



Application of the LoCoH method in the analysis of roe deer habitat use

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Introduction

Roe deer is one of the most important big game species for wildlife management in Hungary, occurring throughout the whole country (Csányi et al., 2003; Csányi et al., 2006a). To widen our knowledge about the habitat use and behaviour of European roe deer, the Institute for Wildlife Conservation (Szent István University) has been conducting a research programme in Jász-Nagykun-Szolnok county, Hungary since 2001 (Csányi et al., 2003; Csányi et al., 2006a,b). Getz and Wilmsers (2004) described a new method for home range estimation: the local nearest-neighbour convex-hull (LoCoH). The aim of our study is to identify the extent of the annual home ranges of roe deer living in a floodplain forest with this new method LoCoH.



Material and Method

Roe deer were captured and radio-tracked on the area of Hofi Géza Hunting Club (game management unit). The size of the area is 5238 ha, with mostly agricultural fields (73.75%). Forest cover is only 6.56%. Capturing and radio-tagging of roe deer took place on 17-18 January 2007 in the floodplain forest. In this paper we used the data of 6 roe deer (Table 1) which were supplied with GPS-GSM collars (GPS PRO Light-1). The collars recorded localization points every three hours, which were stored on a SIM-card, and were sent in SMS format to the ground receiver through the GSM system. To visualize the localization data, and to calculate and represent the home ranges we used the ESRI ArcView GIS (Version 3.1) software. We determined the home ranges of individuals with the method of fixed-k LoCoH. The fixed-k LoCoH takes every localisation point and locates its "k" nearest neighbours. Every hull successively is merged from small to large to form isopleths (contour lines). In our research we used 50% (core area) and 95% (home range) (Morse et al., 2009). The k value was selected with the "minimum spurious hole covering" (MSHC) rule (Getz and Wilmsers, 2004).

Collar code	Sex of individual	Age at tagging	Number of localisation points (2007)
S1	female	2 years	2509
SG1	female	1 year	2521
B1	male	3 years	2520
B2	male	3 years	2521
S2	female	2 years	2504
S3	female	2 years	2488

Table 1. Data of studied roe deer and the number of their localizations in 2007.

Collar code/ Value of k	Size of home range (100%, ha)					
	S1	SG1	B1	B2	S2	S3
10	302.31	272.84	243.09	492.76	249.13	116.30
11	305.36	310.33	249.23	520.68	262.04	175.75
12	337.76	317.57	254.52	527.40	268.46	186.85
13	343.18	324.58	269.70	529.08	281.09	196.55
14	345.69	331.46	274.49	531.70	287.02	200.55
15	347.69	335.74	276.15	534.56	290.56	217.36
16	350.25	337.14	277.75	536.71	294.43	224.60
17	354.40	340.57	282.53	538.21	295.53	227.45
18	358.43	341.71	282.89	539.35	298.63	228.71
19	358.96	344.22	283.34	553.25	300.91	231.86
20	360.93	346.03	286.46	604.72	304.32	232.39
21	363.03	346.55	287.18	606.02	306.01	233.60
22	366.87	350.47	287.26	608.08	308.72	233.86
23	367.58	351.02	287.52	609.86	309.81	236.67
24	370.53	351.31	287.73	618.18	311.06	237.11
25	373.16	352.33	287.75	669.08	312.69	237.53
26	375.23	352.68	288.83	669.23	316.18	237.99
27	375.37	355.70	290.12	670.57	318.59	238.24
28	376.25	356.16	290.16	671.25	319.25	239.25
29	376.31	356.48	290.18	673.05	320.37	239.71
30	376.38	356.99	290.20	673.05	321.79	239.11

Table 2. The sizes of the annual home ranges were estimated with different k values with the method LoCoH.

Results

The home ranges at low k value contain a number of holes that disappear with the increasing value of k. Differences between real and spurious holes in LoCoH coverings of data sets should be evident in plots of the number of holes in a particular LoCoH covering against the value of k: the covering of spurious holes should correspond to a levelling off of the resulting graph (Getz and Wilmsers, 2004). The right k is the last value in the sequence before the sudden value increase (Internet 1). So we performed the calculation with k between 10 and 30 and we select the appropriate k from the graph. The "right" of final k is differed between the individuals, it varies from 16 to 21 (Table 2).

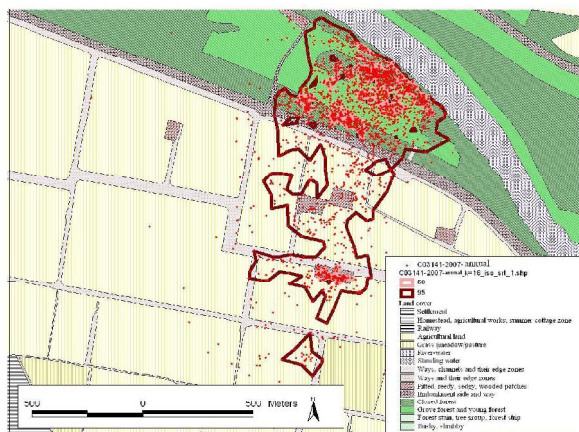


Figure 1. The annual home range (95% isopleth, red) and core area (50% isopleth, pink) of the B1 roe deer.

The size of the annual LoCoH home ranges varied between 38-82 hectares (Table 3). The size of the core areas (50% isopleths) varied between 5-8.2 hectares. There is a sample map to demonstrate the fixed-k LoCoH home range and core area (Figure 1).

Collar code	Value of k	Home range isopleths	
		95% (ha)	50% (ha)
S1	19	67.30	5.02
SG1	21	76.37	6.39
B1	16	54.02	6.01
B2	18	81.91	6.95
S2	17	72.86	8.23
S3	18	37.93	5.70

Table 3. The sizes of each studied roe deer annual home ranges estimated with the LoCoH method.



Conclusions

The data and maps are showing that the MSHC rule seems appropriate to select the k value as proposed by (Getz and Wilmsers, 2004; Morse et al., 2009), and can be used in further research. Based on our results the annual home ranges did not exceed 82 hectares, and the core areas did not attain nine hectares (!) in the case of the 6 individuals. This also means that the most important areas used by the tagged roe deer are merely some ten hectares. We notice that there were considerable differences in the home range sizes between individuals. It also can be seen that the localisation points have a number of centres (Figure 1). The LoCoH method is a good estimate if the localisation points are clustered around one or more centres of activity, because in such cases the minimum convex polygon will overestimate the area of the home ranges (Ryan, 2011). Based on these results we suppose that this method may be better to estimate the home ranges of roe deer, but it needs more examination. We will compare the results of home range sizes to our earlier results of MCP and KHR home ranges methods.

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