

From: [A J](#)
To: [Grizzle, Betty](#)
Subject: old paper
Date: Sunday, December 31, 2017 6:42:01 AM
Attachments: [Bjärvall 1982 scanned.pdf](#)

Hi Betty

Just wanted to send this old paper in case you haven't seen it.

usly rare and undetected *Sphaerodactylus* ame a conspicuous part of the fauna, le the arboreal *Anolis* maintained its ulation. The change in makeup of the rd fauna may have been the factor al- ing *Orthoptera* and *Lepidoptera* to estab- populations capable of widespread dam- to plants.

All known mongoose were removed from island in the fall of 1979. Retrapping in ch of 1980 yielded no further animals. May 1980 there were approximately 600 eate tern nests on the eastern ridge of island. As Roseate terns are very sensi- to disturbance, their colonization of the d was taken as proof of the absence of gooses.

Ameiva lizards can still not be found educk by 1982, their extirpation will be ned and I will reintroduce them from a oy island.

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A Study of the Wolverine Female during the Denning Period

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Abstract

During 1975-78 four wolverine females have been studied at the dens to obtain information mainly about habitat utilization and food ecology. A ski-track about 10 kilometers long was done around but out of sight of the den. Every day when conditions permitted the female's track from the previous night was followed outside that ski-track. The area inside it was never visited but the study includes some observations of the female and the cubs outside the den. The total distance tracked during 81 days was 905 kilometers. Measured as the minimum area used by the female the home-range during three of the years was 109, 180 and 221 km². Within the study areas four major types of habitats are represented — treeless alpine heath, alpine birch forest, coniferous forest and swamps/lakes. The wolverines used these habitats for travelling in almost the same proportion as they occur. However, almost all food was obtained in the coniferous forest, which constitutes only about 52% of the total surface of the study areas. Observed food items during the four years were 50 reindeer, 2 small rodents, 2 willow grouse and 2 red foxes. Of the reindeer 5 were killed by the tracked wolverines, 10 by unknown wolverines (some much prior to the period of tracking), 7 by lynxes, while cause of death is unknown for the remaining 28 individuals. From most of the reindeer carcasses the females fetched food several times. The females had access to a surplus of cached food during at least 3 of the years and were still regularly hunting. The explanation could be that the wolverine is a poor hunter which is why the female has to take every opportunity to hunt for immediate and future needs. May be, food stored within the home-range is of importance for the young even after their departure from the den.

The distribution of the wolverine in Sweden is restricted to remote areas in the northwest. The species has been fully protected since 1969, when the population was judged to be low and probably declining.

Since 1974 the population within an area of approximately 50,000 km² has been sur-

veyed annually by snow-mobile patrols. The method is based on tracks (Björvall, in print) and gives information about distribution, abundance and changes between years.

It has been found that the population is increasing and the distribution very irregular

(Björvall, Nilsson & Österdahl 1978). One area may have few or no wolverines while another, seemingly similar ecologically, has a high density, including active dens. To investigate habitat utilisation, possible disturbance from human activities etc. wolverine females have been studied during part of the 1975-78 denning seasons.

Methods and Material

The kits are born in early March and when the first dens have been located during the survey, one a year has been selected for this study. The work has started in late March and ended in the beginning of May, when the family has left the den. The four dens were so far apart that there is every reason to believe that four different females have been studied.

The female has been tracked in the field by two skiers – in 1975 and 1978 Mais Hansson and Mart Marens, in the intermediate years Lars Lidholm and Ove Johansson. The patrol established a camp in the vicinity of the den, in an available shack or using a tent. We are grateful to the lap village of Tuorpon for lending us a suitable cottage in 1976.

The patrol made a ski-track, about 10 km long, in a loop around the den but out of sight of it. The area inside the loop was never visited. Every morning in suitable weather the patrol followed the loop to the first wolverine track where normally the female had either left or returned to the denning area the previous night. The wolverine track was swept over next to the loop (to be able to tell whether she used the same track again later) and one of the skiers then followed it, while his companion continued along the loop, leaving this when he found the other wolverine track. Sometimes the female had left and returned by the same track, upsetting the basic idea that the skiers would work separately along the track until they met; this also occurred if the female had travelled further than the skiers could go during the day. The route of the female,

everything that could be seen along the track of her behaviour etc, as well as weather and snow conditions, were noted on maps and special field forms.

If tracking had been completed before nightfall and on days with unsuitable tracking conditions, the den was observed from a distance of between one and two km. This yielded some information about the behaviour of the female and the kits and also about the reaction of the female to various kinds of disturbances.

All four dens were situated in the alpine zone above the tree-line, at altitudes between 700 and 800 m above sea level. They were dug in deep snow drifts in exposures ranging between southwest and southeast, all of which seems typical for the species (Myrberget 1968). Tracking conditions in 1976 were generally much poorer than in the other three years, chiefly on account of long periods with strong winds.

Results and Discussion

Activity

Observations of the daily rhythm of the wolverine seems to be few and somewhat conflicting. Murie (1961) reports that the wolverine is frequently day-active and Haglund (1966) that it moves during the dark part of the day but that its habits in this respect are very irregular. He mentions that of the four big predators in Sweden, the wolverine is seen most often in broad daylight and that this even applies to females during the propagation period. Folk (pers. comm), in a study of body temperatures and activity of captive wolverines, reports for one group of three individuals peaks of activity around midnight, sometimes extending through the early morning. Another group of four individuals showed activity peaks from 8 a.m. to 2 p.m. and bouts of sleep between 8 p.m. and 8 a.m.

Watching the den from a distance (after completed trackings or when weather was unsuitable for tracking) resulted in some direct observations of when the female left

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Tracking the den from a distance (after failed trackings or when weather was unsuitable for tracking) resulted in some observations of when the female left

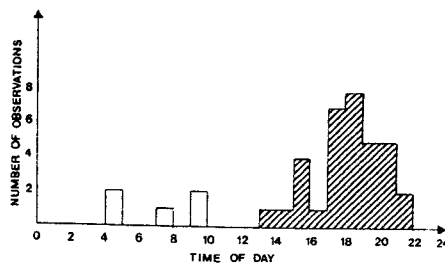


Figure 1. Returns to $\square$ and departures from hatched the den by observed wolverine females.

the den and returned. These are summarised in fig. 1. The female usually left in the evening but the decrease after 7 p.m. is largely a consequence of waning light (and falling temperature!), which obstructs observations. Very few returns have been witnessed mainly because in the morning the patrol was busy with the day's tracking. However, the first check of the loop in the morning usually showed that the female had been out during the night. In 1977, for instance, she had returned to the den before 7 a.m. on 19 out of 29 mornings and been later on only 2 occasions. On the remaining 8 days tracking conditions did not allow the patrol to determine whether the female had been out or not.

During the winter one can identify at least three different classes of animals in a wolverine population — breeding females, adult males and yearlings. The latter have recently broken their bonds with the female, should be trying to establish new territories and are inexperienced hunters. Such individuals are presumably unusually active (probably even in daylight), while breeding females with a surplus of cached food in an established territory seem to have virtually nocturnal habits.

Movements

In the course of 81 days over four years the females were tracked a total of 905 km. About half this distance (427 km) was covered in 1978, mainly thanks to suitable

weather conditions. Since tracking usually led to a cache or kill, which took a lot of time to study, the entire night track was not always followed. However, observations during the tracking always enabled the patrol to estimate the total length of the night track, e.g. as the sum of the distance tracked and the straight line back to the den. The average length of complete night tracks ranged from 9.0 km ($n = 14$) in 1975 to 31.4 km ($n = 8$) in 1978. The corresponding range for the estimated lengths was 16.5 km ($n = 8$) to 38.3 km ($n = 21$), which gives grand averages of 11.7 km and 36.4 km respectively. Wolverines — not necessarily propagating females — have earlier been reported to move around 30 km/day (Haglund 1966) and 45-85 km/day (Makridin 1964). The variation is probably mainly a reflection of food availability. All the females studied had access to a surplus of food but the average distance between all known caches and the den was 3.9 km in 1975 and 10.6 km in 1978. However, food availability is not the sole determinant of the female's movements. On several occasions the female walked from the den to a cache, ate and then proceeded instead of returning to the kits with food (Fig. 2.).

Home range and habitat utilisation

It is well known that the female chooses her denning area early in the winter (e.g. Haglund 1966) but there is little information about the size of the area that she uses. Based mainly upon the distance between discovered dens, Krott (1959) stated the home range of the female to be around 300 km², a report later referred to by e.g. Myhre (1967) and van Zyll de Jong (1975).

In the present study the home ranges of the females have been calculated by measuring the area covered during their nightly walks. The results, given in table 1, show minimum areas of between 110 and 220 km². There is no estimate for 1976 because the distance tracked that year was too short (111 km) and too many tracks followed the

same routes.

Table 1. Minimum size of home ranges of 3 wolverine females.

	Size of home-range (km ²)
1975	109
1977	180
1978	221

The true size of the home range is larger than found here — in 1978, for instance, the female is known to have travelled a couple of times in the area northwest of the den (Fig. 2) but conditions prevented the patrol from following her tracks. The number of such trips was very limited that year and they could not possibly add more than approximately 10% to the given size of the home range. On years with less good contact with the female the figure is higher — maybe up to 20 or 25% in 1975 and 1977. This indicates a home range for the wolverine females studies here of between 140 and 240 km². The individual variation can be even greater. Magoun (pers. comm.), in a study of radio-collared wolverines in northern Alaska, has found female home ranges during periods of a couple of months extending from about 50 to more than 350 km².

In northernmost Sweden the wolverine lives in the low mountains or in the coniferous forests bordering on the high mountains (Haglund 1966). Here four major types of habitat are to be found — treeless alpine heath, subalpine birch forest, coniferous forest and lakes. All movements of the females have been plotted on maps and their distribution by types of habitat has been studied. The results given in table 2, strongly suggest that the females have used these habitats for travelling in almost the same proportions as they occur. However, as discussed later, almost all food has been obtained in the coniferous forest. This type of habitat makes up about 52% of the total surface of the study areas.

Food

Along the 905 kilometers the tracked females were observed to feed on a total of 50 reindeer, 2 small rodents, 2 willow-grouse and 2 red foxes. Several of the reindeer, but none of the other carcasses, were visited more than once. This agrees well with earlier studies, showing that in Fennoscandia reindeer is the most important winter-food of the wolverine (Lönnerberg 1936, Haglund 1966, Myrberget 1968, Myhre & Myrberget 1975). Food items, other than those mentioned above, reported in those studies are bear, moose, roe-deer, sheep, shrew and hare.

From a big carcass the wolverine can

Table 2. Utilisation by wolverine females of different habitats in 3 study areas in northernmost Sweden.

	Treeless Alpine Heath		Subalpine Birch Forest		Coniferous Forest		Swamps/Lakes	
	Area (%)	Distance Tracked (%)	Area (%)	Distance Tracked (%)	Area (%)	Distance Tracked (%)	Area (%)	Distance Tracked (%)
1975	11	18	28	28	59	50	2	4
1977	17	9	7	7	61	76	16	8
1978	35	27	18	24	36	44	11	5
Average	21	20	18	21	52	54	10	5

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Coniferous Forest		Swamps/Lakes	
Area (%)	Distance Tracked (%)	Area (%)	Distance Tracked (%)
59	50	2	4
61	76	16	8
36	44	11	5
52	54	10	5



Figure 2. Wolverine movements around the den during one of the study seasons.



= reindeer carcass.

feed or take food to a cache or back to the kits. The latter was observed several times in all four years. In 1978 the female once carried a reindeer head with antlers about 22 km back to the den. It has been reported by e.g. Haglund (1966) that females, carrying meat back to kits, often lay it on the ground in order to rest. This has been taken to indicate that they find the job exhausting. A couple of times in the present study the female was seen carrying the kits from one den to another and in these cases, too, she put her burden down on the ground several times. During these breaks, however, she maintained a very alert position, which gives us the impression that the main reason is not to rest but to make a more careful inspection of the immediate surroundings.

Of the 50 reindeer carcasses found during this study, 5 were kills by the tracked wolverine females. Another 10 reindeer

had been killed by wolverines, some much earlier than the tracking period, but as far as is known not by the tracked female. Of the remaining 35 reindeer, seven had been killed by lynxes and the cause of death is unknown for 28.

These figures can be compared with the previous Swedish wolverine study from the early 1960s (Haglund 1966). That study extended over 957 km (905 in this study) and led the trackers to about 54 reindeer carcasses (50). Of these, 16 had been killed by wolverines (15) and 7 by lynxes (7), while the rest had died of unknown causes. So far there is almost complete conformity between the two investigations. However, the 54 carcasses in Haglund's study were visited 72 times by wolverines, while our 50 carcasses were visited 90 times. Moreover, his trackers found a total of 26 cases where the tracked wolverine had killed a reindeer,

compared to 5 in our study. This is an important difference, only a small part of which might be explained by differences in experience between the two groups of trackers.

In Haglund's study about 2/3 of the distance was tracked in March and April, i.e. during our study season. Haglund was very uncertain as to the number of tracked individuals but considered 22 adult wolverines a minimum figure. Of these an unknown but low number were propagating females. It seems reasonable to conclude that this is the main reason for the difference described above. Thus the denning female relies more on cached food and less on her own hunting efficiency than the average wolverine.

The five successful chases by wolverines in the present study have at least one factor in common — they all occurred in spruce forest. Information about snow conditions is available for only three of them but in these cases snow crust bore the wolverine but not the reindeer. This tallies with reports that the success of the wolverine is dependant on favourable snow conditions (Haglund 1966 and others).

Removal of litters

In three of the four years the litters were moved from one den to at least one new site. This was done in broad daylight and while the kits were still too small to walk by themselves — the females carried them. The distances were 300-500 meters, in one case about 1 km. People with experience of wolverine hunting from the time when the species was unprotected have reported that a move frequently occurred when the female had been disturbed but that it always happened at night. The idea that direct disturbance lies behind this behaviour has been expressed also by Myrberget (1968) and Pulliainen (1968).

The female may have been disturbed the first time we saw this. Later, however, we were more careful and she still moved her kits in situations when we were hidden at a distance of 2 km and there was no other detectable source of disturbance around.

There are other explanations to consider. The old den might have grown unsuitable, e.g. because snow had melted and run down into the tunnels or because too much faeces had accumulated. The latter has been reported to be the reason why kits are moved from one part of a den to another (Myrberget 1968). Since, however, females have moved the kits back to a den which they had left earlier, this does not seem to be a likely explanation. Another possibility relates to the fact that for centuries the wolverine has been persecuted intensely and that this persecution has been concentrated on the dens. The accumulation of tracks around the den makes this easier for the hunter to locate as the season progresses, provided it does not snow heavily. Thus it seems likely that moving to one or several new sites during the denning period has survival value for the female and her kits. The idea is supported by observations which indicate that the new den can be prepared much prior to the removal (Myrberget 1968).

The Male

Wolverines are believed to breed in late spring or early summer (Pulliainen 1968 and others). This is supported by observations of captive animals (Mohr 1938, Davis 1967, Mehrer 1976) and investigations of reproductive tracts (Rausch & Pearson 1972). Late May and June have been mentioned as the peak period. The role of the male during the denning period, however, seems unclear. In descriptions of 31 dens from Finland, the presence of the male was noted in only 3-5 cases (Pulliainen 1968). Haglund (1966) mentioned a number of cases with contact between female and male during January to May and believed that the male might sometimes kill a reindeer which is utilised by the female and partly carried off to the den for feeding the young. In the present study it is believed that this happened once. The female on her nightly walk met a male about 5 km from the den in an area which she had not been known to visit before. The animals accompanied each other for about 1 km

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along the track of the male to a carcass surrounded by his fresh and old tracks. The female ate and then returned to the den.

In the present study three of the four denning areas were visited several times by big wolverines that we believe were males. We refrained from tracking them inside the loop but they were observed there a couple of times. The contact between female and male could be very cautious, the animals watching each other at some distance, sniffing each others tracks and then disappearing in opposite directions. One female was, however, seen to be very aggressive and chased the male away from the vicinity of the den. On April 15, 1977, a male followed the track of a female for more than 3.5 km from the den. When he caught her up they ran around together over a large area, climbed trees and also left a track that was interpreted as a breeding session. Along parts of this track spots of urine were found. When the female left and went back to the den, the male lay down in a bed for a long time. Later he followed the track of the female for about 2 km, rolling in her urine spots and biting little branches that he passed. About 1 km from the den he left her track.

Concluding Remarks

The wolverine is not a particularly well-known species and most of the available information is based on tracked animals of essentially unknown origin or studies of captive or killed animals. The results of the present study of the ecology of the denning female therefore supplement earlier findings.

The denning female occupies a territory which is rarely visited by other wolverines except for a male. He is not always accepted but there is also an indication that mating can take place as early as mid-April. The breeding female seems to have a more stable daily rhythm than the average wolverine and the survival of her and her kits largely depends on food cached before the breeding season, probably mainly by the female

herself. There is a surplus of cached food and the idea that small rodent-abundance would have a major influence on breeding results, as suggested by Myrberger & Sörumgård (1979), seems unlikely. In spite of this food surplus, the female hunts during the breeding season. This agrees well with the general picture of the wolverine as a poor hunter which has to take every opportunity for immediate and future needs.

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