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Activity patterns and home ranges of the American mink *Mustela vison* in the Finnish outer archipelago

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Activity patterns and size of home ranges were studied in the American mink (*Mustela vison*) by the means of radio-tracking in a sea archipelago in southern Finland. Activity pattern was analyzed in 7 tracking periods of individual minks in different times of the year: 1 was nocturnal, 2 were diurnal and 4 were neutral. Total activity was negatively correlated with night length. Home range size varied largely according to season and sex, for instance. The paper discusses some details about the use of home ranges consisting of several islands and skerries.

1. Introduction

Activity patterns and home ranges of the American mink have been studied by several authors in river or seaside habitats (Gerell 1969, 1970, Birks & Linn 1982, Dunstone & Birks 1983). In the 1980s I made an attempt to study population and food ecology of the mink in the Tvärminne archipelago. In this note I report about the activity patterns and home ranges of the mink in a sea archipelago gathered by radio-tracking in 1984–87. The study on the food habits of the mink has been published elsewhere (Niemimaa & Pokki 1990).

1. Material and methods

The study area is situated on the coast of SW Finland (Fig. 1). It is a typical outer archipelago with rather barren rocky islands. The largest islands are predominated by conifers but the skerries are only partly covered by a complex mosaic of junipers and/or miniature meadows. The shores are often covered by heaps of bolders offering exellent shelter for mink. There is no tide but the irregular sea level changes may have a direct influence on mink especially during the ice-cover period, which in mid 1980s lasted from December or January to April. There are several seabird colonies and three species of small mammals are regularly found in the area (for a more detailed description see Pokki 1981, Niemimaa & Pokki 1990).

The minks were fitted with collar transmitters. I used a 230 MHz one-channel system (AML, Finland) until January 1986. However, because of a need to track simultaneously several individuals, a 27 MHz multi-channel system (Televilt, Sweden) was introduced. The expected battery life was 4 months for males and 2 for females. After the attachment of the transmitter the animal was released and the tracking started 24 hours later. Minks were tracked on a shift basis by 2 to 3 persons day and night. Altogether 19 minks were radio-tracked during 25 periods in 1984–87. Because of technical failures and/or lost radio-collars only 7 tracking periods were considered long enough for activity pattern study and 6 for home range study. Activity was

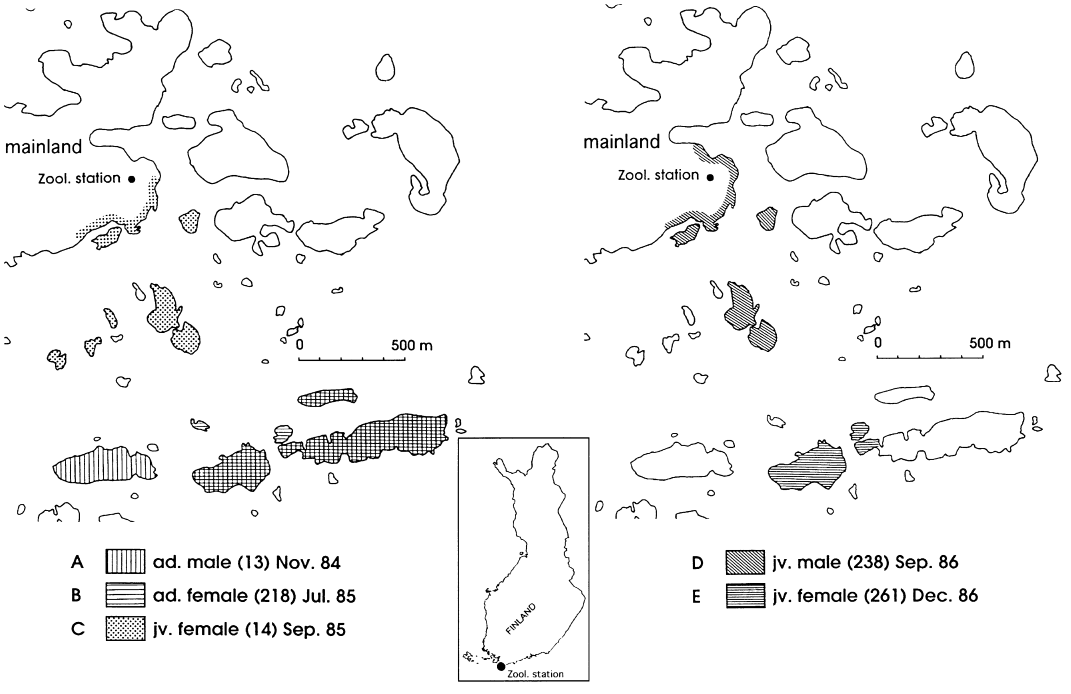

Fig. 1. Home ranges of five American minks as revealed by radio tracking.

determined as the time of varying signal strength. This includes both in- and outside den activity because sometimes it was difficult to say if the animal had left the den or not. Location and activity were observed uninterruptedly.

Home ranges were measured in two ways. The usual way is to measure the length of the shore-line. In archipelago, however, the home ranges were more two-dimensional as the minks regularly visited several islands and the inner parts of the islands, too. This home range area of land was calculated simply by using the sizes of the islands used by an animal. In two cases (Fig. 1C and D) part of the mainland was included. Here I used an observed average of 15 m for the width of home range.

In the following a short account is given of those radio-tracking periods, from which a reasonable data is available.

Adult male (13), November 7–14, 1984. The tracking period lasted for seven days but the total tracking time was only about 60 hrs. This is why I don't present any activity diagram. The total activity is however used in Fig. 3. The home range covered four islands (Fig. 1A).

Adult female (218), August 27–7, 1985 and December 12–29, 1986. She was captured in July and two cubs were occasionally seen with her. Her activity pattern was nocturnal. Her home range covered 5 islands (Fig. 1B). She was radio-tracked for the second time over one year later and now the home range covered only the largest island of the first period. The last observation of her was in August 1987 on the same island.

Juvenile female (14), September 23–October 5, 1985. The home range covered both islands and mainland (Fig. 1C). On three occasions I managed to record the route of swimming and time needed for it. The calculated velocities were 0.65, 0.79 and 0.84 m/s. She made "a record" by swimming about 1100 m in several sections in less than four hours. She was mainly diurnal.

Juvenile male (208), December 1–6, 1985 and January 20–25, 1986. This individual was captured on November 30. His activity pattern was diurnal and he spent most of the time under a boathouse. On December 5 he moved along the coast rapidly some 3 kms to a new area where he stayed till December 7, when the transmitter was removed. He was radio-tracked again in January when his behaviour was quite the same. He stayed rather inactive at the Zoological station (see Fig. 1), but then suddenly moved to a new area and was lost. However, he was caught again without the transmitter and stayed at the station till April 1986.

Juvenile male (236), August 23–28, 1986. He was roaming over a large area of 56.4 ha. Extensive movements suggest that he was looking for a place to settle down.

Juvenile male (238), September 15–26, 1986 and December 11, 1986 –January 7, 1987. His home range covered

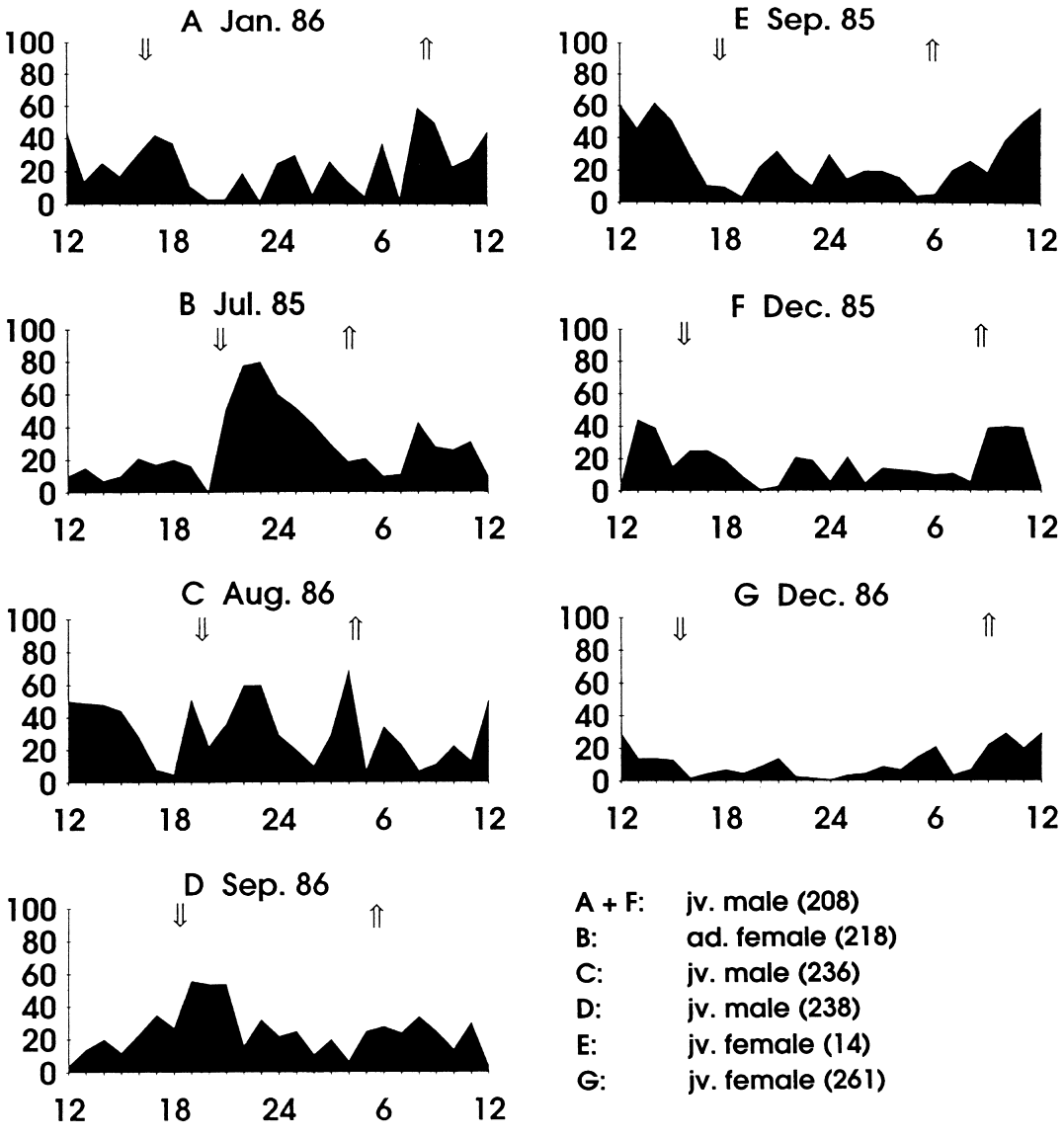

Fig. 2. Diel activity pattern of American minks in 1985–86. Activity is expressed as per cent per one-hour period. Arrows indicate the times of sunrise and sunset.

both mainland and islands (Fig.1D) and included a juvenile female's home range. He was tracked for the second time in December 1986 – January 1987. The home range covered now the same islands as in September but not mainland, where he however was trapped without the transmitter in January.

Juvenile female (261), December 13–19, 1986. Her home range overlapped with that of the female 218 (Fig. 1E). Her total activity was the lowest recorded. This may have been due to the harsh weather conditions. The tracking period was stopped for the time of isolation. The transmitter was found later on stuck to tree roots in a den. The last record of her was in March 1987 on the same island.

2. Activity patterns

Mink is commonly regarded as a nocturnal species. This kind of activity pattern was not however obvious in this study (Fig 2.). The percent-

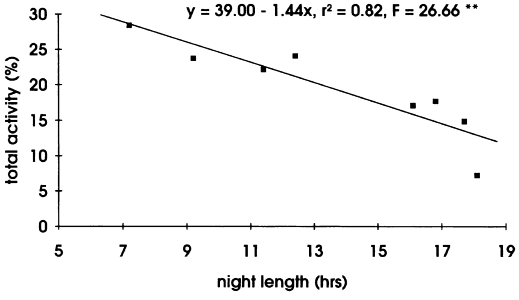

Fig. 3. Total activity of eight radio-tracking periods in 1984–86 in relation to the length of night.

ages of daily day- and night-time activity were tested by Mann-Whitney *U*-test. Of the 7 tracking periods only 1 was nocturnal, 2 were diurnal and 4 were neutral (Table 1). The activity pattern is often related to the availability of different prey (Gerell 1969, Dunstone & Birks 1983). During autumn-early winter minks eat mainly fish (Niemimaa & Pokki 1990) so diurnal or neutral activity pattern could be expected.

The only nocturnal individual was female 218 who was still having cubs with her. Her total activity was the highest recorded maybe because of the greater energy requirements. On the other hand, there was a clear decrease in total activity as the days got shorter (and colder) (Fig. 3). Also Birks & Linn (1982) found evidende for a lower level of activity in winter compared to summer which may partly be due to reduced territorial behaviour. Gerell (1969), however, reported that the male mink increased its activity when it was getting colder.

3. Home ranges

The home range sizes of 6 minks are presented in Table 1. The data are scattered over three years and concentrate to the autumn-early winter period and the juvenile part of the population.

In mid-winter minks seemed to restrict their movements to small areas and usually only a short track in the snow between a den and a crack in the ice revealed the animals. The importance of aquatic prey may keep minks in the vicinity of suitable fishing places. During rutting season the territorial system breaks down and males expand their movements over large areas (Gerell 1970). In March 1987 I radio-tracked a male, which travelled 20 km in 10 days and was then lost. At this time of the year the sea was still ice covered. Three months later the transmitter was found still functioning in a den some 10 km from the last observation point.

During the open water the stretches between islands form natural barriers which may have an unifying effect (Fig. 1C and D). A distance of 250 m between islands seemed to be no difficulty for even a female. Both sexes (ind. 238 and 14) swam this distance almost daily, sometimes even twice a day. In mid-summer rearing of the litter makes great demands on the female who now has the most active part of the year (ind. 218, see text and Table 1). The dispersal of juveniles starts in July and especially males may move over relatively large areas (Table 1, male 236). During autumn-early winter the territorial system stabilizes and the minks move around less than in summer (Gerell 1970). This seemed to be the

Table 1. Diurnal activity and/or home range size of seven radio–tracked American minks.

Period	No.	Sex	Age	Diurnal activity				Tracking time	Home range	
				Mann–Whitney	*df*	*P*	pattern		ha	length
Nov 7–14, 1984	13	male	ad.	–	–	–	–	60	22	5350
Jul 27–Aug 7, 1985	218	female	ad.	12	11, 11	<0.05	nocturnal	174	17	4200
Sep 23–0ct 5, 1985	14	female	juv.	24	13, 13	<0.01	diurnal	231	7	3440
Dec 1–6, 1985	208	male	juv.	5	5, 6	<0.05	diurnal	–	–	–
Jan 20–25, 1986	208	male	juv.	12	5, 6	*N. S.*	neutral	–	–	–
Aug 23–28, 1986	236	male	juv.	14	5, 6	*N. S.*	neutral	78	56	10170
Sep 15–26, 1986	238	male	juv.	48.5	12, 10	*N. S.*	neutral	184	6	2850
Dec 13–19, 1986	261	female	juv.	11.5	6, 7	*N. S.*	neutral	98	6	2150

case also in my study (Table 1, with the exception of male 13). Because of the poor live-trapping success the effect of neighbouring animals remained obscure.

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