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Pygmy spotted skunk *(Spilogale pygmaea)* from Chamela, Jalisco, Mexico - Photo: Lisette Cantú

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The aim of this publication is to offer the members of the IUCN/SSC MV&PSG, and those who are concerned with mustelids, viverrids, and procyonids, brief papers, news items, abstracts, and titles of recent literature. All readers are invited to send material to:

Small Carnivore Conservation
c/o Dr. H. Van Rompaey
Jan Verbertlei, 15
2650 Edegem - Belgium
e-mail: Harry.VanRompaey@ping.be

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Ecology of the Pygmy spotted skunk (*Spilogale pygmaea*) in the Chamela Cuixmala Biosphere Reserve, Mexico: Preliminary findings

Lisette CANTÚ-SALAZAR[1], Mircea Gabriel HIDALGO-MIHART[1], Carlos A. LÓPEZ-GONZÁLEZ[1,2] and Alberto GONZÁLEZ-ROMERO[1]

Introduction

The Pygmy skunk (*Spilogale pygmaea*, Thomas 1898) is a small carnivore endemic to Mexico, distributed throughout the Pacific coast, from the state of Sinaloa to the Istmo de Tehuantepec (Van Gelder, 1959; Baker & Sánchez, 1973). The first specimen of pygmy skunk captured came from Rosario, Sinaloa, on the Pacific coast in 1897. They were collected occasionally and, besides Sinaloa, a few specimens were captured in Guerrero, Oaxaca, Colima, Nayarit, Jalisco, and Michoacan (Baker & Sánchez, 1973; Genoways & Jones, 1968; Greer & Greer, 1970; Hall 1981; Martínez & Vargas, 1996). Although it is an endemic species protected by Mexican laws (SEDESOL, 1994) little is known about the pygmy skunk's natural history and ecology. The most detailed information about movement patterns, home range size, and temporal and spatial resource utilization relates to the other two species included in this genus, *Spilogale putorius* and *S. gracilis* (Crooks & Van Vuren, 1995; Kinlaw, 1995). Until today most information reported about the pygmy skunk is based on data obtained for other skunk species (Ceballos & Miranda, 1986; Medellín *et al.*, 1998). Because of that, our research team started to generate basic information about this species as a part of the project «Ecology and conservation of the mesocarnivore community from western Mexico».

This progress article reports the work carried out from 1996 to January 1999, where important information about some ecological issues of this small carnivore in Chamela, Jalisco, has been obtained.

Study area

The study was carried out at the Chamela IBUNAM Biology Station, part of the Chamela-Cuixmala Biosphere Reserve. This is the only protected area where, until now, the presence of the pygmy skunk is known. The annual mean precipitation in the area is 750 mm, and it presents as the most outstanding characteristic a marked seasonality, with a rainy season from July to October, and a long dry season that extends to May. Therefore, water availability for wildlife is very limited at the end of the dry season. Tropical dry forest is the most abundant type of vegetation and covers almost the complete study area. The second important type of vegetation is semi-deciduous tropical forest, restricted to the riverbeds in Chamela, and with a very limited extension. Other types of vegetation present in the area are mangroves, xerophilous bushes, riparian vegetation and palm groves. Next to these vegetation groups, it is also possible to find some deforested areas, covered by secondary vegetation and several crops. The most important problem at a regional level is the rate of deforestation due to the expansion of agriculture and cattle ranching, as well as tourist development in the Pacific Coast area.

Methods

Animals were obtained with live traps baited with spicy meat and live chicks. Once captured, animals were anaesthetised

with a xilacine hydrochloride and ketamine hydrochloride mixture (López-González *et al.*, 1998). Conventional somatic measurements were taken; physical and reproductive conditions were evaluated, as well as approximate age (based on tooth-wear characteristics). Some animals were equipped with collar or harness radiotransmitters. Once completely recovered from anaesthesia, skunks were released at the capture site. Animals equipped with radiotransmitters are directly located at their dens by homing, and radiotracking was carried out. The information obtained will allow us to describe the species' home range size during different seasons, its denning ecology and its habitat use. The droppings of captured skunks were gathered, and through the analysis we obtained information about the food habits of the species in Chamela.

Results

It has not been possible to observe any pygmy skunk during its normal activities, due to its nocturnal habits. All individuals captured for the first time were aggressive,and only some of those re-captured tolerated our presence more or less. However, no physical contact was allowed without showing agression, an attitude different to that reported by López-Forment & Urbano (1979), who stated that they are «daring and unsuspicious animals».

A total of 50 different individuals have been captured, 13 females and 37 males, all of them inside the undisturbed dry forest. Up to date, no trace of this species has been found in agricultural areas and pastures adjacent to the Chamela Biological Station (Cantú-Salazar *et al.*, 1998). Table 1 summarizes morphometric data obtained for these individuals. The maximum weight obtained was 230 g (a large and healthy male), compared to 320 g as reported by Ceballos & Miranda (1986) in the same area. Therefore, we believe that the data supplied by these authors are somewhat exaggerated.

A male with semi-descended testes was captured in March 1997. During April and May 1997, and May and June 1998, 16 males with descended testes were captured. Two pregnant fe-

	Females (n=13)		Males (n=27)	
	mean	range	mean	range
Total length	250.1	204-298	271	247-300
Tail length	67	50-80	69.5	55-87
Hind foot length	30.8	26-35	33.6	30-37
Ear length	20.3	15-25	21	17-25
Weight	156	130-173	185.7	145-230

Table1. Somatic measurements (in mm and g) of 40 adult pygmy skunks captured in Chamela, Jalisco

males were captured in May and June 1998. Other studies indicate that pregnant females were captured from May to August, which suggests that this species may produce two litters per year (Baker & Sánchez, 1973; Genoways & Jones, 1968; Teska *et al.*, 1981).

López-Forment & Urbano (1979) make observations regarding this species' diet, reporting insects, large arachnids, crayfish, scorpions, bats, and wild figs (*Ficus* sp.). This is the only study on this particular species' diet, although it has been inferred that feeding habits may be similar to those of other species included in the genus which feed upon insects, spiders, birds, eggs, small mammals, fruits and seeds (Ceballos & Miranda, 1986: Medellín *et al.*, 1998). In this project, we have collected 48 scats, corresponding to individuals captured in traps, and their analysis is being carried out.

During the dry season of 1997 and 1998, mainly, the home range size of nine animals was obtained (Cantú-Salazar, 1998). The mean home range was 20.4 ha (Kernel adapted method). Male home ranges were larger than those of females. A wide overlap of male and female home ranges was observed, but both males and females monitored presented exclusivity in their core areas, with the exception of a sympatric male and female where a wide overlap was found. Nine other individuals were monitored during 1998 (including in the rainy season),and these data are currently being analyzed.

Most of the biological information collected about pygmy skunks up to our findings is anecdotical and therefore has almost a mythological and folkloric touch. We believe our information should be helpful in understanding the real ecological needs for the conservation of this «endangered» species, which, in our belief, should be regarded as a «vulnerable» species.

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[1] Instituto de Ecologia, A. C., Apdo. Postal 63, Xalapa Veracruz 91000, Mexico

[2] Arizona State University, PO Box 871501, Tempe AZ 85287-1501, USA

Badgers (*Meles meles* L., 1758) in a mountain area north of Varese (Lombardy – Italy)

C. M. BIANCARDI and L. RINETTI

Introduction

The ecology of badgers (*Meles meles*) in alpine and pre-alpine environments, where food availability is scarce and subject to seasonal fluctuations, is poorly known. Our research began in 1989 in a mountain area of Italian Pre-Alps and this work presents our results in several aspects of badger ecology: food, sett distribution and use, interactions with humans and historical data.

Study area

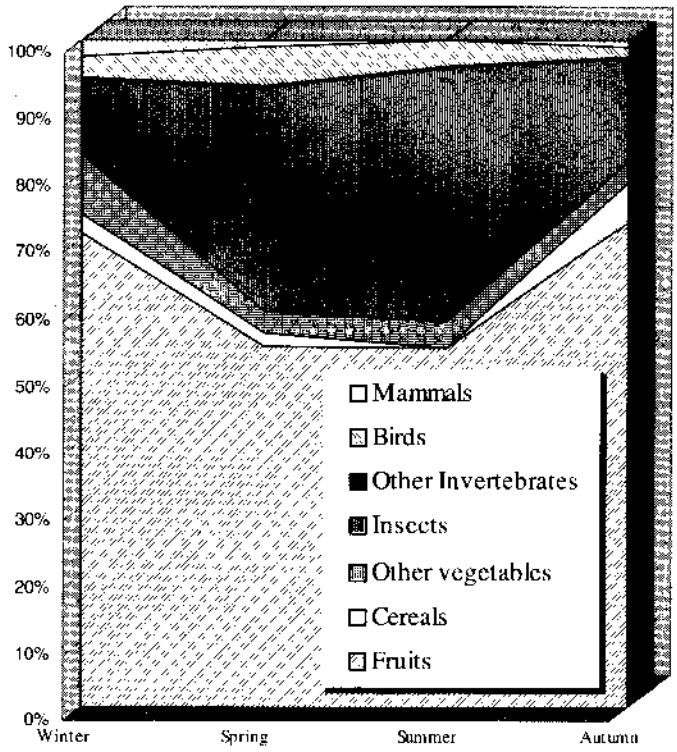
The study area consists of 180 km^2 between the eastern coast of Lake Maggiore and the Swiss border; the main town is Luino (46°00'N; 08°77'E) in the county of Varese. The altitude ranges between 200 – 1,600 m ASL. The climate is temperate sub-maritime (Mennella, 1967), with high rainfall (average 1,469 mm/y) mainly in spring and late summer but with a high number of annual hours of sunshine (average = 2,309 h/y). The mean temperatures range from +2.8°C in January to +20.9°C in July (Spinedi, 1992).

Large chestnut (*Castanea sativa*) woods grow in the vegetational belt between the lake shore and 700-900 m. Chestnut trees, whose dispersal is favoured by man, replaced the original oak woods in almost the whole area; only on arid and warmer slopes does the *Quercus pubescens* remain. Cherry trees (*Prunus avium*), hazel (*Corylus avellana*) and ash (*Fraxinus excelsior*) are other species in these woods. Beech (*Fagus sylvatica*) woods lie in the central vegetation belt, mainly on cold and humid slopes. This coniferous presence is due to reforestation activity in small patches in the area. Poor grassland and abandoned pasture (*Nardetum*) characterise the higher vegetation belt.

Methods

218 badger faeces were collected between October 1989 and December 1991 and analysed as described by Kruuk & Parish (1981); see further details in Biancardi, Pavesi & Rinetti (1995). During that period we began a periodic survey of all setts, a survey that is still going on. We have collected information about the kind of sett and its use, its altitude, its orientation on the slope, the vegetation, the percentage of coverage and of soil (Biancardi & Rinetti, 1998).

Although radio-tracking could improve our knowledge on badgers' movements, territory size and social behaviour, it is very difficult to adapt that technique to mountain environments except to diurnal mammals: e.g. large ungulates such as chamois and ibex, or rodents like squirrels. Therefore, we are now attempting to define badger territories through Dirichlet tessellation (Doncaster & Woodroffe, 1993).



Graph. 1: Seasonal variation in badger's diet

Information on the historical presence of badgers and their interactions with humans was collected in interviews with eldery people, former hunters or poachers. The Local Volunteers Ecological Guards (GEV) help us to collect more information, e.g. about road kills.

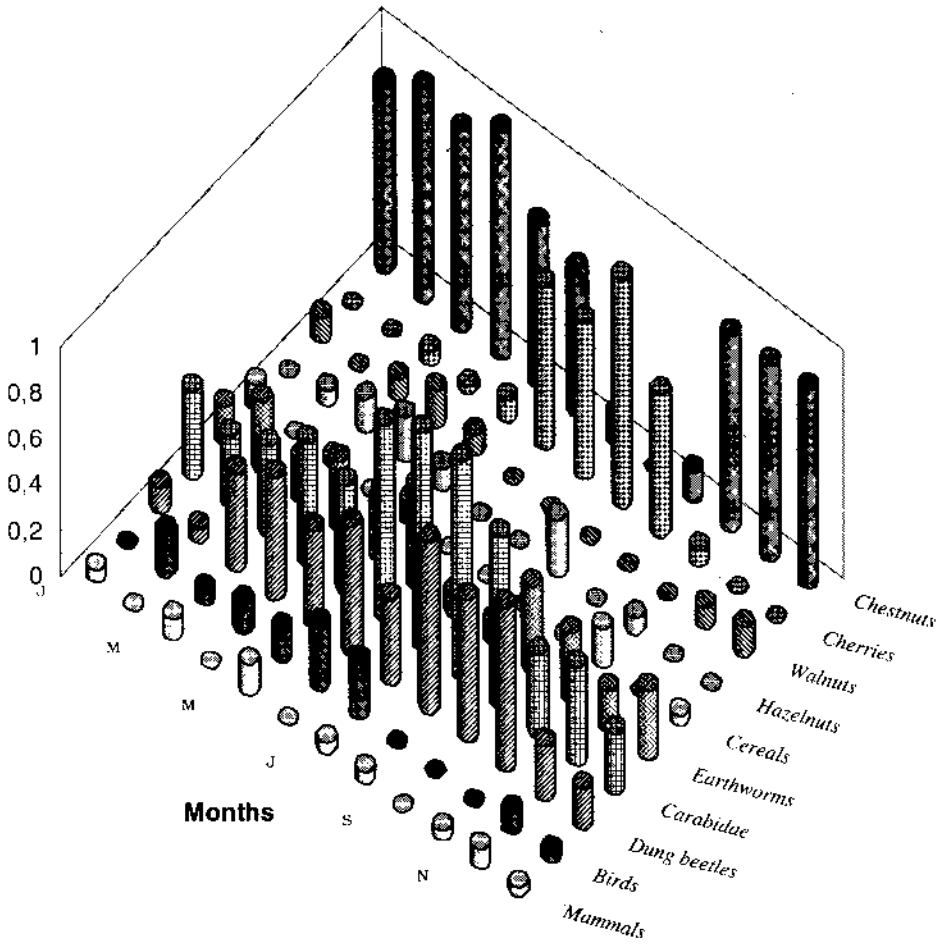
Results

Food

Fruits and insects, mainly Coleoptera, represent over 85% of the volume of badger diet in our study area. Seasonal variations are shown in Graph. 1; the importance of fruits decreases in spring and summer, when many more insects are available.

				Glucids			
Fruits	Water	Proteins	Lipids	Soluble	Starch	Fibre	Energy Kcal
Chestnut (*Castanea sativa*)	41,0	3,5	1,8	8,1	34,3	8,4	189
Hazelnuts (*Corylus avellana*)	5,7	13,0	62,9	1,8	0,0	6,7	625
Walnuts (*Juglans regia*)	19,2	10,5	57,7	3,4	2,1	0,0	582
Cherries (*Prunus avium*)	86,2	0,8	0,1	9,0	0,0	1,3	38
Cereals							
Maize (*Zea mais*)	12,5	9,2	3,8	2,5	66,0	0,0	355

Table 1: Composition of some foods items (% of edible fraction). From: Carnovale E. & Miuccio F., 1989



Graph. 2: Frequency of occurrence of some food items

The frequency of occurrence of some specific items (Graph. 2) shows that chestnuts (*Castanea sativa*) represent the staple food in autumn and winter; in summer they are replaced by cherries; figs and grapes, not shown in the graph, are eaten in September – October when they are ripe. Chestnuts contain, in a great part, glucides such as starch and a little water (Table 1); their resistance in litter, their abundance in the cold season and their contents in protein and lipids, could account for the high percentage in frequency of occurrence and volume, although many undigested parts were found in faeces.

Cereals are frequently eaten in the southern part of the study area, where small maize fields are present. Frequency of occurrence and percentage in volume of insects increase in spring and summer thanks to their greater availability in the warmer seasons. The most eaten insects are dung-beetles *Geotrupes stercorosus* and Carabidae, *Abax* spp. and *Carabus* spp. In two specimens collected in October we obtained evidence of the destruction of wasp nests: a great number of adults of *Vespula germanica* had been eaten.

The acid soils of the study area do not support a high density of populations of earthworms. In addition, abandoned high pastures are now decaying and their substrata acidifying. Very few earthworm chetae were found in almost a quarter of the samples.

Among birds a jay (*Garrulus glandarius*) and a blackbird (*Turdus merula*) (probably dying individuals), were found in winter, and some young passerines, probably fallen from the nest, were found in spring. In samples coming from a sett near a small farm we detected some feathers of chicken (*Gallus gallus*) and guinea-fowl (*Numida meleagris*).

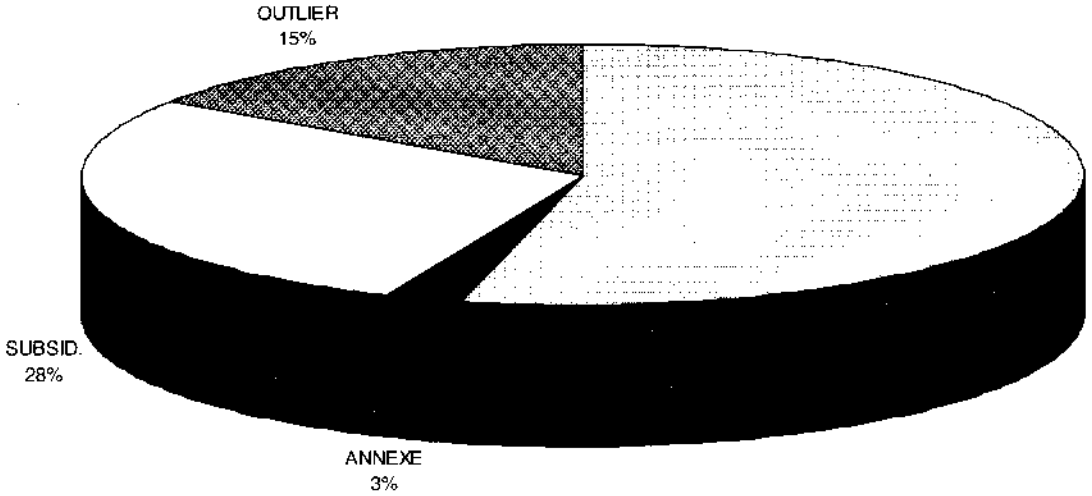
Among mammals we found moles (*Talpa caeca*), a shrew (*Crocidura leucodon*), voles (*Microtus* spp.), rabbits (*Oryctolagus cuniculus*) and one red squirrel (*Sciurus vulgaris*).

In short, in the Luino area there is a great availability of chestnuts almost throughout the year, and they represent the easiest way to obtain some proteins, lipids and energy; more or less the same situation was found on Monte Baldo with olives (Kruuk & De Kock, 1981). When other more appetizing food is available (maize, for example) badgers seem to prefer it.

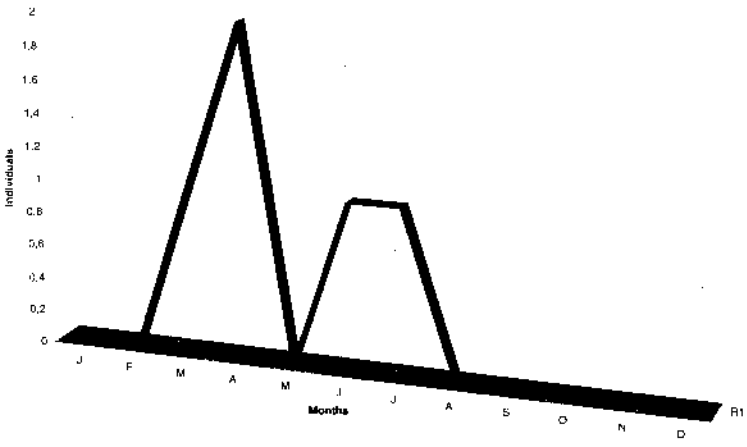
Badgers seem to take advantage of human activities: the presence of farms and cultivated patches in the southern part of the study area affects badgers' food; also former cultivated, now abandoned fields, are frequently visited.

Setts and territory

Territory size and social structure of populations of badgers in alpine environments are very poorly known. We collected data from 39 setts in our study area, 38 are described in Biancardi & Rinetti (1998), but one sett is new. As shown in Graph. 3, more than half of the setts are main setts; but there is only one annexe sett, which means that one clan has two "great" setts. In other cases badger clans have one main sett and perhaps a subsidiary or an outlier. We think this is evidence of low population density and of poorly-defined territory sizes, which could account for the scarcity of marking activities: we found few real "boundary latrines" and many more Temporary Defecation Sites (TDS).



Graph. 3: Badger setts



Graph. 4: Road kills (1991-92)

As shown, methods as bait marking here are unpracticable for defining the territory boundaries. Moreover, the geomorphology of the study area, with steep slopes and thick vegetation, does not easily allow night-time radio-tracking. Other methods "on paper" as Dirichlet tessellation give results showing enormous territory size, probably due to two factors: (i) the lack of information (not all setts are known) and (ii) the large areas deserted by badgers (some northern slopes, the poor alpine beech woods). We are now thinking of mapping all known badger paths with a GPS device.

The distribution of setts appears to be related to food availability and is relatively independent from different geological aspects of the study area (Biancardi & Rinetti, 1998). These results are partial and many more studies are needed before an accurate account of badger behaviour in alpine and pre-alpine environments can be produced.

Badgers and humans

Several former hunters and poachers said that they could find a difference between two "varieties" of badgers: "tass canin" (dog badger), with long hairs, weighing around 8 kg, not edible and "tass purscell" (pig badger), with short hair, weighing around 15 kg, edible. This distinction has no systematic meaning, but frequently occurs in Italy (Gandolfi, 1996; Griffiths & Thomas, 1997) and also in Croatia (Griffiths, pers. comm.); these differences may be due to seasonal variation in weight and hairs (Griffiths, pers. comm.) or, perhaps, to animals of a different age class. The fattest badgers hunted in the Luino area weigh 18 kg.

Badgers were hunted because they were considered to be an agricultural pest: farmers said that badgers would eat potatoes and tomato roots, knock down maize plants to eat their cobs, and rummage in the dunghills to find larvas and dung-beetles. Badgers were hunted also as an economic and a gastronomic resource: in the period between the two world wars catching a badger meant enough money on which to live for 2 – 3 weeks and meat at dinner for the family; badger furs were sold on the Luino market, badger fat was sold to chemists to make unguents and badger meat was cooked in different ways. We also collected some old recipes as evidence of old local traditions (Biancardi & Rinetti, 1995). Hunting was carried out with traps or dogs (terriers or dachshunds), usually in October-November; sometimes dogs were seriously injuried or killed by badgers, and dogs were sometimes "trapped" in the badger sett. We recorded one case of a man who had a tame badger in the 1950s. The two of them were not well-liked when they went in the local "osteria" (bar) because of the badger's smell.

Nowadays badgers are protected by law but, occasionally, somebody still attempts to catch them: in July 1991 a gamekeeper from Dumenza, a village near Luino, found and set free an adult male which had been trapped (probably in order to have a badger at dinner). Road-kills have become a serious cause of death. Our preliminary data, that refer to the years 1991-92 report four adult females and one male killed in road-accidents (Graph. 4). Our data are few and incomplete, but the seasonal course of road mortality seems to agree with the observations of Davies, Roper & Shepherdson (1987).

Acknowledgements

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Centro Studi Faunistica dei Vertebrati,
Società Italiana Scienze Naturali
c.so Venezia 55, 20121 Milano MI, Italy

Observations of the Red panda (*Ailurus fulgens*) in the Singhalila Parc, Darjeeling, India

Sunita PRADHAN

Introduction

By being a bamboo eater, the Red panda is an unusual carnivore. Apart from this, the panda has a high mortality rate, very low reproductive or protracted growth rate and very small litter sizes, features in contrast with other carnivores (Glatston, 1989; Gittleman, 1994). Carnivores which have high mortality rates produce more litters in less time (Harvey *et al.*, 1989; Charnov, 1991; Gittleman, 1994). The high mortality rate of the panda has been attributed to various factors such as inefficient maternal care of vulnerable young, and high susceptibility of the pandas to canine distemper virus and other bacteria and ectoparasites (Roberts & Gittleman, 1984; Gittleman, 1994). The problem of mortality due to diseases also could be due to the deleterious effects of inbreeding (O'Brien & Knight, 1987). Therefore, in addition to the threats of habitat loss and fragmentation, poaching, death of bamboo after its mass flowering, sustenance on the low nutritive bamboo diet, the red panda is faced with biological sources of mortality as well (Glatston, 1989; Gittleman, 1994). Red panda are distributed from Nepal in the west to a few provinces of China in the east. In India, red panda are found in the state of Sikkim, the Darjeeling hills of North Bengal and the north-eastern state of Arunachal Pradesh. Red pandas have been subjected to more studies in captivity than in the wild, hence very little is known about the species in its natural habitat. An ecological study of red panda in the Singhalila National Park, Darjeeling was conducted from 1993-1996.

Singhalila National Park (26°31'N, 87°59'E) is located on the north-western border of Darjeeling District (Fig. 1) and ranges between 2,400 to 3,636 m ASL. Observations of red panda during the course of field work were done when and where sighted and for as long as an animal was in sight. For each sighting, a note on the habitat, the number of animals, sex, age, and activity was noted. There is no apparent sexual dimorphism in red panda which makes it difficult to identify the sex of animals when sighted. Whenever possible, I assigned sex and age to a red panda as cub, female(adult panda seen with cub), subadult and adult or unsexed.

	GB		KT		SD	
	SGT	IND	SGT	IND	SGT	IND
Jan	2	2	1	1	0	0
Feb	0	0	2	2	0	0
Mar	0	0	1	1	3	3
Apr	0	0	3	3	1	1
May	0	0	1	1	1	1
Jun	1	1	0	0	1	1
Jul	2	2	1	1	0	0
Aug	2	2	0	0	1	1
Sep	0	0	0	0	0	0
Oct	1	1	2	4	3	4
Nov	0	0	1	1	0	0
Dec	1	1	1	3	0	0
Total	9	10	13	17	10	11

Table 1: Details of red panda sightings in the study sites at Singhalila NP, Darjeeling (SGT=Sighting; IND=Individuals; GB= Gairibans;KT=Kaiyakatta-Kalipokhari; SD=Sandakphu)

Observations and discussion

A total of 32 sightings of the red panda was made during the course of the two year study. These included 18 sightings made during actual monitoring and 14 sightings made during other field work. The maximum number of sightings during the study period were in October. Details of sightings in the study area are presented in Table 1.

With the exception of sudden chance encounters, the red panda did not immediately flee when encountered. When it was resting in a tree, it would continue to rest after some initial inspection of the intruder by sniffing the air or remaining alert for some time. However, the few who moved off were seen to do so sluggishly, by climbing down the tree or walking on to other trees via connecting branches.

The longest sighting observation of a red panda in the study area was for 180 minutes (10.00 - 13.00 hrs) when three adult red pandas were seen together on 26th December (winter). They were seen on a huge *Rhododendron arboreum* tree at Kayakatta (2,900 m ASL) at a height of 5.5 m from the ground, and were resting on several branches of the tree. Along with other tree species such as *Magnolia cambelli, Ilex* sp., *Osmanthus sauvis, Sorbus cuspidata* and *Daphepyllum himalyensis*, the area where this sighting was made is dominated by an association of Rhododendron-bamboo. Although the three red pandas interacted very little, they stayed together in the same tree throughout the three hours of observation. Finally one of the animals got up, climbed up to a higher branch, defecated and left the tree. While climbing up the tree, it brushed past its mate, but no aggression or offence was shown by the animals during this short period of direct interaction. In red pandas mating occurs during winter, usually between early January and mid-March (Dittoe, 1944; Zucherman, 1953; Mottershead, 1958, 1963; Erken & Jacobi, 1972; Roberts & Kessler, 1979; Keller, 1980; Roberts, 1980, 1981; Pradhan & Saha, 1994). In the wild they are solitary outside the mating period (Yonzon & Hunter, 1989). Johnson *et al.* (1988) also report red pandas to remain oblivious of other red pandas in the near vicinity during their study in the Wolong Natural Reserve, China. A discrete distance is also maintained when the animals are housed together in captivity (Keller, 1977). During the present study the group of three red pandas was seen at the end of December, i.e. approximately during their mating period, and the pandas could have been adults in a premating aggregation.

Two adult red pandas were seen together on 28th October at Gairibans Research Base (2,000 m ASL) at 14.30 hrs. As October is not known to fall within the breeding period of the species, it is difficult to say anything about the association of these animals.

Apart from these sightings, cubs and adult pandas were seen together in the Singhalila National Park during the month of October. Female red pandas give birth mainly in June (Hodgson, 1847; Wall, 1908; Pocock, 1941). The litter consists of an average of two young (range = 1-4)(Glatston, 1989). The young ones are

small and helpless at birth. Wild pandas use tree cavities as maternity dens. Yonzon & Hunter (1989) report that red panda use hollows of *Abies* sp., and Reid *et al.* (1991) report that the hollows in *Abies lasiocarpa* trees could have been used as maternity dens in the Wolong Nature Reserve. During the present study, a local cattle herder showed me the hollow base of a huge *Vitex* sp. tree which had been used by a red panda as its nest. On inspection, I found red panda hair, testifying to the presence of the animal in the tree base. In captivity, red panda cubs do not attain independence from maternal care before they are 6 months old, but nothing is known about the dispersal patterns in the wild (Roberts, 1981). The cub seen in October 1994 in Sandakphu (Singhalila National Park) at 3,450 m ASL was a suckling. The mother seemed to be lazing, but the cub was exremely active and playful. It climbed and descended efficiently but did not venture too far away from its mother. This mother and cub pair was seen on a huge Silver fir (*Abies densa*) tree, approximately 7.5 m above ground level on the north-west aspect at 14.30-15.15 hrs in Silver fir-birch-bamboo forest. Two cubs and a female were seen at 2,820 m ASL on the south-east aspect on Quercus-rhododendron-bamboo forest at Kaiyakatta in October 1995. They were on a huge *Quercus pachyphylla* tree, approximately 6.5 m above the ground. The trio was also seen on the same tree on the consecutive day during which one of the cubs was suckling. In captivity, even the male (father) has been observed to play with the young ones (Muller, 1989; Stevenson *et al.*, 1989) but presence of an adult other than the mother was not seen on the three ocassions when a cub and female were seen during this study in the Singhalila National Park. Both the *Abies densa* tree and the *Quercus pachyphylla* tree used by the adult female panda and the cubs were mature evergreen trees that provided good cover, whilst the broad branches provided a larger surface area for the mother and the cubs to sit, play and rest.

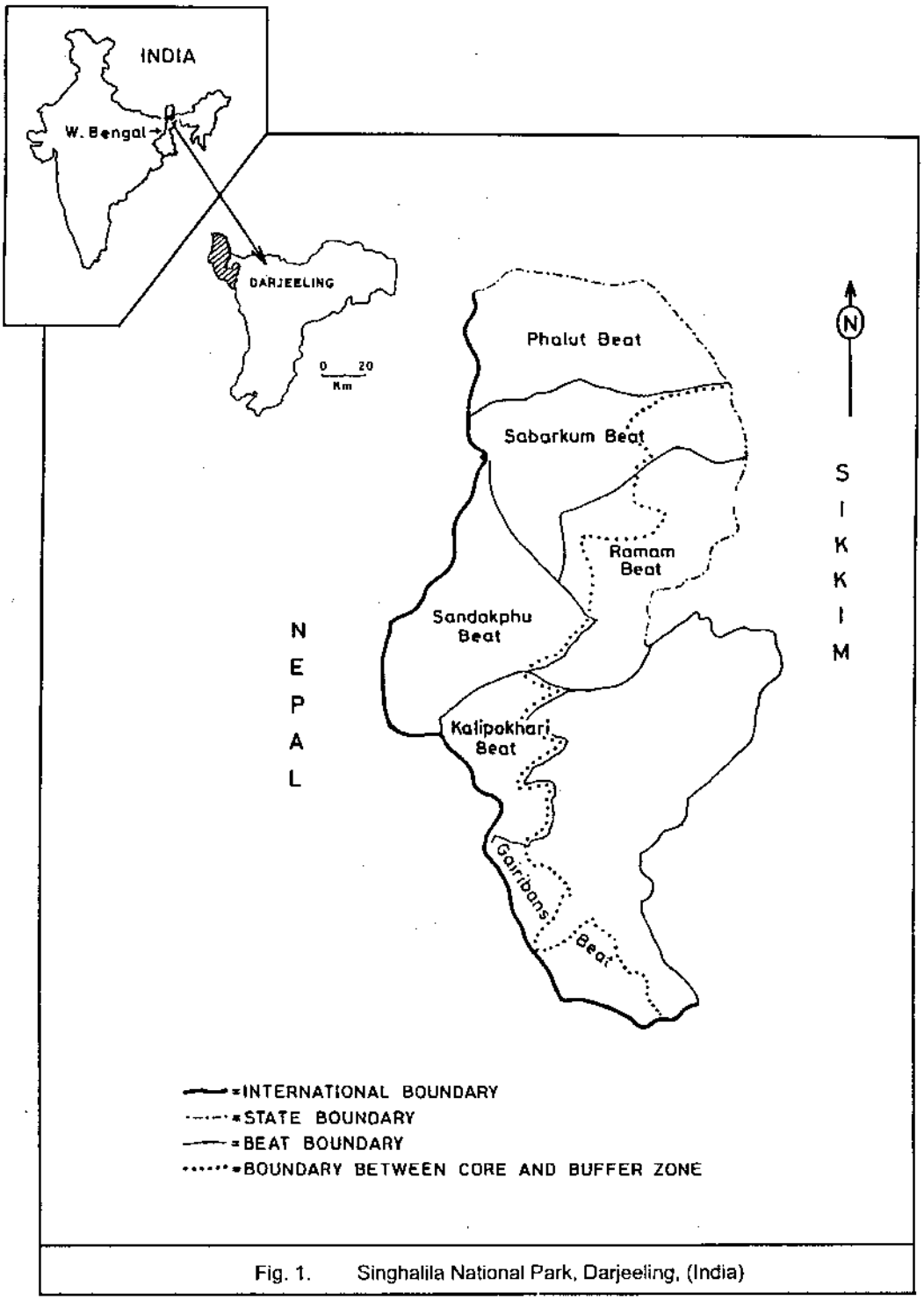

Fig. 1. Singhalila National Park, Darjeeling, (India)

All the other animals seen were alone. Out of all these animals sighted and observed, only one exhibited a kind of aggression. This was sighted in August 1995, in Sandakphu at 3,450 m ASL in Silver fir-birch-bamboo forest on the northern aspect at 10.00 hrs, and was observed for 30 minutes. It was on the base of the slope when it was first seen while my field assistant and I were on the ridge. This animal, instead of walking or running away, walked up the hill towards us. Whilst doing this, it scent marked by rubbing its anal portion on three occasions, twice on a fallen log and once on the base of a tree. In red panda scent marking is effected by depositing a secretion from anal and circumanal glands on various substrata in the enclosure or habitat; these are used either for marking territories and home ranges or as cues for mates during breeding season (Roberts & Gittleman, 1984). We did not move from our place of observation, but the panda positioned itself at about 7 m from us. It stayed there for a few minutes sniffing the air around, then descended out of sight. We packed up and, when we were just about to move, realised that the panda had stealthily climbed the birch (*Betula utilis*) tree behind us and was looking at us. This was unusual behaviour for the red panda which is known to be shy. On one only occasion was a red panda observed when feeding. This animal was sighted in a rhododendron-bamboo forest 2,890 m ASL at Kalipokhari on a *Rhododendron* tree feeding on leaves of *A. aristata* bamboo which was tall enough to reach the height of the branch where the

panda was resting. On January 1995, a subadult red panda was seen walking on the soft snow on the ground at 2,800 m ASL in Kaiyakatta.

Eighty seven % of the sightings of red panda in the Singhalila National park were on trees and the rest on the ground. Some of the trees used, and which form important components of red panda habitat were *Abies densa, Quercus pachyphylla, Sorbus cuspidata,* and *Magnolia campbellii.*

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P. G. Department of Zoology, Darjeeling Government College, Darjeeling, West Bengal, India
Present address: **Batasia, Ghoom, Darjeeling 734102, West Bengal, India**

Recent publication

Carnivores of South East Asia

Kanchanasakha, B., Simcharoen, S. & U Tin Than. 1998. *Carnivores of mainland South East Asia.* Bangkok: WWF-Thailand Project Office. 236 pp.

This handy pocket-sized field guide is concerned with the 49 wild carnivores (including the recently discovered *Viverra tainguensis*) distributed over eastern India, eastern Bangladesh, Bhutan, northern Sumatra, Singapore, south-west China, Hainan, and particularly Myanmar (Burma), Thailand, Laos, Cambodia, Vietnam, and Malaysia. For each species there are notes on size, weight, shape & colour, distribution, variation (possible subspecies), and ecology & behaviour, as well as a schematic map and a fine line drawing of the animal. A table shows the conservation status of all species, including both IUCN categories and CITES Appendix listings. For 34 of the species drawings of the tracks are given and for a few the form of the scats.

The modern state of European mink (*Mustela lutreola* L.) populations

I. L. TUMANOV

The protection of rare and disappearing animals represents the most complicated problem within the general task of conserving natural richness. To resolve these problems it is necessary to have data on distribution boundaries, species number, and status. Among the rare smaller mammals of Europe it is necessary to distinguish the European mink, *Mustela lutreola* which on the threshold of the 21st century has almost completely disappeared from the majority of European countries and its numbers are dramatically decreasing within the former USSR. We have carried out monitoring of the European mink during the last 30 years, allowing us to follow population changes in the species' range boundaries and also, periodically, to evaluate the state of its population (Tumanov & Ternovskij, 1972; Tumanov & Zverev, 1984, 1986; Tumanov, 1992, 1996).

The results of my own field investigations carried out in different regions of Russia, of literature researches, of inquiries and questionaire data obtained from colleagues, hunters and records of local hunting organizations, were used in the present work.

As early as in the beginning of the 19th century the aboriginal mink was widely distributed in Europe. It inhabited a vast territory from the eastern boundaries of Spain up to the tributaries of Irtysh in western Siberia. The species was absent only from Sweden, Norway, Great Britain, Ireland, Denmark, Belgium, Portugal, Italy and, apparently, Bulgaria (Novikov, 1939). However, already by the middle of the last century it had disappeared from the fauna of the major part of Austria, Germany, Switzerland, the Czech and Slovak Republics, and earlier from the Netherlands. At the end of the 19th century the European mink was not recorded in these countries any more. In the first half of the 20th century its range continued to shrink. In Poland the last specimen was captured in 1915, in Yugoslavia in 1941, and in Hungary in 1952 (Youngman, 1982). Then the aboriginal mink disappeared from Finland (Henttonen, 1992) and many French departments (Saint-Girons, 1991). At the present time in the western part of its range small populations remain only in the south-west of France, in northern Spain (where it apparently penetrated from France), and in Rumania on the mouth of Danube (Ruiz-Olmo & Palazon, 1990; Palazon & Ruiz-Olmo, 1993; Moutou, 1994). According to Maran (1994) the general size of these populations does not exceed 3,000 individuals.

At the east of the European mink's range the decrease in numbers became noticeable at the end of the 1950s-1960s. Here the reduction of the species' distribution area has a clear direction from west to east, and from the periphery to the center of its range.

On the water bodies of Bessarabia at the beginning of the 20th century the European mink was still considered to be a common representative of the local fauna. Then, in the 1930s its numbers in Moldavia suddenly began to drop and in the 1940s only single skins were coming in to the state organization for pelt purchases. At the beginning of the 1960s in the basins of Dnestr and Prut it was possible to find marks of the activity of aboriginal mink, which, at the end of this decade finally disappeared (Korchmar', 1968).

In Ukraine in the 1930s-1940s the European mink was widely distributed along the whole area of suitable habitat; it was absent only from Crimea. The catastrophic decrease in its numbers was distinctly observed at the border of the 1950s-1960s (Abelentzev, 1968). Thus, according to data available from the Chernigovsky region, the last time it was recorded was in 1951; in Poltavsky in 1955; in Sumsky in 1968; and in L'vovsky in 1981-1983. At present, in the water bodies of Ukraine it remains, apparently solitarily, mainly in the south-western part of the country.

A similar picture is typical for the republic of Belarus. If in the 1930s-1940s the European mink here occurred in the whole territory, on the border of the 1950s-1960s it disappeared in the western and then in the central part of the Republic (Serzhanin, 1970). In recent times a small population of the species (numbering 120-150 individuals) remained only in the north-east of Belarus along the border with Russia (Sidorovich, 1991) and in the south-west of the Byelorussia Republic in the Polesye Region (pers. comm. L. S. Tzvirko, 1999).

In the Kaliningrad region and the Baltic countries the aboriginal mink is practically absent. According to the official census data of game animals in Latvia and Lithuania mink has not appeared in the local fauna from the beginning of the 1960s. However, in recent years signs of its occurrence in Lithuania were again discovered. In Estonia the European mink is also sometimes trapped in the north-eastern part of the country (Maran, 1994).

In Russia aboriginal mink markedly began to disappear along the boundary of its range at the end of the 1950s and in the 1970s its numbers had already drastically decreased along the whole of the species' distribution range. According to our expert estimation, at the beginning of the 1980s on the entire territory of the former USSR its number did not exceed 40-50 thousand individuals, and its main population was concentrated in a number of central and north-western regions of Russia (Tumanov & Zverev, 1984, 1986). An intense worsening of the European mink's numbers and shrinkage of its range continues to be observed until the present time. Hence, only decisive means directed at its restoration can save the species from totally disappearing from nature within several decades.

What is the number of the European mink in Russia? The results of analysis of the corrected evidence in the main economic regions of the country, i.e. within the whole eastern range of the species, are given below.

North-western and Northern regions

The north-western border of the European mink's distribution in general always coincided with the administrative border between the Murmansky region and Karelia (Danilov & Tumanov, 1976). However, at the present time in Karelia and adjacent regions of the Leningrad area it has already disappeared. The water bodies of the Leningrad area are mainly inhabited by American mink which appeared here due to escapes from farms and the dispersion of animals from Karelia (where the species was introduced in 1962-1965).

The range of the European mink in the Leningrad area is constantly decreasing. If at the end of the 1970s it here inhabited an area of 4.5 Mha already by the beginning of the 1990s this had diminished to 2.0 Mha, and numbers decreased from 3.0-3.5 to 1.0-1.5 thousand individuals.

In the adjacent Pskov and Novgorod areas, in the basins of the rivers Velikaya, Shelon', Lovat, Polist, and Msta, considerable populations of European mink are still remaining. According to data from a 1995 census of some water bodies in this territory, species population densities achieved 2.5-4.2 individuals per 10 km of the river and general numbers comprise 5.0-5.5 thousands. Unfortunately, according to the information available, American mink have also dispersed into practically all regions of Pskov and Novgorod in the last few years.

In the Arkhangelsk area and the Komi Republic the European mink mainly inhabits the basins of the rivers Onega, Pechera, Mezen', and Vychegda. In the Komi Republic the density of the species population comprises 0.5-0.7 individuals per 10 km of river, and its number is about 4.0 thousand individuals. Although the population density of European mink is everywhere small, taking into account the length of the rivers, we evaluate the species' numbers in this territory at approximately 7-8 thousand individuals.

In the Vologda area the aboriginal mink occupies the rivers of Volga and the North-Dvinsk water basins, where its density sometimes achieves 3-5 individuals per 10 km of river. American mink here only started to penetrate into the western regions of the area where during the last 10 years, it occupied a fourth part. Nevertheless, the analysis of census data for 1982, 1987, and 1995 has shown that in this region the number of European mink is at a comparatively stable level and its fluctuations correspond to the natural course of population dynamics. In the last years the numbers of aboriginal mink in the area have fluctuated between 6-8 thousand. Thus, its general abundance within the north-western and northern boundaries of its range at the moment comprises not less than 19-23 thousand individuals.

Ural region

The major part of this territory is inhabited by American mink. In the Bashkiriya, Udmurtiya, and Sverdlovskaya areas the marks of occurrence of the aboriginal species are no longer counted. In the Chelyabinsk, Orenburg, and Perm' areas it could be met as a single animal (Kiseleva, 1999; Rudi, 1999). In the Omskaya area attempts to find *Mustela lutreola* were unsuccessful. The last reliable case of its non-intentional capture here refers to 1984 (Mal'kova & Sidorov, 1999; Sidorov, 1999).

Volga territory

Practically all water bodies in the Volga region suitable for habitation by the mink are occupied by the American species. In the Tatarstan, Chuvashiya, and Volgograd areas the aboriginal mink apparently does not remain, and in the Kuibyshev, Saratov, and Ul'yanovsk areas it could be met only as a solitary animal.

North-Caucasian region

The southern boundary of the eastern part of the European mink's range is along the territory of 'Fore Caucasus'. Here lives the large but everywhere increasingly rare subspecies *M. lutreola turovi*. In the 1920s-1930s Caucasian mink was widely distributed within this region; already by the beginning of the 1970s it was considered to be under threat of extinction. Particularly noticeable decreases in its numbers are taking place in the floating and steppe biotopes and, less intensively, in the forest-steppe, and mountain-forest biotopes. The center of the range of the aboriginal mink is contracting towards the western part of the North Caucasus and also decreasing in the east.

In the territory of the republics of Fore Caucasus the European mink is still met solitarily along the tributaries of the River Terek. In the Rostov area, Krasnodar and Stavropol' regions, along the basins of the rivers Kuban', Don, Severnyi

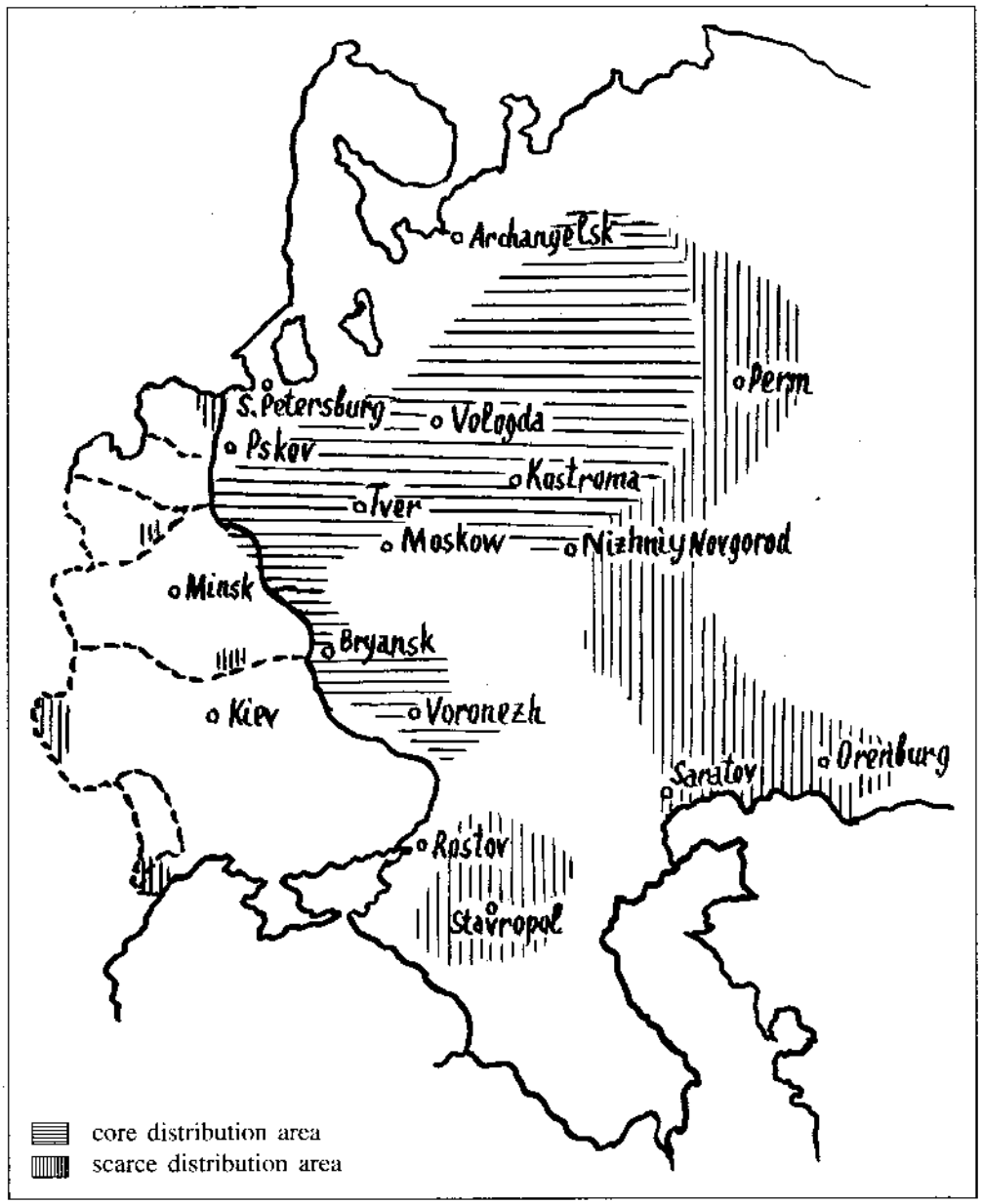

Fig. 1. Distribution of European mink in former USSR