SMALL CARNIVORE CONSERVATION

The Newsletter and Journal of the IUCN/SSC
Mustelid, Viverrid & Procyonid Specialist Group

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SPECIES SURVIVAL COMMISSION

Spotted linsang *(Prionodon pardicolor)* from Vietnam - Photo by K. Baranauskas.

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We are particularly grateful to Walter Rasmussen for reading the manuscripts and improving the English style.

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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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Small Carnivore 'Camp' Workshop Report

In February the MV&PSG held two consecutive workshops, the first on Conservation Assessment and Management Plan (CAMP) followed by a European mink Population and Habitat Viability Assessment (PHVA), both at Rotterdam Zoo. The workshops, which ran from the 11th to the 13th and 13th to 14th respectively, were organized in collaboration with the IUCN/SSC Captive Breeding Specialist Group (CBSG) and lead by its chairman, Dr Ullie Seal.

The workshops, announced in the October 1992 Newsletter, were well attended with delegates from several different institutions and countries:

- MV&PSG members: John Carnio, Shelagh Heard (Canada), Tiit Maran (Estonia), Don Moore (USA), Paul Robinson (UK), Viatcheslav Rozhnov (Russia), Harry Van Rompaey (Belgium), and Roland Wirth (Germany);

- delegates from various institutions and observers: Koen Brouwer (Holland), Alfredo Cuaron (Mexico), A. de Jongh (Holland), Eladio Fernandez-Galiano (France), Ajit Kumar (India), C. Maizeret (France), Roland Melisch (Germany), Dumitru T. Murariu (Rumania), Claus Reuther (Germany), Barbel Rogoschik (Germany), Jordi Ruiz-Olmo (Spain), M.-C. Saint Girons (France), Rudiger Schröpfer (Germany), Vadim Sidorovich (Belorus), T. Tew (UK), Pat Turley-Foster (USA), P. van Bree (Holland), and Daisy Wirth (Germany).

In addition to tackling the business at hand, the workshops offered a rare and welcome opportunity for SG members to network informally, beginning with a welcome reception on the 10th at the Zoo. The CAMP workshop was formally opened on the morning of the 11th with a welcome from the director of Rotterdam Zoo, Drs A.H. Dorresteijn and followed by Roland Wirth, chairman of the MV&PSG who set the CAMP process in context. Roland also warned those involved in the process that, having worked with Ullie Seal on previous CAMPs , there would be late nights until the task was completed!

The aim of a CAMP workshop is to provide strategic guidance on intensive conservation action for threatened taxa. During the CAMP people thus had to assess the conservation status of **all** species and subspecies (if necessary) of the groups in question, which was no easy task considering the taxonomic chaos of the small carnivores! This problem aside, Ullie Seal was able to guide the process expertly drawing from his experiences running CAMPs for a number of bird and mammal orders over the past two years.

The time-consuming task of considering all taxa was completed by the participants working in small groups, divided up according to their region of expertise (America, Africa, Europe, and Asia). While dividing on this basis was not perfect given that many people possessed specialist knowledge on a family or group rather than an area, it was workable. However, some participants had to make several visits abroad to other "continents" so that individuals could share their expert knowledge or offer input elsewhere when the need arose! Pat Turley-Foster did a great deal of travelling to ensure the otters were well attended to, while Roland Wirth went from group to group sharing his encyclopedic-like knowledge of the small carnivores.

Conservation status was determined by applying the Mace/Lande criteria of assessing extinction threats, thereby assigning each taxon to a category (Critical, Endangered, Vulnerable, Safe). In addition to and based on these extinction threats, each group attempted to identify and recommend management, research, captive breeding, and information-gathering priorities for each taxon they examined. While at the start of the CAMP most participants appeared very reluctant or concerned about the validity of assigning population numbers to species about which very little is known, and making educated guesses at the threats they are under, it became clear that this was a necessary first step in the aim to eventually establish accurate information.

The two and a half day workshop was therefore the starting point of what will be a long process. Once the information generated is compiled into a draft CAMP document, it will be circulated and reviewed by wildlife managers, researchers and institutions internationally, with the intention that they correct and expand it. The draft CAMP document should also be reviewed at regional review sessions conducted at CBSG meetings and workshops, utilizing local expertise. Thus, this workshop was the first step in the production of a document which will continuously evolve as new information becomes available, changes occur, and priorities shift.

While some groups worked on the CAMP material until the last day, those with a special interest in the European mink began the PHVA on the 13th, again under the guidance of Ullie Seal. Tiit Maran reports on this PHVA in this number.

Generous thanks are due to Dr Angela Glatston who did a magnificent job organizing all the logistics and ensuring the workshops ran without problems. Participants were able to work steadily throughout the day without any worries and were guaranteed a constant supply of coffee and nourishment to keep their energy going.

The MV&PSG also extends its gratitude to Drs Dorresteijn, the Director of Rotterdam Zoo for the ongoing support which the Zoo has demonstrated for our group. Not only does Rotterdam Zoo contributes significantly to the Newsletter, but it gave generously of its funds, resources, and staff time in organizing and hosting these two very important workshops. On behalf of all those who participated in the workshops and those who will be involved in further activities relating to the CAMP and PHVA, we are deeply indebted to Rotterdam Zoo for its visible assistance and commitment to small carnivore conservation.

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PHVA Workshop on the European mink

A "Population and Habitat Viability Assessment Workshop" for the European mink was held in Rotterdam Zoo from 13 to 14 February 1993. Experts from countries that still have European mink in the wild as well as representatives of several nature conservation organizations and academic institutions were present: Jordi Ruiz-Olmo (Spain, Direccio General del Medi Natural), Dr M-C. Saint Girons (France), C. Maizeret (France, GRECE), Dimitru T. Murariu (Rumania, "Grigore antipa"), Tiit Maran (Estonia, Tallinn Zoo), Dr Vadim Sidorovich (Belorus, Institute of Zoology), Dr Viatcheslav Rozhnov (Russia, A.N. Severtzov Institute of Evolutionary Ecology & Morphology of Animals), Roland Wirth (Germany, IUCN), Dr Ullie Seal (USA, CBSG), Don Moore (USA, Burnet Park Zoo), Drs. Koen Brouwer (Netherlands, EEP Headquarters), Dr Angela Glatston (Netherlands, Rotterdam Zoo), Paul Robinson (UK, Southport Zoo), John Carnio (Canada, Metro Toronto zoo), Dr P.J.H. van Bree (Netherlands, Instituut voor Taxonomische Zoölogie), Claus Reuther & Barbel Rogoschik (Germany, Aktion Fischotterschutz e. V. Otterzentrum), Dr T. E. Tew (UK, Joint Nature Conservation Committee), and Prof. Rüdiger Schröpfer (Germany, Osnabrück University).

It was stated that almost everywhere the European mink's status is worsening quickly. The total number of individuals were estimated to be less than 30,000 (1,000 in Spain, 2,000 in France, 200? in Rumania, 150-200 in Estonia, 150-200 in Belorus, and more than 25,000 in other states of CIS). During the last 3 to 5 years the wild populations of Estonia and Belorus suffered a very rapid decline and are expected to die out within the next five years. In the whole of the eastern range the distribution is fragmented. In Finland, where the European mink was thought to be extinct since at least 15 years, a wild specimen was caught in April last year. In Spain, the European mink's distribrution seems to spread into the south.

The main causes of decline were estimated to be the impact of the American mink, habitat loss, pollution, and human interference. But it seems that the clear mechanism of decline is not yet known; especially the role of the American mink needs further investigation. The necessity to continue the coordinated captive breeding programme was expressed by the workshop. Concerning the status of the European mink in eastern Europe, the results of the workshop showed that a detailed survey as well as follow-up monitoring in all eastern countries, but also studies on several aspects of its biology, are urgently needed. The idea to start with a global coordinated project for conservation and research of the European mink in eastern Europe was put forward.

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Lesser known bibliography of rare mustelids

Recently Schröfer & Paliocha (1989) and Youngman (1991) undertook great efforts to complete bibliographies on the European mink. The authors rediscovered unique historical sources and provided us with a reference collection updated for the whole of western Europe. Challenged by these publications I returned to my uncompleted 1989 bibliography of rare mustelids with the idea of updating it for all the area of the former Soviet Union and East Europe. The majority of publications that originated from the area is still unknown to foreign researchers: Schröfer & Paliocha (1989) do not list a single recent Soviet publication.

The goal of my work is to break the isolation based on the language barrier (Mustelidae researchers study mustelids, not foreign languages) and on the local character of many publications. I believe that it is very important that every single paper on endangered species is taken notice of. It is only later that some may be considered as trivial and the others selected as valuable ones.

My intention is to record all original papers, proceedings, books, popular articles, field guides, and game publications that mention rare mustelids and were published after 1980. The species of my interest are: European mink, Steppe polecat, Marbled polecat, Honey-badger, and Otter. The area covered is the former Soviet Union, Poland, Slovakia, Czech Republic, Hungary, former Yugoslavia, Bulgaria, and Romania. The bibliography will include the English translation of the title, journal name, publisher, year, and other typical details, and in addition: species mentioned, language, and short English abstract (when possible).

To much of my surprise the work on the bibliography is proceeding faster than anticipated. As of Jan. 31, 1993 the bibliography consisted of 230 entries, and was accompanied by about 40 short English abstracts. A brief analysis of the first 200 titles has shown that the majority came from the former Soviet Union. The most extensively covered species was the otter (114 entries) followed by the European mink (52), marbled polecat (28), steppe polecat (27), and honey-badger (5).

The compilation of the bibliography involves more desk work than I would desire. Fortunately every time I am getting bored I encounter some exciting news that keeps me running for the next few hours. My last finding was the proceedings abstract by Sauckiy (1989). We all read about the European mink introduction to the Kuril Archipelago, but it was something new to me to learn that a similar introduction was carried out in Tajikistan. Here 62 European mink were released near the mountain river Shingidara in 1988, and their tracks were registered 8 months later.

I hope to complete the bibliography during 1993. It will be sent out for comments and supplements in the summer of 1993. It would be a great help if any of the newsletter readers could send me abstracts or copies of articles that should be included in the bibliography.

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Observations on procyonids in Paraguay and adjacent regions

Daniel M. BROOKS

Introduction

Paraguay harbors a varied representation of the carnivore assemblage (Redford & Eisenberg, 1992). Although basic ecological information has been provided for most Paraguayan terrestrial carnivore taxa (e.g., Berrie, 1978; Brooks, 1991, 1992), there are still exceptions -notably the procyonids. Ecologically, procyonids exhibit a wide range of guilds, spatially (ranging from largely terrestrial to almost entirely arboreal) and dietarily (all species are omnivorous, consuming varying quantities of plant and animal matter); dietary items vary considerably (e.g., crustacivory [Ojeda & Mares, 1991], nectarivory [Emmons & Feer, 1990], etc.), and stenophagy is common in some areas (Redford *et al.*, 1989). Of the seven genera identified by Nowak (1992), two are extant in Paraguay.

Herein, basic ecological information is provided for the Crab-eating raccoon *(Procyon cancrivorous)* and the South American coati *(Nasua nasua)* in the Paraguayan Chaco, and a portion of Brasilian South-Atlantic rain forest. Additionally, speculations are made on status and potential threats of these species in the region where they were studied. The preliminary nature of these results cannot be overemphasized, as the data sets were conservative.

Methods

Methods have been described elsewhere (Brooks, 1991, 1992). The central study site, Estancia Toledo (22°33'S, 60°30'W, 35 km W of the Mennonite Colony of Filadelfia, Boqueron, Paraguay), was surveyed for an entire year (August 1989- August 1990). The Iguacu region (Ziman & Scherer, 1976) of Parana, Brasil, where coatis were observed, was surveyed in late January and early February of 1990.

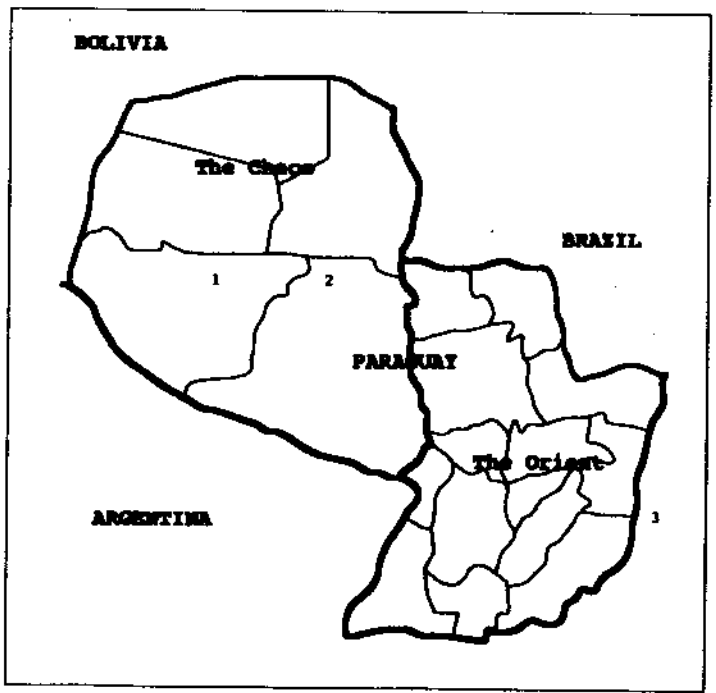

Fig. 1 - 1. Estancia Toledo
- 2. Eastern Chaco, xeric forest (Kure-f Rd.)
- 3. Iguacú N.P., Paraná State

All locales and areas were driven to by vehicle, and surveyed on foot. Opportunistic sightings of live individuals and tracks were logged proximal to areas associated with. Fig. 1 illustrates the region, with recordings. Habitat in the Paraguayan Chaco (west of the Paraguay River) has been described elsewhere (Brooks, 1991, 1992). Less stochastic than the Chaco, but more seasonally defined than the South-Atlantic rain forest, the majority of the Oriental (east of the Paraguay River) consists of rolling savannah, punctuated with tropical forest. The eastern Oriental is essentially an extension of the historically vast, contiguous South-Atlantic rain forest.

CRAB-EATING RACCOON *PROCYON CANCRIVOROUS*

Habitat association

The occurrence of this species in the central (xeric) region of the Chaco, where the majority of available water is from man-made cattle pondlets, indicates that this species is not "...restricted to waterside habitats such as swamps, rivers, streams, and beaches". (Emmons & Feer, 1990). Live individuals were observed to be active on the ground.

Social structure

Sightings of live individuals (N=2) were both solitary. Speculation that pairs may bond shortly during the breeding season was based upon increased frequency of tracks of more than one individual in the same area during the austral winter. Thus it is probable that animals are solitary, except during the breeding season when they come together to reproduce.

Daily activity

Although live individuals were observed to be active diurnally, tracks were frequently found early in the morning in areas where they were not present the previous evening, suggesting that this species is active nocturnally as well. Because of this, no firm conclusions could be made on *P. cancrivorous* activity patterns. However, it is interesting to note that tracks of one individual extended for more than 4 km along an unused dirt road.

Seasonal activity

Although Estancia Toledo was surveyed every month for an entire year, signs of *P. cancrivorous* were present only from April to September (mid-autumn to early spring). The reason for this may be due to increased activity during the cooler part of the year (that is, metabolic constraints -thermoregulation through increasing activity). To test this hypothesis, monthly variation of abiotic factors (temperature, rainfall, cloud cover, and relative wind velocity) were each paired with relative abundance of *P. cancrivorous* following Sokal & Rohlf (1981). Temperature significantly correlated negatively ($n=12$, $r=-.9302$, $P<0.05$), concordant with the hypothesis that *P. cancrivorous* increases activity during the 'cooler' part of the year.

Status and threats

Although *P. cancrivorous* does not share the plasticity of its North American congener with regards to human development, the species does not appear to be seriously threatened (based upon

frequency of sign). A potential threat to this species may be unregulated hunting for pelts and sport.

SOUTH AMERICAN COATI *NASUA NASUA*

Habitat association

This species was scarcely encountered in the Chaco, and never encountered at Estancio Toledo. *N. nasua* probably occurs more frequently along riverine gallery forest, which has a higher canopy and is more stratified than xeric chaco forest. In the eastern Chaco a group of two individuals was observed in xeric forest (22°30'S, 59°13'W), in the vicinity of one of many vast, salinated lagoons, which most likely serve as seasonal runoff reservoirs from the Paraguay River.

Groups encountered in Parque Nacional do Iguacú0, Parana, Brasil (25°35'S, 54°28'W) were associated with multistratal primary broadleaf rain forest. Activity of all live individuals took place on the ground during time of observation (Fig. 2)

Group composition

All recorded groups comprised 2-5 individuals. Seasonal group composition has been described in detail for the Central American coati (e. g. Russell, 1981). All groups constituted individuals of two color phases (approximately 50% reddish-brown and 50% grizzled-gray).

Daily activity

During time of observation, Chacoan individuals were active crepuscularly (early dawn), while individuals from Iguacu were active diurnally (mid morning).

Status and threats

N. nasua was observed associated solely within forested habitat. If this species is stenoecious with regards to macro-habitat selection, it may be threatened with deforestation of habitat. However, *N. nasua* has reportedly been associated with a variety of habitats, not restricted to forest (e. g. Emmons & Feer, 1990; Redford & Eisenberg, 1992). Despite multiple surveys in unforested habitat, signs of *N. nasua* were never encountered. It is possible that the high activity level which characterizes this species reduced chance of encounter (i. e. individuals in the Chaco disappeared deep into the forest without a trace, the moment my presence was realized).

Long regarded for their acrobatic antics, coatis are well known among South American people, and are frequently kept as pets. The impact of the pet trade upon wild populations is unknown. If feasable and properly managed, coati 'farming' may stimulate local economy and provide a means to avoid taking coatis from the wild unsustainably.

Fig. 2 Terrestrially active coati associated with multistratal rain forest

Summary

The purpose of this paper was to provide basic ecological information, while assessing status, and potential threats for the crab-eating raccoon and the South American coati in the Paraguayan region. The study took place from August 1989 to August 1990; the central study site was Estancia Toledo, located in the central Paraguayan Chaco. All opportunistic sightings were recorded.

Terrestrially active *P. cancrivorous* were associated with xeric chaco shrub. It is probable that this species is solitary, except during the breeding season. No firm conclusions were established regarding daily activity patterns of *P. cancrivorous*, although one individual's tracks extended for over 4 km. Activity increases during the 'cooler' part of the year; signs of *P. cancrivorous* were present only from mid fall to early spring. *P. cancrivorous* does not appear to be seriously threatened in the central Paraguayan Chaco.

Terrestrially active *N. nasua* probably occurs more frequently along riverine gallery forest in the Chaco, and were associated with multistratal rain forest in Parque Nacional do Iguacu. Groups comprised 2-5 individuals, of which approximately 50% were reddish-brown, and 50% were grizzled-gray. Chacoan *N. nasua* were active crepuscularly, while Iguacú individuals were active diurnally. If this species is associated only with forest, it may be threatened with deforestation of habitat. The impact of the pet trade upon wild populations is unknown.

Acknowledgements

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Notes on the viour, activity, and feeding of the Spotted linsang *Prionodon pardicolor*) in captivity

German V. KUZNETZOV and Kazimieras BARANAUSKAS

The Spotted linsang (*Prionodon pardicolor* Hodgson, 1842) is a rare species of viverrid from Indochina ranging up to Nepal. The rarity of the species means that any observations of its behaviour are of special interest.

Between February 1988 and August 1989, a female spotted linsang from Vietnam was observed in an enclosure measuring 2 x 3 x 2.2 m. The enclosure was furnished with tree stumps and vertical trunks and boughs (1 - 15 cm diameter). Hollowed logs (hiding holes) were placed on the floor at heights of 0.5, 1.0, 1.5 and 2.0 m. The floor of the enclosure imitated forest litter. The temperature of the enclosure ranged from 20°C at night to 25°C during the day, and was maintained by a thermostatically controlled heater. A 12:12 hour light:dark photoperiod was maintained to imitate conditions at the locality where the spotted linsang lived in the wild. During observations of the linsang, the duration of all forms of activity and behaviour within a 24-hour period were timed, visual observations totalling 245 h. It was determined that activity of the female spotted linsang was of the polyphase type, but it was most active during the night. During an average 24-hour period, the linsang was active for 7.8 hours (32.5%) and passive (*i.e.* at rest or sleeping) for 16.2 hours (67.5%).

The linsang preferred a height 1 m above the floor (18.1 h, 75.7% per 24 h), was at other heights for 2.2 h (9.7%) of the time, and on the floor for 3.3 h (14.6%). Behavioural reactions of this species are also interesting. Within a few minutes of being introduced to the enclosure, the linsang started to mark a territory, leaving urine and excrement in open places. If startled or sensing danger (e.g. by the sudden appearance of a human or by some other disturbance) the linsang squeaked, whilst "drumming" with one or other foreleg on the surface of any object it was on at that moment. In the enclosure the animal liked to ascend and descend boughs at high speed, and often changed direction in midrun. Wilst bough-climbing, the linsang usually made jumps of 30 - 50 cm, and sometimes of up to 1 m. When tree-climbing, the long tail served as a brake. When the animal descended quickly from the trunk to the floor, it seemed to "flow" down the trunk, holding onto boughs and the rough bark of the trunk. At that moment the animal pressed its belly and the lower part of its tail to the trunk, and then jumped down onto the floor. When moving on the floor, the linsang held its tail horizontally, although it sometimes raised it up almost vertically. During rest and sleep, the animal usually wound its tail around its body. We noticed that the element of play was always a component of the linsang's behaviour, comprising between 0.4 - 1.4% per 24 hours.

When the linsang saw a Yellow-necked mouse (*Apodemus flavicollis*) or Bank vole (*Clethrionomys glareolus*) on the floor, it slowly descended from the tree and jumped silently to the floor from a height of half a meter. Then the animal waited for the right moment, and snapped at the neck of the prey with its teeth. When dealing with larger prey (e.g. young rats), the animal rushed upon it with a jump, and then, holding the prey with its paws, fell on its side and killed the prey in this position. When replete the animal usually did not persecute rodents and lay up. During each 24-hour period the linsang ate, on the average, about 100 g of food (its own weight was 600 g) -equivalent to four yellow-necked mice or six bank voles. The spotted linsang digested 76.5% of animal food. Its favourite food was small passerine birds, which were eaten almost completely, with the exception of the wing-feathers and the stomach. The linsang always ate on the floor, never climbing a tree with its prey. Neither did it hide food remains, and only rarely returned to them.

Despite the fact that little is known about the behaviour of this species under natural conditions, on the basis of our observations we can characterize the spotted linsang as a species that mainly inhabits the lower shrub layer. Our observational data revealed that during 24 hours, the linsang spent about 85% of its time at heights of up to 1 m. This together with the appearance of the animal: the long tail, the structure of the claws, its colouration and habits, show that the spotted linsang is well adapted to the pursuit of prey (small birds and rodents) in the shrub layer.

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Preliminary data on the use of space and activity of the European mink (*Mustela lutreola*) as revealed by radio-tracking

Santiago PALAZON and Jordi RUIZ-OLMO

The European mink is, without doubt, one of the most threatened mammals in Europe, and is probably the species which displays the most marked distributional regression within the area (Schreiber *et al.*, 1989). Concern over this issue led numerous researchers, groups and administrative bodies to pay particular attention to the species' conservation (see Ternovsky & Ternovskaya, 1989; Schröpfer & Paliocha, 1989; Maran, 1990; Camby, 1990; Braun, 1990; Sidorovich, 1991). Thus the Council of Europe has promoted the compilation of a report summarizing the data accumulated on the species (Saint-Girons, 1991) and has approved a Recommendation to the Member States (which today only affects French and Spanish populations; see Mustelid & Viverrid Conserv., 5:15).

The aforementioned report emphasises the deficiencies in the available information with regard to the species' distribution and trophic ecology (see also Camby, 1990; Sidorovich, 1992). Behavioural information is virtually non-existent, leading Saint-Girons (1991) to say only the following on the subject: "European mink live along watercourses and near lakes and marshes whose banks are covered by dense vegetation....They live in holes dug in the banks by itself or by other mammals. For example, it frequently uses those of the muskrat, a newcomer in western Europe, but it can also be discovered in reed beds, hollow trees and even piles of driftwood".

Camby (1990) goes no further than to suggest that: "Le vison s'installe dans les terriers situés dans la berge et entre les racines des arbres de la ripisylve. Il peut indifféremment creuser lui-même ses refuges, ou utiliser, après les avoir agrandis, des abris aménagés par d'autres espèces (rongeurs)..." and here he confines himself to quoting the only estimated data which are available on its home range (Novikov, 1939; Novikov, 1975; Danilov & Tumanov, 1976).

Recently, Maran (1989) carried out the first studies on this animal's activity and gregariousness in captivity, although it remains to be seen whether these data coincide with the norms for wild mink.

Material and methods

During the period from December 1991 to February 1992, trapping was carried out on different rivers in Navarra Province (northern Spain), on which the species was known to be present: these habitats had Eurosiberian or sub-Mediterranean characteristics (oak and beechwood). Two types of trap were used: 60 toothless-jaw traps (VICTOR & COIL, USA; 12 cm in diameter, protected by leather, cloth and sticking plaster, and equipped with a 35 cm long spring, a chain and a karabiner), and 20 box traps (given to C. Maizeret and L. Lafontaine for the Franco-Spanish project).

Trapping was carried out at 10 different locations at altitudes ranging between 475 and 560 metres. There was a total of 1627 trap nights; 1227 involving toothlees-jaw traps, and 400 using box traps. During the entire period no European mink were captured, and the only information gathered consisted of a single

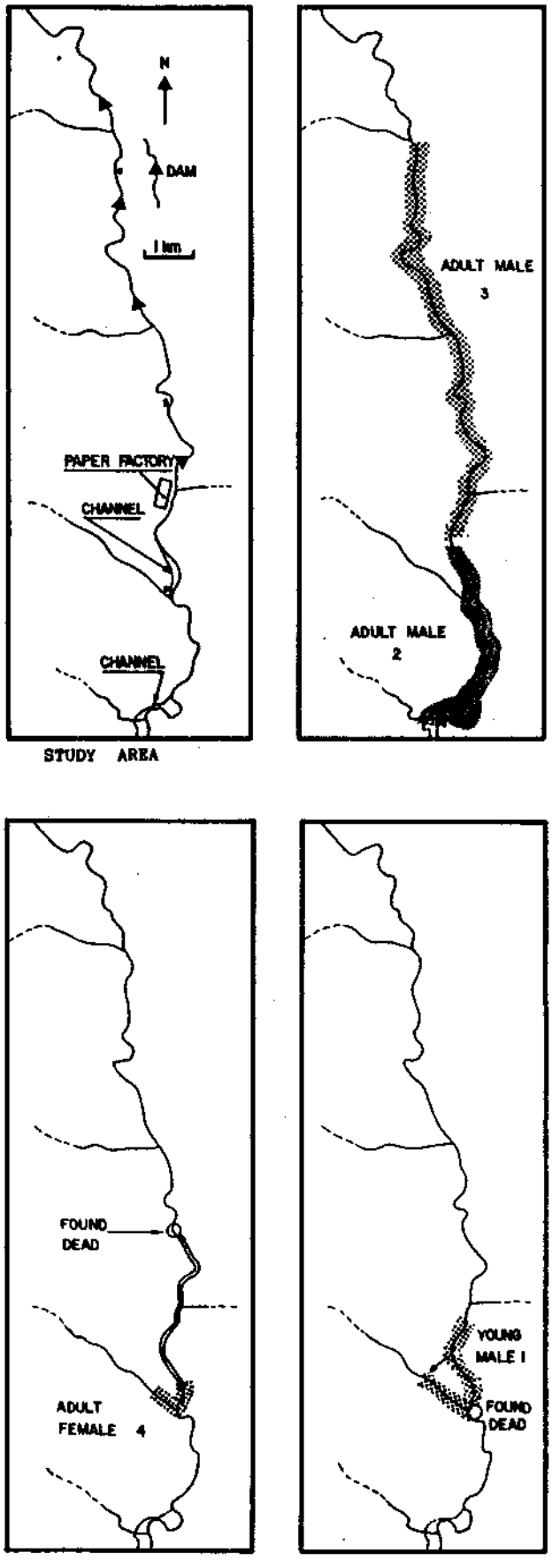

Fig. 1. Home ranges of the four mink studied

trail of tracks from one individual. On the other hand, 12 genets *(Genetta genetta)*, 3 beech martens *(Martes foina)*, 1 weasel *(Mustela nivalis)*, and a buzzard *(Buteo buteo)* were captured. Box traps seem to be better than toothless-jaw traps.

To the south of the trapping area, there is an American mink *(Mustela vison)* farm, equipped with good security precautions to prevent accidental escapes, and with no escaped minks having been observed to date. Nevertheless, at a nearby poultry farm, mink came regularly to eat chickens, young turkeys and ducklings, etc. Since this locality was outside the known distributional range of the European mink, and in a dry area (total annual rainfall ca 400-600 mm), surrounded by fields of cereals and asparagus, the *a priori* possibility of this being due to the European species was rejected. Because of this, it was decided to trap the American mink in order to confirm their presence, and to erradicate them.

It was therefore a complete surprise when European mink were caught with only a few box traps (initially only six). Six different individuals were captured in this way on 1.25 km of riverbank. Some were recaptured several times. Four of the mink were fitted with radio-transmitter collars (URMENETA, Navarra, Spain), weighing 20 g and broadcasting on 150,000-151,000 MHz [two adult males (ML02 and ML03) weighing 820 and 720 g, one female (ML04) weighing 460 g, and one young male (ML01) weighing 610 g]. Tracking was carried out using a CE-12 CUSTOMS ELECTRONICS receiver (URBANA, Ill., USA).

Results

The four mink (ML01, ML02, ML03, and ML04) were tracked and monitored for 25, 58, 4, and 8 days respectively. The female (ML04) and the young male (ML01) were found dead after 14 and 51 days of the collar being attached. Both were killed deliberately. The female, pregnant, with five embryos in the early stages of development (and whose weight had risen by 50 g to 510 g) was found dead beside a fishing spot, on the first day of the fishing season and almost certainly killed by a fisherman. The young male was discovered in an advanced state of decomposition (skin and bones), on the riverbank just opposite the poultry farm where it was first captured; it was not possible to firmly establish what caused its death. The radio transmitters of the other two mink eventually failed.

Fig. 1 represents the home range of the four mink. For the two adult males, this comprised 6.1 km of river in ML02 and 8 km in ML03, although the latter was only monitored for four days, after which its trail was lost. During this time their home ranges did not overlap.

The female, however, exploited a much smaller area around the farm (ca 0.5 km of river-course). Nevertheless, during the last days she moved upstream, being found 4.2 km from the farm, representing a home range of 4.5 km.

Finally, the young male (ML01) also remained linked to the environs of the farm, on a total of 3.1 km of river-course. On one of the nights when monitoring was carried out, a movement of 0.7 km across holm oak wood and farmland was detected, in an area stretching from the river to a small stream which merges downstream of the river, level with the farm.

As for habitat, in all cases (except the one mentioned above), mink were found in fluvial habitats. Male ML03 always

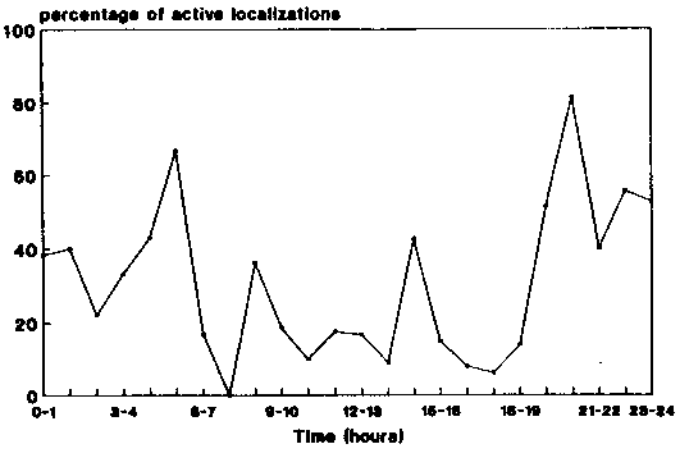

Fig. 2. Percentage of active radio-localisations in the four mink, considered together.

used the river. ML02 mainly used the river, but was also found in an irrigation canal and a small stream entering the right bank of the Ega River. In addition to the river, female ML04 and the young male ML01 made considerable use of a small open brook with helophytic vegetation. All the female's burrows were situated in this area.

Male ML02 also used burrows in the helophytic vegetation of a small stream and of the canal. The burrows of the others were located in roots and bramble patches on the banks of the river.

Regarding the animals' activities, Fig. 2 shows the percentage of radio locations with associated signs of activity (n=421 radio locations with such information, *i.e.* 38.2%). Some kind of activity was detected throughout the whole day, with a higher level being registered at night (45% of the nocturnal radio locations were active, especially during the first hours of the night and the twilight period of the morning). In any case, data are still scarce.

Conclusion

One of the most manifest observations is the rather fearless behaviour displayed by this species: three of the specimens were captured repeatedly in the same area, and with the same type of trap. Moreover, two of them were almost certainly killed by humans, and another was observed on two occasions by the authors. Without a doubt, this was favoured by their daytime behaviour and their none-too-elusive charater. This aspect will need to be taken into consideration when managing their populations.

The European mink's practice of entering farms to eat domestic animals (behaviour which we have also observed repeatedly in American mink in the NE of Spain; unpublished data) had not been described in the consulted literature (Saint-Girons, 1991; Camby, 1990). This fact may be important for its conservation, since the damage caused can lead to its persecution by the farmers affected.

As for the occupation of space, this mustelid appears to display a high level of movement for its size which is greater, for example, than the American mink (Birks & Linn, 1982; Linn & Birks, 1980; Lodé, 1991; personal data). This may mean that the species is far more vulnerable (possibly linked to a less well-developed knowledge of its territory), but at the same time

endowed with a greater capacity for colonizing new areas (Schröpfer & Paliocha, 1989; Ruiz-Olmo & Palazon, 1991). The data obtained here appear to surpass the average 2.4 km of river used by the European mink in Karelia (Danilov & Tumanov, 1976).

Regarding activity, in general our data coincide with Maran's (1989), with the mink displaying activity throughout the whole day, but being more active at night. On the other hand, there are some differences between the data collected by Maran (1989), principally regarding the second half of the night where the mink in northern Spain are somewhat less active. In contrast, the mink we studied displayed greater activity in the dawn twilight hours. Nevertheless, there seems to be a greater coincidence in the start of nocturnal activity with the animals' apparent inactivity during dusk.

Studies are to be continued, which will provide further information applicable to the conservation biology of this mustelid.

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More on the European mink

The aim of the "Groupe de travail sur la répartition du Vison d'Europe" is to 1) complete the actual data on the distribution 2) determine the ecological needs of the European mink.

In January, February, and April 1992 traps were used in four areas of Brittany, six areas of southeast France, and two areas of the Basque part of Spain. Eighteen European and two American mink were caught. As 76% of the European mink were caught during the first 10 days it seems that this species is rather easy to trap.

Of the two kinds of traps used, the metallic ones proved more reliable than the wooden ones. Only in a few cases fresh fish was used; mostly oily preserved sardines were employed. The general trapping programme plans three trapping campaigns for each area.

Several of the trapped mink showed slight lesions on the lips and/or front feet; to avoid this, improvements are planned (especially on the metallic traps).

The trapped males weighed between 820 and 1,050 g; the females between 520 and 670 g. The distinctive white patch showed little variability: the patch on the upper lip only extends from the lip to the snout, and the patch on the lower lip barely goes beyond the chin.

Etude de la répartition du vison d'Europe. Document N°1: Présenta[illegible] des résultats de la première année d'étude. Novemb[illegible]2. Groupe de travail sur la répartition du Vison d'Europ[illegible]

The conservation status of the badger *Meles meles* (L., 1758) in Slovenia

Boris KRY,TUFEK

The Eurasian badger is widely distributed in Slovenia (Kry™tufek, 1991), being rare or absent only from the mountains and deforested plains under intensive cultivation.

In the spring of 1990, the badger population was estimated at 4,302 animals (official statistics of the Hunter's Association of Slovenia). Slovene game-bag statistics (badgers killed/year and spring population estimates) are derived from the operation of revier hunting. Population estimates are based on "direct" counts which provide only a rough estimate of actual badger density. For this reason, the annual number of badgers killed is frequently considered to be more accurate as an index of population density in Slovene game management practice.

In 1990, 782 badgers were killed legally, i.e. 18.2% of the estimated spring population. The average animal density was 0.251 badgers per km^2, of which 0.034 animals were killed per km^2. Only the area of the country under hunting management was taken into consideration (17,169.98 km , i.e. 84.8% of the total area of Slovenia).

Badger densities and the number of badgers killed per area unit are not regularly distributed in Slovenia (Figs. 1 & 2). In 1990, relative to their spring densities, the percentage of badgers killed was between 2.9 and 57.7 % in the different regions. This most probably reflects defects in the estimation of spring population sizes.

However, the correlation between the estimated badger density and the number of badgers killed per area unit is positive and significant ($r=0.821$, $P< 0.001$). This suggests that the annual badger-bags do reflect estimated densities.

The number of badgers hunted per year has decreased during the last 30 years, although the number of registered hunters has increased during the same period (Fig. 3). The correlation between the two variables is significant and negative ($r = -0.789$, $P< 0.001$). Consequently, the number of badgers killed per hunter per year has also declined (Fig. 4). Adamic (in Griffiths, 1992) ascribed declines in the Slovene badger-bag since 1975 to the advent of rabies. Rabies appeared in Slovenia in the 1970's, and probably increased badger mortality and reduced population densities, although this was not actually studied in Slovenia.

The decrease (if genuine) would be expected to be small as, over the last twenty years, no single article or note on a decrease in badger numbers has appeared in "Lovec", the journal of the Hunters' Association of Slovenia.

In the period between 1980-1990, the Faculty of Veterinary Science at Ljubljana screened 30,316 mammals for rabies, including 896 badgers (2.96%). Of these, 195 badgers were rabies positive (i.e. 21.8% of all badgers, but only 0.64% of the total number of animals was tested).

Fluctuations in the number of badgers sent for examination suggest an epidemic of rabies amongst badgers, with an outbreak at the beginning of the 1980's.

On the other hand, the outbreak of rabies drastically reduced hunter interest in badgers; Slovene hunters are well-informed of the dangers involved in handling carnivores in areas infected with rabies. Only certain vaccinated personnel are allowed to skin carnivores, and the head of each skinned animal must be tested for rabies. If the animal is rabies positive, the skin has to be destroyed. All this leads to additional expense, whilst the commercial value of the badger's skin is insignificant.

There are also other reasons for the loss of interest in badgers by hunters. The trophy cult is an important motivation for Slovene hunters. However, badgers are not regarded as a trophy species, despite the existence of formalized standards for awarding medals for both skulls and skins. The most important game species in Slovenia is the roe deer (42,736 hunted in 1990 compared to 782 badgers), so the badger-kill only equalled 1.83% of the roe deer game-bag. In the first half of this century the den hunting of badgers

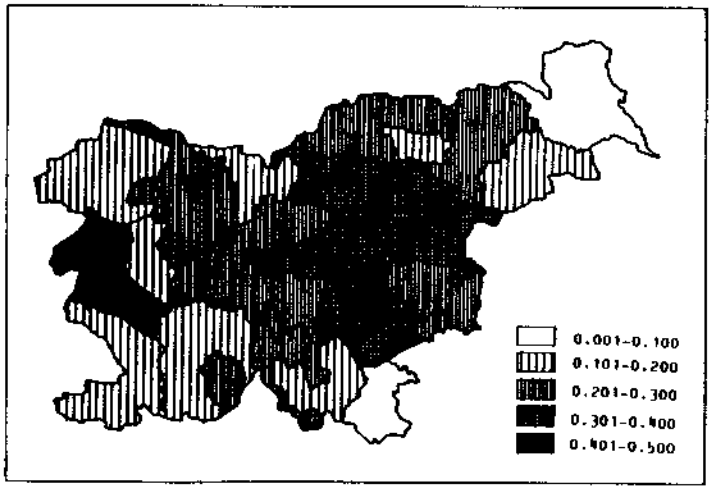

Fig. 1 Population density of badgers (animals per km^2) in different hunting districts of Slovenia in spring 1990 (based on the official statistics of the Hunters' Association of Slovenia).

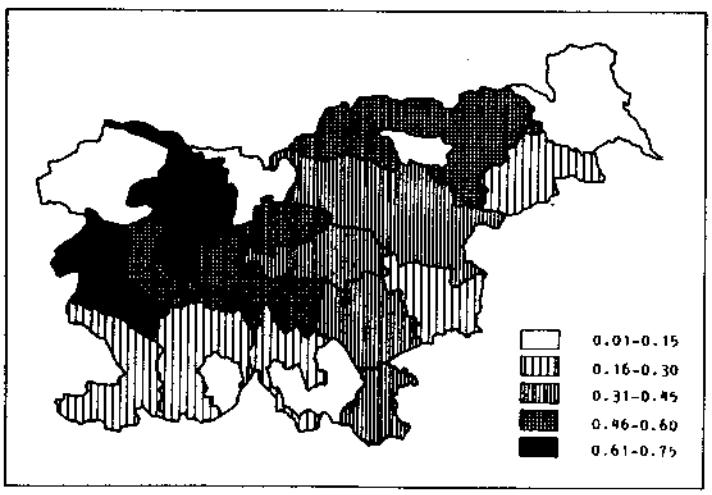

Fig. 2 Badgers hunted per 10 km^2 in 1990 in the hunting districts of Slovenia (based on the official statistics of the Hunters' Association of Slovenia).

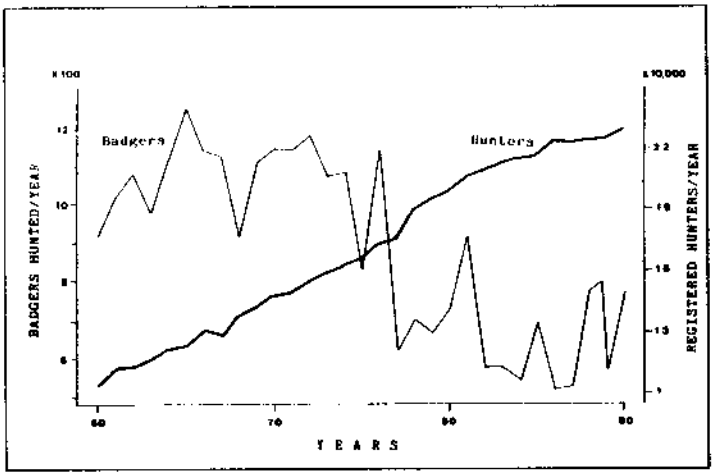

Fig. 3 Trends in the badger game-bag and the numbers of registered hunters in Slovenia between 1960 and 1991.

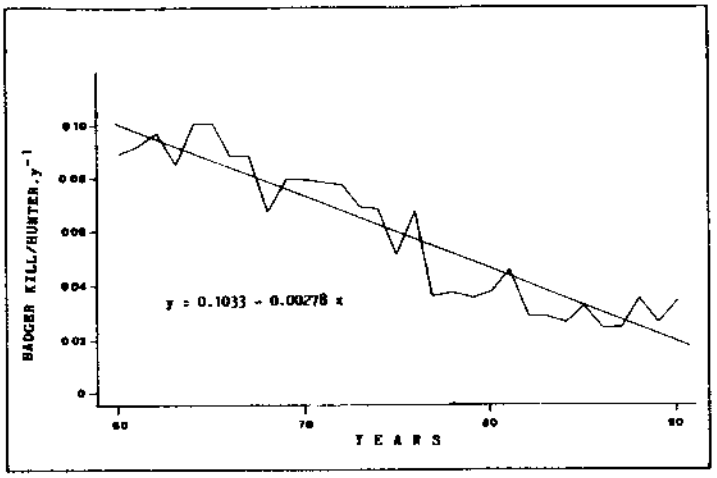

Fig. 4 Decline of the badger kill per hunter per year in Slovenia between 1960 and 1991.

(and red fox) was popular, even though much of Slovenia is unsuitable for this type of hunting, one third of its area being karstic. Den hunting requires well trained dogs, which are owned by very few hunters. Since the outbreak of rabies in the 1970's, den hunting has been prohibited.

Threats

In 1990 there were 22,971 registered hunters in Slovenia, equal to a density of 1.34 hunters per km^2, of hunting territory. In spite of the large hunter population, and the fact that their numbers have been increasing over recent decades, the pressure of hunters on badgers (expressed either as badgers killed per hunter per year, or as badgers killed per year) decreased.

One important reason for this decrease is the lack of acceptance by hunters of the badger as a trophy species. Popularization of the standards for bronze, silver, and gold medal standard badger skins and skulls is thus highly undesirable, and contradicts nature conservation efforts.

In the first half of this century badgers were persecuted as crop pests. Although crop damage has diminished in importance, badgers continue to be killed by both hunters and farmers for crop protection. Since hunters must pay for the damage caused to crops by game, this acts as an incentive for the removal of species which are of no special importance for trophies.

Nonetheless, badgers are not widely persecuted for the damages they cause. Some fifty years ago the badger was listed as one of the predators that should be controlled to improve roe deer numbers (Sustersic, 1951). However, there is no mention of such measures in more recent literature (e.g. Simonic, 1976).

Diseases other than rabies do not appear to threaten the badger population of Slovenia. Since 1986, only four cases have been recorded by the Faculty of Veterinary Science in Ljubljana: canine distemper (1 case), anaemia (1 case), and pasteurellosis (2 cases). With regard to rabies, an oral vaccination programme has commenced recently in Slovenia.

The influence of passive anthropogenic mortality (Griffiths, 1992) upon badger populations is not known. Road traffic casualties have been recorded, but are supposedly rare. Landscape changes and the effects of xenobiotics are also believed to effect badgers, but these have not been studied yet.

Protective measures

Badger hunting is permitted, but only for registered hunters, in the period between August 1st and January 31st. Snares and other traps are prohibited and the badger must be killed by rifle. Hunting is regulated throughout the country. Under rabies control legislation, badgers (and other carnivores), can be killed in infected areas at any time. This is undoubtedly one of the great disadvantages of the current legislation.

The old beliefs that carnivores are harmful, and that their numbers should be kept as low as possible, are still strong amongst Slovene hunters. The Hunters' Association of Slovenia does educate its members on the role of the carnivores in ecosystems, and on the need for their conservation. Besides organizing regular courses for its members, the Association also edited a book on mustelids living in Slovenia (Kry™tufek *et al.*, 1986) and provided it, free of charge, to each of its 22,000 members. Despite such efforts, a recent call by the Nature Conservancy authorities for the total protection of all Slovene mustelids was rejected by hunters.

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