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Nilgiri marten (*Martes gwatkinsi*) - Artwork: Jeff Cain

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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 trapped 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 & Rúa-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 & Rúa-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 XIIIth 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.*

1996). Total effort was 1,199 trap-nights in winter and 952 in summer. Of these traps, 319 trap-nights in winter and 507 trap-nights in summer were set in the area sampled in both seasons, - whenever possible in or near the same place.

Captured animals were anaesthetised, photographed, measured, weighed, sexed and tagged. Some genet and all the mink were fitted with radio-collars. Animals were then released at the place of capture and observed until they fled. Recaptures have been excluded from the data analysis to avoid possible biases due to 'trap-happy' or 'trap-shy' behaviour of different individuals. Animal live trapping and handling were conducted under license from the Basque government and the UBR administration.

The Chi-square test was used to analyse variation in trappability between different habitats and seasons. This computation was modified by applying the Yates correction for continuity when dealing with double dichotomy (Zar 1999). In some cases, data from European mink were analysed together with genet data in order to fulfil the requirements of the chi-square analysis (Chalmers *et al.* 1989).

Results

In total nine mink, 28 genets and one stone marten (*Martes foina*) were caught: seven mink, and 21 genets in the first season and two mink, one stone marten and seven genets during the second. Minks were only captured in riparian habitats whilst genets were found in all habitats (Table 1) except open areas.

Overall trapping efficiency was correlated with the season, trappability being higher during late winter ($X^2=5.278$, $df=1$, $p=0.022$). Genet capturability was also higher in winter but did not reach statistical significance ($X^2=3.458$, $df=1$, $p=0.063$). Data from the area trapped in the two seasons also showed a statistically significant higher overall efficiency during winter ($X^2=8.167$, $df=1$, $p=0.004$) for both species together, and for genets ($X^2=6.662$, $df=1$, $p=0.01$).

Two mink died during the study. In the winter trapping period a male was recaptured but died during entrapment during a blizzard three days after first capture. Also in winter, a female remained for a week at the place of release and finally died. Anatomical and pathological analysis of both individuals revealed post-capture stress as the cause of death. These two animals showed a common pattern during handling: a consistent lack of aggression, no vocalisation, weakness and an unusually long

response to anaesthesia (up to 6 hours instead of the usual 30 or 60 minutes). No other carnivore but the two European mink died as a consequence of trapping.

Discussion

In our opinion the higher trappability observed in late winter is a consequence of two factors: scarcity of food and ethological changes during the mating season. During the heat, a higher degree of activity and longer displacements should be expected, at least in males, due to their active search for mates (Dunstone 1993, Lodé 1999, Garin *et al.* 2001). So, there is a greater chance for animals to encounter traps. Indeed, the heat period for both species in the Iberian Peninsula is coincident with our late winter trapping period (Ruíz-Olmo 1997). Winter is also the season with the most severe conditions for mustelids, with scarcity of food resources (Sidorovich 1992). Mustelids usually show a wider food spectrum in winter (Brzezinski *et al.* 1992, Genovesi *et al.* 1996, Virgós *et al.* 1996), and they are more likely to be attracted by carcasses (Zielinski & Kucera 1996). Therefore, they would probably be more attracted to baits than in late summer, when there may be plenty of food. This agrees with Brzezinski *et al.* (1992), who states that nomadism forced by severe winter conditions was the most probable reason for the high numbers of polecats caught in winter. These two factors probably act over the activity patterns of each species. Unfortunately, there is a shortage of year-round studies on the activity of small mustelids, and those are not conclusive.

There are few studies on the mortality of European mink. During our study two mink out of nine died as a direct consequence of the trapping (i. e. 22%). Palazón (1997) tagged 15 European mink, 4 of which died in less than 12 days and another was found in an advanced state of decomposition 26 days after its last recapture. Besides, six mink disappeared in less than seven days and were never recaptured. This implies a certified mortality rate of 33% and a disappearance rate after capture of 40%. Analysis of the remains revealed that three mink were clubbed to death and another one died as a result of cold and starvation. In our opinion the very reason underlying those casualties might be weakness of animals due to post-capture stress. From a total of 31 dead European mink Arambarri *et al.* (1997) cite one as dying during scientific handling. There are no further data on the subject, but it would be very interesting to hear news from other groups working with European mink. No paper dealing with the decline of the European mink discusses the deleterious effects of some methods used for scientific research on its populations (Maran & Henttonen 1995,

Table 1: Number of trap-nights and captures per habitat type in different seasons (g = genet, m = mink, f = stone marten).

Habitat	Trap-nights winter	Trap-nights summer-autumn	Trap-nights total	Captures winter	Captures summer-autumn	Total captures
Holm oak forest	29	90	119	3g	1g	4g
Deciduous forest	43	41	84	0	2g	2g
Marshland	140	0	140	0	0	0
Pineland	119	85	204	0	1g	1g
Eucalypti	0	22	22	0	0	0
Meadows	5	83	88	0	0	0
Streams	863	631	1494	18g, 7m	3g, 2m, 1f	21g, 9m, 1f
Overall	1199	952	2151	21g, 7m	7g, 2m, 1f	28g, 9m, 1f

Tumanov 1996). Indeed, it does not seem a cause of disappearance of itself, but in some small populations its effect could be dramatic, specifically in populations like the western one which has low genetic variability (Lodé 1999) and is being systematically trapped for scientific and management purposes (Palazón 1997, Maizeret *et al.* 1998 and this paper). Because of this, we strongly advise not carrying out live trapping in areas where the European mink is supposed to be present unless necessary, due to the negative effect it might have on its populations.

For the same reason, we also advise against live-trapping as a method to determine the distribution of European mink, and propose the development and standardisation of other methods applicable for the species' whole area in order to assess interregional comparability (photographic traps or foot-print traps (Zielinski & Kucera 1996) for instance). In addition, seasonal differences in trapping success make it hard to estimate the status of a population from a single trapping period. They also undermine comparisons among works conducted in different seasons, or samplings of different subpopulations carried out not simultaneously. This is very important when taking into account that capture indices are a technique that is widely advised and used by biologists for species census and management (Sutherland 1996, Wilson *et al.* 1996), and which are currently being used to determine the distribution of European mink in its south-western range.

Finally, when it is necessary to capture wild mustelids it seems advisable to carry out trappings in late winter, at least in areas with a climate similar to that in the UBR. Higher effectiveness makes it less expensive, and there is less chance to interfere with either pregnancy or cub rearing. Anyway, the possibility of enlarging postcapture mortality, at least in some species, should be borne in mind.

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