SMALL CARNIVORE CONSERVATION

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

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SPECIES SURVIVAL COMMISSION

Scandinavian wolverine (*Gulo gulo gulo*). Photo by Franz Müller.

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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 M,V&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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An action plan for procyonids and ailurids ready soon

Angela GLATSTON

The animals considered in this action plan are all small-bodied members of the Order Carnivora: none of them are truly carnivorous in their feeding-habits and the largest specimens are no bigger than a well fed domestic cat. The majority are confined totally to the New World where they can be regarded as the local equivalent of the Old World viverrids which they resemble both in body size and in ecological niches filled. They comprise a small group of arboreal or semi-arboreal, plantigrade or semi-plantigrade, omnivores and frugivores most of which are totally nocturnal in their habits. Their distribution encompasses the whole American continent from Palaearctic to tropical regions: from Canada to Argentina. They have adapted to live in a wide variety of habitats ranging from tropical rain-forest to arid semi-desert regions and chaparral. Nevertheless, there is one factor generally common to all these species in all their habitats and that is an affinity for tree cover; all these species climb trees to escape danger and all, with the exception of prairie dwelling raccoons, have their young in tree nests. The only exception to this picture is the red or lesser panda, *Ailurus fulgens*.

The New World procyonids comprise five or six genera: *Procyon*, the raccoons; *Nasua*, the coatis; *Potos*, the kinkajous; *Bassaricyon*, the olingos; and *Bassariscus*, the ringtails or cacomistles. *Nasuella*, the mountain or little coati is usually placed apart from the other coatis in its own genus.

Seven years have elapsed since 1985 when the project to develop an action plan for these species was initiated. This is an inordinately long time for the completion of a slim document covering only the few species represented by this Action Plan. However, in our defence it must be noted that in the procyonids and ailurids (i.e. the red panda) we are generally dealing not only with species of which little is known but also often with species for which the interest of the scientific and conservation communities is limited to a few species: there are few data available from the field and fewer scientists available to collect them. This has meant that the compiler of the action plan has had to send a continuous stream of letters to various organisations and individuals associated with Nature Conservation in those countries where procyonids are endemic, in order to glean scraps of information. The recipients of these letters were only remotely connected with the species of interest and so the information which they were able to supply has been limited. The difficulties of the task will be amply reflected in the nature of the information presented in the action plan when it is finished and the duration of the task.

The title of the action plan, "An Action Plan for the Conservation of Procyonids and Ailurids", gives a hint of some of the problems and confusions which confronted the compiler while producing this report, foremost amongst these is the taxonomic confusion which besets this whole group from the family to subspecies levels. These arguments include the question of whether the red panda should in fact be classified as a procyonid or the status of the various island forms of raccoon or the five currently recognised species of olingos are other examples. To avoid confusion to the reader and irritation to various experts as regards the red panda (the only Old World member of the procyonidae according to classical taxonomy), the term "Ailurid" has been used throughout the action plan to refer to the red panda while the term "Procyonid" is used only for the New World species under consideration.

The procyonids and ailurids are, with the exception of some raccoons and coatis, a group of species relatively unknown and little studied by the scientific community. The limited nature of our knowledge of these species is one major factor contributing to the fact that, until recently, not one single member of either of these groups was mentioned in the IUCN Red List of Threatened Species. It has also meant that very few procyonid (sub)species have been afforded the protection Appendix II or even Appendix III of CITES. In several instances it can be categorically stated that these omissions have indeed been a reflection of our ignorance of these species rather than a cause for optimism about their future.

The comparative absence of recent field studies or suveys of most of the species has resulted in a dearth of information as to the numbers, actual distribution, habitat requirements, etc. In terms of this report this means that, in many cases, we do not have direct information regarding the status of, or threats to, the species concerned but rather that we have had to deduce these from direct evidence; for example, where high levels of deforestation have been reported in many of the countries comprising the range of a largely arboreal or forest dwelling species we may assume that the species is threatened even if direct proof of this fact is not available. In addition, the lack of familiarity with these species has lead to known instances of misidentification by field workers or local informants which in turn casts doubt on the reliability of some of the data we have received. One example which illustrates this problem is a report on the occurrence of the red panda from Burma. This report stated that red pandas were still fairly common in some areas and as proof, the report was accompanied by a photograph of a "red panda" taken during a visit to one such area, the photograph in question depicted a species of civet. Other examples are to be found where field workers in Central America who, when questioned about the occurrence of the mountain coati, were uncertain as to whether the animals which they had seen in the field belonged to this species or to that of the more familiar Central American coati. Similarly, reports of the Guadeloupe raccoon are confused by the fact that some respondents indicate that the species they have seen on the island is the crab-eating raccoon rather than the local endemic species.

The collection of data and its evaluation has been hampered by the taxonomic problems mentioned above which will be covered in detail later. The most surprising of these related to the actual relationship of the red panda to the procyonids; one expert was so adamant that the red panda could not be considered as a procyonid that he refused to work for or with a group called the Procyonid Specialist Group which also dealt with the red panda. Luckily this only occurred on one occasion but it serves not only to illustrate the kind of reaction which may be encountered when people's (scientific) beliefs are questioned but also that taxonomic questions can have far reaching effects.

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Comparative analysis of the diets of European mink (*Mustela lutreola*), American mink (*M. vison*), and Polecat (*M. putorius*) in Byelorussia

Vadim E. SIDOROVICH

Introduction

The problem of the rapid reduction of both the range and numbers of the European mink (*Mustela lutreola*) remains unresolved, although discussed by many authors (Danilov & Tumanov, 1976; Ternovsky, 1977; Henttonen & Lahti, 1978; Granquist, 1981; Tumanov & Zverev, 1986; Ternovsky & Ternovskaya, 1988; Schropfer & Paliocha, 1989; Sidorovich, 1990). For an explanation, some postulate competition with the American mink (*M. vison*), an ecologically similar species introduced into Europe (Heptner *et al.*, 1967; Henttonen & Kahti, 1978; Sidorovich, 1990). Other workers have favoured increased competition with the polecat (*M. putorius*) in habitats altered by man (Schropfer & Paliocha, 1989).

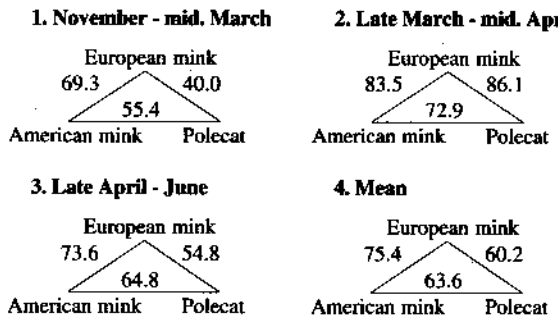
There is a large literature dealing with the nutritional ecology of these species, which includes comparisons of feeding spectra (Grigoriev & Teplov, 1939; Heptner et al., 1967; Danilov & Tumanov, 1976; Tumanov & Smelov, 1980). However, all these authors presented data gathered from large geographical areas. In the analysis of interspecific interactions, dietary information is required that is derived from the study of animals in patchy, local environments that are simultaneously inhabited by all species (Begon et al., 1986; Sidorovich, 1990). Such information is lacking when the two species of mink and the polecat are considered together.

The three species co-exist along a medium-sized river, typical of northern Byelorussia. This provided an opportunity to undertake a comparative study of their feeding ecology. By examining dietary similarities between these species, the possibility of interspecific competition through dietary overlap could be investigated. This study is connected with a research programme investigating the decline of the European mink.

Table 1 - Diet of European mink on Lovat River, 1989-91

Prey classes	% prey items			
	Nov.-mid Mar.	Late Mar. -mid Apr.	Late Apr. -June	Mean
Insects	18.9	8.1	26.4	15.5
Dytiscidae	18.9	8.1	18.9	13.4
Other insects	-	-	7.5	2.1
Fish	8.1	8.1	15.1	10.2
Esox lucius	-	1.0	-	0.5
Perca fluviatilis	2.7	1.0	-	1.1
Rutilus rutilus	-	2.0	1.9	1.6
Misgurnus fossilis	2.7	2.0	5.7	3.2
Gasterosteus aculeatus	2.7	1.0	5.7	2.7
Other fish	-	1.0	1.9	1.1
Amphibians	56.8	55.1	35.8	50.3
Rana arvalis, temporaria	56.8	55.1	30.2	48.7
R. ridibunda, esculenta	-	-	3.8	1.1
Bufo sp.	-	-	1.9	0.5
Birds	2.7	3.1	9.4	4.8
Mammals	13.5	25.5	11.3	19.3
Murinae	2.7	1.0	-	1.1
Arvicola terrestris	5.4	6.1	3.8	5.3
Other Microtinae	2.7	4.1	3.8	3.7
Soricidae	2.7	7.1	1.9	4.8
Other small mammals	-	7.1	1.9	4.3
	n=37	n=98	n=53	n=187

Figure 1 - Dietary similarity in Minks and Polecat on Lovat River, 1989-91



Material and methods

The study was carried out along a 40 km stretch of the River Lovat (West Dvina Basin, Gorodok District, Vitebsk Region) between April 1988 and May 1991. River width varied between 5 and 20 m, depth between 0.5 and 20 m, and flow speed between 0.2 and 0.5 km/h. The area is characterised by diverse riparian habitats; the width of the floodplain ranged between 100 and 800 m, with about 30% of its total area covered by open meadows. Elsewhere, willow (*Salix* spp.), shrubs and conifer-dominated forests occur in equal proportions. Between 10% to 90% of the floodplain of the river corridor was subject to innundation.

The contents of both scats and gastero-intestinal tracts were analysed. Scats were collected on a regular basis from dens where the identity of the occupant was known, either by trapping or from observation. Stomachs and intestines were collected from trapped specimens. A total of 78 scats and 11 stomachs and intestines were collected from European mink, 64 scats and 16 alimentary tracts from American mink, and 43 scats and 5 alimentary tracts from polecats.

The identity and size of prey items were determined from remains extracted from stomachs, intestines and scats. The material examined consisted of chitinous insect remains, fish scales and vertebrae, amphibian bones, avian bones and feathers, and the teeth of mammals (see details in Sidorovich, 1991; Pikulik & Sidorovich, in press).

To analyse seasonal variation in diets, study data were divided between three periods: November to mid March, late March to mid April, and late April to late June (see Tables). These periods were characterised by different environmental conditions and the diets of semi-aquatic mustelids appeared different in each (Sidorovich, 1990). No data were collected between August and October, although it is probable that the diets of all three species during this period did not differ markedly from their diets during the months of May, June, and July (cf. Heptner *et al.*, 1967; Tumarov & Smelov, 1980; Sidorovich, 1991).

Trophic similarity was determined using the equation:
$T = \Sigma_h \min (P_{ih}, P_{jh})$
where P_{ih} and P_{ij} are the fractions of prey h in the diet of species i and j (expressed as percentage biomass)

Results

Five prey classes were present in the diets of the mustelids on the River Lovat: amphibians, small mammals, fish, birds, and insects (Tables 1-3). A total of 22 species were found in the diet of the European mink, 30 species in the diet of the American mink, and 24 species were recorded in the polecat's diet. Amphibians and small mammals contributed most to the dietary biomass of the species studied, although fish were also important constituents of the diets of both mink species (Table 4). Amphibia were the major type of prey taken by both species of mink, but made up a greater proportion of the diet of American mink than of European mink (47% and 31% respectively). Small mammals were a major component of the diet of the polecat (65%) with amphibia contributing a further 21.5% by biomass. Birds were of minor importance in the diets of all species, contributing between 8-10% of prey biomass. Insects were of negligable importance, comprising no more than 1.5% of the prey items recovered.

The trophic similarity of the species studied is shown in Fig. 1. The maximum mean index value observed was between the two mink species (75.4%). Dietary overlap between the polecat and both species of mink was lower (60%)(Fig. 1). In all three species pairs, similar variability of trophic overlap was observed. This reached its maximum level in early spring and a minimum in late autumn/winter.

Discussion

Every prey item present in the diets of the mustelid species studied may be considered to be a potential prey item for any of these three species.

The data presented show that different prey items were taken in differing proportions by different species. The frequency differences between major prey items is one of the indices that classifies the trophic plasticity of a predator. The range of major prey species taken by American mink on the River Lovat was more diverse than that of either the European mink or the polecat. American mink preyed upon more species of fish and small mammals, whilst polecats took less fish but a wider range of mammalian and avian prey than did European mink. American mink appeared to be a more generalist predator than did native European mink. This suggests a greater competitive ability in the introduced species. Comparison of the diets of European mink and the polecat, on both the River and in adjacent riparian habitats, showed that the European mink may be more competitive in unfavourable environments. This is due to its greater ability to forage underwater. Thus, when feeding conditions in riparian habitats become unfavourable, European mink can respond by foraging in the river itself.

Table 2 - Diet of American mink on Lovat River, 1989-91

Prey classes	% prey items			
	Nov.-mid Mar.	Late Mar. -mid Apr.	Late Apr. -June	Mean
Insects	7.4	5.8	14.0	8.2
Dytiscidae	7.4	5.8	12.0	7.7
Other insects	-	-	2.0	0.5
Fish	23.9	23.5	28.0	24.7
Esox licius	1.4	9.8	2.0	5.5
Perca fluviatilis	3.0	1.0	8.0	3.2
Rutilus rutilus	3.0	2.9	10.0	4.6
Misgurnus fossilis	7.5	5.9	4.0	5.9
Gasterosteus aculeatus	5.9	1.0	-	2.3
Other fish	3.0	2.9	4.0	3.2
Amphibians	37.3	42.1	30.0	37.8
Rana arvalis, temporaria	32.8	41.2	18.0	33.3
R. ridibunda, esculenta	4.5	1.0	6.0	3.2
Bufo sp.	-	-	6.0	1.4
Birds	1.4	2.9	10.0	4.1
Mammals	29.8	24.5	18.0	25.1
Murinae	1.5	1.0	-	0.9
Arvicola terrestris	7.5	8.8	6.0	7.8
Other Microtinae	7.5	3.9	2.0	4.6
Soricidae	11.9	9.8	4.0	9.1
Other small mammals	1.5	2.0	6.0	2.7
	n=67	n=102	n=50	n=219

Table 3 - Diet of Polecat on Lovat River, 1989-91

Prey classes	% prey items			
	Nov.-mid Mar.	Late Mar. -mid Apr.	Late Apr. -June	Mean
Insects	3.2	5.0	11.1	5.8
Dytiscidae	3.2	5.0	5.6	4.3
Other insects	-	-	5.6	1.5
Fish	2.2	7.5	2.8	4.3
Amphibians	27.4	55.0	44.4	40.0
Rana arvalis, temporaria	27.4	50.0	25.0	33.3
R. ridibunda, esculenta	-	-	5.6	1.5
Bufo sp.	-	5.0	13.8	5.1
Birds	4.8	5.0	13.8	7.3
Mammals	61.3	27.5	27.7	42.8
Murinae	8.1	-	2.8	4.4
Arvicola terrestris	6.5	5.0	5.6	5.8
Microtus agrestis	8.1	7.5	2.8	6.5
M. arvalis	8.1	2.5	2.8	5.1
Clethrionomys glareolus	19.4	5.0	8.3	12.3
Soricidae	4.8	2.5	-	2.9
Other small mammals	6.5	5.0	5.6	5.8
	n=62	n=40	n=36	n=138

Studies of seasonal dietary variation showed that the greatest trophic plasticity was that of the American mink. In winter the species takes terrestrial prey (small mammals) more often than the European mink (Tables 1 & 2). Sometimes American mink feed exclusively on small mammals in winter (Sidorovich, 1991). The ability of American mink to prey upon small mammals allows the species to adapt to prey scarcities caused by the winter freezing of riparian habitats, when access to water may be either limited or impossible. In winter European mink preyed primarily on amphibia (especially *Rana temporaria*) that overwinter in ponds. Thus, during the early stages of freezing over, when lack of access to water limits foraging, conditions become much poorer for European mink than for American mink. In winter polecats feed primarily on small mammals (61.3%). However, polecats cannot forage in water when the air temperature drops below 0°C, their fur becomes wet easily and this makes aquatic foraging bioenergetically expensive. When the winter availability of small mammals decreases, e.g. during periods of snow cover, the polecat is in a poorer nutritional situation than either species of mink.

Comparison of the seasonal changes in dietary composition and prey availability show that all species (and particularly American mink) tend to take prey according to its availability. Birds and insects were most frequently preyed upon in summer. Furthermore, American mink preyed most heavily upon various amphibian and fish species during their spawning periods, behaviour that is not typical of either the European mink or the polecat. A high degree of nutritional plasticity in American mink, in terms of predation upon small rodents and birds, has also been reported in other areas (Pulliainen, 1984; Arnold & Fritzell, 1987). All these facts lead to the conclusion that the American mink has a greater trophic plasticity and competitiveness on ponds and adjacent riparian habitats than either of the other mustelids studied.

Table 4 - Composition of diet of Minks and Polecat on Lovat River 1989-91

Prey classes	% biomass		
	European mink	American mink	Polecat
Insects	1.5	0.7	0.3
Fish	13.3	28.5	3.3
Amphibians	47.0	31.2	21.5
Birds	10.8	8.1	9.4
Small mammals	27.4	31.5	65.5
	n=187	n=219	n=138

The greatest trophic similarity observed was between the two species of mink (75.4%) with little seasonal variation. The high level of overlap during the period of unfavourable environmental trophic conditions may lead to intense competition between the two species (Giller, 1984; Begon *et al.*, 1986). Trophic similarity between the two species of mink and the polecat was somewhat lower (about 60%). However, seasonal variation was greater, with the lowest indices being observed in winter. Therefore, differences in the diets between European and American mink and the polecat were sufficiently large to prevent intense competition. Such competition may occur near ponds however, where high densities of all three species were observed during periods of poor feeding conditions.

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Changes in the occupation of badger setts in the environs of Vilnius within the last decade

Census data show that the number of badgers in Lithuania has decreased during the last ten years. Although the reliability of Lithuanian badger census data is somewhat questionable, it is evident that the number of badgers in the suburbs of Vilnius has decreased within this period. Systematic observations have shown that badgers have abandoned eight setts during the last decade. In 1980 suburban setts were used by badgers, foxes and raccoon dogs. Nowadays badgers inhabit only two setts out of eleven, whereas ten setts were inhabited in 1980. Foxes currently live in only one of these setts, and both foxes and badgers are absent from nine others. Now only raccoon dogs use these setts from time to time. What are the reasons for these decreases in the numbers of foxes and badgers in the suburbs of Vilnius? The main reason is increased anthropogenic pressure upon these areas. Built-up zones have sprung-up around the patches of forest in which the setts were originally excavated. Continuous disturbance of the setts followed; children blocked the holes with logs and stones, whilst poachers placed snares. It is interesting to note that raccoon dogs have occupied some setts that have experienced high levels of human disturbance. Perhaps this is due to the ecological plasticity of the raccoon dog in Lithuania. Raccoon dogs dispersed into Lithuania from Latvia and Byelorussia between 1948 and 1960, so the species is new to Lithuania. The raccoon dog has been forced to search for its own ecological niche in the Lithuanian ecosystem, and to adapt itself to this different environment. In conclusion it is necessary to mention the following:

1. In the suburbs of Vilnius the raccoon dog has occupied setts vacated by badgers and foxes.
2. It is important to increase environmental education for children to teach them how to care for wildlife, and how to observe suburban animals, but not to disturb them.

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The biology and status of Owston's palm civet in Vietnam

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Ecology and biology

Owston's palm civet *(Chrotogale owstoni* Thomas, 1912), is one of the rarest members of the viverrid family in Vietnam and a critically endangered species worldwide.

It is a very beautiful animal (Fig. 1). The brown pelage has four large triangular black bands crossing the back, and two black bands running along the shoulders on each side. The long tail has two complete brown rings at its root, the rest being completely black. *Chrotogale* is a medium-sized viverrid with a head and body length of 560 to 720 mm, a tail length of 350 to 470 mm, and an ear length of 40 to 50 mm. The body weight is between 2,500 and 4,000 g.

Very little is known of the ecology and biology of the species. It prefers humid habitats; valley forests, hillsides, foothills with streams, lakes, and the headwaters of rivers. They also inhabit the shrubby surroundings of forests, bushland along river banks and even scrub near cultivated fields. *Chrotogale* makes simple dens under large tree-trunks or in dense bushes (Le Hien Hao, 1973; Pham Trong Ahn, 1982). They also frequently use natural holes in trees, rocks, or in the ground for nesting and resting. These dens are not used for long periods of time, they often change dens in response to the availability of food resources and changing seasons.

Owston's palm civet is terrestrial but can climb very well. In their search for food they often climb trees to prey on small animals (birds, lizards, insects, etc.) or to take fruits. Being nocturnal they remain in their den during the day. Emergence time depends on the security of the habitat, the food supply, and their physiological status. Usually activity commences at dusk and ends early in the morning. Sometimes they may go out late in the afternoon at sunset. Pregnant and lactating females often become active later than the others (Le Hien Hao, 1973). They are most active between 21.00 h and 24.00 h (Pham Trong Anh, 1982). Our observations of captive specimens revealed that they were active for between 7 and 10 hours per day. During daytime they usually

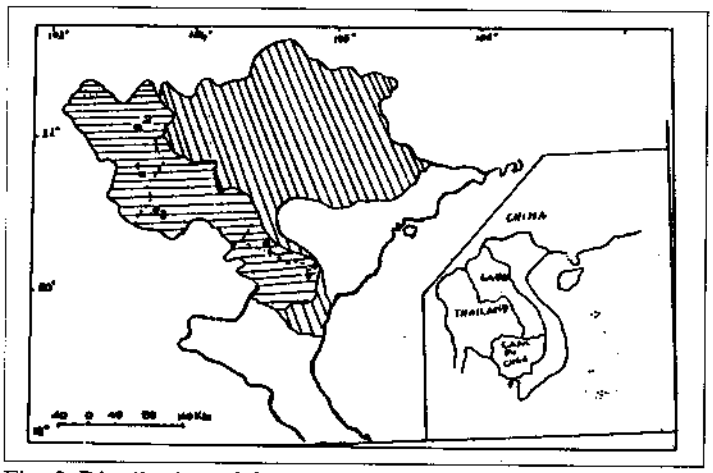

Fig. 2 Distribution of Owston's palm civet in Vietnam
▨ Distibution before 1973
▭ Probable present distribution
● Recent records: 1. Muong Phang, 2. Muong Te, 3. Sop Cop, 4. Hoa Binh, 5. Cuc Phuong Nat. Park

Fig. 1 Owston's palm civet (*Chrotogale owstoni*) in captivity. Photo by Nguyen Xuan Dang.

only leave their dens for a few minutes, either to drink or urinate. Activity begins begins between 17.00 h and 20.00 hours and ends between 04.00 and 06.00 hours the next day. During the activity period, rests lasting between 30 min to 2 h are taken. Subadult animals are active for longer than adults. Food is usually searched for in forest surroundings, along rivers, and in cultivated fields. Sometimes they may take poultry from local villages.

Owston's palm civet marks its home territory with the secretions from scent glands located in both sexes' ano-genital region. Whilst moving the animal suddenly stops, lowers his/her pelvis and touches the ground, tree, etc. with the ano-genital region, after which the animal stands up quickly and moves on. The frequency of marking increases when the animal enters new territory, or when an unfamiliar animal enters their territory. They habitually defecate and urinate at the same spot near the den.

According to Le Hien Hao (1973) and Pham Trong Anh (1982), *Chrotogale* is solitary except during the breeding season. Our captive specimens live in social groups of two or three females, or in mixed-sex groups. Moreover, the animals usually lie side by side or even on top of one another. They appear of a peaceful disposition; readily accepting new members to their group without any show of aggression or fighting.

Owston's palm civet is usually silent but can produce a sound similar to that of a domestic cat. The diet is specialized, consisting mainly of earthworms plus a small percentage of other small animals and fruits. Stomach contents'revealed that earthworms may make between 65 to 100% of the total contents (Le Hien Hao, 1973; Pham Trong Anh, 1982). Earlier research also found eathworms in the stomach contents (Nowak & Paradiso, 1983; Dao Van Tien, 1985). Other prey items include amphibians, birds, rats, eggs, and insects (locusts, crickets, cockroaches). In captivity our animals willingly take earthworms, lean beef, chicken, frogs, small birds, eggs, and insects. Of all the fruits given, they

prefer bananas and chiku fruit (*Manilkara achras).* It was estimated that an adult animal can eat about 100 g meat (beef, chicken, earthworms) and 200 to 300 g of fresh fruit per day.

Chrotogale has one or two litters per year, each consisting of one to three kits. The gestation period lasts about 60 days (Le Hien Hao, 1973). The mating season appears to be mainly from January to March, but breeding may last until November. Le Hien Hao (1973) described fully-grown embryos as having a total length of 180-193 mm and a weight of 75-88 g, with a pelage similar to the adult's. A newborn female of about 3-4 days old looked helpless, had closed eyes, and had a total length of 190 mm, a tail of 110 mm and a body weight of 86 g.

Status and conservation

The distribution of Owston's palm civet is confined to a very small area in Asia that includes northern Vietnam, northern Laos, southern Yunnan and southern Guangxi in China (Schreiber *et al.*, 1989). In Vietnam the species has been found in most of the northern provinces (Fig. 2), but always in low numbers (Le Hien Hao, 1975; Pham Trong Anh, 1982; Dao Van Tien, 1985).

Habitat loss and disturbance and intense hunting pressure during the last few decades have eliminated much of their former range and critically reduced the number of animals.In Vietnam *Chrotogale* is protected by law as an endangered species and listed on the "Checklist of National Endangered Species" and the "Red Data Book of Vietnam".A number of nature reserves have been gazetted in their range, but the Cuc Phuong National Park is the only reserve where the occurrence of the species is occasionally recorded.

At present, evidence for the occurrence of Owston's palm civet comes only from the provinces of Lai Chau, Na Son Binh, and Son La, and the Cuc Phuong National Park. In the mean-time, habitat loss, disturbance, and intense hunting pressure still remain immediate threats which could lead the species to extinction in the near future.

Since 1990 the Institute of Ecology and Biological Resources, NCSR of Vietnam, has started to implement the "Programme of Conservation and Restoration of Owston's palm civet in Vietnam". The aims of this Programme are:

- to assess the exact status and distribution of the species in Vietnam
- to elaborate recommendations relevant to the conservation and restoration of the species
- to select suitable sites for the establishment of *Chrotogale* reserves
- to establish a captive population in Vietnam for reintroduction in well-managed reserves. The first attempt at captive breeding has been conducted (Nguyen Xuan Dang *et al.*, 1991)
- to study the biology and ecology of the species
- to seek international cooperation in the conservation and restoration of the species in Vietnam

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Better protection for the Hog-nosed skunk ?

A motion to include the genus *Conepatus* in Appendix II of CITES was made by Argentina. The genus *Conepatus* is distributed over nearly the whole of southern America. Four species, *Conepatus chinga, C. castaneus, C. rex,* and *C. humboldtii* are recognized but the population size of none of them is known.

In Argentina *Conepatus* skins are used in the fabrication of a. o. bags, and in former times, the meat was used for consumption. During the period 1972-1979, 1,243,129 skins were officially exported; the number contains all four species without any numbers known for any of the species. The remarkable reduction of the number of skins exported since 1983 could be ascribed partly to the inclusion of *C. humboldtii* in CITES Appendix II but may also be the result of skins becoming scarcer, while the demand for skins is rising since 1990. Illegal trade in skins and trade in live animals is considered as insignificant.

It is considered necessary to include all four species of *Conepatus* in CITES Appendix II in order to obtain data on the trade in the different species, to estimate the exploitation level, and to enforce a better control of the exports, and to avoid that one of the species is exported under the name of any of the other species.

MANAGING FOREST CARNIVORES

A special session "Managing Forest Carnivores" featuring presentations on habitat relations of forest carnivores throughout the world will be held at: International Union of Game Biologists, Congress XXI, Halifax, Nova Scotia, Canada, 15 to 20 August '93 Those interested in making a poster or platform presentation should contact: Steven Buskirk, Associate Professor, Department of Zoology and Physiology, University of Wyoming, P.O.Box 3166, Laramie, Wyoming 82071-3166, USA, Tel. 307-766-2357

New distributional information on Owston's palm civet

Viatcheslav V. ROZHNOV, German V. KUZNETZOV & PHAM TRONG ANH

Owston's palm civet, *Chrotogale owstoni* Thomas, 1912, is a rare and insufficiently known species occurring in southeastern Asia (Fig. 1). Sokolov (1979) and Wenzel & Haltenorth (1972) mentioned that its range includes only northern Vietnam (formerly Tonkin) and northern Laos. Schreiber *et al.* (1989) and Tan Banjie (1989) also included southern Yunnan and southwestern Guangxi provinces in China.

The distribution of Owston's palm civet in Vietnam is little known. Its presence was only observed in the north of the country, in the regions of Yenbai, Myongmin, Shapa, Nganson, Thainien, and Hoabinh (Thomas, 1912, 1928; Osgood, 1932; Bourret, 1944). One of the authors (Pham Trong Anh) recorded *Chrotogale* in the provinces of Langshon, Bacthai, Tuenkuang, Vinhphu, and Hoabinh. Van Peenen *et al.* (1969) did not include this species in the list of mammals of South Vietnam. Thus, up till now, the most southern known locality of *Chrotogale*'s distribution was in northern Laos.

We caught two specimens of *Chrotogale* in two localities in the northern part of the Thainguen Plateau in Zalai Province (formerly Zalai-Kontum), Vietnam (Table 1).

Table 1. Data on the specimens of *Chrotogale* caught in the central part of Vietnam

Sex	Date of capture	Body mass, g	Length, mm			
			body	tail	hindfoot	ear
?	14.01.1988	2,100	560	400	93	58
female	14.01.1990	3,500	610	450	60	48

The first locality (14°34'N, 108°35'E) is in the upper reaches of the rivers Ba and Kon, approximately 75 km north of Ankhe city. The animal inhabited primary tropical forest, 900 m ASL.

The second locality is situated more to the south, in the suburbs of Buon Lyoi (14°20'N, 108°36'E), 50 km north of Ankhe city. The animal, an adult female, dwelled also in an area of high primary tropical forest, 600 to 700 m ASL.

Since the study area is in the central part of Vietnam, formerly being a part of South Vietnam, there is no need to exclude the species from the list of mammals of southern Vietnam, as has been done by Van Peenen *et al.* (1969). The southern limit of *Chrotogale*'s range should be extended to the province of Zalai, thus changing our view on the distribution of this species.

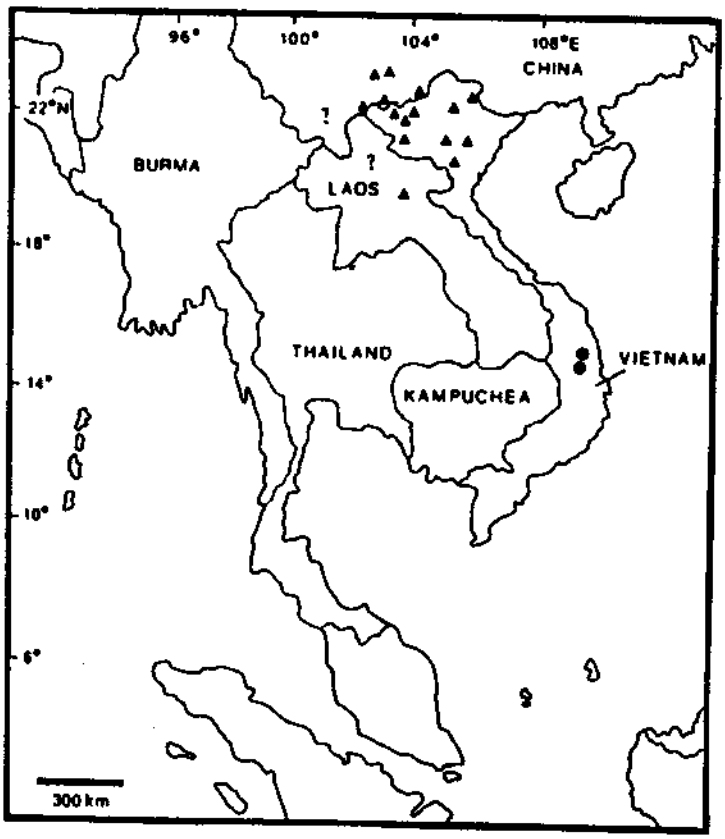

Fig. 1. Distribution of Owston's palm civet (*Chrotogale owstoni*). Black triangles indicate known localities (modified from Schreiber *et al.*, 1989); black circles indicate new localities.

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Report on the Norwegian wolverine (*Gulo gulo* L.)

Kjetil BEVANGER

Introduction

As a classic top predator, the wolverine naturally has never been abundant. This and the fact that its habitats are often located in difficult terrain in relatively inaccessible, mountainous areas, help to make the biology of the species poorly known. Its position in folklore also reflects this. Numerous tales and stories about the wolverine chiefly tell of its strength and ability to consume huge quantities of food, abilities which naturally could be transferred to those who dressed it into fur.

Conflicts with domestic animals have dominated the debate on the wolverine in Norway for several decades, a debate which has grown in recent years due to the increasing numbers of sheep killed by wolverines in some mountain areas of southern Norway (Skogland, 1991).

Because Norway is one of the few European countries that still has a viable wolverine population, the responsibility for managing the species has increased. Consequently, Norway has ratified an international agreement obliging it to protect the wolverine. Conflicts with farmers and domestic animals have led to a dramatic decrease in the population in the last 150 years. Today, only 120-150 animals are left (Kvam *et al.*, 1984). Man is therefore the most dangerous enemy of the wolverine. Because of the way the conflict has developed during the last few years, prospects are poor for winning improved understanding and tolerance for the species. Thus, ecologists, wildlife managers, and nature conservancy groups still have to fight a rather lonely battle.

Although there is no immediate risk of the species becoming extinct, the position for the subpopulation of southern Norway is at present an open question. Thus it is imperative that we follow the species with Argus eyes.

Distribution and biology

Although wolverine tracks may frequently be met with high up in the mountains, the northernmost coniferous forest, the taiga, is the main home of the species (Bjärvall, 1982). In Norway, it is mostly to be found in subalpine birch forests. Six subpopulations are normally recognized (Kvam *et al.*, 1984). Two of these are isolated Norwegian ones and four are border populations which should be considered together with Swedish wolverine populations.

The wolverine belongs to the Holarctic fauna (Krott, 1959; Liskop *et al.*, 1981). Although the question is frequently discussed, the North American and Scandinavian wolverines are today regarded as a single species (Grinell *et al.*, 1937; Kurtén, 1973; Chapman & Feldhammer, 1982; Røskaft, 1990). The wolverine is the largest of the mustelid species. The average weight of a female is 10 kg, while an adult male weighs 15-20 kg (Røskaft, 1990) which means that it overlaps the autumn weight of a badger.

Nocturnal behaviour together with excellent audible and olfactory senses make the chances of observing the animal in the field limited. Using specially-placed carrion, it has been shown that the animals are able to change direction from their original route up to 3 km away and walk straight to the carrion (Røskaft, 1990). They are therefore extremely sensitive to the smell of humans and are difficult to trap. As with most mammalian communication, olfactory stimuli are important. Places in the territory that are marked with urine or excrements are usually elevated, exposed, windy spots where the smell is easily distributed to neighbouring areas (cf. Haglund, 1966).

Telemetry has shown that adult males in Alaska need a home range of more than 600 km^2 (Magoun, 1985). Home-range figures are lacking in Scandinavia. However, preliminary studies at Dovrefjell in central Norway indicate that the size of the home range depends on both animal density and the type of the habitat, but there does not seem to be room for more than one female wolverine in each mountain valley (Røskaft, 1990). Skogland (1991) reports having found four dens in the Dovrefjell area during the last few years, three having been used each year. He stresses that dens regularly used for reproduction have not been found elsewhere in the mountain areas of southern and central Norway.

The wolverine may reach an age of 12-14 years, but does not normally live more than 5-8 years (Rausch & Pearson, 1972). The mating season seems to be April-August (Røskaft, 1990). During that time, the male and female stay together for 2-3 days. After copulation the fertilized blastocyst remains in the uterus and the development of the young does not start until up to six months later (delayed implantation) and active pregnancy lasts 30-40 days (Rausch & Pearson, 1972). The cubs are born between February 15th and March 15th (Røskaft, 1990), and their birth corresponds closely with the period when the hunting conditions for reindeer are optimal (Haglund, 1966). The den where the birth takes place is usually located just above the timberline far into a narrow mountain valley. The area should have large, deep snowdrifts and a rocky scree in the neighbourhood (Røskaft, 1990). The female burrows into the drift, making a birth chamber in the snow. Usually the cubs are moved between several chambers and different dens (Haglund, 1966; Lidholm & Johansson, 1977). The den often has a complicated network of tunnels, up to 50-60 m long. Towards the end of April or the beginning of May when the thaw is at its maximum, the cubs are moved into a rocky scree (Røskaft, 1990).

The mean litter size seems to be 2.5 (Kvam & Røskaft, 1987). The newly born cubs have white fur, weigh barely 100 g and

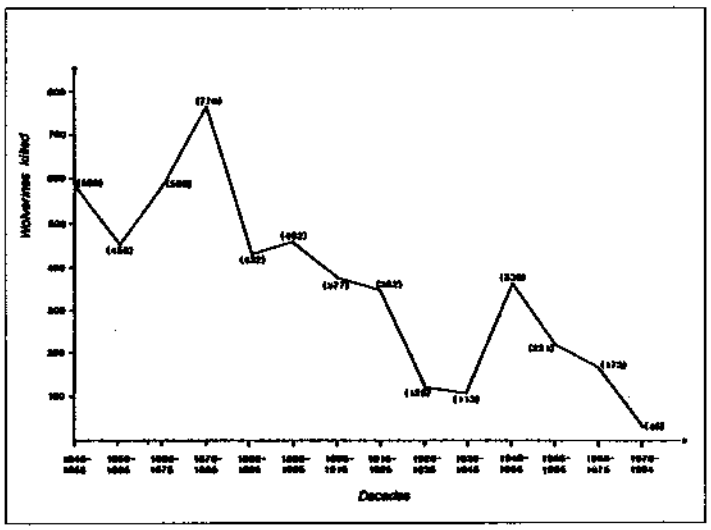

Fig. 1. Bounties paid for wolverines killed per decade 1946-1984 (after Kvam *et al.*, 1984).

are about 130 mm long (Mehrer, 1975; Myrberget & Sørumgård, 1979). The cubs grow quickly and the fur soon becomes brown. After a suckling period of two months, they begin to take solid food in addition to the milk from the mother. By mid-May, the cubs weigh nearly 3 kg, and towards the end of the month the mother and cubs leave the den area and walk around in the territory of the mother (Kvam & Røskaft, 1987; Røskaft, 1990).

In Scandinavia, reindeer are the main prey of the wolverine (Lønnberg, 1936; Haglund, 1966; Myrberget, 1968; Myhre & Myrberget, 1975), but it also catches foxes, mountain hares, rodents, and birds such as willow grouse and ptarmigan (Haglund, 1966; Bjärvall, 1982). In some areas, other cervid species like moose, red deer, and roe deer are also important prey. The wolverine is therefore regarded as an exclusively carnivorous species. The menu of the North American wolverine is more varied (Hornocker & Hash, 1981; Magoun, 1985), probably because it is more or less independent of reindeer meat (Røskaft, 1990).

The high mountain areas of Norway can be dangerous, especially during winter. Single reindeer, as well as large herds, are each year killed in avalanches. Therefore, the wolverine normally has few problems in getting enough food. In areas where such catastrophes have taken place and where there are numbers of reindeer carcasses, it is possible to see several wolverines at the same time. The skull, the strong jaw muscles and the construction of the teeth enable wolverines to crush large bones and eat frozen meat.

In America (Magoun, 1985), the average walking speed of male wolverines is 8.6 km per hour and females have been observed to walk at 4.6 km per hour. The wolverine is especially well known for its endurance; it may well walk up to 30-80 km during a single night (Makridin, 1964), the males usually further than the females. This ability is naturally closely connected with the hunting behaviour. In Sweden (Haglund, 1966), it has been observed that wolverines particularly hunt after heavy snowfalls. In the wolverine world, snow is a dominating factor for most of the year. The animal is perfectly suited to this environment, having, for example, large paws which distribute the body weight evenly on the ground, i.e. the pressure per unit area is small. Where the snow is loose and reindeer (and skiers) have to give up, the wolverine "floats" without any problem. When a wolverine reaches a reindeer that is standing in deep snow, it quickly jumps on its neck and kills it efficiently with a powerful bite across the neck vertebrae. This of course means that weak animals and those that are ill are easily caught. A close correlation has actually been shown to exist between the health of the reindeer and which individuals are caught by the wolverine. The age of the reindeer killed by the wolverine in the late winter was 10-13 years and all animals had completely worn down teeth and were consequently in a poor physical condition (Skogland, 1991). The wolverine is therefore a selective hunter and makes its contribution to keeping the wild reindeer herds of southern Norway in a healthy condition.

In summer, the opportunities for hunting are severely reduced. The menu then consists to a great extent of carcasses, small rodents, bird's eggs, insects, etc. (cf. Krott, 1960). Consequently, like man, it has developed abilities to hoard food when a surplus is available. Individuals which manage to find appropriate places to store and conserve food in summer manage best. Natural selection has ensured that the genes responsible for this behaviour were passed from one generation to the next. The species has therefore developed an ability to kill more prey than it needs in good periods to store for poor times. The ability to be a surplus killer is extremely important for an animal living under extreme conditions which only now and then give an opportunity for killing more than one prey on each hunting trip. Proper storage facilities for surplus food in the high mountain areas of Norway during summer are nature's own natural fridges -swamps, snowdrifts, and rocky screes.

The development of the Norwegian wolverine population during the last 150 years

The development of the Norwegian wolverine population during the last 100-150 years is a depressing story. Bounties for 432-770 wolverines were paid for each 10-year period between 1846 and 1906 (Kvam *et al.*, 1984). The numbers fell steadily from 1906 to 1946, from 377 animals in the first period to 113 in the last one. Only 173 were killed between 1966 and 1975 (Fig. 1), in spite of improved possibilities for effective hunting, e.g. by using snow scooters.

If we assume that a rather strong, healthy wolverine population can stand a 10% yearly harvest, the bounty statistics of 50-80 animals a year, such as we had before the turn of this century, indicate a maximum wolverine population during this period of about 500 animals, i.e. three times higher than today. The harvest was obviously far beyond what a population could stand; a steady decrease was the result, a decrease which seems to have culminated with a minimum population some time during the 1960's (Røskaft, 1990).

Fortunately, it now looks as if this negative trend has turned and the population seems to be slowly recovering. However, strained relationships with farmers make it difficult to obtain data to confirm this. And it is important to stress that so far there are no data or research results on the population biology of the wolverine that give a basis for estimates of the minimum size of a viable population (cf. Kvam *et al.*, 1984).

The conflict between wolverine and sheep

In Norway, increasing numbers of sheep are released into mountain areas during summer season. During the last 10-15 years, sheep owners have doubled the number of sheep in the core area of the South Norwegian subpopulation in the Dovre area (Skogland, 1991). Naturally, sheep are no match for the wolverine and are easily killed. Consequently, the wolverine from time to time revels in this dish. Some sheep farmers may loose hundreds of sheep this way during one summer season within relatively restricted areas. This situation has resulted in a rather bitter conflict between sections of the Norwegian agricultural community and wildlife managers and ecologists. Of about two million sheep and lambs which are released on to rough grazing every year, about 100 000 disappear, i.e. about 5%. Each year, economic compensation is paid for sheep killed by the wolverine for about 2.5% of the animals that disappear, i.e. 1/1000 of all the sheep released to outdoor grazing (Røskaft, 1990). From a national point of view, this is a small problem for which a rich country like Norway can so far afford to pay. However, the individual sheep farmer, losing up to 80% of his flock, naturally takes a different view.

Consequently, the wildlife authorities each year give dispensation from the protection regulations to allow individual wolverines to be shot in areas where losses are heaviest, although the population numbers clearly tell us that any killing should be banned. Another important point in this connection is that the shooting of such "killer" individuals has not affected the extent of