SMALL CARNIVORE CONSERVATION

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

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Fossa (*Cryptoprocta ferox*) - Photo: Dipl.-Biol. F. Ostenrath

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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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The European endangered breeding program for the Fossa (*Cryptoprocta ferox*)

Achim WINKLER

The Fossa is the largest native carnivore on the island of Madagascar, with a head and body length of 60-75 cm, plus a tail of 55-70 cm. Adult males can weigh more than 14 kg, while females are considerably smaller, rarely weighing as much as 10 kg. The body of the fossa is long and slender with short reddish-brown fur. Fossas are solitary hunters which inhabit the woodlands remaining throughout Madagascar. They are agile climbers and can jump exceptionally well. Their diet consists primarily of birds and small to medium-sized mammals, including lemurs.

Systematically the fossa forms a link between the true cats and the viverrids, showing a range of morphological traits characteristic of both felines and viverrids. The overall appearance of the animal, its dentition and the retractible claws are reminiscent of felids, whilst the skeleton, brain, feet, and anal glands are more characteristic of viverrids. Formerly in the cat family, the fossa is now classified in a separate subfamily, Cryptoproctinae, within family Viverridae.

The fossa are widespread over the entire island of Madagascar but nowhere are they very common. They are absent from the many deforested regions (particularly in the central mountainous zones) but are still considered to occur in larger numbers in the forests remaining in western and eastern Madagascar. Numbers are declining however, although no exact figures are known. Today the fossa is listed as "vulnerable" in the IUCN Mammal Red Data Book and is listed on CITES Appendix II.

Fossa (*Cryptoprocta ferox*) in Zoo Duisburg

The reason for the population decline of the fossa is to be seen largely in the ongoing destruction of the natural environment of Madagascar. Woodlands are continuously being cleared on a large scale to gain land for the grazing of cattle and to allow the use of valuable timber, so depriving the animals of their prime woodland habitat.

Already more than 80% of Madagascar's original woodlands has been destroyed. Many of the intact forests remaining are incorporated into protected areas such as national parks and nature reserves, which warrant protection for the fossa and other threatened wildlife. However, in a country as poor as is Madagascar, there is immense human pressure to explore any remaining parts of the country's natural heritage.

In addition to the effects of habitat destruction, fossas are hunted in many parts of the country since they are known to prey on domesticated animals, particularly poultry and young pigs.

Fossas have been held in captivity in small numbers at a few zoos since the beginning of this century. The first success in breeding in captivity was recorded at the Parc Tsimbazaza in Antananarivo, Madagascar in 1967. The first birth outside Madagascar was at Montpellier Zoo, France in 1974.

At the end of 1995 a total of 34 fossas was held in zoos worldwide (11 in Europe and 2 in the USA). Twelve of these animals are held at Zoo Duisburg in Germany, and most of the other captive fossas originate from the Duisburg population. In recent years Zoo Duisburg has been the only zoo to record the regular annual breeding of the fossa. Basle Zoo in Switzerland, Montpellier Zoo, San Diego Zoo (USA), and Parc Tsimbazaza thus far have been the only other zoos where fossas have reproduced successfully. Breeding at Basle and Montpellier, however, has not occurred since the early 1980s, whilst the only female held in San Diego no longer reproduces. Parc Tsimbazaza does not keep fossas at present. The future development of the captive

population of the fossa thus depends solely on ongoing reproductive successes at Zoo Duisburg.

The sex ratio of the present captive population of 18:16 is rather well-balanced. The founder population of five animals is small however, although inbreeding has been prevented largely in the past. Two further potential founder animals (at Basle and Montpellier) have not yet reproduced. However, with new partners having been established recently, it is hoped to produce some offspring from these genetically valuable animals.

In the ten years since 1985 a total of 20 fossas have been raised successfully from six different females from the captive population. Surplus animals were transfered to a number of zoos in Europe to establish new potential breeding pairs. Further zoos in Europe and in the USA are also interested in obtaining fossas.

In 1994 a European Endangered Breeding Program (EEP) for the fossa was initiated at Zoo Duisburg. The EEP was started with two aims in mind. Firstly, the breeding program is intended to maintain a genetically viable population in captivity. The program is based on a masterplan for the cooperative management of fossas in captivity, incorporating the distribution, pairing and breeding the animals, evaluation of a target population, and long-term population planning to minimize inbreeding and to maintain high genetic variability. The international studbook for the fossa in coordinated at Duisburg Zoo.

The second aim of the EEP is to support nature conservation in Madagascar. A Fossa-Fund was established at Zoo Duisburg to obtain funding necessary for *in situ* conservation activities. Most of the money generated thusfar originates from the transfers of fossas between zoo. Fossas which are translocated within the EEP-program are offered on a breeding loan basis without changing ownership. Apart from paying transport costs, the recipient zoo is requested to pay a one-off sum of at least US$ 1,000 to the Fossa-Fund for each fossa obtained. (Naturally, each zoo is welcome to donate more money if they so desire). Additional money for the Fossa-Fund is being collected from the public. By the end of 1995 more than US$ 12,000 already had been gathered by the Fossa-Fund.

Some of this money has been invested in a research project to evaluate the behavioural ecology and reproductive biology of the fossa in western Madagascar. This PhD study, conducted by Clare Hawkins (University of Aberdeen), will be the first detailed biological account of the fossa in the wild. Animals are radio-tracked for information on home range sizes, population densities, and habitat preferences. Skin and blood samples are taken for DNA fingerprinting and hormonal analyses, respectively, while faeces are collected for dietary studies. The only previous study of the fossa in the wild, carried out by Bernardin Rasolonandrasana in 1994, focussed on the collection of faecal material only, so gaining our first insights into the diet of the fossa. Almost all that we know of the animal's biology at present derives from observations made on animals in captive environments.

More of the money from the Fossa-Fund is to be allocated to a joint project with Parc Tsimbazaza, Madagascar. The Parc has already developed plans to re-establish fossas at the zoo, while the Fossa-EEP urgently requires new animals from Madagascar to broaden the genetic base of the EEP-population. With support from the Fossa-Fund, the staff at Parc Tsimbazaza will also be looking to assess the overall number of the fossa on Madagascar.

In conclusion it can be said that the initiation of the Fossa-Fund in 1994 has led to marked changes in the conservation activities undertaken for the fossa. The captive situation has been greatly improved with the establishment of various potential breeding pairs at a number of zoos throughout Europe, whilst further institutions in Europe and America are due to receive any surplus fossas. With more zoos joining the Fossa-EEP, a greater number of fossas can be presented to the visiting public. This provides an opportunity for participating zoos to raise public awareness of an unfamiliar animal species such as the fossa, and to inform the zoo-going public about the status of the fossa in its increasingly diminishing natural environment. The conservation of the fossa and other threatened wildlife on Madagascar will be further supported with the finances generated by the Fossa-EEP's Fossa-Fund.

Zoo Duisburg, Mülheimer Strasse 273,
47058 Duisburg, Germany

The Netherlands ban the importation of furs from animals caught in leghold traps

In 1991, the European Commission announced its intention to prohibit the introduction into the Community of pelts and manufactured goods of certain wild animal species originating in countries which catch them by means of leghold traps or trapping methods which do not meet international humane trapping standards. A regulation (EC 3254/91) was to take effect on 1 January 1995. However, implementation of the ban has been delayed twice by the Commission in anticipation of the establishment of international humane trapping standards.

The Commission left the way open for individual members of the EU to impose the ban, however, and the Netherlands is the first country to do so. Fur exporters from the USA, Canada, and Russia fiercely oppose the ban which, they argue, runs counter the World Trade Organization rules.

Dutch Ministerial Decree of 24 December 1995, effective 1 January 1996, bans the import of pelts, skins and furs, and manufactured goods that contain pelts, skins or furs, of the following species:

American badger *Taxidea taxus*; American pine marten *Martes americana*; Beaver *Castor canadensis*; Coyote *Canis latrans*; Ermine *Mustela erminea*; Fisher *Martes pennanti*; Grey wolf *Canis lupus*; Muskrat *Ondatra zibethicus*; Otter *Lutra canadensis*; Raccoon *Procyon lotor*; Sable *Martes zibellina*.

The ban does not apply to imports from other EU Member States.

Netherlands clamps down on leghold pelts. 1966. *Traffic Bull.*, 16(2):38.

Sightings of Nilgiri marten (*Martes gwatkinsi* Horsfield) at Peppara Wildlife Sanctuary and Silent Valley National Park, Kerala, India.

G. CHRISTOPHER and E. A. JAYSON

Western Ghats of the Indian sub-continent is well known for its extensive floral and faunal diversity. The complex topography and wide range of micro climatic and soil conditions results in a mosaic of plant communities and animal associations. In particular, the southern part of the Western Ghats is a refuge to many threatened, endangered and endemic plants and animals, amongst which the large mammals are better known than the smaller mammals. The small carnivore community of this region has remained under-recorded (Yoganand & Kumar, 1995). Scientifically, most viverrids and mustelids, and particularly the tropical forms, are among the least known carnivores (Schreiber *et al.*, 1989).

The Nilgiri marten is a rare mustelid which is endemic to the forested tracts of the Western Ghat mountain range. Sightings of this species have also been very few (Madusudan, 1995). The UICN/SSC Mustelid, Viverrid & Procyonid Specialist Group listed the Nilgiri marten as a threatened species for priority conservation action.

Though the distribution of *Martes gwatkinsi* in the southern Western Ghats has been described by various authors (Pocock, 1941; Hutton, 1949; Finn, 1980; Prater, 1980; Jerdon, 1984), there is a remarkable paucity of information on the distribution and status of this species. Apart from the early descriptions, direct sightings of Nilgiri marten have been reported from the Brahmagiri Wildlife Sanctuary in Karnataka (Karanth, 1984), the Eravikulam National Park in Kerala (Madusudan, 1995) and , more recently, from Upper Bhavani of the Nilgiris (Gokula & Ramachandran, 1996). Indirect evidence (scats) of the animal were identified from the Mukuruthi National Park by Yoganand & Kumar (1995). The species is likely to occur at the Indira Gandhi Wildlife Sanctuary and the Kalakad-Mundanthurai Tiger Reserve of Tamil Nadu, and the Neyyar Wildlife Sanctuary of Kerala (Schreiber *et al.*, 1989). The present observations (Fig. 1) are the first records of the Nilgiri marten from the Peppara Wildlife Sanctuary and the Silent Valley National Park.

Peppara Wildlife Sanctuary

The Peppara Wildlife Sanctuary (08°34'-08°42'N, 77°07'-77°14'E) is situated at the southern end of the Western Ghats. To its east lies the Kalakad-Mundanthurai Tiger Reserve and towards its south is the Neyyar Wildlife Sanctuary. The sanctuary occupies an area of 53 km^2. It is drained by the River Karamana where a reservoir formed by a dam across the river occupies an area of 5.82 km^2. The terrain is rugged, with elevations ranging from 100 m to 1717 m ASL.

The sanctuary is endowed with west coast tropical evergreen and semi-evergreen, southern moist mixed deciduous, southern tropical hill forests, and southern hill top evergreen forests (Champion & Seth, 1968). Reed brakes and *Myristica* swamps can also be seen in this tract. During our three-year study on man-wildlife conflicts in and around the sanctuary area, we made sightings of various small and large mammals interacting with the local Kani-tribals.

Occasionally, a strange animal with dark coat, pale yellow throat, flat otter-like head which it wagged up and down slightly, was found in the moist deciduous and hill top evergreen tracts of the sanctuary. The 'Kani' tribals call this animal 'Koduvalli'; after a direct sighting we confirmed this to be the Nilgiri marten.

In May 1995, at Vazhukkampara (450 m ASL), near the Bonaccord Hills, we noticed an animal feeding on honey by inserting the front half of its body into a tree hole (*Dillenia pentagyna*) about five metres above the ground. It was around 11.00 hours, and the animal actively fed for 10 minutes without bothering about its surroundings. Immediately after withdrawing from the tree hollow it noticed the observers, raised its fore body slightly, and made a harsh chuckling noise. Soon, it climbed down from the tree and swiftly moved off into the grassy undergrowth. With its head raised, the pale yellow throat was clearly visible, with a total body length (head to tail) of about 1.3 m. The area of the sighting was rocky with mixed deciduous forest.

In February 1996, again we observed a Nilgiri marten in a cultivated area near the Chathankode Kani tribal settlement (120 m ASL). In the clear sunlight, we were able to observe the yellow

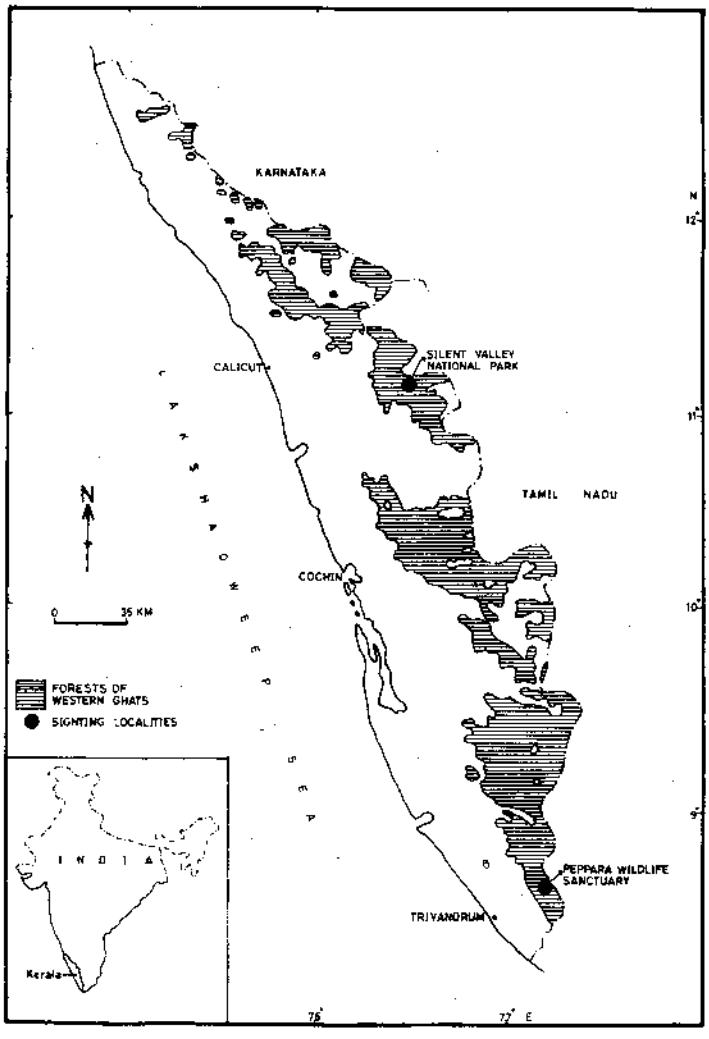

Fig. 1 Sighting localities of Nilgiri marten

throat and the dorsally flattened head. When disturbed the animal ran along the ground with small leaps before disappearing into the adjoining moist deciduous vegetation. During its movement, though there were many trees and shrubs on the way, the animal moved only on the ground until it disappeared from sight.

The Nilgiri marten is well known to the Kani tribals of the region. They believe that a disturbed marten (Koduvalli) in the forest will call other members of its kind and will attack an unarmed person. Being hunter-gatherers, the Kanis will consume any type of wild animal (herbivores, omnivores, and carnivores), but they avoid eating the Nilgiri marten because they believe its meat to be poisonous. The unpleasant body odour of the marten may be the reason for this belief.

Silent Valley National Park

The Silent Valley National Park (11°04'-11°13'N, 76°24'-76°29'E) is unique for its high biological diversity and endemism; it forms the core-zone of the Nilgiri Biosphere Reserve. The elevation ranges from 900 m to 2,383 m ASL. The park is covered mostly by west coast tropical wet evergreen forests and grassland-shola eco-system in the higher reaches.

On 29 May 1996, during the wildlife census, a Nilgiri was spotted by us near Anginda peak (2,383 m ASL). At 10.20 hours, we saw an animal with a black coat and orange-yellow throat, moving on the grassland which came out from the nearby shola. We were watching the animal at a distance of about 5 m and, when it realized our presence, it raised its fore body to stand on its hind legs for a moment. Then it moved swiftly off into the shola it had come from. The animal had a darker colour than those sighted earlier at Peppara (which had a dark brown coat with a pale yellow throat). From the earlier reports from Anamalai and Coorg (Riley, 1913; Gouldsbury, 1949. Finn, 1980; Jerdon, 1984), it appears to have been either a male, or a female in summer coat.

Clear visibility and good sun light, combined with the background of green grass, made that sighting of Nilgiri marten at the Anginda Peak spectacular. The animal is known as 'Karumverugu' to the 'Muduga' tribes of this region.

Our present observations also reveal that *Martes gwatkinsi* is adaptable to a wide range of habitats, from high altitude shola grassland to tropical deciduous forest at low elevation. This adaptability resembles that of the closely related Himalayan species *Martes flavigula*, (Prater, 1971; Roberts, 1977). Apart from our direct sightings, Nilgiri marten were reported by the local tribals from the Kaviar, Cherukad, Chemmunji, and Athirumalai areas of the Peppara Wildlife Sanctuary, and also from the contiguous Kiamalai Reserved Forests and Neyyar Wildlife Sanctuary.

In the Mundanthurai-Kalakad Tiger Reserve, a marten attacking a mouse deer (*Tragulus meminna*) was observed by a group of students (1991) from the School of Ecology, Pondicherry University, near the diversion bund on Pachaiar River. In 1992, an animal again was observed along the Sengaltheri-Kakkachi trek-king path (M. Vinayak, pers. comm.).

In the Peppara Wildlife Sanctuary, apart from the Nilgiri marten, we have made direct sightings of Common mongoose (*Herpestes edwardsii*), Ruddy mongoose (*H. smithii*), Small Indian civet (*Viverricula indica*), Common palm civet (*Paradoxurus hermaphroditus*), Leopard cat (*Felis bengalensis*), Jungle cat (*F. chaus*), and the Common otter (*Lutra lutra*).

Therefore, in addition to the Nilgiri Biosphere region, the Ashambu Hills of the southern Western Ghats may be another potential area for studying small carnivore communities. Though the tribal myths and taboos help in the conservation of this endagered mustelid to some extent, none of the locals are aware of its status and importance.

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Comments on the behaviour of a Grison (*Galictis vittata*) hunting an Agouti (*Dasyprocta punctata*)

Roland W. KAYS

The grison (*Galictis vittata*) is a little-known neotropical mustelid. Reports on captive individuals (Dalquest & Roberts, 1951; Kaufmann & Kaufmann, 1965), carnivore communities (Sunquist *et al.*, 1989), and the neotropical fauna in general (Emmons, 1990) describe the grison as a terrestrial hunter of small mammals and other small vertebrates.

Given such scant information on the grison, I report here observations of an incidental encounter. On the morning of 17 December 1995, myself and three other biologists were hiking the Plantation Loop trail in Soberania National Park in Central Panama. The park contains 22,000 ha of lowland moist forest including both old and new growth. The Plantation Loop trail runs through young forest (30-50 years) that has grown up in an abandoned cacao plantation.

At approximately 08.15 we were standing in the middle of a 2 m wide trail when we heard something running towards us. An agouti (*Dasyprocta punctata*) rounded the corner of the trail 10 m ahead and proceeded to run directly at us without slowing; the animal ran right through the four of us and continued on the trail behind. Immediately following, we heard another animal running towards us on the trail: a grison rounded the corner, stopped about 8 m from us, and ran off into the forest.

When the grison momentarily stopped for about two seconds on the trail, it provided us with direct, clear views of its facial markings; we also observed partial side-views of the animal as it ran off into the forest. The animal could be clearly distinguished from a striped hog-nosed skunk (*Conepatus semistriatus*) because its tail was not bushy and its body was not black and white striped. The comparatively small size and distinctive facial markings permitted exclusion of other carnivores such as the tayra (*Eira barbara*) and the bush dog (*Speothos venaticus*). The grison we observed resembled the darker, more stout depiction in Eisenberg's (1989) book more than the painting in Emmon's (1990) field guide.

Several additional observations about the encounter are worthy of note here since they lead to speculation about the hunting methods of the species. The grison was obviously in pursuit of the agouti, yet there were approximately 15 m separating the two animals. Furthermore, all four observers have seen countless agoutis in the forest and we were all struck by three unique features of this individual. First, it was not running at top speed; we have all seen agoutis sprint away in the forest and this animal was not running that fast. Second, it looked to be in bad condition, as some fur was missing from the middle of its back, and it appeared to be close to exhaustion. Third, its fur looked wet, as if it recently swam or ran through a river.

These observations permit speculation that grison may hunt by scent, following a prey's trail and continuing pursuit across rivers and in and out of holes and other possible refuges until it can finally catch the exhausted prey. This is consistent with comments on grison behaviour reported by other authors. Sunquist *et al.* (1989) noted the keen sense of smell and apparently poor eyesight of free-ranging grison, and Kaufmann & Kaufmann (1965) reported that their captive grison frequently explored agouti burrows. I have found no reports of agoutis as prey of grison in published literature. However, one unpublished account of the mammals of San Blas, Panama, includes a report of a grison attacking an agouti in a river at mid-day (Charnley, 1985). Additional information is needed to verify the hunting methods of grison and the importance of agoutis in their diets.

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ABSTRACT

Agonistic behaviour of male striped weasels

Agonistic behaviour of captive adult male Striped weasels *Poecilogale albinucha* was investigated by arranging encounters between separately housed individuals. Three distinct phases of intensity were recognised going from immediate submission by one individual to ritualised fighting with no or only minor injury. It is speculated that adult weasel in the wild are solitary. Recommendations are made for keeping and breeding weasels in captivity.

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THERIOLOGICAL CONGRESS

The 'Seventh International Congress' will be held from 6 to 12 September 1997 in Acapulco, Guerrero, Mexico. Contact: Dr. Rodrigo A. Medellin, Communications Coordinator e-mail: ogaona@miranda.ecologia.unam.mx.

Seasonal changes in energetics of nutrition in males of small mustelid species (Mustelidae)

Igor L. TUMANOV and Elena A. SORINA

The rapid developments in the biological sciences make it important to apply different research methods that promote a more comprehensive understanding of the features of a species that determine its ecology. Information about seasonal changes in the levels of food consumption and physiological parameters allow us to judge the adaptability of an organism to one or another environmental factor. This is a necessary consideration in the development of a strategy for the management for an animal population, or breeding it in captivity.

In this paper the authors try to trace seasonal changes in body weight, levels of food consumption and also some physiological parameters in males of small species of mustelids that have been kept in captivity for four years. The data obtained significantly supplement the presently fragmentary and heterogeneous information available on the seasonal changes in energy balance and nutrition of the species under consideration in captivity (Slonim, 1952; Heidt *et al.*, 1968, Tumanov & Levin, 1974; Segal, 1975; Danilov & Tumanov, 1976; Chappel, 1980; King, 1980; Korhonen *et al.*, 1990; Tumanov, 1993b).

Ten mammals were used in the experiments: three European mink (*Mustela lutreola* L.), three polecats (*M. putorius* L.), two American mink (*M. vison* Schreb.), and two weasels (*M. nivalis* L.). During the research period the animals were weighed monthly and received control feeding following generally accepted methods (Danilov & Tumanov, 1976). The physiological status of the animals (all male) was determined by visual inspections of their genitalia, the dimensions and colour which changed markedly during the rutting period. Rectal temperature was measured with a medical TEMP-60 electrothermometer. The ambient temperature during experiments was 18-20°C in summer and 12-15°C in other seasons.

Body weight

Changes in the live weight of mammals during the seasons are highly significant as a sign of periodic changes in the level of their energy metabolism. Our observations on captive mustelids revealed the following changes in the body weight of males during the seasons (Fig. 1). At the end of summer (i.e. in autumn) this index noticeably increased in all animals observed, this corresponding with intens food consumption during this period and the accumulation of the fat reserves required for survival in winter. For example, during the period from September to December, the increase in weight with respect to June-July was on the average 8.1% in the weasel, 6.3% in the American mink, 7.0% in the European mink, and 20.9% in the polecat. Thus, the most intensive fat accumulation was observed in polecats in autumn, which should be considered a specific adaptation related to the reduction of heat irradiation and energy expenses in winter. In the cold season in all mustelid fat reserves gradually decreased and their weights reduced, but in spring (before the beginning of the moulting and reproductive period) the value of these indices rose again. At the end of spring the animals had their lowest body weights and fat reserves. These changes were observed in each year of research (Figs. 2 & 3).

Daily food consumption

Collected data show that the seasonal body weight dynamics are closely connected with the changes in the food consumptions of the carnivores under observation (Fig. 4). In summer when it was hot, mammals ate comparatively little. A decrease in daily food consumption became visible in polecats and weasels in June, and in mink in July. Since the middle of August (approximately) the amount of daily food eaten began to increase sharply and in September the food consumptions of the animals were maximised. Thus, in September-December, in comparison with the summer season (June-July), this index increased on average by 9.3% in weasels, by 13.8% in American mink, and by 19.9% in European mink. The greatest increase in autumn food consumption observed was in the polecat; the daily food consumption of which increased by 59.0%. A notable feature of animals of this species is the clear agreement with the increase in their body weight in autumn, due to the accumulation of considerable fat reserves. In the cold season the need for high-caloric food markedly decreased in all mustelids, which should be considered as a stable adaptive response aimed at the more 'economical' expenditure of accumulated energy reserves. In carnivores, when metabolic processes decrease in winter, the need for high quantities of food and high energy expenditure is reduced, which determines the successful outcome of over-wintering (Slonim, 1952; Tumanov, 1993b). In spring, before moulting and rutting the daily food consumption of males increased again in the time determined for that species. Furthermore, in different years these changes were stable in character (Figs. 5 & 6).

Rectal temperature

The rectal temperature of animals is an index of the intensity of their metabolism. Its seasonal changes in the carnivores observed were easily monitored. The highest rectal temperature levels were noted in spring and summer, and the lowest in winter. In warm seasons the body temperature of mammals was higher than in December by an average of 0.8-1.8°C, which clearly correlates with the changes in their energy metabolism levels during these periods (Tumanov & Levin, 1974; Tumanov, 1993a).

Among the species investigated, the average annual body temperature was highest in the American mink and the polecat. It was lower in weasels and European mink (Figs. 7 & 8). It is interesting that in the last of these, rectal temperatures in all seasons were lower than in the American mink, which had a higher level of energy metabolism (Segal, 1975; Tumanov, 1993b). The average annual disparity in this test was 1.9°C, although in separate months it reached 2.5°C. Thus, in different years in June-July the body temperature fluctuated within the limits of 36.4-38.2°C in the American mink, and 34.4-37.1°C in the European mink (Figs. 9 & 10). The maximum increase in this index in the species investigated was seen at different times of the year. In the American mink the maximal rectal temperature was in April and July, in the European mink it was in April and June, in March and May in the polecat, and in June and October in the

weasel. At the end of autumn and in winter, the animals' body temperatures were at their lowest. For instance, if in July the body temperature of an American mink was on the average 37.9°C, and that of a weasel 36.3°C, then in December it decreased correspondingly to 36.7°C and 35.1°C. Its respective decrease in winter should be considered as a form of thermo-regulation, since a decrease of temperature amplitude between an animal's body and the environment promotes a decrease in the intensity of heat irradiation (Shilov, 1962).

Reproductive features of the species

The mustelid species observed have a high level of energy metabolism, and experience strong influences from unfavourable environmental factors. Apparently this determines their tendency to high fecundity, early sexual maturation, short pregnancies, and the ability of males to engage in productive matings over a comparatively long period (Table 1).

The results of our observations on captive carnivores show a remarkable increase in reproductive status and readiness to mate in male American mink in February and March, and in other species in the period from March to July, inclusive. The most intensive rut in captivity was in the American mink (from the middle of February to the 20th of March). In the European mink it lasted from March to May, in polecats from March to the beginning of June, and in the weasel from April to the middle of July.

It is necessary also to note that in males of all the species under consideration, the beginning of rut coincided with high levels of food requirement, body temperature and body weight (the dimensions of which decreased by the end of the reproductive period).

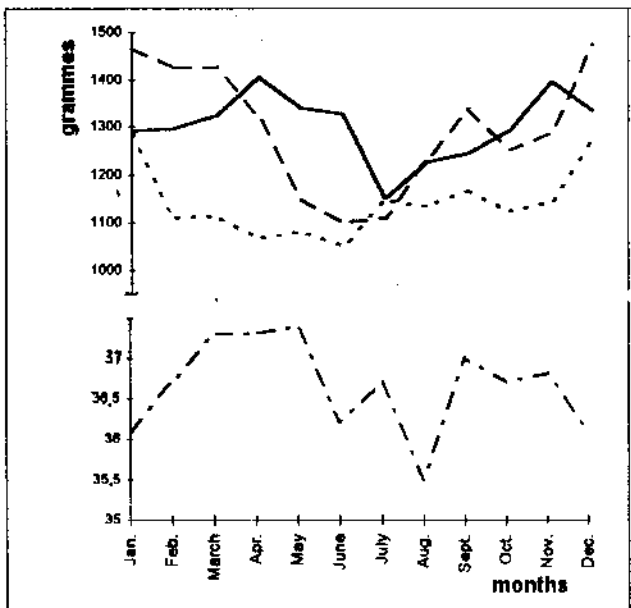

Fig. 1. Dynamics of body weight in males of small mustelid species in the course of a year

Conventional signs for fig.1 & 4:

1- American mink
2 - European mink
3 - polecat
4 - weasel

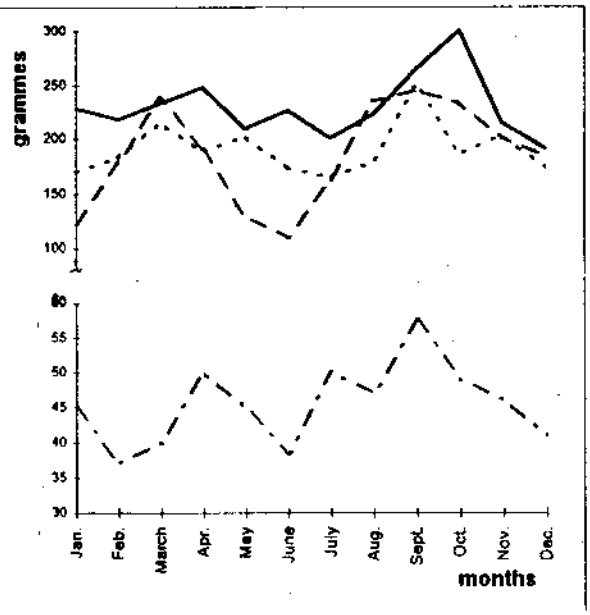

Fig. 4. Daily food consumption in males of mustelids in different months

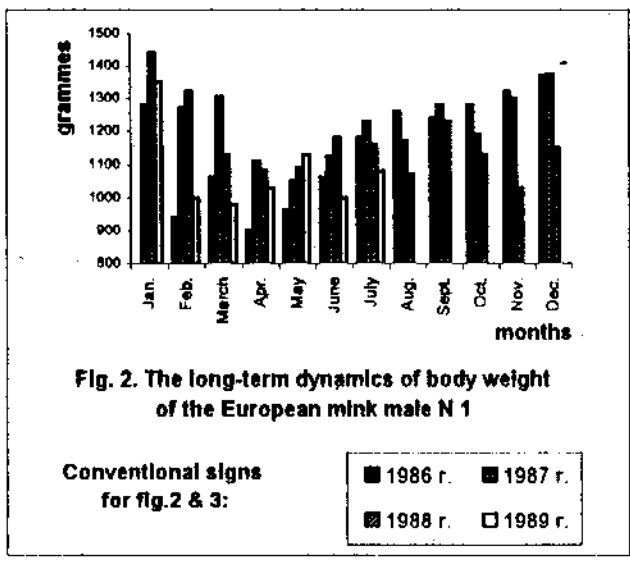

Fig. 2. The long-term dynamics of body weight of the European mink male N 1

Conventional signs for fig.2 & 3:

1986 r. 1987 r.
1988 r. 1989 r.

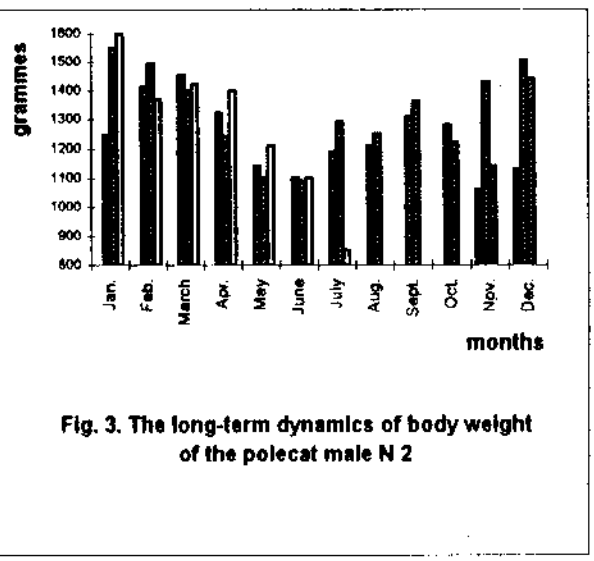

Fig. 3. The long-term dynamics of body weight of the polecat male N 2

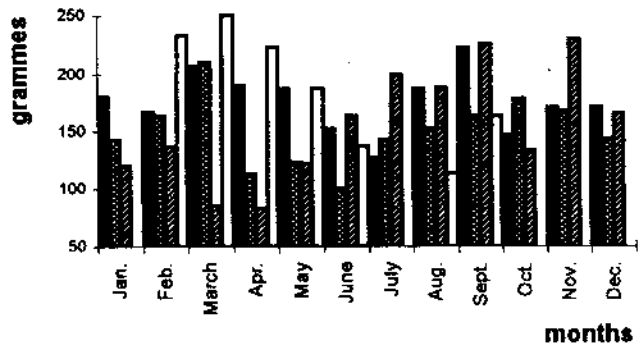

Fig. 5. Changes in daily food consumption in the European mink male N 2 in different years

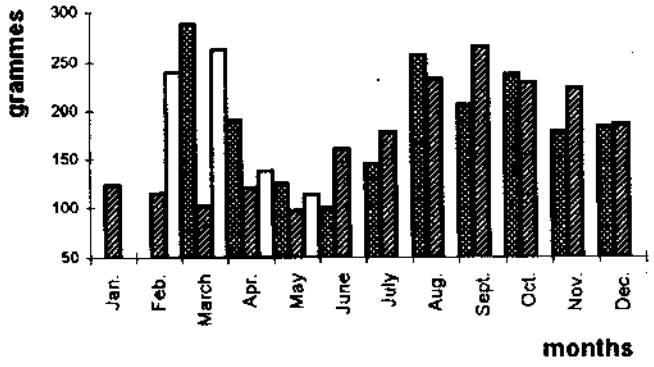

Fig. 6. Changes in daily food consamption in the polecat male N 1 in different years

Conventional signs for fig. 5, 6, 9 & 10:

1986 r. 1987 r.
1988 r. 1989 r.

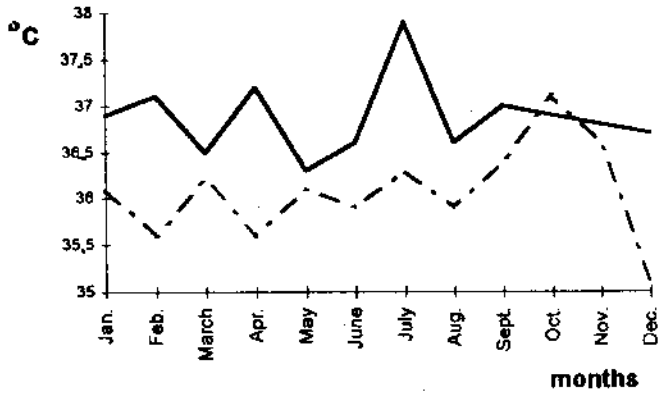

Fig. 7. Seasonal dynamics of rectal temperature in American mink (1) and weasel (2) males

Conventional signs:

1
2

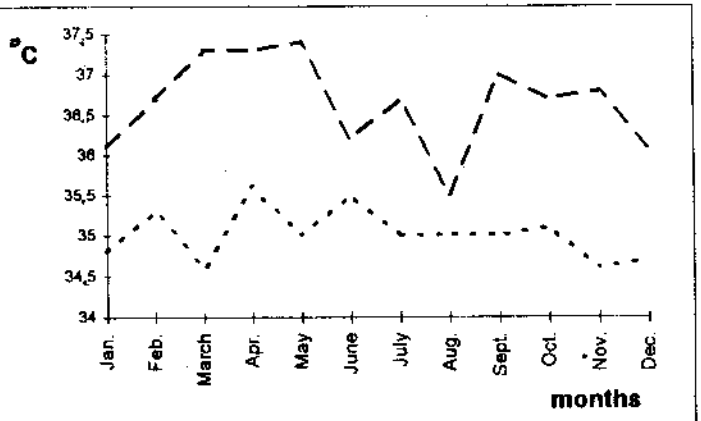

Fig. 8. Seasonal dynamics of rectal temperature in European mink (1) and polecat (2) males

Conventional signs:

1
2

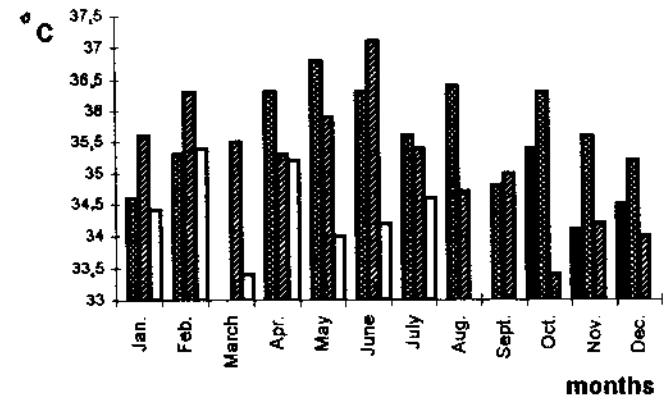

Fig. 9. The long-term dynamics of rectal temperature in the male N 1 of the European mink

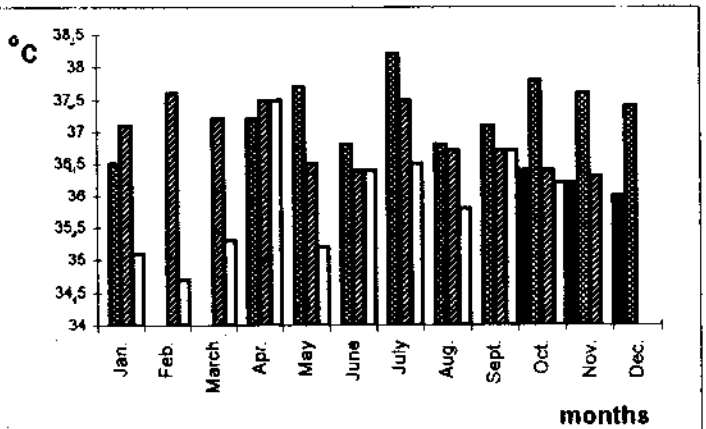

Fig. 10. The long-term dynamics of rectal temperature in the male N 1 of the American mink

Species	Years	Readiness to mating (+) by months											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
American mink	1986	-	+	+	-	-	-	-	-	-	-	-	-
	1987	-	+	-	-	-	-	-	-	-	-	-	-
	1988	-	-	+	-	-	-	-	-	-	-	-	-
	1989	-	+	+	-	-	-	-	-	-	-	-	-
European mink	1986	-	-	-	-	+	+	+	-	-	-	-	-
	1987	-	-	+	+	+	-	-	-	-	-	-	-
	1988	-	-	+	+	+	-	-	-	-	-	-	-
	1989	-	-	+	+	+	+	-	-	-	-	-	-
Polecat	1986	-	-	-	+	+	-	-	-	-	-	-	-
	1987	-	-	-	+	+	+	-	-	-	-	-	-
	1988	-	-	+	+	+	+	+	-	-	-	-	-
	1989	-	-	+	+	+	-	-	-	-	-	-	-
Weasel	1986	-	-	+	+	+	+	+	+	-	-	-	-
	1987	-	-	+	+	+	+	+	-	-	-	-	-
	1988	-	-	-	-	-	+	+	-	-	-	-	-
	1989	-	-	-	+	+	-	-	-	-	-	-	-

Table 1. Reproductive period duration in males of small carnivores kept in captivity.

Conclusion

Specificity of feeding, seasonal dynamics of weight and food requirements in many cases determine the physiological status, readiness to rut, reproductive potential, and, in the end, the number of mustelids in nature. Seasonal changes in the energy balace of the diets of small carnivores are revealed sufficiently clearly to present a stable adaptive response aimed at the economical expenditure of accumulated energy reserves. When metabolic processes decrease in winter, the food requirement of mustelids decrease sharply, which determines whether there is a satisfactory outcome to over-wintering. In this period these species are usually not very active and consume little food, only gradually expending their internal reserves. Before the reproductive season and spring moult the intensities of feeding and body weight increase noticeably again. In April-May, when males moult intensely, are in rut, or before a rut state, they eat comparatively little. In this period the reserves of nutrients in their bodies are again spent rapidly and the body weights of the animals decrease.

In the summer when it is hot, males consume little food. A decrease in daily food consumption becomes noticeable in June, and lasts on average until the middle or end of August. After that, the level of this index begins to increase. In summer males are usually less fat and their weight is appreciably less than in spring and autumn.

The seasonal dynamics of body temperatures are one of the indices of the level of basic metabolism, and can be observed in mustelids quite readily. Temperature is closely connected with changes in body weight, and is characterized by a sharp increase of rectal temperatures in the summer and in early spring in comparison with winter.

In September-October the food requirement of males noticeably increases. By the middle of autumn the animals reach maximum fatness, after which their food needs decrease. Autumn fattening is important in the lives of all mustelids, because acquiring fat reserves promotes survival of the mammals in the unfavourable seasons. In November both the indices of metabolic processes and the food requirements of males decrease. They become less active, their weights decrease, and the cycle is repeated.

Thus, the autumn period, when the intensity of metabolic processes decreases and fat reserves or energy potential increases, is very important in the life of small predators. Apparently their survival in winter is in many respects determined by the availability and acceptability of high-calory foods in autumn, when food requirements are especially high.

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Project: The feeding habits and habitat use of the Long-tailed weasel (*Mustela frenata*) in El Tambo, Cauca, Colombia

Elizabeth Mesa GONZALEZ

Introduction

The Western Cordillera (mountain chain) and the Pacific Basin of Cauca is considered to be one of the regions of greatest biological diversity in Colombia. It forms part of the Choco biogeographic region and contains a variety of endemic species such as the recently discovered Colombian weasel (*Mustela felipei*).

Other species, mostly ecological generalists, have benefited from human influences on the area. These include the Long-tailed weasel (*Mustela frenata*), which has adapted to a variety of habitats. In spite of its being a widely distributed species, knowledge of its biology is only partial, being based on descriptive, anecdotal, and a small number of formal studies carried out in North America over the last few decades. In her study of northern hemisphere weasels, King (1989) comments: "...it is not that tropical weasels are less important, just that they are less known and probably very different from the three northern species".

All these factors combine to motivate the present work, the objectives of which include the determination of home range, nutritional habits, and an evaluation of weasel capture methods.

Although *M. frenata* appears to be little threatened, it is worthwhile to study its nutritional habits and movement patterns, as these must have partly contributed to the success of its expansion in 'high pressure' zones. The comparison of results obtained from sampling localities with different degrees of alteration/disturbance should reveal the current status of the species and its response to human pressure.

1. Considerations

Mustela frenata is a highly adaptive species (Emmons, 1990) and its diet is considered to be generalist and opportunistic (Simms, 1979; King, 1989). It may thus be hypothesised that: "there is no preference for or rejection of the different types of habitat with different degrees of alteration or disturbance". It follows that:

1. the type of habitat (altered or not altered) does not affect the individual home range sizes,
2. feeding habits vary from one locality to another,
3. the proportions of each food type found in the diet are similar,
4. the animals can be captured using any type of bait.

2. Objectives

- To determine the home range sizes in *Mustela frenata*
- To evaluate the composition of its diet during the rainy period (August to February)
- To establish if the activities and diet of *M. frenata* are affected by alteration of the habitat
- To determine the optimum type of trap to use to study the species

The above objectives are set out to answer the following questions:

- Is the size of the home range of individuals determined by the type of habitat (i.e. natural/disturbed)?
- Are there size differences between male and female home ranges ?
- Is there overlap in the spatial niche occupied by individuals?
- Does the degree of alteration of the natural habitat determine the composition of the diet?
- Which is the most appropriate bait for weasel capture?

3. Justification

In Colombia there is no knowledge of the biology of many mammal species and, in the case of *M. frenata*, data derive only from studies at other latitudes, where many of its habits and behaviours are determined by marked seasonal changes in climate, that are absent in the tropics. It is therefore important to develop studies that contribute to the knowledge of the species in Colombia. Studies of species intervened zones and their interactions with human occupants can help in the development of new alternatives for appropriate resource use.

Field study methods such as radiotelemetry, live trapping using appropriate baits, and recognition of the unique colouration patterns of specific individuals, allow close study of animals with minimal effect upon the natural behaviour. This permits a better approximation of the species' biology.

4. Bibliographical review

The family Mustelidae is the most diverse group of the carnivores, being distributed over all continents except Australia and Antarctica. There are species adapted to arboreal, fossorial, aquatic, and terrestrial life, and they assume various biological roles: carnivory, frugivory, insectivory, and earthworm-feeding (Schreiber *et al.*, 1989).

The family is made up of 67 species (King, 1989), and in Colombia is represented by the following species: *Eira barbara* (tayra or ulama), *Conepatus semistriatus* (Amazonian hog-nosed skunk), *Pteromura brasilensis* (giant otter or river wolf), *Lutra longicaudis* (southern river otter), *Galictis vittata* (greater grison or huron), *Mustela frenata* (long-tailed weasel), and *M. felipei* (Colombian weasel)(Emmons, 1990).

The genus *Mustela* was described by Linnaeus in 1758 and includes between 13 and 16 species. The species *M. frenata*, described by Lichtenstein in 1831, is distributed throughout the Americas from southern Canada to Venezuela and Bolivia, but excluding the south-western deserts of the United States (Wozencraft, 1993). It made its appearance, perhaps abruptly, in North America more than two million years ago, before the first glaciation and, like other carnivores, reached South America during the Pleistocene faunal exchanges, quickly occupying the small carnivore niche (King, 1989).

Mustela frenata has a combined head-body length of 215-320 mm, a tail length of 115-207 mm, foot length = 35-55mm, ear length = 10-20 mm, and weight = 85-340 g. Males are larger than the females. The colouration of the upper parts is black to coffee coloured, with a cream or yellowish abdomen, either with or without white facial spots. The tip of the tail ends in a characteristic tuft of black hair, and the tail length is 40-70% of the head-body length. Hair is present on the plantar and palmar surfaces (Eisenberg, 1989; Emmons, 1990). Long-tailed weasels are highly adaptable. They can be present in forests, farmland and clearings, and occur at a wide elevational range, from 1,000 to 4,000 m ASL (Eisenberg (1989).

Mustela frenata differs externally from *M. felipei*. The latter has a darker dorsal colouration, an elongated oval spot of 15-18 mm on the lower part of the neck, lacks hair on the plantar and palmar surfaces, and its tail does not have a black tip. At the skeletal level *M. felipei* differs in having a trifid baculum (Izor & de la Torre, 1978; Alberico, 1994). Records obtained up until now locate *M. felipei* in the western and central cordilleras between altitudes of 1,750 and 2,700 m in the departments of Cauca, Huila, and in the borders between Valle del Cauca and Choco (Fawcett, 1993).

Mustela frenata has been studied in some detail in North America, but little is known of its natural history in South America. Weasels are terrestrial, diurnal and nocturnal, their diet is generalist and can include mice, rabbits, birds, and reptiles (Simms, 1979; King, 1989). Their dens are in hollows under roots or between rocks. The mother and young can forage as a social unit during the weaning period, but the adults are typically solitary, except during the mating period (Hall, 1951). The seasonality of mating in the tropics has yet to be investigated (Eisenberg, 1989).

4.1 TRAPPING AND MARKING

There are several factors that influence the capture of weasels in general (*Mustela* spp.), including the types of trap and bait used, the physical attributes of the forest, seasonal variations in behaviour (reproduction), territoriality, etc. During the last 20 years various projects have been carried out, some with an emphasis on investigating the efficiency of traps already in use, or to test several models that do not cause physical injury to the animal (e.g. fractures or damage to extremities, skin, canines, etc.).

Work of note includes that carried out by King & Edgar (1977), Simms (1979), King (1973, 1989), Belant (1992), and Palazon & Ruiz-Olmo (1993), all of whom used wooden box traps with appropriate treadle mechanisms to capture live weasels.

Although mustelids in general are curious animals and are attracted to empty traps, they can cease their exploration if they are not 'rewarded' frequently (King, 1973). Hence the importance of choosing lures and baits that are effective as attractants (Day *et al.*, 1987). Of equal importance is a period of prebaiting of the trapping area.

Various baits have been used previously. Fresh blood and pheasant or quail eggs fail to attract stoats (*M. erminea*)(King, 1973), but success has been reported in attracting long-tailed weasels (*M. frenata*) with bacon (Simms, 1979), the Amazon weasel (*M. africana*) with maize and bananas (Izor & Paterson, 1985), and Colombian weasels (*M. felipei*) with sardines in oil mixed with toasted maize (Alberico, 1994). In addition, use has been made of live baits, fresh conspecific faeces, the scent of rabbit or hare intestines, and laboratory mice (*Mus musculus*), the last being advisable in areas where *Mus* exists in the wild (King, 1973, 1989).

The recognition of individuals is important should recapture occur and, because of this methods of marking are used, such as the amputation of digits under anaesthesia (Simms, 1979) (as used frequently for rodents), the attachment of coloured necklaces, and variously-positioned ear tags, made of either aluminium (King, 1973) or plastic (Lockie, 1962).

Linn & Day (1966) found difficulties with the last technique because the tags tended to fall off or irritate the animals, and the number of animals marked was limited by the small number of tag combinations possible. A solution to this is to employ methods involving the sketching of the animals' ventral colouration pattern, since this is individually unique in all mustelids. However, the method can present problems in long-term studies, since identification necessitates capture, and furthermore an individual's colouration pattern can change with moulting.

Although King (1973) considers this method to be subjective, it can be combined with other characters such as weight, fur colour, sex, and dentition, and can be used to assist in the identification of individuals without using artificial markings that may modify their natural behaviour.

4.2 DIET AND HOME RANGE

Dietary analysis can be carried out using the scats (faeces) left in dens or gut contents, but only the latter provide information on individuals. The teeth and bones of prey items can be identified, although finding dens can be difficult unless their occupants are followed by radio-tracking.

The stomach capacity of a weasel is 10-20 g, whilst the weight of a mouse is 20-30 g. Only a single mouse can be eaten at once, and each gut or scat analysed will contain only a single food type, whilst the remains of a given food source could appear in more than one scat. As a result, any group of scats collected at the same place and time is usually treated as single sample (King, 1989).

The most complete data on the diet of the long-tailed weasel in the Northern Hemisphere are given by Simms (1979) and King (1989). They agree that the principal source of food is mice, mainly genus *Peromyscus*. Squirrels, rats, and shrews are also eaten. Insects are eaten occasionally, but Simms (1979) attributes this to accidental ingestion during the consumption of plant material.

The home range is defined as the area in which an animal moves during the course of its activities (Dunstone, 1989). It can be determined using capture-recapture, the radio-tracking of animals, or through visual records. Radio-tracking an animal can reduce interference with its life style through the remote monitoring of its activities, i.e. fixing a radio transmitter to the animal and following its movements with a radio receiver and antenna.

The activity radius of the long-tailed weasel has been estimated from den use to be 100 m, and from path use to be 105 and 205 m for females and males respectively. The home range has been estimated through radio-tracking to average 12-16 ha (Svendsen, 1982 in King, 1989).

4.3 STUDIES IN COLOMBIA

Reports of weasels in Colombia come from many accidental captures (Montenegro, pers. comm.) and from inventories carried out in some areas. Records from museum collections place *M. frenata* in the departments of Antioquia, Cauca, Huila, Magdalena, Risaralda and Valle, and between altitudes of 1,700 to 3,050 m ASL. Negret (1991) reports it in his faunal inventory of the PNN Munchique.

A study is presently being carried out on the Colombian weasel (*M. felipei*) in southern Colombia and northern Ecuador, which intends to determine its nutritional habits, population parameters, and home range by radio-tracking (Fawcett, 1993). *Mustela felipei* has been described by Schreiber *et al.* (1989) as "probably the rarest carnivore in South America". *Mustela felipei* has not yet been captured during the study by Fawcett, but individual *M. frenata* have been captured in the PNN Cueva de los Guacharos and in the PRN Ucumari (Fawcett, 1994). In the latter locality a subadult male was radio-tracked for four days before dying on recapture, but the results have not been published yet (Fawcett, pers. comm.).

5. Methodology

5.1 STUDY AREA

The study area is located in the south-west of the department of Cauca, on the eastern slope of the western cordillera, within the jurisdiction of the municipality of El Tambo, and also includes the El Tambito Reserve which borders PNN Munchique, where there is evidence of the presence of *M. frenata* (Negret, pers. comm.).

In general the department of Cauca is physically varied (IGAC, 1980). The temperature of the region varies from 5°C in the highlands to 27°C in the lowlands, with an annual rainfall of 5.258 mm and a unimodal annual rain regime with minimum values between July and August and its maximum from October to December. The dry season (or summer) occurs in February and March (Acevedo, 1994).

The area forms part of the Choco biogeographic region and features the following biomes: lowland forest in undulating and flat areas with 40 m high trees, subandean forest in areas of intermediate topography with 30 m high trees, and Andean cloud forest on steep hillsides with low trees (Acevedo, 1994).

5.2 LOCATION OF SAMPLING SIDES

The field phase will comprise two stages: the first (August) will be a reconnaissance trip in which a series of informal interviews with inhabitants of the region will be carried out to collect evidence of the weasels' presence (footprints, sightings, signs of predation), and to establish two sampling sites with different degrees of alteration/disturbance. In the second stage (in September-January) the following activities will be carried out:

5.3 TRAPPING (BAIT TESTING)

Wooden box traps (75 x 11 x 14 cm) will be used (similar to those employed by Simms, 1979) but with some modifications for the use of live baits. The traps are intended to simulate burrows, and hence will be placed in sheltered positions (between rocks, roots, trunks) and lined with bedding such as non-absorbent cotton wool, sprigs of vegetation, or straw.

The following baits will be used: live baits (chicken, mouse), bacon, and sardines preserved in oil mixed with toasted maize. Trap transects will be placed randomly in each of the chosen sites, with each trap being separated by a distance of not less than 10 m (depending on the total area of the site). The trap sites will first be prebaited without placing traps, and then the traps will be put in place but locked open, so that the animals become familiar with them (Day *et al.*, 1989). The traps will be checked every 12 hours (at 06.00 and 18.00 hours). Since weasels learn to avoid traps (King, 1989), they will be left for 24 hours a day and for a 15 day period. The above procedure will then be repeated until three periods of sampling have been completed in each habitat type. Unbaited traps will also be used as a control to see if the animals are attracted by the bait or by curiosity.

The results obtained will be expressed as the number of captures in 100 trap-days or C/100TD for each bait and site. A trap-day is equal to one trap being set for 24 hours. Not all traps will be triggered by weasels, and those triggered by other animals or found triggered and empty will be taken into account. To control for the animals that visit the traps and do not activate them, footprint 'traps' will be made near trap entrances, using a fresh surface or mud.

Captured individuals will be transferred to cloth bags to be weighed, and anaesthesized with ketamine hydrochloride (Ketalar), at a dose of 10-30 mg/kg given intramuscularly in the hind leg (Cooper, 1992). This will minimise stressing of the animal and facilitate handling. Sex will be noted, and age class determined (juvenile/adult) based on the development of the testes and the teats (both of these are inconspicuous in juveniles) and tooth wear examined. Note will also be made of head-body length (HB), tail length (T), ear length (E), hind foot length (HF), and fore foot length (FF). A sketch will be made of the ventral colouration pattern for subsequent recognition (Linn & Day, 1966). A field number will be assigned to each individual and a photograph taken of the animal's venter to complement the sketch. These data will be entered on a capture sheet. Once this is done, the animals will be put in a cage designed to avoid any injuries occurring on awakening from anaesthesia. Once totally recovered weasels will be freed at the site of capture. At no time will any animals be sacrificed.

5.4 RADIO-TRACKING: HOME RANGE SIZE

One adult male and one adult female will be selected from the individuals captured at each site for radio-tagging. These individuals will be fitted with a collar that weighs less than 4% of the animal's weight (Kenward, 1990). They will be maintained in observation for 3-4 hours before being freed to assess their reaction to the collar. A three-element Yagi antenna and a Mariner M-57 receiver will be used to pick up the signal from the transmitter collar. Animals will be tracked for three months.

Radio-location tests to estimate any errors in the readings will be carried out in advance at the different study sites, using collars located at known points. Recording stations will also be located at known points. Location readings will be made by day in a random order, so maintaining independence between them. All the locations will be logged on a map of the area.

It will be possible to locate the dens used by the animal when resting by 'homing-in' on the direction of the strongest and clearest signal (Cochran, 1987). When the animals are moving three or more 'fixes' will be taken, at short time intervals (not greater than 10 min), and using points known on the map. Triangulation of these bearings, using the method of Lenth (Saltz & Alkon, 1982), will allow determination of the

position of the animal in relation to those points. The 'fix' is estimated as the position of the antenna at which the maximum intensity response is achieved, using vertical polarizations where there are water bodies and horizontal when there is forest vegetation (Cochran, 1987; Kenward, 1990).

"Minimum convex polygon" analysis is affected by extreme points and produces home range estimates which include areas that the animal may not visit (Kenward, 1990). Models obtained from the INSANE computer program YOU II will be used to calculate the size of the home range of each tracked animal.

5.6 FEEDING HABITS

Weasel scats found in traps, dens, and on trails will be gathered in plastic bags. These will be washed with detergent and 5% sodium hypochloride for 30 min. Samples will be separated by site and analysed using the method employed by Sanchez (1993) (i.e. separating them into subsamples for each site). Each subsample will be spread on a sheet of grid-lined paper 20 x 20 cm with 2 x 2 cm grid-squares. Twenty squares will be selected at random, and the different food types in each one will be identified using reference collections.

The presence of each food type in a sample will be calculated as: RATE =sum frequency for each subsample/total number of squares counted. When dead animals are found their stomachs will be removed and preserved in 70% alcohol for similar analysis.

5.7 HABITAT DESCRIPTION

A physionomic-structural description will be made of the vegetation in the sites where evidence of activity is recorded (successful trapping, footprints, scats, dens), identifying the strata present, strata height and cover, leaf litter cover and the degree of alteration/disturbance (felling, burning, cultivation, pastoral clearance). This information will be complemented by vegetation studies already carried out in the area.

5.8 STATISTICAL ANALYSIS

Contingency tables of R x X will be used to test whether a particular bait attracts weasels. Two-way ANOVA will be used to test whether habitat and/or the sex of the animals influence home range size. Mixed model two-way ANOVA will be used to test whether there are differences in the proportion of each food type consumed and whether this varies between habitat types. Graphical analysis of niche utilization will be carried out using radio-tracking data.

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Conservation, welfare, and caring for the wild.

Huw I. GRIFFITHS

Over recent years there have been great increases in awareness of animal welfare issues in general, as illustrated by the development of specialist journals (e.g. Animal Welfare, Animals and Society), the birth of university courses and associated texts (e.g. Ryder, 1992; Webster, 1995), and an enormous boom in NGOs and pressure groups associated, in one way or another, with the improvement of the welfare status of animals.

Within the research community itself there has been a very marked increase in ethical awareness in both field and laboratory research (e.g. Bateson, 1991; Bekoff & Jamieson, 1996) with the ethics committees of many journals and learned societies now acting to attempt to ensure ethically appropriate behaviour (e.g. American Society of Mammalogists, 1987). Against this background, there is also constant and more radical pressure on behalf of animals both from outside science by 'animal rights' and 'dark green' pressure groups, and within science itself from movements such as the eco-feminists (e.g. Emel, 1995).

Issues involving the humane treatment of other species often are fraught with ethical, conceptual and practical problems, although when dealing with domestic animals it is much easier to put down meaningful 'markers' for discussion and development. Here at least it is clear that the general public of the West is interested (at least passively) in improving the condition of domestic and companion species, and there is widespread support for organisations such as the UK's 'Compassion in World Farming' and Germany's Verein gegen tierquälerische Massentierhaltung'.

Indeed, when it comes to consumers actually being willing to pay extra for 'ethically-produced' foods, there has been a considerable growth in the market-share held by 'cruelty-free' and 'free-range' products, particularly when the consumer can validate a product's 'ethical credentials'. Thus programmes such as the british RSPCA's (Royal Society for the Prevention of Cruelty to Animals) 'freedom foods' labelling scheme, in which food items are ethically vetted prior to being endorsed for sale, clearly demonstrate that at least a proportion of people are willing to pay extra to shop with a clear (or clearer) conscience.

Welfare issues are pusued relatively easily when livestock-based issues are considered (and particularly cruelty-free/humane husbandry and slaughter), but the point at which human interest can and should stop has always been blurred. In the case of UK law, the main item of legislation to deal with animal welfare is the Protection of Animals Act 1911. This avoids conflicts of definition (and also conflicts with the hunting interests lobby) by specifically confining itself to the welfare and protection from cruelty (both passive and active) of domestic and companion species only -thus all wild animals are excluded. Furthermore, the public's perceptions of the values of wild creatures are complex and difficult to predict (e.g. Kellert, 1986).

Thus, although frameworks do exist for the estimation of the 'inherent worth' of animals, as in the case of some US court rulings for compensation by polluters (Lyster, 1985), actually defining what the welfare of these creatures is worth, or even what welfare comprises for many species, are both actually highly problematical, as would be any process by which this could be translated into fiscal values.

Despite this, progressively more and more people are interested in extending humane issues to wild animals, even though it is often difficult to see where humans have the right (or even the opportunity and ability) to affect the welfare of wild creatures (Bekoff & Jamieson, 1996; Kirkwood & Sainsbury, 1996). Arguably, of course, conservation is itself a form of welfare, but moved from the level of the individual or captive population to that of the wild-living metapopulation or species-population.

Indeed, the existence of concepts such as MVPs (Minimum Viable Population) discussed in works such as that of Soulé (1989) and which forms the basis of PVAs (Population Viability Analyses) suggests that there are minimum numerical thresholds for species populations below which numbers should not fall. If these concepts are to be practical and robust, this can suggest that intervention is required to prevent these thresholds being crossed -this can easily be framed as a population genetics based concept of animal welfare.

Intervention with wild animal populations seems to be becoming more and more significant as a part of the conservation movement. For example, many people at the grass roots level now are involved in the wildlife rehabilitation movement. Here local people, often initially with very little specialist knowledge, may become deeply involved in the taking-in, healing, and eventual release of various sick, injured or road-casualty wild animals, even though it is sometimes unclear whether such forms of 'intervention' are actually in the animals' best welfare interests (Kirkwood, 1992).

Despite this the RSPCA now maintains a number of facilities that deal exclusively with wildlife rehabilitation, as does the Wildlife Hospitals Trust. In the UK a loose coalition of such individuals and organisations has formed under the umbrella of the British Wildlife Rehabilitation Council, which acts as a medium for information collation and exchange and also provides training seminars and conferences (e.g. Harris & Thomas, 1988; Thomas, 1990). Even though there is actually very little research done that is specifically geared towards investigation of the welfare of wild species, there is a growing literature that features aspects relevant to wildlife rehabilitation, and notably assessments of animals subsequent to their release (e.g. Brown & Cheeseman, 1996; Morris *et al.*, 1993; Robertson & Harris, 1995).

In a similar manner the reintroduction movement, which seeks to reintroduce endangered or extirpated species to habitats from which they have disappeared, has broad grass roots support. These types of projects often require a great deal of logistic input from field naturalists and wildlife enthusiasts, and in the British Isles alone interest has been expressed in reintroduction programmes for a variety of birds and mammals, the latter including the Polecat and Pine marten (Griffiths *et al.*, 1996), the beaver (Macdonald *et al.*, 1995), and also (less seriously) brown bear and wolf.

The healing and release or the reintroduction of extirpated animals may both seem to be well-defined acts with well-delineated, morally defensible short-term objectives. However, if either are done badly, they can readily change to acts in which the amount of harm done to the creatures themselves, or caused to others in their environment, soon may outweigh any benefits derived, at least by the animals.

Despite this many people believe that there should be more proactive human involvement in the welfare of wild species, even though this may also possibly entail the risk of simultaneously doing unwitting harm (Kirkwood & Sainsbury, 1995). Some wild and reintroduced populations already have been vaccinated against viral, bacterial or protozoan diseases (e.g. Gascoyne *et al.*, 1993; Woodford & Rossiter, 1994), others have been 'brought in' to assist their survival through periods of particularly harsh environmental conditions (e.g. Johnson & Green, 1990), whilst many UK badger groups provide supplementary feeding and veterinary care, actively search out and remove snares which threaten animals, and build various defence systems to protect badger setts from hunters (e.g. Baker, 1992; Harris *et al.*, 1990).

Activities such as these, or the provision of road-crossings for creatures such as badgers, otters, and even migrating toads (Langton, 1989) all act to bring together welfare and conservation interests, and take human intervention further out into the wild. Of course, it can be argued that when animals live in a human-dominated environment they are already subject to human influence, and that acts of 'interference' are simply remedial, e.g. cleaning oil from seabirds following an oil-spill (Kirkwood & Sainsbury, 1996). Certainly, we have no real idea of what the extent of human actions (both active and passive) is upon wildlife, although the few attempts at assessment do suggest that they may involve vast numbers of individuals (Salisbury *et al.*, 1994).

The UK, like most other European countries, takes a rather passive stance towards wild species. Most animals are considered under what broadly can be termed 'hunting laws' (Game Acts, Deer Acts) or 'conservation laws' (Wildlife & Countryside Act, Conservation of Seals Act). These tend to deal with specific problems as they arise and, with the exception of the Badgers Act (which was largely a product of pressure from welfarists) there is no consideration of the appropriateness of 'handling' or of humane treatment.

Furthermore, as the Protection of Animals Act specifically excludes wild creatures from consideration, when there have been cases of the deliberate cruel treatment of wild animals, there simply has not been a legal framework within which prosecutions can be placed (cruelty inflicted in scientific work is an exception, being governed by the Animals (Scientific Procedures) Act 1986). This has long represented a source of discontent to animal welfarists, as there are clearly instances in which wild creatures are deliberatly subjected to suffering (hedgehogs being tortured by youth, for example).

What is more, there is no real reason to assume that the degree of suffering by a wild mammal should be any less than that experienced by a domestic one (although there have been some claims to the contrary, e.g. Howard, 1993). Because of this, organisations such as the RSPCA have a long history of 'testing' the Protection of Animals Act in an attempt to find out exactly when an animal is considered to be wild or not: for example, is a mink kept in a cardboard box a 'captive' under the Act and, if so, is it entitled to humane treatment and hence the protection of the law? Not surprisingly, this has generated a large amount of 'case law', and there have been some court decisions that are extremely difficult to understand.

Cooper (1987) points out that circus elephants have been ruled to be non-domesticated creatures whilst camels, which no longer occur in the wild, are domesticated. Similarly, a beached whale is not a 'captive' so it is not an act of cruelty to 'cut pieces from it while still alive' (Cooper, 1987:14). Much of the basis for this confusion is that were it a crime to cruelly ill-treat a wild animal, then a great many sporting activities might automatically become crimes as well. British animal welfare legislation has always been constructed carefully so as not to infringe on the rights of hunting.

A new item of UK legislation sets a new standard for conduct towards wild species: the Wild Mammals (Protection Act) 1996. To my knowledge this is the first item of legislation anywhere to provide welfare consideration specifically to wild species. Under the terms of the Act, it is now a criminal offence to cause deliberate suffering of any kind to any wild mammal. (The specific wording is "If, save as permitted by this Act, any person mutilates, kicks, beats, nails or otherwise impales, stabs, burns, stones, crushes, drowns, drags or asphyxiates any wild mammal with intent to inflict unnecessary suffering he shall be guilty of an offence").

There had been earlier attempts to passage similar legislation through the British Parliament but, because of careless legal wording and conflicts with hunting and wildlife management interests, these always had failed.

The present Act, however, made specific exclusions from prosecution for the relief of animal suffering (i.e. mercy killing) and for any person involved in genuine, legitimate and legal hunting, wildlife management or pest control. Thus, with MPs being allowed a 'free vote', it was successful (i.e. MPs were permitted to vote following their individual consciences rather than party policy guidelines).

As yet there have been few tests of the law in the courts. Although it is quite clear that the law will not affect hunting or pest management activities at all, it will be able to act against any person who, for reasons of their own, wishes deliberatly to hurt or harm any wild mammal (most birds already are protected rigorously by the 'conservation' laws).

What will be of interest, however, is how defence lawyers will interpret wording within the Act such as 'intent', 'deliberate' and 'unnecessary', as these could conceivably provide defences against charges of cruelty, at least under some circumstances. (But when is it 'necessary' to nail an animal to a tree?). There also may be some basis for confusion over the definition of the term 'wild' as that given in the Act is "...any mammal which is not a domestic or captive animal within the meaning of the Protection of Animals Act 1911..."!

Many animal welfarists see the Wild Mammals (Protection Act) simply as being the start of a process in which all animals will be accorded legal protection from human 'inhumanity'. Clearly no-one would argue that to deliberatly inflict pain upon any animal, wild or not, is acceptable, but to what extent welfare considerations should operate over other concerns offers a deeper set of questions. For those of us interested in the study of wild

animals this does suggest that many of the activities that we engage in now (whether invasive or not) may become progressively more and more unacceptable in the eyes of the public, and to the pressure groups that seem often to drive national legislatures.

A few years ago one British animal rights organisation with a particular remit for education sent questionnaires to all university biology departments demanding to know how many animals were "vivisected" in undergraduate teaching each year. The definition of vivisection offered was the use of any living animal for experimental or teaching purposes of any kind, including behavioural and observational studies.

In the case of my department at the time it was difficult to provide an answer to the questionnaire. In terms of vivisection by the usual definitions, e.g. "...surgical operations on living animals..." (cf. Chambers' Twentieth Century Dictionary) our answer would have been zero, but under the definition offered the answer would have been tens of thousands: much of our teaching involved studies of insects (particularly *Musca* and *Drosophila*) and one notable exercise involved watching the shoaling behaviour of large numbers of small fishes in a tank.

There is clearly some genuine common ground for animal welfare issues but, as wildlife professionals, perhaps we should be involved as educators as well. To date, many scientists have taken a highly entrenched stance to welfare, occasionally peeking over the top of that trench to see what is happening around us. Some of what we see is good, and some of it seems not so good. It is also fair to say that in the past most wildlife biologists have given far too little thought to the effects of their actions upon the creatures with which the work (Bekoff & Jamieson, 1996).

However, as those members of the broader community with first-hand experience of wild creatures and their behavioural ecology, we are in a strong position to provide well-reasoned and meaningful information to the populace as a whole. The lack of participation in debate and discussion by the scientific community, and particularly by non-medical biologists, can lead to public suspicion. As welfare legislation moves further from the laboratory and the farmyard into the field, it is perhaps time we started to speak out because, if we do not, then field biology could soon be a thing of the past.

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Ecology of the Malay civet (*Viverra tangalunga*) in logged and unlogged forests.

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Background

Selective logging in tropical rain forests significantly alters the structure and resource base of the ecosystem, yet virtually no information exists on its impact on most species of wildlife. Data are particularly lacking regarding the impact on mammalian carnivores, despite their ecological importance as keystone species. The goal of this project is to assess the impact of selective logging on the population density, feeding ecology, health, and behavior of the Malay civet (*Viverra tangalunga*) in a lowland dipterocarp rain forest. A secondary goal is to generate baseline data on the behavior and ecology of the Malay civet, about which little is known. Two populations of Malay civets will be studied; one in an area of undisturbed rain forest, and the other in an area where selective logging occurred in 1988. Differences in diet and feeding ecology will be quantified through analysis of scat samples collected in both study areas. Internal parasite analysis will provide information on the health and stress levels of both populations.

Specific goals

- Compare home range size and overlap of Malay civets in logged and unlogged forests.
- Compare activity budgets of Malay civets in logged and unlogged forests.
- Determine the composition and seasonal changes in diets of the local civet community.
- Quantify differences in feeding ecology of Malay civets in logged and unlogged forest.
- Contrast the internal parasite load of individuals in logged and unlogged areas.

Methods

Six Malay civets in each study area will be captured and fitted with a radio collar. Point locations will be taken at least two times per week for each individual. A diurnal reading will be taken to locate the animal's resting site and a nocturnal reading will be taken to locate the animal's active range area. Once per month, activity levels will be monitored at 30 minute intervals for 24 hours. Scat samples will be collected and dissected for diet analysis. A portion of each sample will be examined for internal parasites and another will be preserved for species identification using DNA amplification.

Status

Trapping efforts in the primary forest have resulted in the capture of four male and two female Malay civets. All animals were radio-collared with the exception of one male, which was subadult. All drugging and collaring procedures went smoothly and all animals appear to have suffered no ill effects. Trapping in the logged forest has resulted in the capture and radio-collaring of one male and two females. Trap success has been lower in the logged forest, giving an initial impression that population densities may in fact be lower in this disturbed area. Insufficient home range data are available to support conclusions. There does appear to be significant home range overlap in both areas.

To date, over 100 scat samples have been collected. Initial analysis indicates that diet consists of a significant portion of invertebrate prey, including some toxic species such as scorpions, millipedes, and giant centipedes.

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ABSTRACTS

Proceedings 2nd Symposium on carnivores Biology and conservation of mustelids Pavia, 20-22 October 1993

These proceedings contain 22 papers on the ecology and conservation of small mustelids, and a further 16 papers devoted to the otter, and in particular to research on the species in captivity.

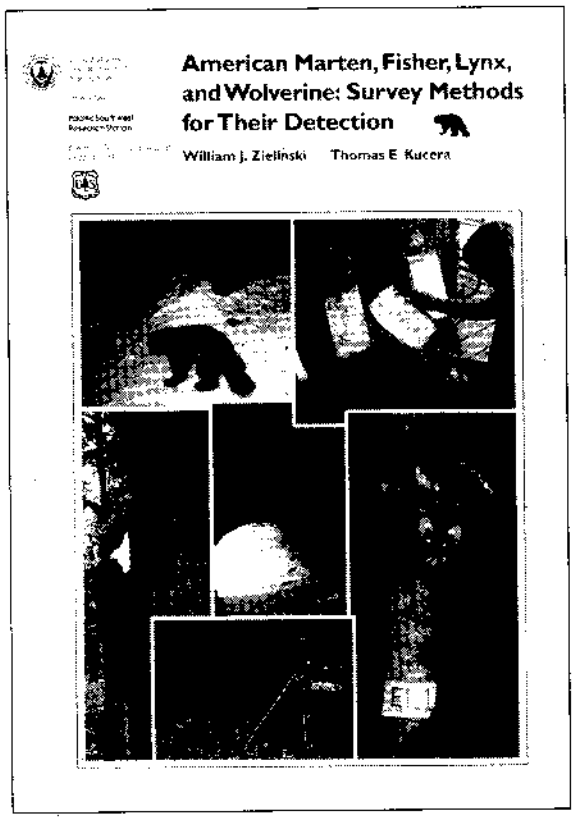
All the papers concerned with the mustelids (otters excluded) are listed in the 'Recent Literature' section.

Prigioni, C. (ed.). 1995. Proceedings II Italian Symposium on carnivores. Biology and conservation of mustelids. *Hystrix* (n.s.) 7(1/2):1-308.

The Galerella mongooses in southwestern Angola

A numerical analysis of cranial measurements taken in specimens of *Galerella* spp. from Angola and their comparison with values given in the literature leads to the conclusion that most of the specimens from the southwestern corner of this country agree with *Galerella nigrata* (Thomas, 1828), which reinforces the statement that this name is synonymous with *Galerella flavescens* (Bocage, 1889). A map on the distribution of *G. flavescens* and *G. sanguinea* in Angola and notes on their ecology are given, as well as colour photographs of skins of eight specimens.

Crawford-Cabral, J. 1996. The species of *Galerella* (Mammalia: Carnivora: Herpestinae) occurring in the southwestern corner of Angola. *Garcia de Orta, Sér. Zool.*, 21(1):7-17.



Survey methods for small carnivores

Zielinski, W. J. & Kucera, T. E. , eds. 1995. *American marten, fisher, lynx, and wolverine: Survey methods for their detection.* Gen. Tech. Rep. PSW-GTR-157. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. 163 pp.

The status of the American marten (*Martes americana*), fisher (*M. pennanti*), Canadian lynx (*Lynx canadensis*), and wolverine (*Gulo gulo*) is of increasing concern to managers and conservationists in much of the western United States. Because these species are protected throughout much of their range in the west, information on population status and trends is not available from trapping records. This report describes methods to detect the four species by using either remote photography, track plates, or snow tracking. A strategy for systematic sampling and advice on the number of devices used, on their deployment, and on the minimum sampling duration for each sampling unit are provided. A method for the disposition of survey data is recommended so that the collective results of multiple surveys can be used to describe regional distribution patterns over time. The report describes not only survey methods for animal detection, but also provides some considerations of their use in monitoring population changes.

The methods described should also be appropriate to the detection of a variety of other rare or shy species worldwide. It is available free of charge from:

Publications/attn. R. Schneider
Rocky Mountain Forest and Range Experiment Station
3825 East Mulberry Street
Fort Collins CO 80524-8597
USA
Tel. 970/498-1719

Nature's keepers

Budiansky, S. 1995. *Nature's keepers. The new science of nature management.* Phoenix, London. 310 pp. £ 10.99 pbk.

I picked up this book with a certain amount of apprehension. It has attractive cover graphics, complete with a very appealing photograph of a wolf, added to which, the blurb on the back is completed with a recommendation from Jonathan Porritt gleaned from the Sunday Times. "Aha", you might think "a book aimed at the armchair ecologist and BBC TV wildlife conservation buff!". To a certain extent you will be right. This is certainly the market-share that the publisher has aimed for and, to some extent, it is also the readership the author is addressing, although whether he ever intended to do it directly is another matter!

Despite this, this book isn't just another bit of "pop science" for the ecologically-aware, and Budiansky does have something to say. The major theme of his book is how our present view of nature is actually something of an artifact, and that what the majority of people want is not to preserve nature, but to preserve a particular vision of it. This is perhaps not an entirely novel viewpoint, as those of you who have wrestled with Sharma's "*Landscape and memory*" will be all too aware. Budiansky just uses this as a part of his argument, however, and doesn't flog the reader to death with the idea. His approach is more to take us through an entertainingly portrayed history of the development of the "wilderness" and "nature conservation" movements, and particularly their roots in the spiritual, romantic, and even mystical longings of Nineteenth Century post-industrial society. Ultimately, the qualities that now are wished for in any "wilderness" area are more a creation of the imaginations of Nineteenth Century artists and poets, rather than having any reality rooted in any landscape that actually has or ever did exist. Moreover, according to Budiansky (and there are many who don't agree with him) much of what we consider to be natural in any landscape is likely to have been placed there deliberately by our predecessors. Furthermore, how much of the "original" landscape actually was original, and how much had been actively managed by prehistoric (or at least pre-technological) man?

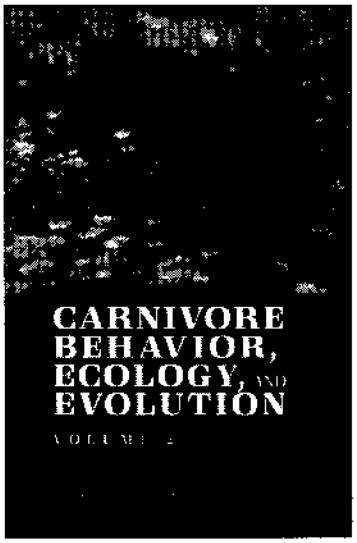
What this leads us to is, if we are to "manage" nature, what are we actually managing, for what reasons, and what parts of it are real (*i.e.* bona fide) and which are not? Also, when some elements of an environment are "natural" and other are "unnatural", how should we deal with this, if at all? For example, what about the management of ecosystems to which introduced animals are "an integral part" (e.g. horses and burros in the rangelands of the USA). In turn, this feeds into the conflicts of interest that can occur between scientific management and the often highly confused welfare and conservation-based interests held by the ecologically aware/concerned public at large. How can the views of professional ecologists be reconciled with what might be called the "ecological apocrypha" -the out-moded and disproved components of pre-war ecology that still form the core of the scientific rational held by grassroots conservationists? (Key amongst these being the belief that natural systems behave in a simple, deterministic and predictable manner).

Nature's keepers is not a polemic, and it doesn't aim to preach, but it certainly does question much of the basis and

direction of the modern nature conservation movement, thus if it is challenging to anyone, it is the aforementioned BBC TV documentary armchair based nature crusaders -particularly those that Budiansky sees as having a certain self-righteous dogmatism. Having said that, he does also remind one to think about some concepts that one hasn't really considered since undergraduate days, and that's no bad thing.

So, this book does have something to say, and it does say it, and says it well. It does, howwever, contain many statements with which one perhaps may not whole-heartedly agree, but on the other hand it contains much of interest as well. Budiansky doesn't take it all too seriously -he has a dry, cynical wit, and small anecdotes and side-swipes crop up throughout the text, causing even the occasional chuckle. We all have to read far too much over-cerebral technical paperwork, so something that entertains and also interests is just the ticket for a little recreational reading -*Nature's keepers* scores highly here. The bottom line is that this book is interesting and enjoyable, and that certainly should recommend it to anyone.

(review by H. I. Griffiths)



Carnivore behavior, ecology, and evolution

Gittleman, J. L., ed. 1996. *Carnivore behavior, ecology, and evolution. Volume 2.* Cornell University Press, Ithaca and London. 644 pp. £ 29.50 pbk.

This, like its predecessor volume, is an important and interesting, significant publication. Furthermore, despite the inclusion of the words "*Volume 2*" in the title, this is a little misleading as the volume does stand on its own, and is worthy of individual attention. This is also a book of its time: many of its contributions are spiced strongly with conservation relevance and, very early on, there is an article on the ethical aspects of carnivore research -something that most of us consider too little.

Gittleman's approach for *Carnivore 2* has been to solicit papers from workers with a range of interests within general biology, and then act as a "quality control" for the compilation. For readers that are not familiar with the first volume, the format adopted is that the articles are designed so as to include the reporting of original research and also some "review" of the context within which the work was done. The end result is not dissimilar to the type of articles one sees in journals such as the *Trends* and *Annual Reviews* series. Thus, in any individual article (e.g. Scott Creel's on the role of hormones in the social ecology of dwarf mongooses) there is reportage of original results, and this is then placed within a broader context (here the endocrine basis of carnivore social behaviour). Furthermore, the authors themselves have been chosen well, and their contributions reflect many of the more significant and exciting fields within evolutionary ecology generally. The studies presented here often are based on the use of carnivorans as model systems rather than any taxonomic constraints and, as a result, the parochiality that always threatens such compilations is avoided. Almost all the articles have broader-scale appeal, so the relevance and interest of the book to the generalist reader are considerably greater than those often achieved in multi-author texts.

The range of articles within *Carnivore 2* is broad. The volume is prefaced by Gittleman and with a short chapter on conservation by George Schaller. It then divides between three loosely-constrained sections, each again being introduced by Gittleman: "behaviour", "ecology", and "evolution". Part one ("behaviour") starts with an excellent piece on the ethics of studying carnivorans (Bekoff & Jamieson), accompanied by discussions of dwarf mongoose behavioural endocrinology (Creel), masculinization in female spotted hyaenas (Frank), the adaptive significance of coat colour patterns (Ortolani & Caro), and sympatry in canids (Johnson, Fuller & Franklin). Part 2 ("ecology") commences with Mills on some practical aspects of the study of the larger African species, followed by Dayan & Simberloff on size separation, Waser on dispersal in social species, Reading & Clark on reintroductions, and ending on Johnson and coworkers on carnivore conservation and management in China. The final section ("evolution") commences with human carnivore associations (Clutton-Brock), and also includes analyses of craniodental adaptations (Biknevicius & van Valkenburgh), genetic relatedness in social species (Gompper & Wayne), the historical demography of genetic variation (Wayne & Koepfli), broad-scale biogeography (Hunt), phylogeny and evolutionary rates (Flynn) and lastly, carnivore ecomorphology (Werdelin). Each of these articles is referenced individually, and the volume concludes with both taxonomic and subject indexes.

Clearly, *Carnivore 2* does not (and could never) deal with every aspect of relevance to carnivore biology, but it does have a good attempt at presenting us with some of the most interesting areas at present. Some readers may complain that some aspect dear to them has been excluded, or perhaps a favourite researcher or group, or may even have preferred that the book was more overtly conservation related (even though conservation biology is a recurrent theme throughout). Certainly, you can never please everybody. However, what Gittleman does achieve is a broad-brushed approach to carnivore research, and one which hopefully will not only be of purely academic interest to those already interested in the carnivores, but also one that will stimulate those with more general biological interests to consider the group more closely.

This is a book that you can dip into, and one that does reward the effort of reading it -it's one that I am happy to have, and am happy to recommend to others. The standard of production is good, and the price for the paperback edition is not excessive, particularly by current standards. It is a little sad that it will be too expensive for post-graduate students, although it is certainly worthwhile as a library purchase for universities and colleges holding courses in wildlife or evolutionary biology. Certainly, there will be few with an interest in carnivores that will not find it worthwhile.

(review by H. I. Griffiths)

Recent literature

Mustelids

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