpopulation in other regions, leading to a lack of suitable places to nest. Currently Mute Swans are common everywhere in Ukraine during the breeding season and migration except for mountain areas. They winter mostly along the coasts of the Azov and Black Seas.

p12-055

Assessing behavioural responses to climate change: nest site selection, breeding success and stress in the Crimson Rosella

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Climate change is resulting in increasing mean temperatures, greater temperature variability and more frequent extreme temperature events. This is predicted to affect bird species in numerous ways, including reducing range, habitat suitability and breeding success. Cavity-nesting species may be particularly at risk because they are limited in their choice of nest location and anthropogenic disturbances are decreasing their availability. Artificial nest boxes are often used to mitigate hollow loss, however nest boxes differ significantly from natural hollows in their thermal characteristics. To date, some studies have explored the effects of nest temperature on breeding success in birds, but few have considered the effects of temperature variability and extremes. We determined the relationship between internal nest box temperature and nest box choice, breeding success and nestling mass in the Crimson Rosella (*Platycercus elegans*). Mean temperature and temperature variability consistently had the greatest impact on reproductive success; however these variables had opposing effects at different stages of the breeding cycle. Higher mean temperatures were related to larger clutch sizes and greater hatchability. In contrast, higher mean temperatures and greater temperature variability had a negative effect on the number of chicks which fledged. In contrast to most studies, higher mean temperatures also negatively affected nestling growth, however higher minimum temperatures had a positive effect. We also found that duration was more important than the magnitude of extreme temperatures. Temperature variables did not differ between occupied and unoccupied boxes, suggesting that rosellas do not choose nest boxes based on temperature. Nestling stress levels in relation to nest thermal history is being examined, and we also report trials of the effectiveness of insulation modifications on nest box temperature. Our findings suggest that variation in nest microclimates due to climate change may have significant consequences for breeding success, particularly in species that cannot adapt behaviorally.

p12-056

Ecological characteristics of nesting Wood Pigeons *Columba palumbus* in the central part of the forest-steppe zone in Ukraine

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Recently, European ornithologists have focused a lot of attention on the Wood Pigeon *Columba palumbus* L. In recent decades this aboriginal forest species has become rightly considered as urbanized. Wood Pigeons have started to nest in parks, forest belts, squares, public gardens and orchards. According to this factor, it becomes a convenient model species for studying its breeding biology. Pigeons start to build their nests in Ukraine in mid-April. The first eggs are found in late April – early May. Both pair members incubate the clutch and start this process from the first egg. The female spends much more time in the nest than the male. The second egg is laid 2–3 days after the first, so the nestlings have different ages. The incubation continues about 20 days. The nestlings spend 20–21 days in the nest. After leaving the nest with their parents they stay together. Old birds take care of young ones. After the nestlings leave their parents, the couple starts a new clutch. Until recently, it was known that there are two clutches within a breeding season. However, our study proved that birds may have a third clutch as well. Along the period 2010–2013 in the central part of the forest-steppe zone of Ukraine we have repeatedly recorded late broods, with egg laying and young individuals occurring in September and October. We also confirmed this observation through female Wood Pigeons obtained during the hunting season with fully formed eggs present in their bodies. This means that the birds were ready to form the next clutch. Similar cases have been reported by our colleagues in the south of Ukraine.

p12-057

Seasonal decline in reproductive parameters within two Wryneck (*Jynx torquilla*) populations

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We studied seasonal patterns of reproductive success in the Wryneck (*Jynx torquilla*), a species that has undergone significant population declines throughout Europe. Wrynecks nested in nest boxes in southern Switzerland (2002-2012) and central Sweden (2003-2012) and were followed throughout the breeding season to establish clutch iniation date, clutch size, fledging success, and initiation of second broods. In the Swiss study area, Wrynecks initiated breeding slightly earlier and also had a second peak of clutch initiations in June (second clutches). Second clutches were exceptionally rare in Sweden, where clutch size was significantly larger. In both study areas clutch size and fledging success declined significantly over the course of the breeding season, but the declines were weaker than that seen in typical temperate zone woodpeckers and passerines.

p12-058

Dark and pale Pied Flycatcher (Ficedula hypoleuca) males differ in foraging strategies

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The influence of caterpillar dynamics on breeding performance of polymorphic Pied Flycatchers (PF) was studied in the Moscow region in 2002-2013. Food items delivered to nestlings by parental birds were detected by video in 2009-2013. Clutch size and nesting success of PF was strongly affected by characteristics of caterpillar abundance. Dark males in comparison to pale ones were more sensitive to the features of caterpillar dynamics and better matched their breeding dates with the favorable feeding period. However, the final reproductive output of dark and pale males was similar. Since dark and pale males did not differ in the quality of their female mates, we proposed that pale males might better cope with low abundance of food resources. Controlling for the year and time of the season, we showed that food items delivered to the nestlings by pale males tended to be more variable than items brought by dark males. In comparison to dark males, pale males more often delivered prey of two or more kinds at the same time. Similarly to other behavioral and physiological features (Kerimov et al., 2012), foraging patterns of pale males reflect their flexibility in comparison to routine-like features of dark males. This foraging flexibility of pale males may compensate their seeming disadvantage in breeding timing.

p12-059

Onset of the Monitoring Avian Productivity and Survivorship (MAPS) program in Japan, to verify impacts on the avifauna in Fukushima

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In Japan, bird banding commenced in 1924, with the main objective of studying movements of birds, resulting in a relatively poor effort put into banding breeding populations. The majority of breeding birds banded were seabirds, and a standardized data collection scheme for landbird population did not exist.
Following the accident at the Fukushima nuclear plant in 2011, long term monitoring has become necessary to determine effects on wildlife in radioactive contaminated areas. To verify if there are apparent changes in productivity and adult survival rates of birds in the contaminated areas, a Monitoring Avian Productivity and Survivorship Program (MAPS) commenced in Japan in 2012.
Research sites include three sites in the Fukushima prefecture, and other sites in uncontaminated prefectures. The site with the highest radiation level was Iitate village, with the ground surface radiation exceeding 20 micro-Sieverts / hour in 2012. Radiation levels of two other sites in Fukushima were relatively low.
We will describe preliminary results from the first two years of the MAPS program in Japan. Data is still insufficient for statistical analysis, but fledgling ratios of major species captured in Iitate village in 2012 and 2013 seemed comparable to uncontaminated areas. The most abundant species captured in Iitate was Japanese Bush-warbler (*Cettia diphone*), followed by Japanese White-eye (*Zosterops japonicus*). 5 out of 28 adult Japanese Bush-warblers banded at Iitate in 2012 were recaptured in 2013 (17.9%), and 2 out of 11 adult Japanese White-eyes were recaptured in 2013 (18.2%). These adult recapture rates also seemed comparable to uncontaminated areas.
During the two years, several individuals with colour aberration in feather or skin were observed in contaminated areas. Data is presently insufficient to judge if the occurrence rate of these colour aberrations is higher compared to uncontaminated areas.

p12-060

Characteristics of the Fairy Pitta call during its breeding season

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The Fairy Pitta is a summer visitor that migrates to the islands of Honshu, Shikoku and Kyushu of Japan. The species is designated as endangered in the Red Data Books of Japan and Southeast Asia. The Fairy Pitta is known to exist locally in the Japanese habitats of Honshu, Shikoku and Kyushu, but it is also thought to reside in habitats as yet undiscovered. Moreover, a solid understanding of the number of individuals residing in these Japanese habitats as well as the breeding circumstances in each habitat is lacking.

The calls of males and females of the species are identical. They have a short, two-tone call. While calls are highly frequent up until pair bond formation, that frequency falls afterward. Also, calls are exchanged several times when the male and female switch turns performing egg incubation. These characteristics provide useful clues to a fuller understanding of population counts and breeding conditions. Starting in 2008, I conducted monitoring of the numbers of Fairy Pitta individuals using a sound recorder set on a timer. In this research I report on the characteristics of the Fairy Pitta call during its breeding season and the efficacy of monitoring using timed sound recording.

p12-061

Population Trends of Wintering Eurasian Coot *Fulica atra* in East Asia

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The range of Eurasian Coot *Fulica atra* in Japan has expanded gradually since the 1980s, and the numbers of coot wintering at several sites in Japan have increased. We summarize the trends in coot numbers wintering in Japan and mainland East Asia from the Asian Waterbird Census data and other various count data in Japan. In Japan, wintering numbers of coot have increased in most regions, except in northern Chiba Prefecture, in the Kanto region of Honshu. The increase began in the late 1990s or around 2000 at several water bodies in the Kanto, Chubu, Kinki and Chugoku regions of Honshu. It also increased in the mid-2000s at several water bodies in the Tohoku, Kanto, Chubu, and Kinki regions of Honshu, and also on the island of Kyushu. The number in Lake Biwa in the Chubu region has reached 47,456 in 2012. In China, huge numbers (6,000-60,000) of coot overwintered at several sites in the lower Yangtze floodplain (e.g., Poyang Lake, Dongting Lake) and along the Jiangsu Coast near the Yangtze River mouth (e.g., Yancheng Nature Reserve, Hongze Hu Lake) during the 1990s. However, during the 2000s, no sites in China held more than 10,000 wintering coot. The number of coot wintering in coastal south China has also decreased. In South Korea, the number of wintering coot has increased especially since the mid-2000s. The increases in the populations of wintering coot in central and western Japan and in South Korea seem to be mainly as a result of changes in coot populations and/or habitats outside Japan. We suggest two possible causes: the breeding population of coot on the East Asian mainland (mainly in Far East Russia) may have increased, or some coot that used to overwinter in China may have begun wintering in Japan and South Korea.

p12-062

Reproduction in the king penguin: constraints imposed by colonial breeding and a long chick raising period.

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The diversity of life histories is mainly explained by the concept that organisms face trade-offs. Vital functions such as growth, reproduction and defence (immunity, maintenance) rely on energy and resources, and investments in one function are expected to occur at the expense of other functions if relying on the same, limited, pool of energy and resources.

The king penguin (*Aptenodytes patagonicus*) is a colonial seabird that takes over a year to fledge its single chick while enduring long-term fasts during incubation and chick-rearing. These reproductive characteristics imply several constraints for the adults: breeding in high density colonies may induce a social stress or locally expose breeding birds to high levels of tick infestation while fasting during incubation or raising the young chick. Growing chicks also have to reach a body mass threshold to sustain the prolonged period of restricted caloric intake during the subantarctic winter.

Our results indicate that i) high social density that could be imposed by limited availability of favourable breeding sites and/or timing of reproduction may induce a chronic stress in adults, ii) tick infestation has strong pervasive effects on the physiology, behaviour and reproduction of adults, with marked effects on offspring growth -chicks of deparasitized adults growing faster than other ones-, iii) extremely rapid bone accretion associated with a desynchronized muscles growth in the chicks (the pectoral girdle growing at a slower rate than the pelvic girdle) allows substantial storage of body reserves before winter and iiii) chicks born late in the reproductive season having shorter telomere lengths (which is considered as a proxy of individual fitness) and higher corticosterone and oxidative stress levels than chicks born early in the season.

These results will be discussed in light of the fitness consequences of these different constraints for this long-lived seabird.

p13-001

Comparative osteology of the family Accipitridae (Aves: Accipitriformes) with a reassessment of its phylogenetic relationships

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The family Accipitridae figures as one of the largest lineages of non-passerine modern birds comprising 67 genera and 256 species globally distributed. Phylogenetic relationships among accipitrid genera have been historically debated, with many efforts aimed at the recognition of subgroups. Although there have been several studies on the comparative anatomy of the group, morphological studies based on cladistic methods are restricted to a single investigation which provided limited insights into the phylogeny of the group. In contrast, over the last decade, several hypotheses based on molecular data have been put forward and demonstrated that many of the traditional assemblages do not correspond to monophyletic groups. As a consequence novel intra-familial arrangements were proposed for the family. Stemming from an investigation of the evolution of morphological attributes in accipitrids, a new phylogenetic hypothesis is presented based on the examination of the cranial and post-cranial skeleton from a comprehensive taxonomic representation of the group. Some 433 specimens from Brazilian and North American collections were consulted, which represented 113 species and 59 accipitrid genera. From the literature and comparative study of the material, 161 osteological characters were coded, of which 116 were binary and 45 non-ordered multistate. The data matrix was submitted to parsimony analysis on the software TNT and resulted in 36 equally most parsimonious trees. The strict consensus topology showed large congruence with recent phylogenetic hypotheses for Accipitridae based on molecular data, with 11 of the 14 subfamilies proposed by those studies recovered in the present study, most with significant support. Based on the topology obtained and previous phylogenies of the group, a taxonomic rearrangement for the family Accipitridae is proposed comprising 10 subfamilies. Furthermore, the data presented here provides a potential framework for the phylogenetic positioning of the fossil taxa and future calibration of divergence time estimates within the family lineages.

p13-002

Turnover of breeding bird communities on land-bridge islands: testing MacArthur and Wilson's theory

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MacArthur and Wilson's theory of island biogeography proposes that the species' colonization rates of islands depend on their isolation, while local extinction rates depend on their area. Alternatives recognise that area can affect colonization and isolation affect extinction and, moreover, that these relationships may dominate. We quantify these relationships using long-term counts of breeding bird communities on 37 land-bridge islands from 2007 to 2012 in the Thousand Island Lake, China. For each island, we estimated colonization and extinction rates using logistic regression. We analysed the colonization and extinction rates, as well as derived estimates of species turnover rates and incidence, across the island attributes of area and isolation. Our results showed that (1) extinction decreased on islands with larger area, (2) colonization decreased with increasing distance to mainland, though the effect was weak, and (3) colonization increased with area. We also found island species turnover had the same pattern as extinction across island area and isolation. Pool turnover is the number of species that colonize or disappear from one year to the next, divided by the number of species in the pool. It increased on islands with larger area. Incidence also increased with area. We found no significant relationship between incidence and distance to nearby larger landmass that was not as expected by the theory. Island area was the best predictor of both colonization and extinction, while isolation was not a significant factor in predicting colonization, island turnover, and incidence. This is likely because of the relatively small scale (~ 580 km2) and recently isolated history (~ 50 years) of our research system, and the strong dispersal ability of birds. Thus, the similarities and differences between processes expected by theory and from a previous study that measured colonization and extinction directly follow from the special features of these islands.

p13-003

Factors that promote large body size in insular varied tits (*Poecile varius*)

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Factors such as latitude, temperature (Bergmann's and Allen's rules), predators, interspecific and intraspecific competitors, and food abundance (island rule) have been hypothesized to play significant roles in influencing geographic variation in body size within species. In addition, certain studies have shown that intraspecific variation in avian bill characteristics, such as bill length, are associated with geographic variation in the size of specific foods. Here, we investigated factors that promote geographic variation in morphological characteristics related to the body size of varied tits (*Poecile varius*) on the Izu Islands, Japan. On the islands, three subspecies were classified on the basis of morphological characteristics; tits were larger on islands located to the south. Molecular analysis of the mtDNA of varied tits on the islands showed identical haplotypes across the islands and the mainland (Ohta 2000); however, microsatellite analysis showed that the genetic structure of large-sized tits resembled those of small-sized tits rather than those of intermediate-sized tits on the islands (Fujita et al. in prep.). The main food of the tits on the islands was acorns of Castanopsis sieboldii, and the large-sized subspecies showed higher foraging rates on acorns than the small-sized subspecies (Higuchi 1975, 1976). Results of generalized mixed models showed that bill and tarsus lengths were correlated with acorn sizes, possible because these traits are associated with manipulation of acorns. In addition, bill-length/body-mass ratios were correlated with temperature, possible because these traits are associated with thermoregulation. The long bill-length of insular tits may be related to foraging efficiency on acorns, in addition to improved thermoregulation. In conclusion, food and physiological limitations may be superior to phylogenetic constraints in generating morphological diversification in varied tits on the Izu Islands.

p13-004

Seasonal niche duality challenges classical predictor variable selection in species distribution models of migratory birds

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Species distribution models (SDMs) have become one of the major tools in many aspects of avian biogeography. However, there are several challenges that have to be met to achieve biologically meaningful results. Herein, we deal with the right choice of environmental predictors for SDMs in bird studies. In contrast to most other organisms, migratory behaviour in birds is a common phenomenon which makes standard procedures of modelling less transferable. Very often, predictor variables are used which are based on year-round climate data although the target species is confronted with this climate only for a small part of the year, e.g. during the breeding or the wintering season. Herein, we test the effects of year-round variables vs. seasonally constricted variables on modelling the breeding range of pairs of migratory sister species occurring in parapatry. We focus on Holarctic systems choosing species pairs either from the Nearctic or from the Palaearctic. Given climate niche conservatism as a premise, we assume that seasonal breeding niches of species pairs should be more similar to each other than niches derived from year-round predictor sets. Furthermore, we expect that different predictors cause disparities in predicted potential distributions. We discuss our results within the growing framework of the theory of recent modelling approaches as well as under practical application-oriented approaches.

p13-005

Predicting the potential distributions of indigobirds and estrildid finches – the impact of climate change on complex parasite-host interactions

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Changes and shifts in the distribution of animal and plant species are one of the consequences of anthropogenic climate change. Especially interacting taxa, whose ranges are influenced by each other, could be affected by changing climatic conditions, particularly if they react in different ways on climate change. In Sub-Saharan Africa, indigobirds (Viduidae) are obligate brood parasites of estrildid finches (Estrildidae). Different levels of complexity characterize the study group: from single indigobird species parasitizing single estrildid finches to parasites with multiple hosts. The parasites' ranges are located within the range limits of their respective hosts or have an even smaller extent. In this study, we analyse possible spatial shifts of host and parasite ranges in the near future in order to assess whether parasites follow their hosts or lag behind. For this purpose, we project the potential distribution of parasites and their host species onto different climate change scenarios using species distribution modelling. We test whether parasites are likely to track possible prospective shifts in the ranges of their hosts and assess whether range relocations come along with shifts in distributional host exposure in more complex parasite-host systems. Therefore, we inferred predictions about potential future discrepancies in the respective potential ranges and discuss similarities and differences in the climatic niches of the species in ecological space.

p13-006

Biodiversity patterns of Passerine birds in the Middle East

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The Middle East is an important zone for a considerable number of bird taxa from the western and eastern Palearctic and from the arid belt of Africa. We digitized and analyzed the geographical distribution maps of Passerine birds in the Middle East using WORLDMAP software.The map of the Middle East region was divided to 1º × 1º grid cells (total grid cell area: 4062km^2). Analyzing the geographic distribution of species richness for our data set depicted the highest richness mostly located in the Alborz and Zagros Mountains in the south of the Caspian Sea and Caucasus and the lowest species richness observed in the south of the Middle East such as the Sahara of Africa and Saudi Arabia, Jordan, Syria, Oman, Kuwait, Iraq, Bahrain and Central parts of Iran. Spatial patterns of species richness are also congruent with climatic and environmental variation. Our results demonstrated that two factors, annual precipitation and mean diurnal range show the largest contribution to the distribution pattern of passerine birds in the Middle East.

p13-007

The exposed continental shelf in the ice age as a long distance colonization route? The southeastern Asian origin of Hainan and Taiwan Hill Partridges

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Research on island biotas has greatly contributed to the development of modern evolutionary and biogeographic theories. Until now, most studies have suggested that continental islands received their biotas directly from the adjacent mainland. However, a few studies have indicated that species on continental islands might originate from other distant regions. Here, we used the hill partridges (genus *Arborophila*) that are widely distributed on the southwest and southeast China mainland, Indochina, Hainan and Taiwan islands to test whether species on continental islands might originate from distant regions rather than the adjacent mainland. Based on a molecular phylogeny inferred from three mitochondrial fragments and three nuclear DNA loci, together with an ancestral area reconstruction, we find that the ancestors of the endemic Hainan and Taiwan Hill Partridges (*A. ardens* and *A. crudigularis*) likely came from Indochina, rather than the adjacent southeast China mainland. Divergence time estimates demonstrate that their ancestors probably colonized Hainan and Taiwan using the long exposed continental shelf between Indochina, Hainan and Taiwan during glacial periods, which had not been shown before. Thus, integrating distribution data with phylogenetic information can shed new lights on historical biogeography of continental islands and surrounding mainland regions.

p13-008

Latitudinal variation in Blue Tit and Blackbird nest characteristics

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Nest construction is widespread amongst birds, yet our understanding of adaptive intraspecific variation in nest design remains poor. Nest design is expected to vary adaptively in response to predictable variation in spring temperatures over large spatial scales, yet such variation remains largely overlooked. Here, we systematically examined the effects of latitudinal variation in spring temperatures on the size, morphology, composition and insulation properties of the nests of hole nesting Blue Tits (*Cyanistes caeruleus*) and open cup nesting Blackbirds (*Turdus merula*). Blue Tit nests were collected from seven study sites over five degrees of latitude and Blackbird nests were collected from four study sites over seven degrees of latitude, both within Great Britain. For both species, the insulation of nests was quantified before the nests were measured to quantify their size and morphology and then disassembled to determine their composition. In hole nesting Blue Tits, increasing spring temperatures with decreasing latitude were correlated with reductions in both the mass of the cup lining material and nest insulation properties, although the mass of the nest base material did not vary. Meanwhile, in open cup nesting blackbirds, increasing spring temperatures with decreasing latitude resulted in systematic decreases in the external diameter of nests, but as nest wall thickness also decreased then there was no latitudinal variation in the diameter of the internal nest cups. The insulation quality and mass of dry grasses decreased as spring temperatures increased with decreasing latitude, whilst the other materials showed no variation. Therefore, we have shown that the insulation quality of the nests of two ecologically contrasting species systematically decreased with warmer spring temperatures at lower latitudes. We conclude that birds are able to gauge environmental conditions and make adaptive changes in nest morphology and composition to create an optimal microclimate for incubation and rearing nestlings.

p13-009

A molecular phylogeny for fruit pigeons, doves and allies

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A large radiation of fruit pigeons and doves occurred across southern hemisphere regions of the Old World, particularly in Southeast Asia where the largest diversity of Columbiformes exists. Most species in this group forage in the canopy, whereas a few species forage on the ground. We used both nuclear and mitochondrial DNA sequences to evaluate the relationships among genera and species in this large clade. We use this phylogeny to examine the evolution of foraging mode. The typical canopy foraging fruit pigeons and doves form a closely allied group together with Australian and New Zealand endemic genera. The canopy-foraging green pigeons are more distantly related. Small-bodied ground foraging genera form a separate clade, as do the large-bodied ground foraging genera. Biogeographic reconstruction suggests an origin in the Australasian regions with multiple dispersal events to the Afrotropics.

p13-010

A possible link between avian and Cenozoic climate evolutions

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Avian morphological evolution is known to be related to habitat type for some species. Unfortunately, the thin, delicate bones that have evolved alongside avian flight do not produce as many high-quality fossils as those animals with heavier bones, making this evolutionary question difficult to study in the fossil record. Here, I examine the relationship between long-term climate change and the diversification of avian species. The method used for the avian phylogenetic tree and fossils (*Gastornis* and *Anthropornis*) is as follows: First, I estimate the time of first occurrence of the genus (Hackett et al., 2008). Second, I classify the avians under three habitat types of terrestrial, aquatic, and land (Hackett et al., 2008). Third, the divergence times for avian lineages are plotted to the benthic marine oxygen isotope (δ^{18}) stack over the past 65 million years (Zachos et al., 2008).

【Aquatic】; (1) The branching factor increased during a high sea level period (50 million years ago), which may be caused by high diversity of marine organism, due to expansion of aquatic area, alongside a warm and humid climate. (2) After the onset of large-scale glaciations on Antarctica about 35 million years ago, the increase of branching factor ceased. The sudden global cooling may have decreased food for marine organism.

【Land】; After the onset of large-scale glaciations on Antarctica about 35 million years ago, the land's branching factor increased, which may be interpreted to be due to the increase in habitat space by a large sea level drop. The climate cooling may also have caused diversity of vegetation.

The present result shows that global climate may have strongly affected avian species diversification.

p13-011

New Paleogene birds from China and avian biogeographic history

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Examination of the biogeography of birds after the Cretaceous mass extinction has largely focused on Europe and North America. The near absence of discussion about Asia is linked to the largely unstudied Asian Paleogene avian fossil record and the publication of many phylogenetically problematic fossils. However, Asia likely played a significant role in avian intercontinental dispersal during episodes of Paleogene climate change. New fossils from across China include many (first) occurrences of various avian clades in Asia and China and change paleobiogeographic hypotheses. The late Paleocene Nomogen Formation in Inner Mongolia has produced a small avifauna of at least four taxa, including the first presbyornithids, likely gruiforms, and stem galliforms from China. A small avifauna from the Middle Eocene Shanghuang fissure fillings had produced a variety of avian taxa allied to gruiforms and multiple higher neoavian clades. Late Eocene bones from Xinjiang Province appear to be that of a large romainvilliine anseriform indicating their occurrence in both central Asia and western Europe. Oligocene specimens from southern China seem to represent the oldest records of cormorants and some gruiform lineages in Asia. All of these Chinese fossils represent undescribed species. Overall, these new fossils indicate that Asia (in particular China) was not as biogeographically isolated as the previously published fossil record would seem to indicate, but several avian clades were widely distributed across the Northern Hemisphere (Asia, Europe, and North America) during the Paleocene and Eocene. However, by the late Eocene and into the Oligocene, those biogeographic affinities seem to shift to a greater sharing of taxa between Europe and Asia that parallels known mammalian faunas. Tentatively, given the ages of these fossil birds from the Northern Hemisphere, it is likely that at least some of the inferred intercontinental dispersals were penecontemporaneous with the well-known significant climate shifts during the Paleogene.

p13-012

Molecular phylogeny and systematic revision of the *Ficedula narcissina* complex

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The taxonomy of *Ficedula narcissina* complex, endemic in East Asia, is highly debated because of the bewildering similarity of the taxon in morphological and acoustic characters. Three designated species are broadly accepted at present, which include *Ficedula zanthopygia*, *F. narcissina* (consisting of two subspecies, *F. n. narcissina* and *F. n. owstoni*) and *F. elisae*. Here, we provide the first molecular phylogenetic revision for these taxa in combination with a morphological and sonagraphic analysis. Reconstructed using three mitochondrial genes and three nuclear markers (in total 3,541 bp), both the gene and species trees corroborated the recently suggested splitting of *F. elisae* from *F. narcissina*, and an exclusive monophyly of the four operational taxonomic units. The corrected genetic distance of the bar-coding gene (COI) between *F. n. narcissina* and *F. n. owstoni* was 2.8%, which indicated a similar degree of divergence with the sister species *F. albicollis* and *F. hypoleuca* (2.2%). All taxa within the complex can be distinguished by several spectral and structural song parameters, and a discriminant analysis also indicated significant morphological differences. Our comprehensive systematic revision thus confirmed that *F. elisae* deserves the species status, and moreover suggested that the two subspecies in *F. narcissina* should also be considered two diagnosable species.

p13-014

A typological analysis of the hoot of the Ryukyu Scops Owl across island populations in the Ryukyu Archipelago and two oceanic islands

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The Ryukyu Scops Owl (*Otus elegans*) is distributed over a 1,200-km area, only inhabiting islands. Within this range, I studied this species across 20 continental islands in the Ryukyu Archipelago and two oceanic islands. Although most studies recently use quantitative continuous measurements of the vocalization, I introduced a new method, ‘‘typological analysis’’ to visually classify variation of spectrograms according to the shape of syllable in the owl species, examining their dialects in relation to their geographical distribution. In the analysis, hoot, syllable, and element types were defined according to the number of syllables, the degree of timescale overlap of the first and second elements in the second syllable, and relative differences of duration and frequency of two elements in the second syllable, respectively. Although frequencies of hoot and element types in each island population were significantly different between the island groups north and south of the Kerama Gap across the archipelago, hoot and element types were shared between the island groups. Furthermore, typological variation occurred in syllable types, however there were no differences in frequencies of syllable types between the island groups. Geographic structure in vocal parameters as steep clines with stepped variation is represented as a dialect. According to the definition, this study found that no unique dialects in hoots occurred between the different island populations of Ryukyu Scops Owls. The Kerama Gap might act as a biogeographical barrier, contributing to the differentiation between owl hoots according to spectro-temporal analyses; however, the typological analysis detected the distribution of typological characteristics of hoots on the small islands north of the Kerama Gap that contradicts this concept of a biogeographical barrier. Because the typological analysis needs to visually examine each individual by careful attention to detail, it is a good method for discovering minor variations and patterns in bird vocalizations.

p13-015

Does the Chinese Grey Shrike *Lanius sphenocercus* possess an alarm vocalization unique within the *Lanius excubitor* complex?

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In his definitive monograph on shrikes (Laniidae) of the world, Panov (2011) used comparative ethological analysis to demonstrate the primary behavioral differences between two assemblages within the *Lanius* genus: those he called the "grey shrike group" and "all others". One of the most important distinctions was the fundamental dissimilarity in alarm calls: birds of the grey shrike group emit a single or repetitions of noise-like sounds, whereas all others generate a rhythmical rattle. Here, we used video cameras to study the breeding biology of Chinese Grey Shrike (*Lanius sphenocercus*) in Primorye, Russia, in which we documented not only the expected alarm call, but also the rattle thought to be exclusive to the non-grey shrike group. Video playback and computer analysis confirmed that the origin of these noises was vocal, rather than mechanical (e.g., bill-clicking), and consisted of a series of rhythmically-organized alarm notes uttered by both sexes, exclusively as response to an imminent, high-risk threat of nest predation by Eurasian Magpie (*Pica pica*). With regards to motivational content, these sounds might indicate warning behavior, by which adults demonstrate their impending readiness to attack an intruder. It is accompanied by a crouch posture typical of many *Lanius* shrikes. This newly-discovered vocalization by Chinese Grey Shrike is similar in note configuration and frequency to those of the non-grey shrike group, including the regionally co-breeding Brown Shrike (*Lanius cristatus*). Series duration varies depending on level of excitement. Length of each call notes ranges from 0.01-0.06 s., frequency range is 0.05-18 kHz (basal frequency is 3-5.8 kHz), and inter-note interval varies from 0.02-2.4 s. (n=202, sexes combined). We suspect that Chinese Grey Shrike is not the only species among the grey shrike group that emits this type of alarm call, but it has likely been overlooked in the past due to its extreme rareness and specific use.

p13-016

Investigation into the taxonomy of the Antarctic Tern *Sterna vittata* from non-breeding birds in South Africa

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The Antarctic Tern breeds on the Antarctic Peninsula and on subantarctic islands in the Indian, Atlantic and Pacific oceans. A large proportion of the population spends the non-breeding season on the coasts of southern Africa and Argentina. Up to seven subspecies have been recognised globally, three of which have been recorded as wintering in southern Africa. Blood and feather samples were collected to test the validity of these subspecies genetically and to link their putative identity with their foraging grounds using stable isotope studies. Samples were collected from 127 birds on the south coast of South Africa (Bird Island) between 2008 and 2010, from seven birds from the west coast in 2009 and from 6 (blood) and 12 (feathers) birds on the south-west coast (Dyer Island) in 2010. Birds were tentatively identified to subspecies from morphological characters in the hand. DNA analysis of blood samples demonstrated some support for the existence of two taxa: *Sterna v. vittata* and *S. v. tristanensis*. However, most morphological differences were not supported genetically and the existence of the subspecies *S. v. sanctipauli* could not be confirmed. This may indicate phenotypic plasticity due to differing environmental conditions at breeding locations. Stable isotope analysis of feathers identified six clusters, with a range of $\delta^{13}C$ and $\delta^{15}N$ values, and indicated that the non-breeding population probably included birds from a number of breeding populations in the Atlantic and Indian oceans. The results also suggested that some birds had spent time further south in high Antarctic waters. This work stresses the need for additional DNA analyses to be conducted on samples collected from birds at breeding colonies.

p13-017

Redrawing the phylogeny and taxonomy of *Calandrella* Larks: one new localized West African taxon and several surprising relationships

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Larks are known as a morphologically diverse family which has long challenged taxonomists. Recently, a multilocus phylogeny of all genera, and >80 % of the species, revealed several surprising relationship warranting a major taxonomical revision. We studied the genus *Calandrella* (excluding the paraphyletic *Alaudala* clade *sensu* Alström *et al*. 2013), covering all species and subspecies currently recognized by IOC. Sampling wild birds we sequenced a large portion of, or the entire, mitochondrial *cytb* gene. This was supplemented by sequencing a 350 bp region from museum specimens. The results reveal some highlights: (1) A localized population of Red-capped Lark *C. cinerea* in Nigeria is a unique, non-recognized taxon, which is sister to the subspecies *C. c. williamsi* in East Africa. This clade differs substantially from all other *C. cinerea* populations in Southern Africa, which in turn make up a panmictic population. (2) In the Horn of Africa and Arabian Peninsula, *C. erlangeri* and *C. b. blanfordi* are recent sister taxa, as are *C. b. daaroodensis* and *C. b. eremica*, whereas these two clades represent deeply split sister lineages. (3) The easternmost subspecies *dukhunensis* of Short-toed Lark *C. brachydactyla* groups as sister to the Hume's Short-toed Lark *C. acutirostris*. Remaining Short-toed Lark populations roughly differentiate into a Western (*brachydactyla*) and an Eastern (*longipennis*) clade, albeit with some mixing. For verification, we performed Restriction site Associated DNA (RAD) sequencing on single representatives for all major clades, yielding some 70,000 orthologous loci across the genome. Phylogenetic modelling of single nucleotide polymorphism data from the RAD dataset was performed to compare to the patterns obtained from the single locus mitochondrial analysis. We will evaluate the use of RAD sequencing for phylogenetic inference, and the possibility to use degraded tissue from museum specimens in RAD sequencing.

p13-018

Comparative analysis of the song variation across the ranges of Chiffchaff (*Phylloscopus collybita*) and Willow Warbler (*Ph.trochilus*).

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We studied song variations across the ranges of two closely related species: Common Chiffchaff and Willow Warbler. There are strong differences in taxonomic structure of these species. In the Willow Warbler 3 poorly differentiated subspecies are normally recognized. By contrast, the Chiffchaff is treated recently as a superspecies including 12 races, 4 of which have the status of separate "species". In order to estimate the extent of intraspecific differentiation in vocalization of both species we studied 10 geographical populations of 8 subspecies of Chiffchaff: *Ph.c.collybita* (W Europe), *Ph.c.abietinus* (Moscow, Ukraine), *Ph.c.tristis* (Central Siberia), *Ph.c.menzberii* (Kopetdag), *Ph.s.sindianus* (Pamir-Alai Mts), *Ph.s.lorenzii* and *Ph.c.caucasicus* (Caucas), *Ph.brehmii* (Iberia) as well as 8 populations belonging to 3 subspecies of Willow Warbler: *Ph.tr.trochilus* (W Europe), *Ph.tr.acredula* (Moscow, Kostroma, South Ural, Mirnoe), *Ph.tr.yakutensis* (Eastern Siberia). We used canonical discriminate analysis of a number of characteristics of songs: maximum and minimum frequency, number of notes and note types per one song, song rate etc. Acoustic differences between different populations of Chiffchaff (Wilk's Lambda =0.00357; p<0,001) were found to be better expressed then between populations of Willow Warbler (LW = 0,042; p<0,001).
The taxonomic structure of the Willow Warbler is not clear so far, different researchers separate from 3 up to 5 subspecies in different areas. According to our data only the westernmost and easternmost geographical populations of that species show reliable bioacoustic differences from other populations (LW = 0,144; p<0,001). The Northern Europe population of *Ph.trochilus* differs from other populations including the east Chukotka population. So it seems unlikely that the subspecies *Ph.tr.yakutensis* spreads from Chukotka up to N E Europe as it is sometimes supposed.

p13-019

Phylogeny and validity of Eurasian Wren *Troglodytes troglodytes* subspecies breeding in Japan

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The Check-List of Japanese Birds recognizes three subspecies of Eurasian Wren *Troglodytes troglodytes* that breed in Japan, and one extinct subspecies. In the Check-List, the subspecies breed on the mainland, including Hokkaido and Kyushu, on the southern islands of the Izu Islands, and in the Osumi Islands, respectively, whereas Momiyama (1927) subdivided them and recognized four additional subspecies that breed in the following regions: Hokkaido, western Honshu, northern Kyushu, and southern Kyushu. According to the original descriptions of the subspecies, they were proposed from one to three samples that were captured in January, February, March, or December, which is considered to be the nonbreeding season. Therefore, their localities may not be appropriate if the individuals had migrated. Furthermore, given that their descriptions depended on plumage color, the sample sizes may have been too small. The latter four subspecies are thought to be synonyms of *T. t. fumigatus* because of these concerns regarding reliability. Nevertheless, no one has sufficiently examined the validity of those subspecies. In this study, we examined whether the putative subspecies from the sampling sites are monophyletic using molecular phylogenetic methods. We used blood or muscle samples collected from May to August, during the tentative breeding season. Complete cytochrome *b* and control regions in mitochondrial DNA were sequenced and the best substitution models were selected. Phylogenetic trees were constructed using Maximum Likelihood (ML) and Bayesian methods with Eurasian Treecreeper *Certhia familiaris* sequences as an outgroup. Although bootstrap values for the ML tree were low overall, both trees showed that three samples collected from the southern Izu Islands were monophyletic. Two samples collected from Yaku Island, of the Osumi Islands, were paraphyletic in the Bayesian tree but not in the ML tree. Therefore, *T. t. mosukei* breeding in the Izu Islands is most likely valid. *T. t. ogawae* needs to be re-examined with more samples. This study is supported by JSPS KAKENHI Grant Number 24770079.

p13-020

Disentangling phylogenetic relationships in an explosive bird radiation

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Rapid evolutionary radiations allow tremendous insights into speciation and biogeographic history. However, a major challenge in studies of these brief bursts of diversification has been poor resolution of species' phylogenetic relationships owing to short internodes among ancestral lineages, incomplete lineage sorting, long-branch attraction, and homoplasy. As a consequence, too few robust phylogenetic hypotheses are available to document such radiations. This study aims to resolve relationships within a very rapid and diverse radiation using both simulated and empirical data to illuminate underlying processes of lineage splitting and dispersal.

The passerine family of white-eyes (Zosteropidae) presents an ideal system for investigating one of the most striking evolutionary radiations known among vertebrates. The distribution of this group of 120 species spans a vast area in the Old World, from the eastern Atlantic to the Western Pacific. A vast majority of this lineage is estimated to have begun diversifying only in the early Pleistocene, resulting in the highest speciation rate yet documented among land vertebrates. The relatively recent diversification of this clade minimizes problems of long-branch attraction and homoplasy confounding phylogenetic inference. Hence, this young and species-rich group provides an excellent system in which to examine macro-evolutionary and biogeographic patterns in rapid radiations, lines of research that depend on a robust estimate of phylogenetic relationships. Data from three mitochondrial genes and two nuclear introns yielded a poorly-resolved phylogeny, but simulations suggested that increasing the number of loci to ~100 may improve resolution considerably. As predicted, DNA sequence data enriched using ultraconserved elements provide a much better resolved estimate of phylogenetic relationships in this rapid radiation.

p14-001

The production of regurgitated pellets by species of Synallaxinae and Furnariinae (Aves: Passeriformes: Furnariidae)

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We present the first records and description of regurgitated pellets produced by species of eight genera of Furnariidae (Aves: Passeriformes) from Argentina. A total of 593 Furnariidae nests were sampled from March 2005 to February 2011, from which 1329 pellets were recovered. These pellets can be related to the regurgitation process as they show the hard indigestible parts of arthropods (mostly Coleoptera), seeds and some mollusk shells. Not all nests contained pellets. *Anumbius annumbi* has the great number of pellets in 50 % of its nests. Prey items identified from the pellets are compared with food items of Furnariidae known from stomach contents reported in the literature. In contrast to other passerine birds, the regurgitated pellets of Furnariidae can be found inside its nests. This is likely because they roost in their nests.

p14-002

Birds in Romanian mythology, beliefs and ritual practices

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Invoked and venerated, expelled and persecuted, birds are omnipresent in Romanian mythology, in ritual practices and in the rural traditional calendar. Also, birds are subjects of fairy tales and legends, and of many faiths and superstitions. Probably, the ancient myths of our Dacian ancestors, from the Thracian people, have been assimilated into the Romanian Christian mythology. The God being the world's creator, but birds appear as the God's principal helping hands. For example, one legend tells us that God called the birds to help him by digging the rivers and springs' valleys so the man and other animals can drink water to quench their thirst. Looking with an ornithologist's eye at the significance of some Romanian legends and beliefs related to birds, it is obvious that the spirit of observation that characterizes the peasant bound to the land and its cultivation, organising his agricultural works and livestock activity considering the annual biological cycle of wild nature around him. There are numerous bird-related days in the traditional calendar, too. Other legends surprise us through the accuracy of the detailed observation on the birds' behaviour or biology.
Some beliefs have a very large covering area - for example, that the Cuckoo (*Cuculus canorus*) eats cherries on the 20th of July and becomes a Sparrowhawk (*Accipiter nisus*); later in July, the Cuckoo stops singing and leaves our country, while the Sparrowhawk becomes more visible in the surrounding landscape as a result of leaving the breeding areas and dispersing in search of new feeding territories. The birds are very important for ritual and magic practices, some bird species being used equally in the ritual practices related to birth and death, as well.

p14-003

Development of an automatic bird-species recognition system from birdsongs in tropical forests

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This study reports on an automatic species recognition system that detects when a birdsong begins and ends from long-time recorded sound data and identifies what species the bird is for each birdsong duration. Although direct observation (e.g., point counting and line census by researchers) is common for avian diversity studies in tropical areas, the results lack objectivity because their quality depends on researchers' skills and environmental factors. In addition, direct observation forces researchers to be in the field during the period of survey. Therefore, direct observation is expensive if one wants to ensure the quality of surveys, and long-term comparison is difficult due to variation in quality. On the other hand, sound recording provides permanent data and we can verify them after field recordings. Skillful researchers are not needed for data collection but they are still needed for a high quality analysis of the data. Automatic species recognition can reduce the amount of work for trained researchers.

The system consists of two classifiers; birdsong activity detection (BAD) and automatic bird-species recognition (ABR). The acoustic features for them are MFCC, commonly used acoustic features in automatic speech recognition, and Deep Scattering Spectrum. Both classifiers are based on Gaussian Mixture Models (GMM), a commonly used machine learning technique. The parameters of GMMs are trained by a set of training data with correct species labels. Additional training data are obtained from the xeno-canto web site. BAD uses a two-class classifier, i.e., birdsong or not, while ABR uses a multi-stage classifier combined with GMM and decision tree. The system captures audio signals with a set of distributed directional microphones as wave files. Since the system uses only acoustic signals, we expect that it will record all singing birds.

p14-004

Let's identify birds in the Nasca lines!

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The Nasca lines were mainly made in the Nasca period (ca 2,100–1,300 years ago) and are located in the desert plateau of Nasca, southern Peru. More than a thousand lines and geoglyphs are known and designated as World Heritage. Because the Nasca society was illiterate and no documentary records exist, what objects are depicted and for what purpose they were depicted remains unknown. Birds were the most portrayed animals in the Nasca lines: 19 geoglyphs of birds, including two hummingbirds, a condor, a flamingo, a *Papagayo* or *Lolo* parrot, a juvenile domestic duck, a pelican and a "guano bird" are recognised. So far, geoglyphs of birds were identified to taxa based on the whole impression or a few characteristics. However, no study examined whether all characters match the identified taxon and whether a similar character is shared with other taxa. In this study, we extracted as many morphological characters as we could from the 19 geoglyphs of birds and compared the characters with ones from modern birds in Peru. The results revealed that one of the geoglyphs of a hummingbird has a long tail with a projecting central part and shares some characteristics with hermits (tropical and subtropical hummingbirds in the subfamily Phaethornithinae), the other hermit-like geoglyph has been identified as an "unknown bird", the "guano bird" has a long hooked beak and shares many characteristics with pelicans and some of the previously identified geoglyphs have some discrepancies with identified taxa. In addition to the lines and geoglyphs, many coloured pot shards with painted birds and bird remains were found in archaeological sites of the Nasca period. Further study of these materials would be useful in identifying birds in the Nasca lines and in answering the largest mystery: for what purpose were they depicted?

p14-005

Local exploitation of the Oriental White Stork as a natural resource for coexistence with humans in Japan

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The native population of the Oriental White Stork (*Ciconia boyciana*) became extinct in Japan in 1971 and a reintroduction project of the stork has been in progress in Tajima District, Hyogo, since 2005. In Japan, the storks inhabit rural environments near human communities and coexistence with humans is thus an integral part of the reintroduction of the storks. The storks feed on a range of animal species and are a top predator in the rural ecosystem. They seasonally use paddy fields, rivers, waterways, grasslands, etc. as foraging habitats. Restoration of biodiversity is essential for the wellbeing of the storks in these environments. The Japanese government, Hyogo Prefecture and Toyooka City promote nature restoration of the rural environment. A high level of biodiversity will contribute to ecosystem services such as supporting, provisioning and regulating cultural services for humans. Furthermore, we actively exploit the Oriental White Stork as a local resource using it for regional development and local vitalization to support developments in tourism, the economy, agriculture, administration, culture, education and research (Kikuchi 2006, Ohsako et. al. 2008). Such local “exploitation” of endangered birds as natural resources enables sustainable development and protection and their coexistence with humans.

p14-006

Bird images that appear in objects housed in Shosoin Treasure House

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The Shosoin Treasure House was established in the middle of the 8th century as the main store house of the Todaiji Temple, the central Buddhist temple of Japan during that era. Shosoin houses various objects ranging from tableware, stationery, furniture, clothing, games, Buddhist utensils to horse riding gear and weapons. A large part of the objects comes from the belongings of Emperor Shomu (701-756), which were donated to the Great Buddha of the Todaiji Temple after his death. Another, large part of the artifacts were used in the Kaigen-kuyo of the Great Buddha, the ceremony to provide the newly made Buddha with soul, held in 752AD. Previous studies on the (non-avian) designs and material of the objects have shown to various degrees that these originate from a wide range of Eurasian localities from West Asia eastwards, reflecting the strong influence of China's Tang Dynasty and the flourishing trade across the continent. We investigated more than 120 objects that bear bird images, identified the images, and categorized them to three degrees of certainty, i.e. A: certain, B: probable and C: possible. Images of birds identified with certainties A and B, included Mandarin Duck, Golden Pheasant, Green Peafowl, cranes, parakeets, Hoopoe and Red-billed Blue Magpie. We found that birds with conspicuous crests, elongated tails or conspicuous coloration were preferred, suggesting that the manufacturers of the objects intended to depict paradise-like scenes. Our analysis suggests that the site of manufacture of the objects was located within the then developed part of China since (1) Chinese species such as Mandarin Duck, Golden Pheasant, Red-billed Blue Magpie were often depicted realistically, while (2) nearly all of the Southeast Asian species were somewhat less realistic, and (3) images of birds whose ranges are restricted to Central and West Asia were not found.

p14-007

The cormorant conflict is a human problem; lessons from Japan

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In order to resolve the conflict and promote coexistence with wildlife, the relationships among interested parties, human resources, and their development are essential, because humans are responsible for developing effective management programs. This study introduces the management systems and personnel issues for Great Cormorants (*Phalacrocorax carbo*) in Japan. Cormorant numbers in Japan, as in many other countries, have increased in recent years. Currently there are estimated to be more than 100,000 Great Cormorants. This has led to growing concerns about their impact on fisheries in particular. A number of regional consultative groups have been established in Japan to discuss cormorant issues. For example, such groups have operated in the Kanto region (around Tokyo) since 2005 and in the Chubu and Kinki regions (around Osaka) since 2006. Meetings have primarily been used to share monitoring data on cormorant numbers at roost sites and in relation to the effectiveness of new measures for reducing cormorant damage at fisheries. However, establishment of regional consultative groups is not a management goal. Experienced staff should work on management for local populations. Unfortunately, people in charge of bird and animal damages are changed by personnel relocation at triennial intervals (shorter than cormorant lifetime!), especially in prefectures. Therefore, we need supervisors for cormorant management. Ms. Nanae Kato is a researcher in a non-profit organization "Japan Bird Research Association" and one of the supervisors for cormorant for more than a decade. She always collects local information on cormorant throughout Japan, such as distribution, population size, fisheries and plant damage, and progress situation of measures, using her own human network. Training workshops for cormorant management have been held by The Japanese Ministry of the Environment. The workshop programs were based on her idea. In 2013, anatomy practice, especially in stomach content, was conducted for quantification of fisheries damage.

p14-008

Differences in potential seed dispersal ability by birds between two morphs of *Scaevola taccada*

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Beach cabbage (*Scaevola taccada*) is a coastal living species of flowering shrub that is distributed throughout much of the Indo-Pacific. This species is interesting because it has two types of fruits which enables two different forms of dispersal: (1) The C-morph which has pulp and cork layers, and can be dispersed by water and by being eaten by birds, and (2) the NC-morph which has only a pulp layer and is dispersed by birds. Within-individual dimorphism has not been observed for this species, but plant individuals with different fruits grow at the same sites. Although birds can disperse both morphs, plants having different fruit morphs tend to inhabit different habitats. The plants producing C-morph fruits tend to be found along beaches whereas the NC- morph plants tend to be found on cliffs. This suggests that the plants on cliffs are likely to be deposited by birds, but also that birds may prefer to eat NC-morph fruits. In this study, we compared the fruit characteristics (sugar content of pulp, pulp load, fruit size and load, and seed size and load) of the two morphs and among three topographies (beach, rock and cliff). The sample size was 1243 C-morph and 642 NC-morph fruits from 16 sites on 6 subtropical islands in Japan. We found that the NC-morph fruits had significantly higher sugar content than the C-morph ones. Fruit sizes of both morphs were smaller in cliff habitats than in other habitats. These results suggest that the NC-morph in cliff habitats may be better adapted to bird dispersal than the C-morph fruits.

p14-009

The ecology of the introduced Chinese Hwamei in Japan

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The Chinese Hwamei (Melodious Laughingthrush) *Garrulax canorus* is naturally distributed in SE China, E Laos, and Vietnam. It was introduced and has been established outside the natural range, in the Hawaiian Islands, Taiwan, and Japan. There is a lack of information on the ecology of this species, not only in its introduced but also native habitats. Here we report observations on the nest location, breeding, singing and flocking behaviors, dispersal of a yearling, and food habits of the introduced Chinese Hwamei in Kanto area, Japan. Data were collected from 2008 to 2010, on the Minami-Ohsawa Campus of Tokyo Metropolitan University (TMU), located in the western Tama Hills, Tokyo. In 2005, additional data for the food item survey were taken in Ranzan-machi, Saitama.

Nests were found not only in secondary mixed-forest, but also in more artificial environments such as garden shrubs and hedgerows. The breeding behaviors were mainly observed from April to July. Males were singing not only in spring and summer but also in winter, although the frequency of singing was lower in winter. Flocks were observed more frequently from June to winter, and the maximum flock size recorded was 7. A color-ringed male, born in 2009 at TMU, bred successfully in this study site next summer, and later was re-found a few times in autumn/winter of the same and the following year. These results are an example of the short-distance natal dispersal and breeding success of a yearling male. Using video-recordings of nestlings and binocular observations of foraging adults, we found that Chinese Hwamei fed on various types of food items; from vertebrates (adult Japanese grass lizard *Takydromus tachydromoides* and juvenile frogs), invertebrates (earthworms, spiders, centipedes, adult cicadas, adult Coleoptera, adult Orthoptera, larva and adult Lepidoptera), to acorns and various kinds of fruit.

p14-010

Old feathers remain in the feather brushes of the Japanese tea ceremony

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In Japan, feathers have been used as feather brushes in *Chanoyu (*the tea ceremony) for more than 400 years. They originally seem to have had a purely practical use - for dusting - but over time came to acquire a ceremonial and even spiritual quality as tools of purification, symbolizing also the purification of mind.

With their refined aesthetic sensibilities, the old tea masters admired feathers as the epitome of "*yo no bi*" - the uncontrived beauty of a perfectly functioning object. As with all their tea articles, the masters cherished their feather brushes and cared for them meticulously, handing them down to succeeding generations. It is thanks to this tradition of care that many old feather brushes have survived to today.

As a relatively minor item of tea equipage no research had been conducted on Japan's feather brushes until I developed an interest and started to investigate them about 15 years ago. I have since documented 700 feather brushes and studied many old tea writings and historical records. My study has shown that most of the feathers used in chanoyu were the flight or tail feathers of large birds, and that in addition to Japanese feathers, quite a number of the feathers used in chanoyu came from non-native birds of Japan. Radiocarbon dating has also been conducted and from this we have learned that at least two extant feather brushes may be as much as 350 years old.

Through the many beautiful photos of old feather brushes presented here I hope many more people will come to know something of the historical relationship Japanese people have had with birds and share an appreciation for the sense of beauty that the tea masters fostered.

p14-011

History of Japan's Illustrated Books of Birds since the Edo period

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The publication of illustrated books* to birds in Japan dates back to the Edo period (1603-1867), said to be a prevailing age in the study of natural history in Japan. The *Chorui Shinsha Zukan* [Realistic sketches of birds in the scroll] by S. WATANABE and the *Hotta Kinpu* [Illustrated book of realistically drawn birds], edited by M. HOTTA are representative works of this period. Compiled in good numbers also during this period was a genre of books known as *SANBUTSUCHO* [Notes on natural resources], which recorded region by region various plants, animals and minerals all over Japan. From the Meiji period (1868-1912), western sciences were introduced and illustrated printed books in the western style began to be published. These included *Yueki Chorui Zufu* [Illustrated book of useful birds] by K. NARUSHIMA and H. MOMIYAMA (1893), and *Hogocho Zufu* [Illustrated book of protected birds] by I. IIJIMA (1898). Furthermore, the year 1914, two years after the foundation of the Ornithological Society of Japan, witnessed the publication of *Nihon Chorui Zusetsu* [Handbook on Japanese birds] by S. UCHIDA, the first book covering all species in Japan. While ornithology gradually developed, publications from the 1930s to the 1950s included *Dr. KURODA'S BIRDS IN LIFE COLOURS* by N. KURODA (1933-34), *A NATURAL HISTORY OF JAPANESE BIRDS* by Y. YAMASHINA (1934・1941) and *THE BIRDS OF JAPAN* by Y. KIYOSU (1952), which became later recognized as the "Three Great Handbooks on Birds in Japan". In 1932, the forerunner in a genre of photographic guide books on birds was published, *Genshoku Chorui Zufu* [Colored guide on birds] by S. UCHIDA and K. SHIMOMURA, and three years later in 1935, Japan's first field guide was published, *Kansatsu Tebiki Genshoku Yacho Zu* [Colored field guide to the birds in Japan] by T. ISHIZAWA and K. SHIMOMURA. From our present vantage point, in which various kinds of illustrated bird books are published both in quality and quantity, we will review significant aspects of illustrated books published from the Edo Period and whether they have changed to the present era.

* Illustrated book here refers to books on natural history that made heavy usage of figures such as drawings and photographs.

p14-012

The Mitochondrial DNA of People Who Brought Shirotori Worship to Japan

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In *The Kojiki*, Yamabe no Ohotaka sets out on a quest for a White Bird on Emperor Suinin's orders, ultimately capturing one near a water gate at Wanami (now in Niigata Prefecture). In his book *Shirotori Densetsu* (*The Legend of White Bird*), Kenichi Tanigawa presents a detailed analysis of the fervent Shirotori worship existing in the Tohoku region before the establishment of the Yamato regime, arguing that this worship was quintessentially Japanese, dating back to the Jomon period. However, we infer that this worship is related to the Shirotori worship found among the Buryat people inhabiting the Lake Baikal region in Siberia. The Whooper Swan is the creature known as the White Bird in the Tohoku and Lake Baikal regions. The white robe worn by the Emperor during the accession ceremony has its origins in this worship and signifies transformation into a White Bird, which then becomes a Heavenly Being. Analysis of mtDNA drifting southward from Lake Baikal to Japan indicates mtDNA belonging to Haplogroup A5. Branching off from Haplogroup A4 7,000 (± 2,800) years ago, Haplogroup A5 is a subgroup found only in Japan and on the Korean Peninsula, tracing a straight line from Lake Baikal to the Korean Peninsula and Japan. People in Haplogroup A5 likely arrived in Japan much later than the Jomon people, who arrived at Hokkaido via Sakhalin and spread throughout Japan—specifically, during the late Jomon period—but not later than people from the Korean Peninsula arriving en masse with wet-rice farming techniques (rice farming and sun/bird-based culture). People in Haplogroup A5 are still found today in the Niigata/Tohoku region of Japan, and, as mentioned above, it is in this part of the country that we find the worship of the White Bird: that is, the swan. At one time during the Jomon period, 70% of the population in Japan lived in the Tohoku region. By the late Jomon period, this figure had plummeted to 10%. We suspect this rapid decline in population may be ascribed to a pandemic of avian influenza. Fables reflect history, in some cases providing warnings. According to a fable in the Tohoku region, those who consume swans will die. We suspect that this is not merely a religious edict, but an epidemiological lesson passed down orally that reflects the historical fact that villagers who captured and ate swans weakened by avian influenza became infected with the virus, resulting in widespread mortality. If we suppose that the culture in the Lake Baikal region was imported directly to Japan by people belonging to Haplogroup A5, it appears likely that Shirotori worship came to Japan long before and independently of wet-rice farming. Unlike divination by birds and crow worship, both rituals based on rice-farming culture, we suspect Shirotori worship merged with the indigenous culture and became integrated into Shinto free of continental influences.

p14-013

Effective net mesh-size and fishing-line interval as countermeasures to Eurasian Tree Sparrow, *Passer montanus*

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Eurasian Tree Sparrow *Passer montanus* are widely distributed in the Eurasian Continent and Japan. Although the sparrows inhabit forest in Europe, they inhabit from urban areas to farmlands throughout Japan. The sparrows, one of the most familiar birds in Japan, depend on human activities, and they are known to cause extensive crop damage especially in rice fields.
Bird nets and fishing lines are often used to prevent crop damage from birds. However, the effective mesh size of bird nets and the effective interval of fishing lines are not known for sparrows. We tested the two countermeasures in an aviary. First, we examined the mesh sizes. The birds were able to go through 31.8×31.7 mm and 21.9×21.9 mm mesh sizes of the bird nets, and 41.1×26.6 mm of the wire net. On the other hand, they were not able to go through 19.4×19 .4 mm of the bird net and 26.2×19.9 mm of the wire net. Besides going through the net, the birds could enter by digging through the ground. Second, we examined the intervals of fishing lines that sparrows could go through. The birds were able to go through 50, 40, 30, 20, 10, 5, and 2.5 cm. They could go through even when wings or body touched lines. Our results suggest that it is difficult to prevent crop damage completely by lines. However, the birds entered less often as the interval became narrower; therefore, lines are effective to reduce damage to some degree. In conclusion, setting nets of the appropriate mesh size and using countermeasures for digging are important to reduce sparrow damage. Fishing lines can be used as an alternative plan if used with the appropriate interval.

p14-014

Bioacoustic collection of the Natural History Museum & Institute, Chiba, Japan: recordings of wildlife and sound environment

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The Natural History Museum and Institute, Chiba has been collecting bioacoustic materials since its establishment in 1989. We counted 1824 recordings of wildlife sound and environment in tapes and CD's at the end of October 2013. Further, we store a large amount of recordings in sound files of the wave format. The latest discography covered 227 original recordings and 367 acquired publications with some information of sound classification, recording methods, storage and maintenance, and acquisition and related projects (Oba 2013). The collection is relevant to avian discrimination, behaviour, ecology and habitats in Japan and worldwide. In the last 5 years, we managed to digitize most of our original recordings and are working on a database of nature sound and sound environment recordings. At our website, you may find the following four programs based upon our collection: 1) "Sound Box" introducing many of the birds and animals found in the Ecology Park, museum observation ground, 2) "Kiki-Mimi Collection" presenting our bioacoustic materials for public listening with some useful information on recording wildlife, 3) "Regional Sound Maps" showing birds and their environment recorded at different localities with local information, 4) an educational program "Project on the Strength of Hearing" to help people listen to and recognize bird sounds aided by the automated bioacoustic identification system.

p14-015

The line installation interval which prevents invasion of crows -implication for damage control in orchards

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Large-billed Crows and Carrion Crows (*Corvus macrorhynchos* and *C. corone*) are major pest birds of orchards in Japan. Although complete bird-net installation is effective to prevent damage, the costs, labor, and maintenance pose problems. Nylon-line installation is simpler than bird nets. However, the effective interval is not clear. Therefore, we examined the effect of line interval on crow behavior.
Twelve Large-billed and three Carrion Crows were captured from the wild. In an outdoor aviary (40m*60m, 12m height), we set a frame structure (11m*20m, 1.6m height) with wires above. The invasions of crows were counted on every experimental session via video recording. The wire interval was set at 10m and narrowed gradually (5m, 2.5m, 1m, 0.5m and 0.25m) every week. We used wires instead of nylon lines because lines with low visibility are known to scare crows. First, under *ad libitum* condition, highly palatable feeds were given inside the structure for eight hours a day. Second, the food was given only inside the structure without usual feeding from sunrise for four hours.
Under *ad libitum* conditions, the number of invasions decreased at line intervals of 2.5m while the ratio of invasion after perching on the frame increased. This tendency became stronger at 1m, and there was no invasion at 0.5m and 0.25m. Under the limited feeding treatment, the rate of invasions after perching increased at 1m, and even when wires were placed at 0.25m interval, a few crows invaded.
Based on these results, we designed crow control methods for orchards, in which the nylon-lines placed one meter apart were combined with bird nets surrounding the orchard. To verify the effectivity, we constructed an outdoor apparatus (15m*30m) with food inside, imitating an orchard. Alternative three-week periods of control and treatment were repeated four times. The treatment decreased crow invasions to 1/250.

p14-016

Why Tree Sparrows are special in Japanese culture: an analysis of family emblems.

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The view and treatment of bird species vary between cultures. For example, granivorous birds tend to be regarded as pests by cereal farmers around the world including Japan. However, Tree Sparrows (*Passer montanus*) have been used as a family emblem in Japan along with other esteemed birds, such as cranes. Therefore, we studied the history of the sparrow emblems to clarify the origin and reason of this special treatment of sparrows in Japanese culture.
Japanese family emblems are generally symmetrical designs that symbolize family names of nobles (Numata 1926), and are used in official occasions in Japanese society. We defined the sparrow emblem basically as the design of small short-winged birds with black cheek patches. Based on a review, "The Study on Japanese Emblems" (Numata 1926), we analyzed the ratios of Tree Sparrows, animals and plants.
Of the eight major categories of family emblem designs, plants are most popular (40 % , N = 5399). Of the animal designs (N = 463), Tree Sparrows rank fifth (8 %), which are preceded by butterflies (32 %), hawk feathers (20 %), cranes (16 %) and geese (11%). Tree Sparrows first appeared in the emblem in combination with bamboo/bamboo grass (Bambusoideae). Simpler Tree Sparrow emblems derived from this bamboo-sparrow design.
This result shows that the family emblems of Tree Sparrows originated from plant designs which were closely associated with their habitat. Although not the most popular among animal emblems, Tree Sparrows occupy a unique place in family emblems. The significance of this result is to be discussed.

p14-017

Loons and people: the case of the Seto Inland Sea of Japan

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The Japanese Islands have provided loons with wintering places, though the birds have remained little known for a long time until a story was born in the Middle Age (12th century). A famous battle was fought at that time between two clans, that is, Genji and Heike clans in and around the Seto Inland Sea area. A story was born when defeated soldiers of Heike Clan fled to a small island, where wintering loons had gathered, crying aloud. Their cries sounded like human voices, which invited Genji soldiers only to betray hidden Heike soldiers there. Whenever they heard wintering loons' sorrowful cries in Spring, people in the region believed that killed Heike soldiers cried out. Loons were nicknamed "Killers of Heike Soldiers". It was much later that collaboration between loons and regional people became known. It was the fact of cooperation named "Abi Ryou (Fishing with loons)" between regional fishers and loons in the same Seto Inland Sea . Only towards the end of the 19th century, the fact of special fishery being carried out by using loons became known. Yet, it was indeed in 1927 that a book published in memory of Prince Hirohito's visit to the Inland Sea of Seto carried a detailed article on fishing with loons. It resulted in a nationwide prevail of knowledge about loons and fishing with loons. It introduced traditions in villages concerned that the fishing with loons had really continued more than 300 years! Fishermen row their boats slowly round a group of loons, catching high class fish like "sea breams", which have come up to catch sand eels being driven by loons. The loons can catch and eat sand eels as they will. Only the two months of fishing with loons brought about enormous profits, which enabled fishermen to live the rest of the year. The fact made the regional people regard loons as God's missionaries. The fishermen treated loons very tenderly, protecting them from any dangers. The feeling of love and trust united the people and the birds, so that the birds swam on the water very close to fishing boats. There took place really an idealistic relationship of co-existance, in which people and nature needed each other. The fishing with loons was accompanied by a traditional ceremony. The shinto-priest sponsored it. Stories concerned with the village shrine, fishermen and thousands of wintering loons were full of merry making folklores, inside-stories of fishing and records of fishermen's living days. They are really attractive stories of wintering loons in Japan! As modernization developed, however, the ecology of Seto Inland Sea deteriorated andnumbers of loons decreased. Thirty years ago, fishing with loons came to an end. At present, only 30~60 loons are observed in a day, in spite of all the local efforts to revive the traditional fishing.

p14-018

Lepidoptera fauna in nests of Wedge-tailed Shearwater, Bulwer's Petrel and Blue Rock Thrush and hygrothermal nest conditions in the oceanic Ogasawara Islands, Japan

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Lepidoptera fauna from nests of three bird species, Wedge-tailed Shearwater *Puffinus pacificus*, Bulwer's Petrel *Bulweria bulwerii* and Blue Rock Thrush *Monticola solitarius*, which bred in the Ogasawara Islands, Japan, was investigated. These birds nest under rocks, on ledges or in burrows beneath the ground. Five moth species were identified: three tineids, *Praeacedes atomosella* (Walker), *Crypsithyris* sp. and *Erechthias* sp., and two pyrarids, *Spoladea recurvalis* (Fabricius) and an undetermined species from nests of the shearwater; *Pr. atomosella* and *C.* sp. from the petrel; *Pr. atomosella* from the thrush. We also monitored temperature and humidity in the nests of the shearwater using data loggers. As a result, both temperature and humidity were maintained at relatively constant level in the nests while those outside the nests fluctuated widely. Some of the moth species might feed on bird feathers. In addition, burrow-nesting birds possibly provide indispensable habitats in harsh environmental conditions of small isolated islands.

Round Table Discussion Abstracts

Restoring seabird breeding colonies invaded by rats and other introduced mammals in Japan and Korea

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Breeding seabirds on more than 10 island groups in Japan and islands in Korea have been greatly impacted by introduced mammals such as rats, weasels, rabbits and mongooses. Methods of eradication and seabird monitoring are needed. For example, an island group off southern Japan is a current focus for exploring these issues. In 1987, rats almost extirpated a colony of Japanese Murrelets (*Synthliboramphus wumizusume*), an IUCN "vulnerable" species and one of the rarest members of the family Alcidae. In 1988, rats were eradicated by the local government. Afterwards, the murrelet population has been gradually recovering but rats reinvaded in 2009 and more dead murrelets were found. In 2012, this colony of murrelets and Swinhoe's Storm-Petrels (*Oceanodroma monorhis*), an IUCN "near threatened" species, appeared very close to extirpation. Successful rat eradication has been conducted in the Ogasawara Islands (Bonin Islands), where native plants were damaged by black rats (*Rattus rattus*). Eradication efforts were conducted in 2007 and 2008; no evidence of rats were found afterwards. In southwestern Korea, many islets host colonies of seabirds, including Streaked Shearwaters (*Calonectris leucomela*), Japanese Murrelets, and Ancient Murrelets (S. antiquus), where rats impact some populations.

This round table discussion is a good opportunity to consider: (1) the general patterns of the cause of island invasions to help prevent future invasions; (2) the most effective eradication techniques; and (3) baseline and post-eradication monitoring programs for seabirds. Discussion will emphasize the uniqueness of seabird breeding islands in Japan and Korea and logistics of conducting eradications and seabird monitoring in these countries. All major cases of eradication of rats and other introduced mammals and related seabird monitoring on seabird islands will be considered. We expect to prepare a brief report with recommendations for eradication program at small islands in Japan and Korea.

Establishing, promoting, and coordinating research needs and priorities for a globally endangered avian order, the Psittaciformes, through global cooperation

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The Parrot Researcher Group (PRG) was created during the 25th International Ornithologists' Congress (IOC) in Campos do Jordão (Brazil) in 2010, as a network of researchers working on Psittaciformes in order to establish, promote, and coordinate research projects on this globally endangered avian order. Since then, over 270 researchers from all continents have joined the network. In order to take into account particular regional needs, the group was organised in five regions: Africa, Australasia, Caribe, Continental Neotropics, extra-Tropical. Each region elected two to three coordinators. An elected Secretary coordinates global projects. Joining the PRG is free. The group organises discussions, exchange of advice, and joint projects through an e-group. In 2011, a large on-line library on Psittaciformes was created and made available to all members. Since its creation the PRG has been working on a variety of projects: (a) reviewing knowledge gaps, research priorities and conservation status of African and Neotropical parrots; (b) evaluating the consequences of climate change, habitat loss, and invasive species on Australasian parrots; (c) investigating the establishment and population dynamics of introduced parrots; (d) studying the presence of pathogens and parasites in wild and introduced Psittaciformes globally; (e) maintaining and expanding the on-line library. In May 2013, the PRG was established as the Research Coordination Committee on Parrots (RCCP) of the International Ornithologist's Union (IOU). The central goal of the RCCP is to build on the achievements of the PRG and to expand the reach and effectiveness of its programs under the umbrella of the IOU. During the planned RTD in Tokyo, we will present our work to colleagues from the broader ornithological community, attract new members, discuss past successes and future plans of the RCCP, and build inter-disciplinary cooperation. Specifically, we aim to discuss: (1) research priorities for the next four years; (2) regional conservation priorities and strategies; (3) ways for organising new joint projects; (4) ways of promoting the participation in the RCCP of colleagues from underrepresented regions such us South and South-east Asia, China, the Indian sub-continent, and the Middle East.

Discussing the causes of the population declines of Eurasian Tree Sparrows in Japan and House Sparrows in Europe

Osamu Mikami[1], Fumio Taguchi[2]

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House and Eurasian Tree Sparrows (*Passer domesticus* & *P. montanus*) are representative of synanthropic birds in Europe and East Asia, respectively. They are most familiar birds to humans and have served as our window into nature. In recent years, however, they have declined in various areas of their range. In London, for example, the number of breeding House Sparrows declined by 60 % between 1994 and 2004 (Summers-Smith 2003). The population decline has aroused great concern among many people and triggered research into the causes of the decline. In Japan where House Sparrows are absent, Eurasian Tree Sparrows have been revealed to decline in recent years and the causes have become a topic of public interest.
This round table discussion aims to review the population trends of two ecologically equivalent species in both sides of the Eurasian Continent and discuss new factors or methods that are likely to contribute toward their conservation from a global perspective.

Applications of Unmanned Vehicle Systems (UAS) for Avian Studies

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The objective of this Round Table is to bring both leading researchers and interested parties together in the area of UAS technologies to discuss the state of the art, emerging trends, current research directions, and potential applications to address challenges for studying avian species.

Background: Unmanned Vehicle Systems, more commonly known as drones, have made dramatic technical advances in the past decade and are now being used by ornithologists all over the world, albeit to a limited extent. While expansion of their use is currently tightly constrained by regulations in most countries, it is expected that within the next few years, various governments will be providing a regulatory framework that will allow for a greatly expanded role for drones in various airspaces for a wide variety of applications, including bird studies. To date, over the last 7 years both Dr. Bird and Dr. Negro have extensively pioneered the use of Unmanned Aerial Vehicles (UAVs) to determine foraging strategies in falcons, to relate distribution of water birds to their habitats, to census migrating geese and peer into raptor nests, and to assess behavioral responses of nesting raptors to the machines. The advent of use of UAVs raises a number of important R&D questions and opportunities, e.g. financial costs and limitations, available payloads, current state of regulations, etc.

Opportunity for Attendees: The RTD will begin with illustrated overviews of the ongoing research of Dr. Bird and Dr. Negro, including a broad look at UAS and their potential and limitations. This will be followed by informal presentations by other invited attendees who have experienced use of the machines. Finally, all participants will have an opportunity to present a summary of their work and to discuss the advances with other researchers in a small group setting before an audience with an interest in such technical advances. The overall goal of this RTD is to provide a relaxed, informal atmosphere in which those interested in using unmanned systems can discuss their successes and failures to date and offer new thoughts and ideas on how these machines can help in our efforts to study, manage and conserve the world's bird populations.

Avian functional morphology and the fossil record: Integrating structure and function across time.

Proffitt, JV[1], Watanabe, J[2]

1. Jackson School of Geosciences, The University of Texas at Austin;
2. Department of Geology & Minerology, Kyoto University

The primary purpose of this round table is to act as a forum for discussion on integration and application of neontological and paleontological methodologies to understand avian function, morphology, and ecology in an evolutionary context. The motivation for this session occurring at IOC 2014 is due to the unique composition of attendees in relation to two complementing meeting symposia: S38 “Evolutionary Morphology of Birds: New Methods and Concepts” and S44 “New finds and old bones – integrative palaeornithology for the 21st century”. A round table will enable direct discussion of key topics raised in the symposia while appealing to a broader range of attending researchers. Such a forum has the potential to significantly contribute to collaboration and information sharing between early career researchers and senior colleagues. Topics for discussion include but are not limited to (1) the integration of functional data gathered from extant birds – both in laboratory and natural settings – with data from fossils, (2) interpreting the functional context of anatomical data gathered from fossils, and (3) the role of comparative phylogenetic methods in investigating the evolution of function in extinct and extant birds. It is our goal that this discussion will result new collaborative networks and exchange of expertise between avian paleontologists, evolutionary morphologists, ecomorphologists, and biomechanicists.

Cooperative project for sharing monitoring data of wildfowls in East Asia

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The migratory waterbirds using the East Asian-Australasian Flyway are amongst the most threatened in the world because of the scale and pace of increasing population and economic development pressures in this region. We urgently need to undertake more research at the flyway level, to derive new knowledge about the magical migrations of waterbirds, to identify key threats and bottlenecks in their annual life cycle, to safeguard sufficient wetlands to ensure their survival, by establishing and improving collaboration and partnerships throughout our flyway, and all around the world. Outbreaks of highly pathogenic avian influenza virus and habitat destruction make matters worse for the avian population in the region. In each country, ornithologists have struggled to understand avian biology for conservation for decades, and they have maintained monitoring systems individually. However, international cooperation has been critically in short in East Asia, making it difficult to promote conservation particularly for migratory birds at the flyway level.

The people sharing the same resources (i.e. migratory bird populations) should recognize the values and discuss the action plans for their conservation and management. This round table will be the best occasion for discussing how to conserve and manage migratory birds in East Asia involving the people from these countries and the people from developed countries which have a long history of international cooperation for conservation of Anatids.

This round table will be the best occasion for discussing how to conserve and manage migratory birds in East Asia involving the people from these countries and the people from developed countries which have a long history of international cooperation for conservation of Anatids.
In this forum, we first introduce our ongoing cooperative project for Anatids in East Asia. This project was set up in order to share monitoring population data of wintering Anatids and to promote collaborative researches, conservation and management of them in East Asia. Secondly, researchers in each country of East Asia explain their research for a few key species of Anatids which need conservation and management in East Asia. They also introduce specific problems which they faced for conservation in each country, and they will suggest rare species with insufficient information needed for conservation. At last, the population status of those key species in the breeding areas is explained, and other key species in the breeding areas are also suggested. We will discuss the direction for conservation and management of Anatids at flyway level in East Asia.
Issues to be discussed include (i) key species and populations which should be conserved, and (ii) the future direction of cooperation in East Asia.

eBird: an increasingly powerful tool for science and conservation

Andrew Farnsworth[1], Hugh Possingham[2]

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The purpose of this round table is to explore eBird (eBird.org), an increasingly powerful tool to further our knowledge of the distribution, movements, and abundance of birds at the global scale. eBird is a real-time, online checklist program that allows participants to submit bird observations for any location around the world and time. It is protocol-driven, providing various options for data gathering including point counts, transects, and area searches. Birders simply enter when, where, and how they went birding, and to complete a checklist of all the birds seen and heard during the outing. All submissions pass through automated data quality filters developed by regional bird experts before they enter the public database. Local experts review unusual records that are flagged by the filters. The observations of each participant join those of others in an international network of eBird users. eBird then shares these observations with a global community of educators, land managers, ornithologists, and conservation biologists.

Since its launch in 2002, eBird has provided rich data sources for basic information on bird abundance and distribution at a variety of spatial and temporal scales. eBird has gathered over 150 million observations, and has evolved from a basic citizen-science project into a much larger collective enterprise. The majority of observations are submitted from United States and Canada, but this is changing quickly since the project went global in 2010. Presently eBird contains data from every country, representing 96% of the world's bird species.

But growth in eBird has not been uniform, with substantial variation in the number and type of observations in space and time. In many areas the distribution of those observations is still sparse, particularly in areas outside North America that have only recently adopted the program. The non-uniform and sparse nature of the data presents major challenges for analysts. Novel modeling techniques are emerging to address these issues, and have already led to highly accurate species distributions and broad scales and high resolutions.

In this discussion we take the opportunity to discuss topics ranging from how birders use eBird tools and data to manage, enter, and display observation data to how eBird directly impacts the conservation of birds and their habitats. Additional topics will include:
- How can eBird be expanded to birding communities that have not yet embraced it?
- How is eBird working with partners around the world to expand the project's reach and impact?
- How do we represent and study occurrence patterns at population levels?
- How do we represent and study migration and other avian movements?
- What can eBird data tell us about subpopulations?
- What can we learn about changes in avian phenology (i.e. arrival/departure dates)?
- How can we purpose scientific findings to application in conservation?
- How do achieve representing spatially explicit full life cycle of birds?

What can we learn from flight calls of migrants?

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The majority of bird migration occurs under the cover of darkness or generally out of sight, and perhaps the only reliable way to determine the species composition of these movements as they occur is to monitor flight calls. Flight calls are species-specific signals, and although their specific functions have yet to be identified, communication among individuals, particularly in situations where birds may experience confusion, seems of primary importance. Increasing numbers of studies are reporting information about flight calls, but there are still many questions remaining. Furthermore, there are still numerous questions about best practices for recording and analyzing flight calls. Answering such questions holds the keys to unlocking flight call monitoring as a powerful tool for the study of nocturnal migration and to applying flight calls in the study of migration biology. List of issues to be discussed:

Some basic questions: Which species call during migration (very brief overview)? What are the acoustical features (frequencies, sound pressure levels, transmission in a noisy environment)? Under what conditions do calls most frequently occur?

Technical background: How to record flight calls: what hardware and software are necessary? What are the most appropriate and commonly used packages? How to analyse flight calls: what are the best summary methods to report results? What measurements are best for classification among species?

Function of flight calls: When and why do migrants call? What do we know and what can we guess on the function of flight calls?

Perspectives: How to approach open questions? What is the value for migration and communication science? What is the value for conservation?

Restoration of tern breeding colonies: state of the art for global conservation efforts

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Populations of colonial seabirds, especially those of terns (Subfamily Sterninae), are frequently limited by the availability of suitable sites for breeding colonies. Overharvest, human disturbance, introduced mammalian predators, and anthropogenic habitat change all contribute to reductions in tern nesting habitat. A majority of the 44 species of terns worldwide are classified by the IUCN as declining or unknown population trend, and 9 are classified as threatened, including the endangered Peruvian Tern (*Sterna lorata*), Black-fronted Tern (*S. albostriata*), and Black-bellied Tern (*S. acuticauda*), and the critically endangered Chinese Crested Tern (*Thalasseus bernsteini*). Efforts to restore breeding colonies of terns have focused on providing suitable nesting habitat on islands and attracting terns to nest at these sites. The overall goal of tern restoration projects is to provide a network of multiple, suitable sites for breeding colonies in order to grow tern breeding populations and conserve these populations over the long-term. Without an extensive network of suitable colony sites, local catastrophic events can have a severe impact on tern populations. A 7-step process for establishing new breeding colonies of terns on islands especially constructed or managed as tern colony sites has been proposed: (1) identify or construct a suitable nesting island, (2) remove all terrestrial mammalian predators, (3) remove dense vegetation, if present, to provide suitable tern nesting substrate, (4) install social attraction (tern decoys and audio playback of tern vocalizations), (5) closely monitor the new tern colony site to identify any impediments to colony formation, (6) remove avian predators if they limit the formation or persistence of the new tern colony, and (7) engage the public in the restoration project through outreach and education. This approach to restoration of tern breeding colonies is currently being used to help rescue the critically endangered Chinese Crested Tern from extinction. In order to best ensure the success of this tern restoration project, as well as others throughout the globe, tern biologists, conservationists, and managers need to share their experiences with tern colony restoration efforts, the factors and environments that have led to success or failure of such projects, and whether their collective experience supports, refutes, or modifies the 7-step process outlined above.

Land bird monitoring in eastern Asia

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Since the late 20th century, ornithologists and birdwatchers in Asia have noticed that many species of land birds are becoming less common than they used to be. Some, such as the Yellow-breasted Bunting *Emberiza aureola*, are now even considered to be globally threatened while they were regarded as common birds only about 20 years ago. The decline of land birds in Asia may be more severe than that of waterbirds but it has never been documented regionally. A common monitoring scheme on land birds in Asia has been suggested for some years, only to be hindered by the potential scale of the project and numbers of participants needed.

In recent years, some Asian countries have shown interest in monitoring migratory land birds. On the other hand, since the late 20th century there has been a rapid growth of civil society participation in birdwatching and conservation in Asia, particularly in China. It seems that for the first time we could have a reasonable coverage of land bird monitoring in the field.

Through governmental cooperation and involvement of the civil societies, we believe we can start a preliminary monitoring scheme and find out more on the status of migratory land birds in Asia, and draft plans for better protection of these species. The only remaining question is which monitoring scheme should be used.

We have proposed a project to develop a pilot scheme in China, Republic of Korea and Japan to test approaches and methodologies for surveying migratory land birds in the breeding season of 2014. Volunteers will test the feasibility of different monitoring schemes in the field and report how they feel about the methodology. Feedback from the field will be presented and discussed at this IOC RTD. We hope ornithologists with experience in bird monitoring (not only confined to Asia) would share their experience and views with us. Recommendations will be summarized and presented to relevant agencies and organizations in the project countries.

Biodiversity and the rare Japanese Murrelet at Kaminoseki: ”The Sea of Miracles” and Kaminoseki nuclear power plant planning

Midori Takashima

Kaminoseki Nature Conservation Association

Kaminoseki, Kumage-gun, Yamaguchi Prefecture, is located near the west end of the Seto Inland Sea and local waters are strongly affected by prevailing westerly winds and strong currents from the Pacific Ocean and the East China Sea. The Seto Inland Sea has only 21.4% of its natural coastal habitats left due to industrial development mainly since the 1960s. The Kaminoseki area, known as “The Sea of Miracles” has escaped most development and still has 75% natural coastal habitats, traditional biodiversity, and small towns long dependent on local ocean environments. Since 1999, the Kaminoseki Nature Conservation Association has conducted biological surveys in this area, in collaboration with the Ecological Society of Japan, Japanese Association of Benthology, the Ornithological Society of Japan, and others. We have found that many rare species survive in the Sea of Miracles, including: Finless Porpoise (*Neophocaena phocaenoides sunameri*; IUCN Vulnerable); Japanese Lancelet (*Branchiostoma belcheri*); a newly described rare gastropod (*Ceratia nagashima*); and Japanese Wood Pigeon (*Columba janthina*; IUCN Near Threatened). In addition, we also found that this area is a year-round habitat for Japanese Murrelets (*Synthliboramphus wumizusume*; IUCN Vulnerable) and the only breeding colony of Streaked Shearwaters (*Calonectris leucomelas*; Japan near endemic) in the Seto Inland Sea.

However, there are plans to build nuclear power plants in this area. We seek to permanently stop construction of a nuclear power plant initiated in 2010 but currently suspended after the 2011 Fukushima disaster. Our primary concerns are: (1) preventing extinction or local extirpation of rare species during reclamation of subtidal environments; and (2) preventing destruction of valuable feeding habitats for rare seabirds and marine mammals due to warm wastewater with radioactive contamination.This round table discussion will be based on the survey results for Japanese Murrelets and Streaked Shearwaters, and it will be a good opportunity to consider future work to survey and protect the biodiversity of Kaminoseki and create an international sanctuary.

Current Status of Avian Morphology

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We will review the current status of avian morphology as a basis for functional and evolutionary studies of extant and fossil birds, based on a multidisciplinary approach to all aspects of avian morphology. We will give special emphasis to the morphology of the Grey Parrot, from various aspects of descriptive and functional morphology, utilizing various techniques.

The objectives are:

- To facilitate exchange of information on new approaches to all aspects of avian morphology, from basic descriptive macro- and micro-morphology, to new imaging techniques, functional morphology, biomechanics, and standard avian veterinary practice in the care of birds, at any organ system level. A new study of the morphology of the Grey Parrot will serve as a "model" for this objective.
- To assess the current status of the associated standardized avian morphological nomenclature in macromorphology (e.g., Nomina Anatomica Avium, 1993), and other anatomical terminology applicable to specific organ systems. Examples here will be based on two recent studies (Zusi & Livezey, 2006; Reiner et al., 2004).
- To assess the integration of avian morphology to understanding the evolution of the avian form, with special reference to enantiornithiform and neo-ornithiform phylogeny and evolution, as well as reptilio-avian evolution. The current and consistent application of the principles of the NAA in these studies will be assessed.

The birds at Fukushima-daiichi NPP and Tohoku Tsunami area, present and future, or good ornithology for and by the people.

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The northeastern area of Japan suffered a large earthquake and tsunami on 11 March 2011. The region was also affected by a Level 7 accident at the Fukushima-daiichi Nuclear Power Plant (F1-NPP). These events led to a large disturbance of the ecosystem in the region which will be addressed from a scientific perspective in Symposium 34 (Møller and Ueda). However, we cannot ignore the fact that there are tens of thousands of refugees from the triple disasters and this change of human activities have consequences for birds and other wildlife in this region as well as the northern Abukuma Highlands and surrounding area. Some ornithologists and conservationists have been studying the ecology and bird communities in the region following the accident and natural disaster. It is recognized that there are serious anthropological and ethical problems relating to both wildlife and human beings. For example, public reports of high contamination levels of barn swallow nests, made of soil, has sometimes caused the destruction of nests and their removal from houses, even in temporally abandoned areas. There is currently insufficient support for basic research in the disaster region that we believe will provide important information for the future humane generations. We shall introduce and discuss these problems from the perspective of Fukushima, Tohoku, and Chernobyl.

Introduction 1: K. Ishida “Nature, society, history and people of Fukushima, and Tohoku district, Japan, and the disasters in 2011.” (10 min.)

Introduction 2: T. Shimada “The Brent Goose wintering at the Tsunami area and radioactive contamination of birds at Izunuma lake district.” (10 min.)

Introduction 3: T. Mousseau "A call for support of very high resolution ecological studies following environmental disasters" (10 min.)

EWA – the Ethno-ornithology World Archive

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Funded by the UK's Arts and Humanities Research Council under the Connected Communities Programme, the Ethno-ornithology World Archive is currently under development as a publically accessible, internet-based archive of all kinds of folk knowledge about birds, hopefully to the benefit of both birds and people. EWA is a collaborative project between the Department of Zoology and School of Anthropology at Oxford University, Birdlife International and Lynx Edicions, and has working agreements with the Endangered Languages Programme at SOAS, London University, and developing partnerships elsewhere. EWA's Mission Statement is reproduced below. In this round-table discussion, and with other members of the EWA development team, we will present the concept of EWA, discuss its operation and development, and invite a full dialogue on the project. The RTD will also link to the IOC symposium (S39) in ethno-ornithology and conservation. We hope to have a working demonstration of EWA by the

EWA Mission Statement: Sharing folk-knowledge about birds to benefit nature and culture

EWA promotes the engagement of all people in bird conservation by sharing their knowledge and understanding of birds, and helping to safeguard cultural identities. EWA is founded on the recognition that humans everywhere are inspired culturally, practically and spiritually by birds. We collect culturally relevant knowledge of birds, including local and traditional ecological knowledge, and share this globally via the internet and other media. We work with indigenous people, local communities, conservationists and academics, and their institutions, to promote bird conservation through the recognition, affirmation and celebration of traditional and contemporary knowledge, and the environmental stewardship ethic inherent within diverse cultural traditions.

East Asia-Australasian Flyway shorebird research and conservation needs

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Migratory shorebirds currently face multiple threats throughout the East Asia-Australasia Flyway. Currently, 48% of shorebirds are globally declining, most likely due to habitat loss and degradation of stopover sites. The primary objective of this session is to bring together shorebird researchers from throughout the East Asia-Australasian Flyway to discuss existing research projects and identify priorities to inform effective conservation strategies and actions. It is important that conservation efforts on shorebirds and their habitat are implemented using the most accurate biological and ecological information. Some proposed knowledge gaps and research priorities are:

1. What and how big are the consequences of climate change and habitat loss for different species;
2. Given the high human population in this flyway and the strong interactions between humans and shorebirds, how do human activities (e.g. shell fishing) affect shorebirds (e.g. resource over-exploitation, habitat destruction)?, are them positive and negative?.
3. To what extent do shorebirds use complementary and/or alternative artificial or natural habitats?. E.g. saltworks, artificial roosts, rice fields.
4. What do we need to learn about the ecology of different shorebird species in order to influence management actions?

The discussion will focus on regional conservation priorities and strategies and ways for collaborating on current and future projects.

Research Coordination Committee Abstracts

Meeting of the Research Coordination Committee on Parrots (RCCP)

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The Parrot Researcher Group (PRG) was created during the 25th IOC in Campos do Jordão (Brazil) in 2010, as a network of researchers working on Psittaciformes in order to establish, promote, and coordinate research projects on this globally endangered avian order. Since then, over 300 researchers from all continents have joined the network. In order to take into account particular regional needs, the group was organised in five regions. The members of each region elected two to three coordinators who coordinate joint regional projects together with an elected Secretary who coordinates global projects. Additionaly, the “Grupo de Interés Temático de Psitácidos” (Sociedad Mesoamericana para la Biología y la Conservación), an independent institution, closely cooperates with the PRG. Joining the PRG is free. The group organises discussions, exchange of advice, and joint

projects through an e-group. In 2011, a virtual library was created and made available to all members. The librarian monthly updates the reference list and uploads recently published works.

In 2013, the PRG was established as the Research Coordination Committee on Parrots (RCCP) of the International Ornithologist's Union (IOU). The central goal of the RCCP is to build on the achievements of the PRG and to expand the reach and effectiveness of its programs under the umbrella of the IOU. Specifically, the RCCP is focusing its effort on: a) Africa: a review of the knowledge gaps and research priorities for the conservation of parrots of Africa and Madagascar, and the production of a special issue of Ostrich: Journal of African Ornithology; b) Australasia: a review paper analysing the factors endangering birds in the region, focusing on evaluating the consequences of climate change on habitat loss and invasive species; c) Caribe: several projects focusing in endangered wild population management, rehabilitation and captive releases, monitoring and placement of artificial nests, and population surveys; e) Continental Neotropics and the "Grupo de Interés Temático de Psitácidos": a compilation of species accounts for the upcoming review of the knowledge gaps and research priorities for the conservation of parrots in the region; f) Urban Parrot Section: a yearly World Parrot Count, aimed to investigate the establishment, diversity, and population dynamics of introduced parrot species worldwide; g) Secretary office: a study of the presence of pathogens and parasites in wild and introduced Psittaciformes globally, and a study the influence of El Niño Southern Oscillation on the breeding biology of parrots worldwide.

During the RCCP meeting at the 26th IOC in Tokyo, we will discuss: (1) past successes and future plans of the RCCP; (2) research priorities for the next four years; (3) regional conservation priorities and strategies; (4) sources of research funding and ways for organising joint applications; (5) elections of regional coordinators and the Secretary for the period of 2014–2018 (until the 27th IOC in 2018); (6) ways of promoting the participation in the RCCP of colleagues from underrepresented regions such us South and South-east Asia, China, the Indian sub-continent, and the Middle East; (7) the building a web page (within the IOU one) which would serve as an enhanced platform for the group's e-library, a place for the advertisement and coordination of funding opportunities, and a forum for the establishment of contacts with colleagues, students and volunteers worldwide who would like to join specific projects.

17th Scheduled Meeting of the Research Coordination Committee on Avian Nomenclature (formerly Standing Committee on Ornithological Nomenclature)

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The newly-named Research Coordination Committee on Avian Nomenclature (formerly Standing Committee on Ornithological Nomenclature) will hold its 17th scheduled meeting at the 26th International Ornithological Congress. This long-standing committee of the IOU, which began life at 10th International Ornithological Congress in Uppsala in 1950, will, just before this meeting, change chairs from Richard Schodde (Australia) to Frank D. Steinheimer (Germany. As is customary, the meeting will be held as a round-table discussion and open to all interested members of the Congress.

Business for the meeting will review results from the Committee's work since the 25th International Ornithological Congress and consider the focus and directions of the Committee's work into the next decade. *Inter alia*, it will (1) canvass submissions to the International Commission on Zoological Nomenclature to improve the working of the next edition of the International Code of Zoological Nomenclature and (2) consider coordination on nomenclatural matters with journals dealing with avian taxonomy and with the IOU group responsible for the development of a global list of English names for the bird species of the world.

Research Coordination Committee on Bird Marking Workshop

Charles M. Francis

Canadian Wildlife Service, Environment Canada, Ottawa, Canada

The Research Coordination Committee on Bird Marking previously known as the IOC Standing Committee on Bird Ringing will host a one day workshop to discuss current issues related to marking birds and the management of banding/ringing schemes and associated data. Representatives of ringing/banding scheme and others interested in these issues are encouraged to participate. Focus will be the finalization of a *Programs Standards Guidance Document* intended to assist developing and established marking schemes work towards high ethical, scientific and data management standard practices and the promotion of bird conservation world-wide. The workshop also provides a forum to promote coordination, cooperation and networking, among marking schemes and networks, facilitate communication of ideas, approaches and best practices among schemes, promote use of new technologies and approaches for project design, field data collection, data management and analysis; and promote international standards for bird marking.

Bird ringing/banding remains a key tool for research, monitoring and conservation of birds worldwide while new bird-marking technologies are being used with greater frequency (i.e. satellite transmitters, GPS, geolocators etc.). Global issues such as climate change, avian conservation and emergent disease issues require a coordinated effort to understand bird movement on a global scale. Communication and coordination among schemes will promote sharing of tools, data, best practices, data management systems, and will allow data gathered to achieve maximum conservation value.

The Committee mission is to enhance international collaboration and standardization on bird marking and associated data management issues of mutual concern by promoting communication, coordination and sharing of data, tools and best practices among bird marking schemes to achieve maximum conservation value while incorporating high ethical and scientific standards.

Draft Agenda:

1. Updates from regional networks
2. International coordination of auxiliary markers
3. Data management of non-standard markers including a presentation by Movebank
4. Program Standards Development
5. Review of Terms of Reference
6. Election of Co-Chairs

For more information or to register your intent to attend the meeting or your interest in staying connected to this committee, please email Lesley.Howes@ec.gc.ca.