A radio-tracking study of home-range of the Korean raccoon dog (*Nyctereutes procyonoides koreensis*)

원격무선추적을 통한 한국너구리 (*Nyctereutes procyonoides koreensis*)의 행동권 연구

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ABSTRACT

The main aim of this study is to estimate home-range of the Korean raccoon dog (*Nyctereutes procyonoides koreensis*) at a rural area of Gurye in the southern part of South Korea. A radio-tracking was regularly carried out on 4 raccoon dogs for 2 days every 2 months in 2006. During the days, the radio-tracking was usually conducted every 1 - 3 hours through day-time to night-time. Among the 4 raccoon dogs, 2 individuals (a permanent breeding pair) could be extensively tracked for 5 to 7 months, including all 4 seasons. The result showed that total home-range sizes of the pair were 0.732 km^2 and 0.373 km^2 for 100% minimum convex polygons (MCP) and 100% kernel (K), respectively, during the monitoring period. Mean home-range sizes of the 2 raccoon dogs were 0.035 - 0.688 km^2 and 0.012 - 0.341 km^2 for MCP and K, respectively. Yearly home-range sizes of the male and female were similar to each other. However, home-range sizes of the raccoon dogs between day-time and night-time were quite different. Furthermore, the raccoon dogs showed a much broader home-range size in spring, summer and fall than in winter season. Finally, the pair had a broad

overlapping home-range (about 70 - 95%), and 1 core area and 4 different feeding areas.

INTRODUCTION

The Korean raccoon dog (*Nyctereutes procyonoides koreensis*) is one of the most abundant mammals in South Korea (Won *et al*. 2004). About 35% of the total mammal casualty cases treated in wildlife rescue centers is from this species, which is the highest among mammals in South Korea (Kim 2006). In addition, Choi and Park (2006b) reported that the incidence of road-kill in this species is second highest among mammals in Jirisan area. On the other hand, it has been known as a major vector, either carrier or transmitter, for sylvatic rabies in regions near the Korean demilitarized zone, DMZ (Hyun *et al*. 2005, Kim *et al*. 2006, So *et al*. 2002a, b).

In a research by Choi and Park (2006b), the only known report on home-range size of raccoon dogs in South Korea up to now, radio-tracking of 9 individuals with 1 or 2 bearings was conducted every day. The report showed that raccoon dogs in Gurye area had a very small home-range size, usually below 1 km^2. However, the number of bearings every day was too small to ascertain the mean home-range of the raccoon dogs. To supplement the previous study by Choi and Park (2006b), we conducted another radio-tracking of 4 raccoon dogs with 46 - 64 bearings through spring to winter. The detailed aims of the present study were to estimate home-range sizes (total, mean, sexual, daily and seasonal), overlap, and habitat utilization of the Korean raccoon dog.

MATERIALS AND METHODS

Study site

The study site (about 4 x 5 km^2) is at a rural area of Gurye, Chonnam province, South Korea (Fig. 1). All raccoon dogs were trapped from open and bush habitats near Seosi-stream where they prefer to inhabit.

Radio-tracking

Four raccoon dogs were mainly captured using traps (e.g., Havahart live trap and Soft catch spring trap) in 3 areas between October 2004 and July 2006 (totally 22 months). After capturing, we sexed, weighted, banded a radio-collar (Model ATX150AA, Wildsystem, Rep. Korea), and released as soon as possible (Table 1).

Home-range Analysis

ArcGIS9 (ESRI Inc., U.S.A.) was used for editing topographic maps and creating thematic maps. All bearing data collected were analyzed to estimate their home-ranges using the Home Range Tools (HRT) for ArcGIS9.x.

RESULTS

Home-range

Total yearly home-range sizes of the pair of raccoon dogs were 0.732 for 100% minimum convex polygons (MCP) method, and 0.373 for 100% kernel (K) method (Fig. 2). There was no significant difference in the total yearly home-range sizes between the MCP and K (ANOVA, $F_{(1, 6)} = 1.522$, $p = 0.263$; Data not shown). The mean size of yearly home-range of the 2 raccoon dogs was 0.688 km^2 for 100% MCP method (n = 2; Table 2). For K method, the mean size of yearly home-range was 0.341 km^2 (n = 2; Table 2). There was no sex difference in home-range sizes for 100% MCP (0.685 and

0.691 km^2) for male and female, respectively (n = 1 for each; Table 2). In K analysis, we could not also find any noticeable sex difference between 2 sexes for 100% K (0.326 and 0.355 km^2) for male and female, respectively (n = 1 for each; Table 2). There was a large difference of home-range sizes between day-time and night-time in both methods (n = 2 for each; Table 2). In addition, we could observe a clear difference in seasonal home-range sizes for all analyses (Table 2).

Habitat overlap

The raccoon dog pair showed a very large home-range overlap during the radio-tracking period. The proportion of overlapping area ranged approximately from 70 to 95% (90, 85, 95 and 70% overlaps for 100, 95, 80, 50% MCP, respectively; Fig. 3).

Habitat utilization

The habitat utilization pattern of the raccoon dogs was shown in Fig. 4. They have 1 core area and 4 different feeding sites in their own home-ranges. Among the feeding sites, two were very close to the core area but the others were relatively far from the core area. The former sites were used more frequently than the latter sites (the number of fixes of the former > that of the latter).

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Figures

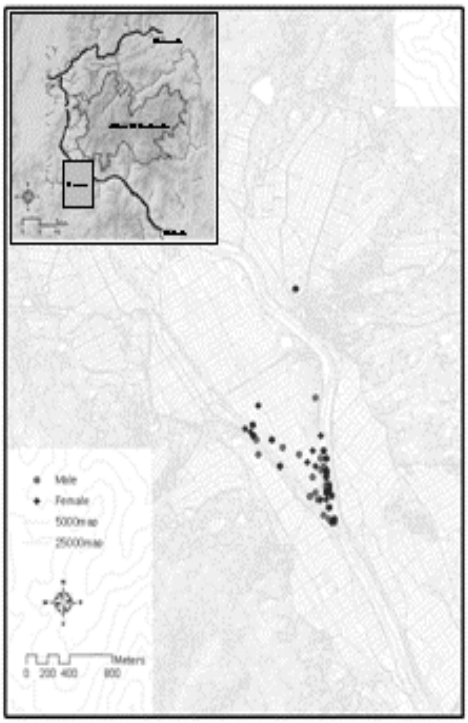

Figure 1. Maps of study site, Gurye, Chonnam province in the southern part of Korea (Large: topographic map, 1: 5,000; Small:

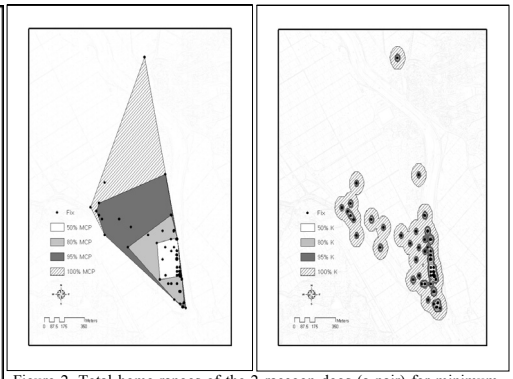

Figure 2. Total home-ranges of the 2 raccoon dogs (a pair) for minimum convex polygons (MCP) and kernel (K) methods (Left: home-ranges for 100, 95, 80 and 50% MCP; Right: home-ranges for 100, 95, 80 and 50%

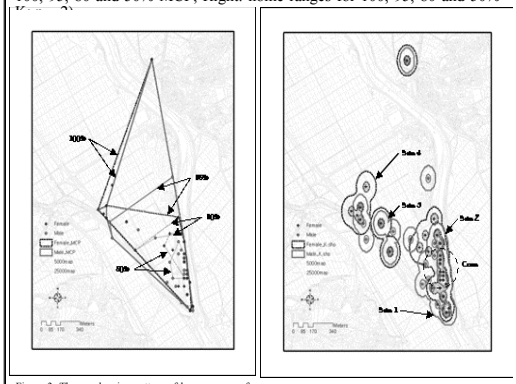

Figure 3. The overlapping pattern of home-ranges of the 2 raccoon dogs (a pair) for 100, 95, 80 and 50% MCP estimates) during the radio-tracking period.

Figure 4. Habitat utilization (100, 95, 80 and 50% Kernel estimates) of the raccoon dogs (n = 2) during the radio-tracking period.

Tables

Individual	Sex	Age	Weight (kg)	Period (months)	Period (days)	No. collected coordinates	Radio-tracking
A	M	Adult	5.6	7	11	64	available during the whole radio-tracking period
B	F	Adult	5.8	5	8	46	available between June and October 2006
C	F	Adult	6.0	N/A (2)	N/A (4)	N/A (6)	killed by disease unidentified
D	F	Yearling*	3.0	N/A (2)	N/A (3)	N/A (0)	killed by disease unidentified
Mean			**5.1**	**6**	**9.5**	**55**	

Table 1. Information of the raccoon dogs (n = 4) captured and radio-tracked in this study. M and F: male and female, respectively. *: yearling a little bit younger than 1 year.

Home-range (km^2)	Individual and Sex			Time			Season				
	A (Male) (n = 1)	B (Female) (n = 1)	Mean (n = 2)	Day (n =2)	Night (n =2)	Mean (n =4)	Spring (n = 2)	Summer (n = 2)	Fall (n = 2)	Winter (n = 1)	Mean (n = 7)
MCP											
100%	0.685	**0.691**	0.688 ± 0.004	0.010 ± 0.001	**0.684 ± 0.009**	0.347 ± 0.389	0.181 ± 0.066	**0.557 ± 0.048**	0.185 ± 0.001	0.002	0.264 ± 0.213
95%	**0.364**	0.275	0.319 ± 0.063	0.010 ± 0.001	**0.351 ± 0.029**	0.180 ± 0.198	0.164 ± 0.071	**0.557 ± 0.048**	0.185 ± 0.001	0.002	0.259 ± 0.216
80%	0.142	**0.159**	0.151 ± 0.012	0.005 ± 0.001	**0.150 ± 0.014**	0.078 ± 0.084	0.033 ± 0.010	**0.207 ± 0.080**	0.012 ± 0.002	0.001	0.072 ± 0.099
50%	0.028	**0.041**	0.035 ± 0.009	0.002 ± 0.001	**0.047 ± 0.010**	0.024 ± 0.027	0.013 ± 0.009	**0.036 ± 0.028**	0.007 ± 0.004	0.001	0.016 ± 0.019
K											
100%	0.326	**0.355**	0.341 ± 0.021	0.012 ± 0.001	**0.524 ± 0.098**	0.268 ± 0.301	0.203 ± 0.046	**0.411 ± 0.072**	0.053 ± 0.005	0.001	0.191 ± 0.173
95%	0.067	**0.084**	0.076 ± 0.012	0.001 ± 0.001	**0.092 ± 0.016**	0.047 ± 0.053	0.025 ± 0.005	**0.088 ± 0.003**	0.035 ± 0.002	0.001	0.043 ± 0.033
80%	0.032	**0.044**	0.038 ± 0.009	0.001 ± 0.001	**0.047 ± 0.011**	0.024 ± 0.027	0.013 ± 0.003	**0.048 ± 0.002**	0.019 ± 0.001	0.001	0.023 ± 0.018
50%	0.010	**0.014**	0.012 ± 0.003	0.001 ± 0.001	**0.015 ± 0.003**	0.008 ± 0.008	0.004 ± 0.001	**0.019 ± 0.001**	0.007 ± 0.001	0.001	0.009 ± 0.008

Table 2. Mean sizes of individual, sexual, daily and seasonal home-range (km^2, mean ± SD) of the 2 raccoon dogs determined by a radio-tracking in the study. MCP (100 - 50%): fixed minimum convex polygons; K (100 - 50%): fixed kernel method. The bold numbers mean the highest values.