HOME RANGES AND MIGRATIONS OF THE KOSTROMA FARM MOOSE

Ekaterina M. Bogomolova[1], Yuriy A. Kurochkin[1], and Alexander N. Minaev[2]

[1]Anokhin Research Institute of Normal Physiology, Russian Academy of Medical Science, Moscow, Russia; [2]Institute of Evolutionary Animal Morphology and Ecology, Russian Academy of Science, 117071, Moscow, Russia

ABSTRACT: The published literature about moose home ranges is rather contradictory. We studied summer (April–September) home ranges, degree of their variability, and features of moose migrations on the Kostroma moose farm during 1977–1989. The home range of a free-living, hand-reared female moose encompassed an aggregated area of 57 km^2 over 8 years, with the yearly home range varying from 15 to 44 km^2. Home ranges of her 4 female offspring proved to be about the same as their natal ranges. We also detected short-term (1–3 day) migrations of cows during the breeding season.

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The published literature about moose home ranges is rather inconsistent. This fact may be explained by the natural variability of moose home ranges dependent upon specific, local environments, and by different estimation methods used by investigators. The results of our work provide evidence that at least some hand-reared and wild female moose in the region of the Kostroma moose farm are highly sedentary. Their home ranges are rather stable. Home ranges of young females in the first years of independent life are almost the same as their natal areas. Besides well-known spring migrations of yearlings, we detected short-term autumn migrations of cows beyond the usual home range with a rather quick return rate of 1–3 days. We assume that the most reliable results may be obtained by long-term studies of radiotagged animals (Cederlund and Okarma 1988, Bogomolova et al. 1989).

STUDY AREA

We used the Kostroma moose farm for our study area. Using this facility made locating radiocollared moose convenient, and we were able to study moose in their forest habitats.

METHODS

We studied summer (April–September) home ranges, degree of their variability, and features of moose migrations on the Kostroma moose farm during 1977–1989. In this work we used the radio-tracking system "Los-2," (designed by A. N. Minaev), and radio-communication among biologists. We repeatedly located free-ranging, radiotagged animals with a portable receiver and observed these moose in their forest habitats. The coordinates of their locations were recorded with accuracy up to 50 m. Each year we studied a free-ranging, hand-reared moose cow, her 4 female offspring (which had their own home ranges) at different ages up to 4 years of age, 5–15 milk moose, and 10–15 yearlings, and other young moose.

We used 2 methods to estimate the home range area: (1) we considered the home range to be a convex polygon contain-

ing all the points where an animal was located (corresponding area is identified as S1); and (2) we divided the entire investigated territory into squares 250 x 250 m and summed the areas of those squares (S2) in which an animal was found 1 or more times.

The important methodical point is the reliability of results of such investigations. We believe it is better to give not only the estimation of the home range area itself but also the number of animal locations and the number of observation days (if an animal could be observed more than once daily).

RESULTS AND DISCUSSION

The home range of the free-ranging cow, Lastochka, and her calves encompassed approximately 57 km^2 over 8 years, with the yearly home range area varying from 15 to 44 km^2 (Table 1). We also studied home ranges of Lastochka's 4 radiotagged wild female offspring (Table 2). Their home range areas were approximately as large as those of Lastochka in the first years of her free life. Unfortunately, the study of these cows was relatively short; at least 2 of them were killed by

Table 1. Summer home range areas of the moose-cow Lastochka and her offspring.

Year	S1 (km^2)	S2 (km^2)	Number of Observations	Number of Days Located
1982 calves	16.4	5.38	248	86
1983 calves	17.6	6.13	214	70
1984 yearlings	17.0	2.94	90	49
1985 calves	43.9	6.13	279	106
1986 yearlings	34.2	8.25	241	122
1987 calves	25.1	4.94	172	135
1988 calves	15.5	1.81	40	36
1989 yearlings	16.4	1.19	20	17

Table 2. Summer home range areas of the wild moose cows born to a hand-reared moose cow Lastochka.

Name	Year of Birth	Period of Observation	Number of Days Located	Home Range Area S1 (km^2)	S2 (km^2)
Devochka	1983	1985	64	49	17.6
Malenkaja	1985	1987	90	85	12.3
Malenkaja	1985	1988	34	28	13.8
Malenkaja	1985	1989	17	17	9.3
Malenkaja	1985	1987–89	141	130	21.2
Bolshaja	1985	1987	96	94	14.7
Lusa	1987	1988	31	28	10.8
Lusa	1987	1989	14	12	8.3
Lusa	1987	1988-89	45	40	13.8

poachers, 1 was lost because of antenna breakage, and 1 more disappeared under unknown circumstances. We found that during the entire period of observation Lastochka's female offspring hardly went out of the natal area boundary (Table 3).

In spite of her attachment to a particular territory, Lastochka, having been transported some kilometers away from her home range in winter to a wood-cutting area with much food, did not return home in spring and instead stayed in the new location. There are 2 possible explanations for this fact. The first was that she did not want to return and formed a new home range. The other explanation was that Lastochka might lose her way to her habitual home range. However, the next year after having been transported in winter to the same wood-cutting area, Lastochka did find her way "home." On her first attempt at finding her home range, Lastochka walked the wrong direction and returned to a woodcut, but the next day we located her already within the bounds of her usual home range.

According to many experienced moose farmers, animals of various ages often leave their home ranges and do not return. The most noticeable are the spring migrations of yearlings and young milk-moose cows. They have been found many kilometers away from the farm. Some moose, especially young males, leave the farm in autumn.

Biologists still do not fully understand the reasons for these migrations. Several cases of migrations may be explained by individual characteristics of some moose that have weak attachments to their home ranges. It is more probable that, having gone occasionally past the limits of its' home range and venturing further, an animal must spend more and more energy to return. The "cost of return" may prove to be too high, and the animal will stay in its newly chosen location. There may be various reasons for "border crossing," such as predators, interactions among males in autumn, or an abundance of gnats in spring.

During the breeding season, some young males left the farm. Twice we observed yearling bulls leaving their mother, mostly during breeding time, while their sisters stayed with their mother until the next spring. Autumn migrations of moose cows may be related to quick displacements of moose cows beyond their usual home ranges during the breeding season. We observed such displacements many times. Without being chased by a bull, very excited estral cows made sudden 10–15 km trips (in autumn they generally walk no more than 2 km per day). As a rule, during these trips the cows returned in 1–3 days.

The results of our work provide evidence that at least some hand-reared and wild female moose in the region of the Kostroma moose farm are highly sedentary. Their home ranges are rather stable.

Table 3. Comparison of home range and natal areas of the wild Lastochka's female offspring.

Name	Home Range Area (km^2)	Natal Area Overlap with Lastochka S1 (km^2)	Home Range Area Outside Bounds of the Natal Area (km^2)	% of Natal Area
Devochka	17.6	21.1	3.5	1.7
Malenkaja	21.2	44.5	1.9	4.3
Bolshaj	14.7	44.5	0.4	0.9
Lusa	13.8	21.2	1.9	9.0

Home ranges of young females in the first years of independent life are almost the same as their natal areas. Besides well-known spring migrations of yearlings, we detected short-term autumn migrations of cows beyond the usual home range with the rather quick return rate of 1–3 days.

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