SMALL CARNIVORE CONSERVATION

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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:

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Certain observations on the behaviour of Nilgiri marten (*Martes gwatkinsi*) in Periyar Tiger Reserve, Kerala, India

Deepakumar N. KURUP and Gigi K. JOSEPH

The forested tracts of the south Western Ghats in the Indian subcontinent remain an abode for many endangered and endemic life forms. Even though a number of studies has been conducted to assess the biodiversity of this region, not much documentation of smaller mammals has been done so far. Particularly, the mustelids and viverrids are among the least known mammals thriving in these mountain ranges (Yoganand & Kumar, 1995; Christopher & Jayson, 1996).

The Nilgiri marten, *Martes gwatkinsi*, Horsfield 1851, is a threatened mustelid, distributed exclusively within the south Western Ghats of India (Pocock, 1941). Although many previous authors have attempted to describe the range of distribution of this species, direct sighting reports are still scanty (Hutton, 1949; Prater, 1980; Jerdon, 1984). Karanth (1984) reported the presence of Nilgiri marten in Brahmagiri Wildlife Sanctuary in Karnataka. More recently direct sighting reports have come from Eravikulam National Park in Kerala (Madusudan, 1995), the upper Bhavani region of the Nilgiris in Tamil Nadu (Gokula & Ramachandran, 1995), Peppara Wildlife Sanctuary and Silent Valley National Park of Kerala State (Christopher & Jayson, 1996). The present note is based on a direct sighting of the Nilgiri marten for the first time in Periyar Tiger Reserve.

Periyar Tiger Reserve is situated in the Idukki district of Kerala State. The total extent of the Reserve is 777 km^2, enclosing a centrally placed lake of 26 km^2. It is bounded by Madurai and Ramanadhapuram districts of Tamil Nadu state to the east and north, Kottayam district of Kerala in the west, and Ranni Forest Division in the south (Fig. 1). The area is drained mainly by three rivers namely Mullayar, Periyar, and Pamba. The terrain is undulating with lofty peaks and precipitious slopes. The elevation ranges from 300 m to 2,019 m above mean sea level. The climate is humid and cool and the temperature varies between 15°C and 31°C. These forests receive an average annual rainfall of 2,500 mm.

Periyar Tiger Reserve is considered to be one of the biologically richest protected areas of the Western Ghats with 1,965 flowering plant species (Sasidharan, 1999). This rich diversity is due to the complex topography and wide range of microclimatic and soil conditions, which in turn results in the formation of a mosaic of different vegetation types. According to Chandrasekharan (1962) and Champion & Seth (1968), the vegetation of Periyar Tiger Reserve can be classified into seven types: west coast tropical evergreen forests, west coast semi evergreen forests, southern moist mixed deciduous forests, southern hill top tropical evergreen forests, southern montane wet temperate forests, south Indian subtropical hill savannahs, and southern west montane grasslands.

On 13 March 2000, while members of the tiger monitoring team proceeded through the semi evergreen patches of Aruvi in Periyar Tiger Reserve, a couple of Nilgiri marten were sighted. The animals were observed for 15 minutes from 10:20 to 10:35 a.m. at a distance of just three metres away. They were identified without mistake by their striking black colour throughout the body except in the throat and chest region. The latter region was marked with a light orange-yellow coat. The head was triangular and dorsally flatted. Total body length including tail exceeded 1 m.

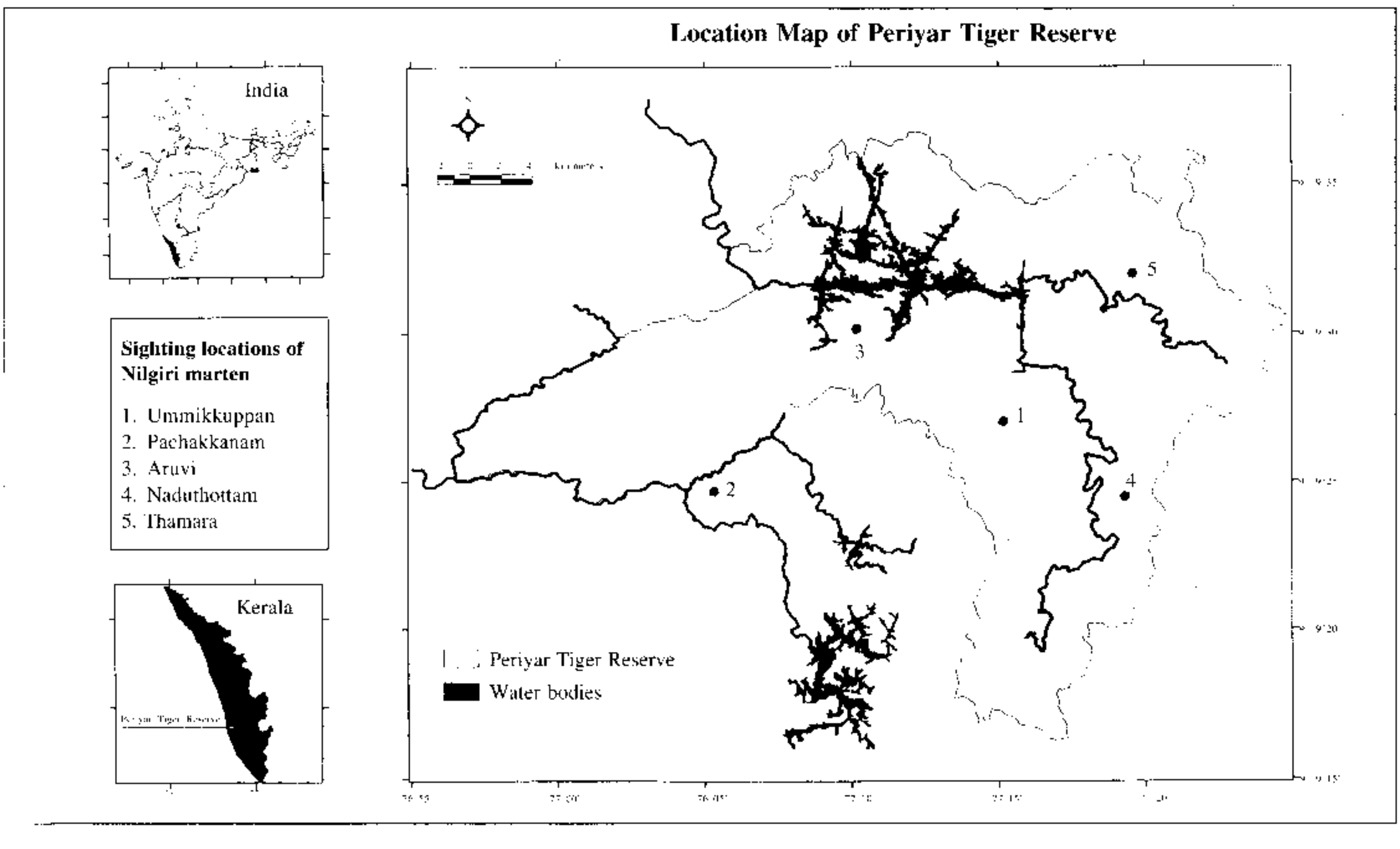

Table 1: Sighting records of Nilgiri Marten in Periyar Tiger Reserve

Sl. No.	Date of sighting			Number of individuals	Location	Type of vegetation	Name of the observer/ Team
	Day	Month	Year				
1.	Unknown	Unknown	1992	1	Ummikkuppan	Evergreen	Mr. Mohanan
2.	Unknown	March	1999	1	Pachakkanam	Evergreen	Mr. O.P. Kaler, IFS
3.	13	March	2000	2	Aruvi	Semi evergreen	Tiger monitoring Team
4.	13	May	2000	1	Naduthottam	Evergreen	Tiger monitoring Team
5.	16	December	2000	4	Thamara	Evergreen	Tiger census Team

Table 1. Sighting records of Nilgiri Marten in Periyar Tiger Reserve

Initially one animal was sighted on a tree trunk at the right side of the road and was found always bobbing its head. When the animal noticed our presence it stared at us for a second and came down to the ground. It appeared unconcerned by our presence but proceeded in a leisurely manner along the ground, climbed another big tree to a height of 2 m, stopped, turned its head and stared at us. After a minute, it descended to the ground and crossed the road slowly. Then it went on to climb a smaller tree, turned towards a small branch and started lying down on the proximal portion. The animal was observed lying flat on its belly with all its four limbs dagling free in the air. While we were observing this animal, another individual also demonstrated a peculiar behaviour of bobbing its head up and down. Subsequently it came to the open area and sniffed the soil for a while. It then crossed the road slowly and climbed the same same tree the other marten was resting on. The second animal took rest on the same branch for five minutes in the same fashion described for the other one. After fifteen minutes of observation we left the animals there and proceeded further on our monthly exercise.

Mr. Mohanan, one of our tiger monitoring team members asserted having seen a similar specimen of the marten about nine years ago at the Ummikkuppan area in the core zone of the reserve, which is exclusively an evergreen area. The locala Mannan tribals call this animal "Enungu" in their language.

On 13th May 2000, the tiger monitoring team on their visit to the core area of Periyar Tiger Reserve, passed by Mlappara-Periyar trek path and a little distance from the abandoned coffee cardamon estate of Naduthottam saw a Nilgiri marten sitting on a fallen *Culleina exanillata* tree and trying to probe into the decaying log for possible grubs. On seeing the team the animal jumped off the log and ran down the ravine below. The time was 10:10 a.m. and the area was wet evergreen mostly of *Holigama* sp. and *Cullenia exarillata*. The ravine was covered with dense reed brakes (*Ochlandra* sp.).

Shri. O. P. Kaler, the previous Wildlife Preservation Officer of Periyar Tiger Reserve, on having been told about the marten sightings, said that he had seen a specimen in March 1999 at Pachakkanam, on the periphery of the Reserve.

On 16 December 2000 a tiger censusing team led by Mr. Joji John, forester accompanied by Mr. Madhukumar (a tiger monitoring watcher) and nine others covering the Thamara block on their way from Vellimala, saw four Nilgiri martens chasing a Mouse deer (*Tragulus meminna*) down towards the Vellimala River (Table 1). They encircled their quarry from the shores but the mouse deer remained immersed in the water for some time. Claw wounds were present on the nape, forehead, and dorsal side of the mouse deer's body. Perhaps because they sensed human presence, the marten left off their quarry and scurried away. One of the animals slid under a fallen *Cullenia exarillata* tree for some time, in the mean time the mouse deer had escaped. Mr. Madhukumar attempted photographing the marten with an auto focus camera. He could approach as close as four metres from the marten climbing down a tree. The area had an altitude of 1,200 m ASL and was of evergreen biotope with the dominating tree species of *Cullenia exarillata, Drypetes elata,* and *Luportia crenulata.*

These observations clearly show that Periyar Tiger Reserve is a potential area for many little described mammals like Nilgiri marten. This species was previously described only from Eravikulam National Park, Silent Valley National Park, and Peppara Wildlife Sanctuary of the 14 protected areas in Kerala State (Madusuda, 1995; Christopher & Jayson, 1996). Though the Nilgiri marten is an elusive creature, it would seem that the species is not as rare as it was once thought, as being manifest in the recent sightings. There is a possibility of sighting this species in other sanctuaries having similar habitats. Therefore it is essential to conduct a detailed survey focusing mainly on the mammalian diversity pertaining to this part of the world.

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We would like to thank Mr. Banakumar, Mr. Madhukumar, Mr. Amar, Mr. Mohanan, Mr. Chellappan, and Mr. Gopi, the members of the Tiger Monitoring Team.

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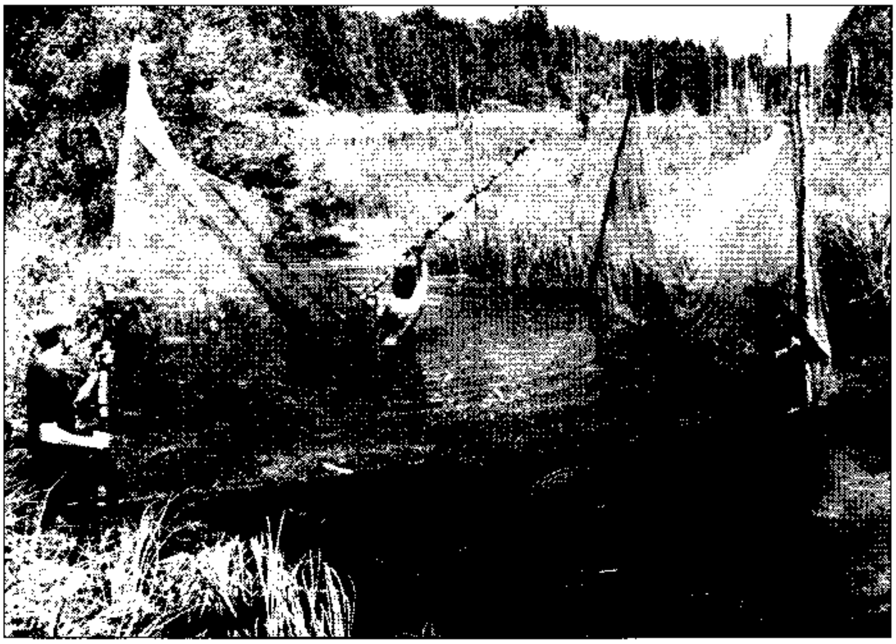
Periyar Tiger Reserve, Thekkady, Kerala, India

A new method to estimate the species diversity, density and biomass of water-living prey of semiaquatic mustelids in beaver ponds and small streams

Vadim SIDOROVICH, Alexey POLOZOV, Inna IZOTOVA and Grigorii JANUTA



Preliminary investigations carried out in Belarus (Zharkov & Rodikov, 1975; Sidorovich, 1990, 1997), Latvia (Balodis, 1990) and Lithuania (Balciauskas & Ulevicius, 1996) have indicated that the beaver *Castor fiber* has a positive effect upon the otter *Lutra lutra* and both mink species *Mustela lutreola* and *M. vison*. Usually, semi-aquatic mustelid densities increased with higher beaver densities and their associated construction activities. However, there are still no exact or detailed studies that show how beaver activities lead to an increase in habitat carrying capacity for semi-aquatic mustelids. In Europe, information related to changes in the species diversity and biomass of their aquatic prey items (fish, crayfish, aquatic beetles, frogs hibernating in water) in brooks and small rivers in connection with beaver damming is still either very poor (Hägglund & Sjöberg, 1999) or anecdotal (Djakov, 1975; Balodis, 1990). In North America, there are publications on this topic (Bailey & Stephens, 1951; Huey & Wolfrum, 1956; Gard, 1961; Knudsen, 1962; Hanson & Campbell, 1963; Keast & Fox, 1990), but it is for another beaver species (*Castor canadensis*) as well as for both another landscape and continent. Moreover, the majority of these results relate to trout, and there is less information about other fish species. Nearly nothing is published about trends in crayfish and frog diversity or biomass, and little information is available in relation to aquatic beetles (McDowell & Naiman, 1986) in stream ecosystems affected by beaver damming.

One of the marked problems while attempting to estimate changes in aquatic prey associations in connection with beaver dam construction is the lack of relevant equipment and methodologies on how to assess species diversity and biomass in beaver ponds. Moreover, ponds should be studied depending on their size, the proportion of shallow to deep waters, age-related eutrophication, and the abundance of dead tree materials and growing vegetation. Estimation of fish diversity and biomass in streams is usually carried out by the well-known method of electrofishing. Nevertheless, in our experience, electrofishing in eutrophic beaver ponds located on forest brooks with both lots of dead tree material and overgrown by vegetation (aquatic plants at the bottom and marshy herbs in the littoral) suggested many shortcomings of this method for estimating fish species diversity and biomass under complex conditions. After electrofishing in a net enclosure has been completed, a substantial part (17-49%, n=7) of the fish remained hidden amongst dead tree material (between roots, under logs, etc.), dense aquatic vegetation or in the mud (as shown by the use of landing-nets). Moreover, electrofishing does not give exact information on other water-

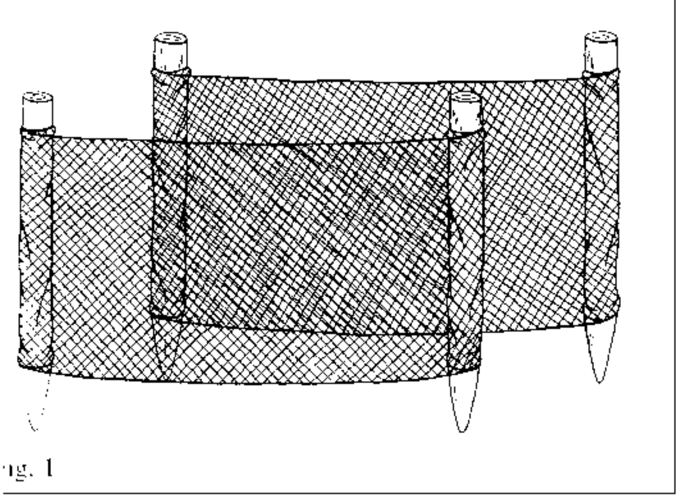


Fig. 1

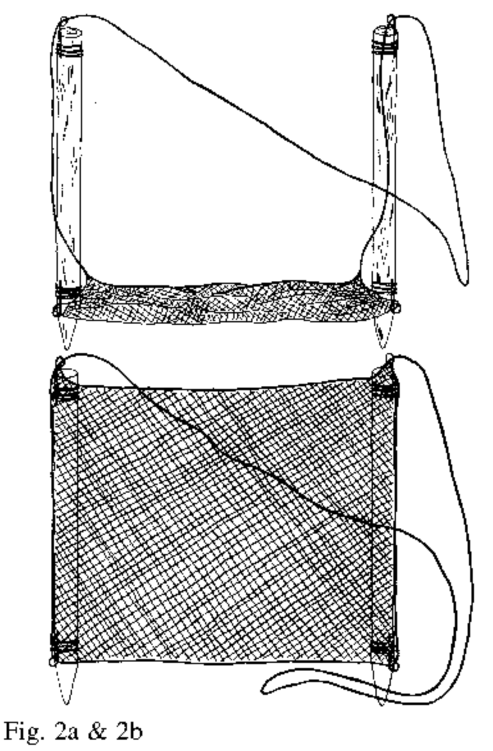


Fig. 2a & 2b

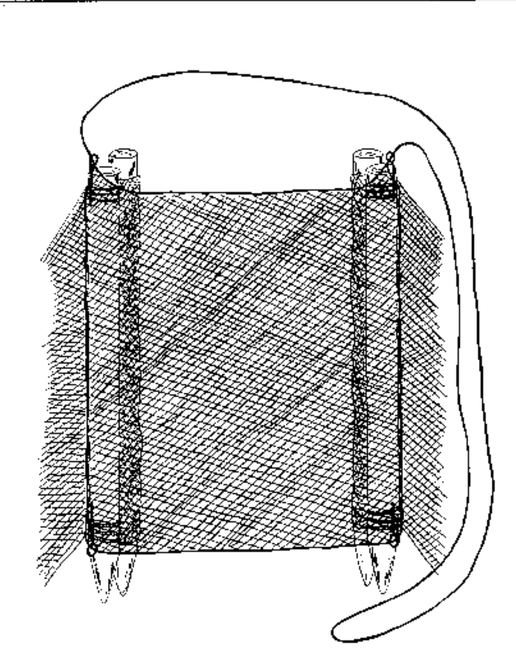


Fig. 3a

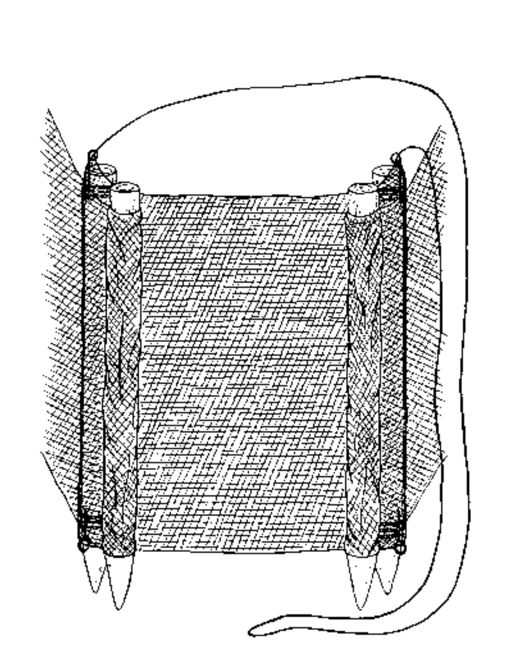


Fig. 3b

dwelling prey, i.e. crayfish, aquatic beetles and hibernating frogs (common frog *Rana temporaria* and edible frog *R.* kl. *esculenta*).

Our new method of estimating the species diversity, density and biomass of the water-dwelling prey of semi-aquatic mustelids in beaver ponds, and the increases in these variables when compared to the parts of streams unaffected by beaver damming, nearly overcomes the shortcomings mentioned. The method consists of the following:

1. Measuring a beaver pond's area in its shallow and deep waters

This should be done by drawing the beaver pond's edge on a detailed map. Littoral parts and deep-waters should be marked separately. Formerly we used 1 m as the border between the shallow and deeper waters, i.e. the part of beaver pond with a depth less than 1 m is the littoral. In practice, we measured depth in different parts of a beaver pond and took that to assess the proportion between shallow and deep waters. Also, to differentiate littoral deep-water areas in a beaver pond, we took into an account the distribution of aquatic plants normally growing densely in shallow waters. After mapping it is not difficult to measure the beaver pond's area. In order to control precision, we also do a visual estimation of the beaver pond's area in both shallow and deep waters. For this work it is important to mentally visualize a rectangle of different sizes (5 m by 10 m, 10 m by 20 m etc). It is not difficult for everybody to get such experience.

2. Section census of species diversity and biomass of water-living prey of semiaquatic mustelids in a beaver pond

A census of water-living prey can be done in sections of 15 m^2 each by means of special net equipment. The sections should be situated in both the shallow and deep waters of beaver ponds. The minimum number of study sections is recommended to be up to 8 for both littoral and deep water parts, depending on their areas. The preliminary data on an increase in the prey species diversity found with higher number of sections studied suggest that their pooled area should cover approximately 0.5-1% of large beaver ponds (>10,000 m^2), 2-10% of medium-sized ones (1,000-10,000 m^2), and 30-50% of small ones (<1,000 m^2). The necessary net equipment (Fig. 1) consists of two continuously standing net walls (length = 5 m, height = 3 m) which should be located across the pond at a distance of 3 m. Another two moving net walls (length = 3 m, height = 3 m) should be used (Fig. 2). The net walls

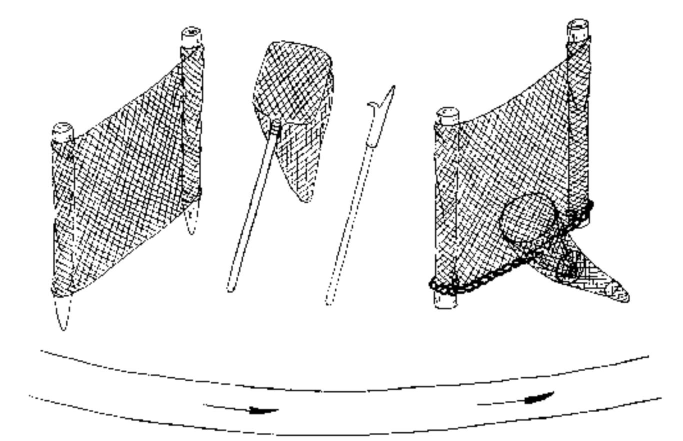


Fig. 4a

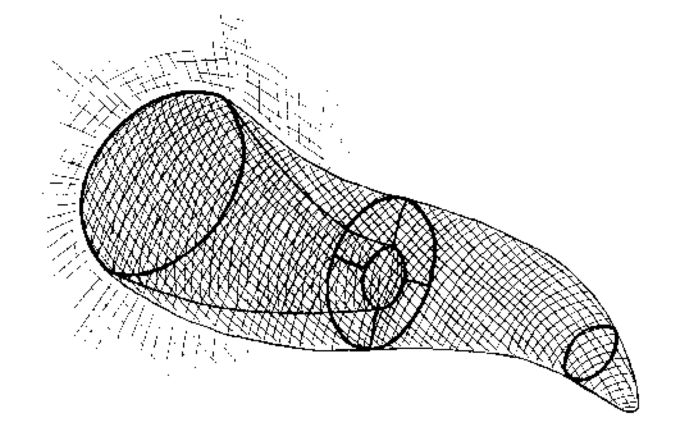


Fig. 4b

Table 1. Species diversity and biomass of aquatic prey of semi-aquatic predators in beaver ponds and comparable parts of small streams in the Lovat river head, Gorodok district, Vitebsk region, NE Belarus, late October and November of 2000

Parameter	BP1	SS1	BP2	SS2	BP3	SS3	BP4	SS4	BP5	SS5
Beaver pond area, m^2	640		16880		6500		140		200	
Beaver pond age, years	3		6		11		10		1	
Eutrophication of beaver pond	low		medium		high		high		medium	
Number of sections studied (their pooled area, m^2)	4(60)		12(180)		8(120)		3(45)		6(90)	
Length of flooded part of small stream, m		36		846		420		28		34
Length of non-flooded small stream studied, m		158		158		100		70		70
Number of fish species	5	-	7	-	3	-	5	1	3	1
Number of frog species	1	1	2	1	2	1	2	1	1	1
Number of crayfish species	-	-	-	-	1	1	-	-	-	-
Number of aquatic beetle species	6	2	10	2	8	3	7	4	6	4
Total prey species number	12	3	19	3	14	5	14	6	10	6
Fish biomass, kg	3.8	-	165.4	-	76.2	0.04	2.90	0.05	1.1	0.06
Frog biomass, kg	9.1	0.024	140.1	0.54	8.2	1.60	0.63	0.10	1.3	0.10
Crayfish biomass, kg	-	-	-	-	13.2	0.08	-	-	-	-
Aquatic beetle biomass, kg	0.4	0.001	7.6	0.03	7.8	0.02	0.42	0.002	0.1	0.003
Total prey biomass, kg	13.3	0.025	313.1	0.57	105.4	1.74	3.95	0.152	2.5	0.163

Denotation: BP1 and SS1, ..., BP5 and SS5 - are the data related to beaver ponds and comparable parts of non-flooded small streams

are fixed by wooden stakes and ropes (Figs. 1-3) and moved by means of long ropes (Fig. 2, 3). By setting the net walls around a particular section of a beaver pond, the section bottom should not be destroyed. After the net equipment has been fixed in a beaver pond it should be left open for several hours (Fig. 2a) and then rapidly closed (Fig. 2b). The aquatic prey contained in the net enclosure are captured by use of landing-nets until all are caught. This is defined by a zero asymptote in the catch result for each prey category (fish, crayfish, frogs and aquatic beetles). The landing-nets used have a mouth of 30 cm and are 70 cm in diameter. The diameter of the nets used was 0.6 cm.

3. Extrapolation of the section data to the whole beaver pond

This should be calculated as follows. The species composition of water-dwelling prey for semi-aquatic predators in a beaver pond is assumed to be their total diversity in all the sections studied. The biomass of a given species or category of water-dwelling prey is estimated for shallow and deep waters of a beaver pond separately, by means of multiplication of the average section biomass and the area of shallow or deep waters (in m^2) divided by 15 (the section area).

4. Estimation of length of the stream part flooded by the beaver pond

Usually, the stream part flooded by a beaver pond can be readily measured by following the bank treeline by row boating in the warm season, or by walking on ice in the cold season. Also, it can be measured from a detailed map of the area.

5. Census of species diversity and biomass of water-living prey in non-flooded stream

This should be done in 100 m of the part of the adjacent stream unaffected by beaver damming, again by means of special net equipment. The diameter of the nets used was 0.6 cm. The net equipment (Fig.4) consists of two net walls (length = 6 m, height = 3 m, approximately). The net walls are fixed by wooden stakes and ropes. One of the net walls has a catching cavity. Its mouth should be 40-60 cm in diameter and located about 50 cm over the lower net side. The net cavity length is 100-150 cm. The net wall with the catching cavity (i.e. catching net) is provided with a heavy chain fixed on the lower side. By doing the census of water-dwelling prey in a 100 m stream section, the net wall without the catching cavity (the guard net) should be situated across the upstream part of the stream studied. All holes through which aquatic prey may escape upstream should be closed by the net wall and other material (for instance, wood material found on the stream bottom). The catching net should be gradually moved by two (or better, three) people from downstream of the stream section. Two people pull the net by the wooden stakes bracing the stream banks. The third person takes care that the lower net side

touches the stream bottom. Another two people have to clear the stream bottom of the section of wood and stones as, well as gradually catching prey with landing-nets. The catching cavity is looked through from time to time. When the catching net is close (about 5 m) to the guard net, the uncaptured prey are caught by landing nets until all are caught. This is defined by a zero asymptote in catch result for each prey category (fish, crayfish, frogs, and aquatic beetles).

6. Data analysis

To reveal the influence of beaver damming on the species diversity and biomass of the aquatic prey of semi-aquatic predators in small streams, the total data from beaver ponds and comparable stretches of small streams should be compared. The length of the part of the small stream used for the comparison should equal its length flooded by the beaver pond. The difference plausibly depends on eutrophication of both small stream and beaver pond. Also, age and size of beaver ponds seem to be very important and must be taken into account. Therefore, all possible different situations in respect to the three parameters mentioned should be studied.

By trying and using this method in late October and November 2000 in the Lovat river head (Gorodok district, Vitebsk region, NE Belarus), the following preliminary results were obtained (Table 1). In total, five beaver ponds and comparable parts of five small streams were studied. The small streams (Lyahovsky, Rudnjansky, and Prosimka) were not eutrophic, and their width varied from 1.5 m to 3 m, depth = 0.2-1 m. The beaver pond areas varied from 140 to 16,880 m^2. Their age was from 1 to 11 years old. The degree of eutrophication was also different (Table 1). The number of fish species captured in the sections studied was 3-7 (mean 4.6) in the beaver ponds versus 0-1(0.4) in the neighbouring non-flooded parts of small streams (U_s=25, P<0.002). It looked like the highest fish species diversity could be attributed to medium-aged, large beaver ponds. A similar trend for aquatic beetles (*Dytiscus* spp.) was revealed [6-10(7.4) versus 2-4(3.0), U_s=25, P<0.002].

Concerning frogs, the common frog and the edible frog were caught in beaver ponds, whereas only the common frog was censused hibernating in small streams. Crayfish, *Astacus astacus*, were only discovered in one of the three brooks studied - both in the beaver pond and in its non-flooded part. The total species number of water-dwelling prey of semi-aquatic predators in the beaver ponds studied was markedly higher than in non-flooded small streams [10-19(13.8) versus 3-6(4.6), U_s=25, P<0.002]. The difference in crude biomass of aquatic prey in beaver ponds compared to the non-flooded small streams was even greater: fish = from 18 to 1905 fold and higher, crayfish = 163 fold, frogs = 5-379, on average 132 fold, aquatic beetles = 33-400(257) fold, total = 16-549(237) fold (Table 1). Fish biomass in the beaver ponds increased with age: 0.98-2.07 kg per 100 m^2 in rather old (6-11 years old) beaver ponds and 0.59-0.55 kg per 100 m^2 in the newly appeared ones. The same trend for aquatic beetle biomass was found: 0.12-0.30 versus 0.05-0.06 kg per 100 m^2. Concerning frog biomass, it seems that much higher values were associated with the medium-aged beaver ponds (Table 1).

Further studies which will be carried out by the above-described census method, which will reveal in detail how both mink species and otters benefit from the construction activities by beavers.

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Zorilla war

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Each species of animal has a unique scientific name. This is usually quite clear. We all accept that the stoat is *Mustela erminea* and the genet is *Genetta genetta*. Now and again it is not so obvious. For example, some naturalists thought that an animal named *Viverra zorilla* or *Mustela zorilla* was the North American spotted skunk (*Spilogale putorius*) while others thought it was the African striped polecat (*Ictonyx striatus*). There was a similar disagreement about the generic name *Zorilla*. Zorilla is derived from the Latin American zorrillo, a diminutive of the Spanish zorra or fox, and means a skunk. It became an alternative vernacular name for the striped polecat because naturalists confused American skunks with African polecats, the cause of all the trouble that will be recounted here. At least seven zoologists became involved in an argument that smouldered for 19 years. On two occasions editors put a stop to the dispute continuing in their journals, yet it was able to fill 14 scientific papers and 37 pages in a bitter confrontation between American and British taxonomists, involving humiliation, blame, sarcasm and obduracy. The issue is now settled. Nevertheless it is instructive to see what went wrong and how so much ink was spilt over what was really quite a simple problem.

Types are important in the story. The type of a species is a reference specimen that we can examine to make sure that the species is what we think it is. The type of a genus is a species that testifies to the nature of the genus. The performers in our drama were out to identify the type specimen of *Viverra zorilla* and the type species of the genus *Zorilla*.

Based on the 'polecat' of pioneer naturalist Mark Catesby, Linnaeus had named the spotted skunk *Viverra putorius* in 1758. Much later it was placed in the genus *Spilogale* Gray, 1865. *Viverra zorilla* von Schreber, 1776 (the name that was to prove so contentious) was based solely on an illustration copied from a picture of an animal called 'Le Zorille' in Buffon's 'Histoire Naturelle'. The text accompanying von Schreber's plate was printed later, in 1777, and hardly concerns us. The striped polecat was not named until 1810 when Perry called it *Bradypus striatus*. Later it was placed in the genus *Ictonyx* Kaup, 1835. I. Geoffroy had proposed the genus *Zorilla* a little earlier, in 1826, with type designation "Le Zorille, Buff., T. XIII, pl. 41; *Mustela Zorilla* et *Viverra Zorilla* des auteurs systématiques," but his text shows that the new generic name was intended for the striped polecat. We would now say that his specimens of the striped polecat and the animal he called *Mustela* or *Viverra zorilla* were syntypes of the genus *Zorilla* — they were to share the position of type species until one was selected for this role.

Hershkovitz (1949) thought that Buffon's Zorille was an African striped polecat because of the diagnostic white edges to its ears and the large amount of white on the tail. From the type designation quoted above, he concluded that *Zorilla* I. Geoffroy, 1826 was the generic name for the striped polecat. He thought the earliest specific name in the genus was *Viverra mapurita* Müller, 1776, based also on Le Zorille, so the striped polecat had to be called *Zorilla mapurita*.

Ellerman & Morrison-Scott (1953) showed very convincingly that Le Zorille is not a striped polecat at all but a spotted skunk. In Buffon's plate, the ears are outlined in white only so as to be seen against black pelage, and the colour pattern on body and tail is certainly that of the skunk. *Viverra mapurita*, based on the same source, must also be a spotted skunk. They concluded that *Zorilla* is founded on a spotted skunk too, and therefore is a senior synonym of *Spilogale*. They asked the International Commission on Zoological Nomenclature (ICZN) to place *Zorilla* on the Official Index. That means it would be suppressed and could not be used as a generic name.

Not finding he could agree with Ellerman & Morrison-Scott (1953), Hershkovitz (1953) altered his opinion and stated that Le Zorille and names based on it could not be identified with certainty. The name *Mustela zorilla* was traceable to É. Geoffroy, 1803 and was no longer regarded as a synonym of *Viverra mapurita* Müller, 1776 or of *V. zorilla* von Schreber, 1777. It was regarded as the type species of *Zorilla*. The type specimen of *M. zorilla* was the skin of a striped polecat #120 in Paris, with paratypes #121 and #122.

Ellerman & Morrison-Scott (1954) concluded that Le Zorille of Buffon is the type of *Zorilla* because this is the only bibliographic reference given in the type designation, but they ignored the actual specimens on which I. Geoffroy founded this name. They upbraided Hershkovitz for changing the type of *Zorilla* from Le Zorille to *Mustela zorilla* É. Geoffroy, 1803 and considered É. Geoffroy's work to be unpublished and therefore unavailable, not to be used as a source of scientific names. They intended to ask the ICZN to confirm that the non-contentious names *Ictonyx*, *Bradypus striatus*, and *Spilogale* are available by placing them on the Official Lists, and to suppress *Zorilla*, *Viverra zorilla* and *Mustela zorilla*.

Quoting I. Geoffroy in translation, Hershkovitz (1955) again emphasised that the animal on which *Zorilla* was founded is an African striped polecat. He admitted that the type designation of *Zorilla* was composite but disagreed that *Zorilla* was based on Le Zorille. He now attributed *Mustela zorilla* not to É. Geoffroy but to G. Cuvier, 1798 who had earlier used this name-combination for polecats of the Cape of Good Hope.

Without any evidence whatsoever, Ellerman & Morrison-Scott (in China 1962) questioned that É. Geoffroy's specimens had really come from Africa and were genuinely striped polecats. They noted that Hershkovitz had changed the type species of *Zorilla* from *Viverra mapurita* Müller, 1776 (yet Hershkovitz had not said this was a type) to *Mustela zorilla* E. Geoff, 1803 and finally to *Mustela zorilla* G. Cuvier, 1798. But the last mentioned name is the same as *Viverra zorilla* 'Linnaeus' (= Gmelin) 1788, based in turn on von Schreber and Buffon, and therefore must be a spotted skunk, not a striped polecat. So the type species that Hershkovitz chose for *Zorilla* is a spotted skunk. Ellerman & Morrison-Scott were right. It was Hershkovitz who had made the wrong choice.

China (1962) reviewed the case and requested the Commission to place *Ictonyx* and *Bradypus striatus* on the Official Lists, and to suppress *Zorilla* I. Geoffroy, 1826, *Viverra zorilla* Gmelin, 1788 and *Mustela zorilla* Cuvier, 1798. But *Mustela* *zorilla* Cuvier, 1798 cannot be suppressed as no such name exists (Holthuis 1963); it is not a new name but just a new combination of *Viverra zorilla* Gmelin, 1788, which is the '*Mustela zorilla* et *Viverra zorilla* des auteurs systématiques' of I. Geoffroy (1826). Therefore the type of *Zorilla* is Gmelin's *V. zorilla*, according to China. A type species (a lectotype) should be selected, said Holthuis, from the literature quoted by Gmelin so as to determine what kind of animal it is. In response China (1963) withdrew one of his requests (to suppress *Mustela zorilla* Cuvier, 1798) but not the other (to suppress *Zorilla*).

Quoting the original French text of I. Geoffroy, Hershkovitz (1963) again stressed that *Zorilla* is based on a single species, the striped polecat. *Mustela zorilla* G. Cuvier, 1798 was the type by monotypy (only one species mentioned) and absolute tautonymy (generic and specific names identical). He requested the Commission to place *Zorilla* I. Geoffroy, 1826 and *Mustela zorilla* G. Cuvier, 1798 on the Official Lists.

China (1965) reviewed the controversy again and cited the authors to which Gmelin referred. He requested the Commission to designate a specimen of spotted skunk as a neotype for *Viverra zorilla* Gmelin so that *Zorilla* would become a synonym of *Spilogale*. *Zorilla* predates *Spilogale* so that would have meant more trouble.

Van Gelder (1966) pointed out that the author and date of *Viverra zorilla* is not Gmelin, but von Schreber, 1776, which we should have known all along, and we should not worry about a type for '*Viverra zorilla* Gmelin' because it is not a new name, merely a quotation of von Schreber's. He presented further evidence from the literature that Le Zorille was a skunk and appreciated that the type of *Viverra zorilla* must be the animal figured by von Schreber, a copy of Le Zorille of Buffon. *Viverra zorilla* name becomes a junior subjective synonym of *Viverra putorius* Linnaeus = *Spilogale putorius* (Linnaeus). Thus the status of *Viverra zorilla* was quite definitively and finally determined.

Then at last Van Gelder made the point that was so crucial to the whole controversy: the genus *Zorilla* is based on a misidentified type species. *Zorilla* is founded upon the African striped polecat misidentified as *Viverra zorilla* (the spotted skunk). *Zorilla* had been used exclusively as a name for the striped polecat. Van Gelder requested the Commission to designate *Bradypus striatus* (the earliest specific name for the African striped polecat) as the type species of *Zorilla* and to place *Viverra zorilla* von Schreber, 1776 (skunk) and *Zorilla* (striped polecat) on the Official Lists.

Hershkovitz (1966) still insisted that *Mustela zorilla* G. Cuvier, 1798 is the type of *Zorilla* and is a different name from *Viverra zorilla* von Schreber, 1776. China (1966) retracted his request for a neotype for *Viverra zorilla* Gmelin and made two proposals. Either *Zorilla* should be placed on the Official List (so that *Ictonyx* becomes a junior synonym), or *Zorilla* and *Viverra zorilla* should be suppressed.

Hayman (in China 1965) had shown that in some major works of reference published after 1900, *Ictonyx* had been used nine times as the generic name of the African striped polecat but *Zorilla* only three times. In 1967, the International Commission for Zoological Nomenclature placed *Ictonyx* and *striatus* on the Official Lists, and perhaps influenced by Hayman's observations, suppressed *Zorilla*. There was no need to suppress *Viverra zorilla* because its status as a junior subjective synonym of *Spilogale putorius* (Linnaeus) was firmly established. End of story.

Hershkovitz had been quite wrong to think that Buffon's animal was either a striped polecat or was unidentifiable, and he was not correct in designating *Mustela zorilla* of E. Geoffroy or Cuvier as the type species of *Zorilla*, because it was not an original scientific name, simply a new name-combination of *Viverra zorilla*. He saw that *Zorilla* was based on a composite of species and though he did not designate a lectotype, he was essentially correct to say that *Zorilla* applied to the African polecat. Ellerman & Morrison-Scott were wrong in insisting that *Zorilla* applied to spotted skunks and was a senior synonym of *Spilogale*, or that its type species was *Mustela* or *Viverra zorilla*. They had no reason to doubt the identity of striped polecats in the Paris Museum. They ignored the evidence that syntypes for *Zorilla* included both the spotted skunk and the striped polecat. But they were quite right to think that Le Zorille of Buffon was a spotted skunk, for which Van Gelder later provided further evidence. We had to wait for Van Gelder's insightful contribution to recognise that *Zorilla* was based on a misidentified type. The type of *Zorilla* is the African striped polecat first named *Bradypus striatus* Perry, 1810 and long misidentified as *Mustela zorilla* = *Viverra zorilla* von Schreber, 1776 = *Spilogale putorius* (Linnaeus, 1758), which is the North American spotted skunk. *Viverra zorilla* was based exclusively on a spotted skunk but over time in the writings of many zoologists it had come to include the striped polecat. Obduracy of both camps in the dispute prevented all this being made clear. The issue of substance was really whether *Zorilla* should maintain seniority over *Ictonyx*. This case was eventually put to the Commission and *Zorilla* was suppressed. A great deal of space was given to the availability of É. Geoffroy's Catalogue of Mammals in the Paris Museum, and although this is an important point, it eventually proved to be irrelevant to the issues in dispute. The experts ought to have known better, but who are we to criticise? We have the advantage of hindsight.

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Small carnivore trappability: Seasonal changes and mortality A case study on European mink *Mustela lutreola* and Spotted genet *Genetta genetta*

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Abstract

Live-trapping is largely used to capture carnivores for census and management of their populations. Until now there have been few studies dealing with its reliability throughout the year or its possible deleterious effects on tapped populations. In this paper we analyse the differences in trapping results between two different seasons carried out in the same area, and propose a possible explanation for this phenomenon based on differences in small carnivore behaviour due to food or mating requirements. In addition, based on radio-tracking data obtained, we discuss the negative effect of live-trapping on endangered European mink, resulting in the death of some animals as a consequence of post-capture stress.

Introduction

The mustelids are the most diverse group of carnivores, and can be found naturally on all continents except Australia and Antarctica. However, due to their secretive lifestyle, the mustelid family are the world's least known carnivores. Several species have not been described by science, and many may disappear before studied in detail (Blomqvist & Maran 2000). This knowledge paucity is more alarming in the case of some species like the endangered European mink, which has disappeared from most of its range and has only recently received scientific attention. Most studies on the European mink deal with its distribution, mainly based on trapping data (Palazón & Rúiz-Olmo 1992, Sidorovich 1993, Palazón 1997, Maizeret *et al.* 1998, Ceña *et al.* 1999), or with the possible causes of its disappearance (Maran & Henttonen 1995, Maran *et al.* 1998). But only recently have deeper studies of its ecology been carried out (Palazón & Rúiz-Olmo 1993, Sidorovich 2000, Sidorovich *et al.* 1999, 2000, Garin *et al.* 2001)

The viverrids are small carnivores (including genets, civets, and others) native to Africa and Asia, which are also poorly known (Ewer 1998, Virgós & Casanovas 1997). It is widely assumed that spotted genets (*Genetta genetta*) have been introduced to Europe, probably from North Africa (Dobson 1998). Their presence is well documented from the XIII th Century onwards (Calzada 1998), and nowadays they are common in the Iberian Peninsula and in south and central France (Corbet & Harris 1991). But studies on their ecology in Europe are scarce (Palomares & Delibes 1988, Clevenger 1995, Virgós *et al.* 1996).

Information on the ecology and distribution of such small carnivores is provided mainly by trapping and radio-tracking data. Trapping is widely used by technicians in order to capture animals, mainly for census and population management using capture-indices as indicators of status (Wilson *et al.* 1996, Sutherland 1996). For above the technique an assumption that capture-probabilities do not vary in different seasons is critical (Wilson *et al.* 1996). However, results from several studies appear to make this statement unreliable. For instance, Smith *et al.* (1994) found that raccoon rates of visitation to scent stations on an island differed with seasons, and that they were not correlated with the density of raccoons on the island. Similarly, capture probability of American mink changes markedly throughout the year (Ireland 1990 *in* Dunstone 1993). In the same way, Brzezinski *et al.* (1992) found their summer polecat (*Mustela putorius*) live-trapping period to be unsuccessful, with most individuals caught between November and February, although they did not test for statistical significance between the differences.

Many ecological and distributional studies of small carnivores, and especially conservation programs for European mink, would benefit from a better knowledge of seasonal variations in capture probability. So, the main aim of our study was to investigate seasonal changes in capture probability and, therefore, to test the reliability of the census data obtained using capture-indices. We also tested capture-probability changes in the different days that traps were operative during a given season. In addition, we discuss the possible negative effects of live trapping on mink populations.

Study area

The present study was carried out in the Urdaibai Biosphere Reserve (UBR), Basque country, northern Iberian Peninsula. The UBR spreads over a whole basin with an area of 270 km². Altitude ranges from 0 to 900 metres ASL. Climate is oceanic, average rainfall ranges between 1,200 and 1,600 mm, and January and July average temperatures are 6°C and 18°C, respectively. Winters are mild and there is no effective snow cover.

The landscape is hilly and rugged; 70% of the land is forested, mainly *Pinus radiata* and *Eucalyptus globulus* plantations. Native holm oak (*Quercus ilex*) forests are also common in rocky areas. Meadows and estuarine habitats occupy 25% of the area; the remaining 5% is urban with nearly 45,000 inhabitants.

Rivers are short and riparian vegetation is usually dense, with large dense bramble (*Rubus ulmifolius*) shrubs along the shores. In the upper parts of the river gallery forests of alder (*Alnus glutinosa*) are not uncommon, the same is true of pine and eucalyptus plantations. There is a moderate overall pollution level, and near industrialised areas streams show significant amounts of heavy metals (Rodríguez & Cid, 1995).

Materials and methods

Animals were live-trapped in single entry cage traps of our own design (25x25x45cm), baited with sardines in vegetable oil. Trapping was conducted in two different seasons, the first in late winter, from 11-02-1999 to 20-03-1999, and the second (carried out in late summer/early autumn) started on 31-8-1999 and finished on 04-10-1999. The basin centre was subdivided into seven areas, each containing some of the more representative habitats and landscapes in the UBR. Four areas were trapped in late winter, and in late summer the remaining three, plus one of those trapped during the first season. Traps were set in different habitats in those areas (Table 1), spaced at least 100 metres apart, and were operative for eight consecutive nights (Wilson *et al.*