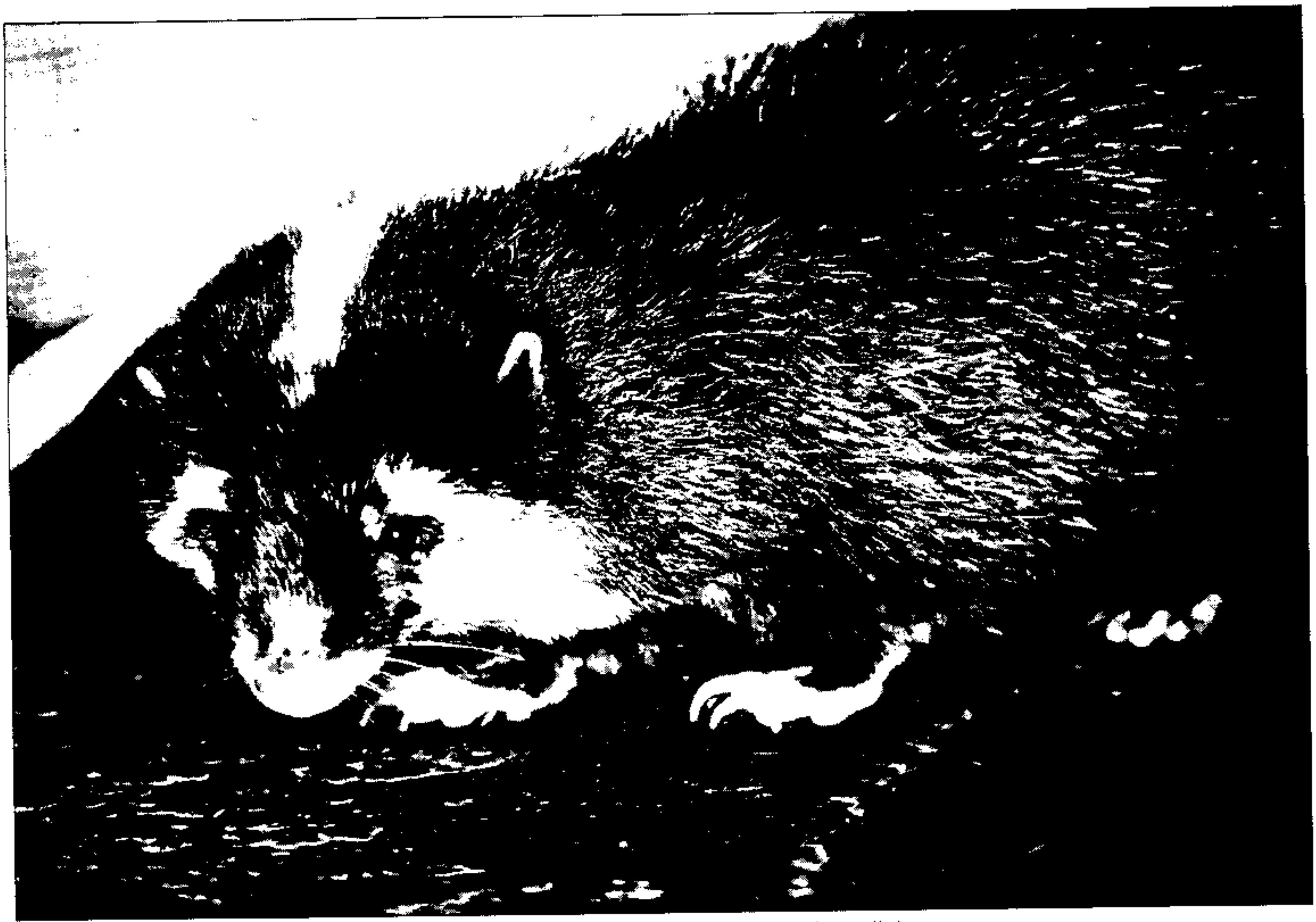
MUSTELID & VIVERRID CONSERVATION

The Newsletter of the IUCN/SSC
Mustelid & Viverrid Specialist Group

Number 5 October 1991



Javan ferret-badger *(Melogale orientalis)*.
This rare mustelid was photographed in Ragunan Zoo, Jakarta, by M. Riffel.

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The Newsletter of the IUCN/SSC Mustelid & Viverrid Specialist Gro

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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 newsletter is to offer the members of the IUCN/SSC M&VSG, and those who are concerned with mustelids or/and viverrids, brief papers, news items, abstracts, and titles of recent literature. All readers are invited to send material to:

Mustelid & Viverrid Conservation
c/o Dr. H. Van Rompaey
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EDITORIAL

As from this year the IUCN/SSC Mustelid & Viverrid Specialist Group has become the IUCN/SSC Mustelid, Viverrid & Procyonid Specialist Group. Mustelids, viverrids, and procyonids look like a rather strange combination of not very closely related families to assemble under one umbrella and in practice it is even more complicated.

The group is responsible for all the lesser known mustelids but not for the comparatively popular otters (Lutrinae), and our responsibilities for the procyonids include the Lesser panda *(Ailurus fulgens)*, which some argue is not a procyonid at all. However, looking after the Greater panda, certainly one of the world's most widely known and beloved carnivores, is excluded from our duties. The viverrids, in comparison, look rather straightforward in this respect in that SSC has entrusted us with the responsibility for the whole family -if indeed it is one family, as mongooses may not be closely related to the rest of the viverrids and quite likely constitute a family of their own.

So, what then have all the animals assembled under the umbrella of the Mustelid, Viverrid & Procyonid Group in common and why has IUCN's Species Survival Commission chosen to entrust one Specialist Group with responsibility for such a mixture of taxonomic groups?

The answer is quite simple: these are the forgotten small carnivores without the public appeal of the cats, canids, bears, seals, and otters. While it may seem as if SSC is looking at the MV&PSG as the "dumping place" for all the forgotten and unwanted small carnivores, quite the opposite is correct. These small carnivores, only because the general public and to some extent also the scientific community is not very interested in them, are ecologically or scientifically no less important or, for that matter, of lesser conservation value than their more glamorous cousins. IUCN has a special role for the Mustelid, Viverrid & Procyonid Specialist Group to play: we need to ensure that all the little known and little studied carnivores receive their share of attention and conservation action. Rather than being the Specialist Group of the "unimportant" carnivores, this is a particular challenge for us.

With this in mind, how have we fared in the last three years or rather since the production of the Action Plan for Mustelid & Viverrid Conservation in 1989? There have been some successes...

Galidictis grandidieri, only described in 1986, has been found alive and not even seriously threatened at this time in Madagascar by Chris Wozencraft.

Liberiictis kuhni, not previously seen alive by any scientist is now being kept in a zoo for the first time, its continuing (albeit threatened) existence in Liberia was confirmed and the species has now also been found to occur in Ivory Coast's Tai National Park. The Metro Toronto Zoo made a considerable financial commitment to the conservation and research programme for the Liberian mongoose in Liberia and it is very disappointing that this project, which would have been so important not only for the Liberian mongoose but also as a forerunner for similar projects we hope to initiate with other zoos, came to an abrupt end due to the suddenly erupting political turmoil in Liberia.

In India the group assisted in getting initial survey work on *Viverra civettina* started. The results of this work, competently carried out by Ashraf Kunhunu of the Wildlife Institute of India, assured us, at least, that the Malabar civet is not yet extinct as feared. However, it also confirmed that the species is seriously threatened and the task of rediscovering the species is negligible compared to the challenge of now ensuring its survival.

Closer to my home we contributed to finally getting the European mink (*Mustela lutreola*), one of Europe's five most endangered mammal species, on the agenda of the decision makers (see this issue of the newsletter). Again, while this is an important step forward, a comprehensive recovery effort for the species is still to come.

The only seriously threatened species under the auspices of the group now well on its way to recovery is the Black-footed ferret *(Mustela nigripes)*. Our American colleagues have demonstrated how a combination of research, education, and captive breeding can have dramatic results. The highly successful captive breeding programme resulted in a rapid increase from a world population of only 17 black-footed ferrets in 1988 to well over 300 animals at present. A first reintroduction attempt may be carried out this year and as a result of a well run publicity campaign there is now protected habitat available for possibly several thousand ferrets, while there was none when the project started.

Joy over the success of the black-footed ferret programme should, however, not lead us to forget that we still do know next to nothing about most of our threatened species. During the last couple of years we made no progress whatsoever in elucidating, for example, the whereabouts of *Mustela felipei*. This species is still only known from four museum specimens. We still know hardly anything on the otter civet *(Cynogale bennettii)* in Asia, a unique species which is probably now seriously threatened. And these are just two out of several dozen similar cases.

I must end my editorial remarks therefore with a plea to all of you to take up the plight of one of these forgotten small carnivores and take a lead in implementing some action for their study or conservation.

For the first time we also have some difficulty filling the pages of the newsletter. Therefore, please do provide Harry Van Rompaey with articles, notes, news clippings, etc. relating to small carnivore conservation.

Roland Wirth
Chairman IUCN/SSC
Mustelid, Viverrid & Procyonid
Specialist Group

As from 1992 "Mustelid & Viverrid Conservation" will become "Small Carnivore Conservation".
After merging with the Procyonid Specialist Group we will be concerned with about 150 species of small carnivores, so the name "Small Carnivore Conservation" seems appropriate enough.
We could not really call the newsletter "Mustelid, Viverrid & Procyonid Conservation"!
At the same time we would like to welcome Angela Glatston as an editor of the newsletter.

An update on the Javan ferret-badger *Melogale orientalis* (Horsfiel

Michael RIFFEL

The ferret-badgers represent a group of mustelids endemic to the Oriental biogeographic realm. Morphologically and ecologically they form a link between the martens and the badgers.

The genus *Melogale* has been a taxonomist's nightmare for a long time as its members are morphologically rather similar. For that reason the composition of the species group is rather heterogenous.

As long as no taxonomic study is available it appears to be wise to accept four species: the Large-toothed or Burmese ferret-badger, *Melogale personata* (Geoffroy, 1831), the Small-toothed or Chinese ferret-badger, *Melogale moschata* (Gray, 1831), the Kinabalu ferret-badger, *Melogale everetti* (Thomas, 1895), and the Javan ferret-badger *Melogale orientalis* (Horsfield, 1821).

The Javan ferret-badger was originally thought to be restricted to Java (Van Strien, 1986; Van der Zon, 1979) and therefore to represent the only endemic carnivore species of that island.

The Javan ferret-badger is distributed throughout the island. Two subspecies have been described: *Melogale orientalis orientalis* (Horsfield, 1821) in the eastern part and *Melogale orientalis sundaicus* Sody, 1937 in the western part of Java. The eastern subspecies tends to be larger (Sody, 1937).

For a long time Java has been known for its human overpopulation and concomitant dramatic decline of natural habitat. Therefore a number of species endemic to Java are nowadays given the highest conservation priorities, a policy that also applies to the mustelids and viverrids. Four taxa, the Javan yellow-throated marten, *Martes flavigula robinsoni*, the Javan small-toothed palm civet, *Arctogalidia trivirgata trilineata*, the Indonesian mountain weasel, *Mustela lutreolina*, and the Javan ferret-badger, *Melogale orientalis*, have been listed in the mustelid and viverrid conservation action plan and Java has been identified as one of seven co areas worldwide for conservation action to be taken for that group of carnivores (Schreiber *et al.*, 1989).

The Javan ferret-badger is virtually unknown with respect to its ecology and conservation status. Data on habitat requirements and distribution are scant. Most of the museum material outside Indonesia is labelled "Java" only and thus useless for identifying the distribution limits of the species.

However in the meantime the material of Museum Zoologicum Bogoriense in Bogor, Indonesia, has been examined and an extended map was drawn using these data (Fig. 1).

The collection of Museum Zoologicum Bogoriense provided first evidence of the occurrence of the Javan ferret-badger in Bali. An immature specimen labelled "Bali" was collected by De Jongh in Bali in 1979. However information on habitat, elevation of the collection site, and detailed data of collection are lacking.

On 27.07.1991 I found a dead Javan ferret-badger on a forest trail approximately 300 m south of Lake Buyan in Central Bali at an elevation of 1,180 m. It had obviously been killed by a motorcycle for the skull was completely smashed. The specimen was fully grown but as the flesh had almost been eaten by maggots the sex could not be identified. The habitat at the locality consisted of secondary forest and a rubber plantation. Human settlements are found 2 to 3 km east of the location.

The Javan ferret-badger has so far not been listed among the mammals known to occur on Bali (Sody, 1933; Van der Zon, 1979; Van Strien, 1986) and has therefore to be omitted from the list of endemic mammals of Java.

Although the known range of the species has now been extended and the existing habitat of the above mentioned locality

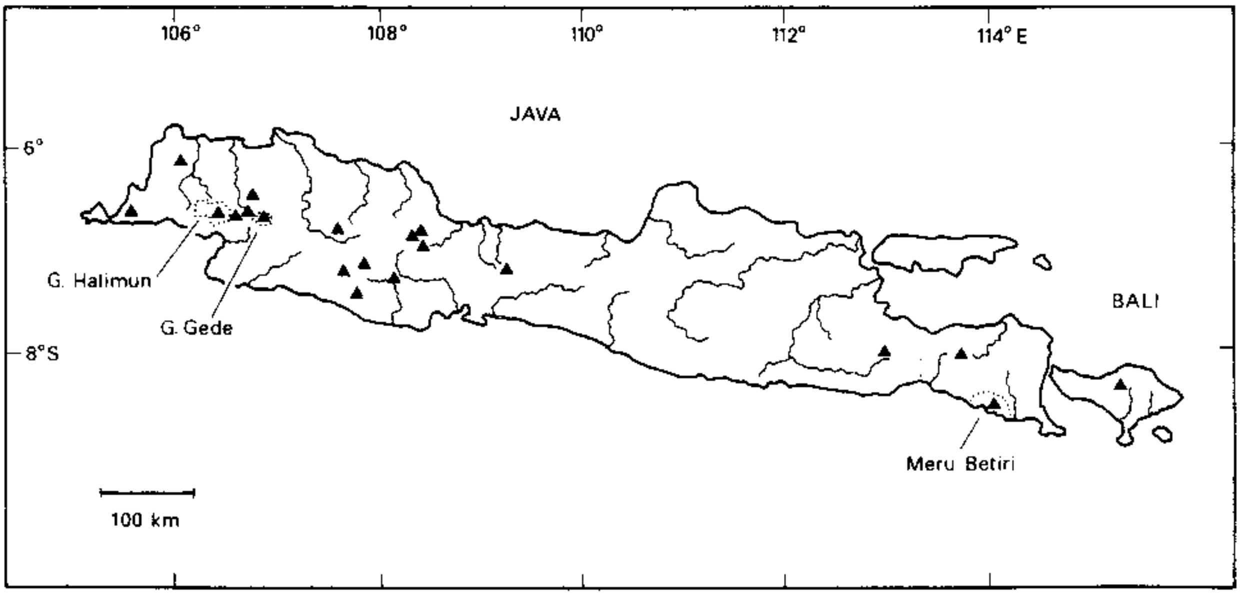

Fig. 1. Distribution map with known records of the Javan ferret-badger (*Melogale orientalis*)

Field, T.

...es some indication that the species is not dependent on primary forest its conservation status is still unknown.

When looking at the data of occurrence of the Javan ferret-badger in protected areas only three records have been confirmed within the last few decades: G. Gede-Pangrango National Park where three specimens were collected in 1970, Meru Betiri National Park (Seidensticker *et al.*, 1980) where the Javan ferret-badger was reported to occur near Sukamade in the centre of the reserve, and Gunung Halimun Nature Reserve, where a survey conducted by the Biological Science Club revealed the species' continuing occurrence in that area (Yossa *et al.*, 1990).

Hence populations of both subspecies are known to occur in protected areas: the western subspecies *Melogale orientalis sundaicus* in Gunung Halimun Reserve and Gunung Gede-Pangrango National Park and the eastern subspecies *Melogale orientalis orientalis* in Meru Betiri National Park.

Records of Javan ferret-badgers in captivity are scant with most of them dating back to the end of last and the beginning of this century with a record from Artis Zoo (Amsterdam) in 1921 being the most recent one (Schreiber *et al.*, 1989).

A male Javan ferret-badger died in Ragunan Zoo (Jakarta) in 1982 and its remains are preserved in the collection of Museum Zoologicum Bogoriense. In the summer of 1990 a pair of Javan ferret-badgers was kept at Ragunan Zoo and both were still alive in August 1991. The geographic origin of the animals is unknown (Madinah, pers. comm.). Interestingly the two ferret-badgers spent most of the time on a board attached to the back wall about 1.5 m above the cage floor. They were also observed climbing in branches in the cage. This gives some indications on the arboreal abilities of this species.

Another Javan ferret-badger was offered for sale at the Pramuka bird market in October 1990. The specimen however was in a very bad condition and died the day after.

As a conclusion of the new data it could be noted that the Javan ferret-badger appears to be the best known among the Javan mustelid taxa identified as threatened by the IUCN/SSC Mustelid, Viverrid & Procyonid Specialist Group since almost no new information on the other taxa has turned up during the last years.

Acknowledgements

I would like to thank Drs. Boeadi, curator of the Mammals Section of Museum Zoologicum Bogoriense, for his kind assistance and access to his collection, and Drs. Madinah of Ragunan Zoo, Jakarta, for his most valuable information on the captive Javan ferret-badgers.

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Survey of the carnivores of Gunung Halimun Nature Reserve, Java

The Indonesian island of Java is home to 17 species of carnivores, six of them belong to the family of the mustelids and another six are members of the viverrid family.

Java has been identified as a 'conservation priority area' for the mustelids and viverrids, and field surveys were strongly recommended (Schreiber *et al.*, 1989).

The Gunung Halimun Nature Reserve in western Java comprises the largest area of evergreen lowland and hill rainforest remaining in Java: 400 km² have been protected area since 1979. It is situated approximately 20 km west of Bogor. Unlike the well known Ujung Kulon National Park Gunung Halimun has never been thoroughly studied despite its outstanding importance for the survival of many endangered species.

The Biological Science Club, a Jakarta-based student organisation, has been conducting a biodiversity project at Gunung Halimun for several years. Within this program a study of the carnivores which was mainly based on questionaires among the local people was initiated by the 'IUCN/SSC Mustelid, Viverrid & Procyonid Specialist Group' and fully funded by the 'Zoological Society for the Conservation of Species and Populations', Munich, Germany.

The survey took place in December 1990 and January 1991. Besides confirmed records of the Javan leopard (*Panthera pardus melas* G. Cuvier, 1809) and evidence of a small population of the Javan tiger (*Panthera tigris sondaica* Temminck, 1844) the expedition found some of the mustelids and viverrids to occur in obviously healthy populations. The Asian small-clawed otter (*Amblonyx cinerea cinerea* Illiger, 1815), the Javan ferret-badger (*Melogale orientalis sundaicus* Sody, 1937), the Malay badger (*Mydaus javanensis javanensis* Leschenault, 1818), the Javan mongoose (*Herpestes javanicus javanicus* Geoffroy, 1818), and the Common palm civet (*Paradoxurus hermaphroditus javanicus* Horsfield, 1824) were common within the vicinity of the reserve. Two species, the Binturong (*Arctictis binturong penicillatus* Temminck, 1841) and the Javan small-toothed palm civet (*Arctogalidia trivirgata trilineata* Wagner, 1841) were only rarely encountered by the local people.

No information however could be obtained about the Small Indian civet (*Viverricula indica rasse* Horsfield, 1823), the Banded linsang (*Prionodon linsang gracilis* Horsfield, 1821), the Indonesian mountain weasel (*Mustela lutreolina* Robinson & Thomas, 1917), and the Javan yellow-throated marten (*Martes flavigula robinsoni* Pocock, 1936).

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Stone martens and cars: A beginning war ?

Nicole LACHAT

Introduction

The Stone marten *(Martes foina)* is a carnivore and a member of the mustelid family (Fig. 1). In Europe, this family counts 12 species. The best known are: weasel, ermine, polecat, otter, badger, wolverine, pine- and stone marten.

Stone martens came originally from Asia. They colonized Europe after the last glacial period. Now, we find them from Mongolia and Himalaya to south-west Europe (Fig. 2). They are absent from most of the Mediterranean islands except Crete, and also from Great Britain, Ireland, and Iceland. The northern limit of their range is Denmark. (Note that Pine martens live in the whole of Scandinavia).

In Switzerland, stone martens live everywhere (up to 2,500 m high), including towns. But their optimal habitat is in the fields, near or in human settlements. Stone martens generally sleep in straw or hay, in wood piles or under tiles. These lodgings are distributed over their complete home range.

Stone martens are more omnivorous than carnivorous generalists. Their diet is based on a great variety of food (animal and vegetable) but also on refuse and carrion. They are great opportunists, using the first easy-found food and keeping the more difficult to catch prey for bad conditions. The best hunting areas are wooded pastures, selvedges, and dry stone walls.

Stone martens are almost exclusively nocturnal. They spend the day inside, beginning their activities only with darkness. Contrary to the other members of the family, stone martens have been in expansion for about twenty years. Very well adapted to humans, they put up with their presence. Furthermore, they use them to find shelter, food, and heat. This cohabitation is not always easy...for both species!

A strange phenomenon

Since the end of the seventies, garage mechanics have noticed an increase of untypical damages in cars: these damages were not due to natural oldness of the material. First, mechanical damages preventing starting were identified as well as "malicious" damages like cut cables and tube's tears. Then, the cars were very well inspected and biologists and hunters interrogated. Particular signs were found in the vehicles. Sometimes, rests of food and hairs were collected. Finally, stone martens were charged with this damage. In fact, teeth prints were really obvious on tubes and rubber parts. Since then stone martens were often called "rodents", although the bite was typically carnivorous. Even strong cables like those of the starter system may be cut with only one bite.

Now, why do stone martens "attack" cars? The answer is not established with enough scientific accuracy yet. However various reasons have been investigated for several years, especially in the Justus-Liebig-University of Giessen (Germany). The first suppositions, saying that stone martens eat those "pieces of cars", were rapidly shown as inexact. After the bite, all pieces are in general still there. Many tests were carried out to establish whether some materials, odours, or temperatures were more attractive than others. Those tests were rather unsuccessful. Finally, the easiest and most sensible explanation is that the marten's bite is playful, like a dog with slippers. Most of the time, only the easiest reached cables and tubes are damaged. This biting behaviour could be a part of an intensive exploratory behaviour, leading to a broad trophied niche. Besides, statistics reveal a seasonal pattern to car damage: in the springtime, after the stone marten cubs are born, there is an increase in the number of attacks on cars. The mother brings her cubs in cars to discover for themselves what items are nutritional or not. By the time the cubs leave their mother in autumn, the attacks begin to decline. They have discovered that there is nothing interesting to eat in cars.

Fig. 1. Stone marten *(Martes foina)*. Photo by N. Lachat.

Fig. 2. Distribution of the Stone marten in Europe.

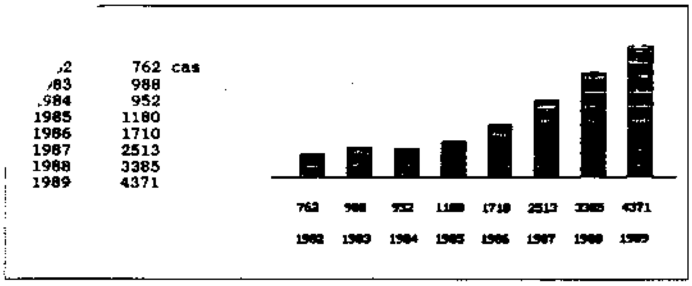

Fig. 3. Statistics of the Swiss Touring Club show increasing reports of car damage cases.

The parts that are most often damaged are: electric cables or their insulation, starter cables or their insulation, cold water tubes, tubes of the windscreen washing system, tubes of the air system, and cold- or noise preventing insulation under the bonnet. There is not yet any precise report on the damage on brake systems, gasoil tubes, or tyres. The hardest parts are normally of less interest.

Historical account

This phenomenon is not new. It began in 1976/77 around Winterthur, in northeast Switzerland. Isolated cases were signalled also in several European countries, but they were generally attributed to mice or rats. During the eighties the problem increased, especially in southern Germany and in northeastern Switzerland. Then it expanded to the southwest, reaching also the French-speaking part of Switzerland.

As mentioned before, stone martens are now in expansion, not really in the fields, but rather in towns. Thus, it is probable that, in the future, drivers in Germany and Switzerland will have to deal with stone martens, the more so because they have no predators except for human ones.

Why do only odd stone martens play in cars? It seems that the potentialities of discovery are very different from one stone marten to another. Probably, stone martens of many regions have not yet learnt that cars can be amusing sites for experiments.

Solutions and advice

What can we do against "car eaters"?
Although the real reasons of this phenomenon are not yet known, solutions should be found rapidly. Damage to cars is very expensive.

Solutions:

1. Population reduction/management: this is the most radical method to fight damage. However, catching stone martens is very difficult because they are so artful and cautious. Therefore it is not *the* suitable solution for car drivers and owners.
2. Use of repulsive products: moth-balls, mint pomade, and other grandmother's recipes or new specialized products like sprays. They are not really effective.
3. Use of light-flashes: stone martens get rapidlyused to this.
4. Mechanical protection: sheaths can be installed on "endangered" parts or a cover fixed under the engine. This should be made by a specialist and is very expensive but no doubt effective.
5. Protection by noise or ultrasonic installation: even the ticking of an alarm clock should frighten the stone marten. These methods seem effective after a few tests. However, stone martens are very adaptable animals and it would be surprising if they would not get used to it.
6. Use of electric kits (put on the market by Audi and Mercedes) converting the current of the battery into high voltage across a plate underneath the engine: laboratory tests showed that a single jolt of high voltage was enough to discourage the curiosity of a stone marten without harming the animal in any way. But this is expensive, not very practical, and probably not working in all conditions.
7. The best solution is without any contest a hermetically closed garage.

For those who do not have a garage the motorist's associations enjoin:

- avoid to leave the car by night with a warm engine near a garden, forest, or vacant site.
- when a car has been damaged by a stone marten, it is not enough to repair it. You have to wash the engine very carefully because, visited once, the car is "marked", and the stone marten will surely come back again.
- treat the "endangered parts" with a transparent rust preventive product.
- if using a repulsive spray, renew the application after a long or rainy trip.

Even though the number of damaged cars is low, the phenomenon is increasing (Fig. 3), and there are only few companies that cover the expenses. So, be careful!

But on the whole, stone martens also pay a high tribute... to the traffic! It could be exaggerated to say that "eating cars" is a revenge. However, who knows?

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The Nilgiri marten, *Martes gwatkinsii* (Horsfield, 1851)

The Nilgiri marten is one of three small carnivores endemic to the Western Ghats of India and identified by the MVPSG as of conservation concern. It is the rarest and least known species of the true martens of the genus *Martes*.

Its taxonomy is not completely agreed on. While some authors regard it as a subspecies of *Martes flavigula*, most consider it as a full species.

According to Pocock (1941), it is distinguished from *flavigula* by the structure of the skull, which is low and flattened, and with zygomatic arches that are less arcuate when viewed from the side (see drawings in Pocock, 1941:342). Also the colour above is much less varied than in *flavigula*, being uniformly dark brown from the head to the loins; the abdomen also is deeper brown, and the throat varies from rusty yellow to nearly lemon-yellow. A male measured: head & body, 515 mm; tail, 419 mm, and weighed 2,040 g.

The most recent sighting of the species we are aware of dates from 17 April 1990 and is by Mr. K. N. Changappa of Arivikad Estate, Munnar, Kerala. Mr. Changappa was driving home when at about 11 p.m., just near his bungalow, a Nilgiri marten was running in front of the car for about 100 yards (K. N. Changappa, in litt., April 1990).

Apart from such annecdotic sightings very little seems to be known on the species and *M. gwatkinsii* never was the focus of a special research or status survey project. Nevertheless what little is known seems to suggest that the species is not critically endangered at this time, at least no more than the Brown palm civet (*Paradoxurus jerdoni*) with which it seems to be largely sympatric according to Dr. Ajith Kumar (A. Kunhunu, in litt., Oct. 1990).

To be on the safe side the MVPSG would nevertheless like to see some investigations being implemented shedding more light on the life history and status of this little known relative of our intensively studied palearctic martens.

Until recently we thought that no photo of a Nilgiri marten existed, when Messrs. Tuinman & Tuinman Ezns., Holland, provided us with one they discovered in a book which was published early this century (Hutchinson, 1923: 301-307). As few of our readers may have seen this book, we are pleased to reproduce the photograph here by courtesy of Tuinman & Tuinman Ezns.

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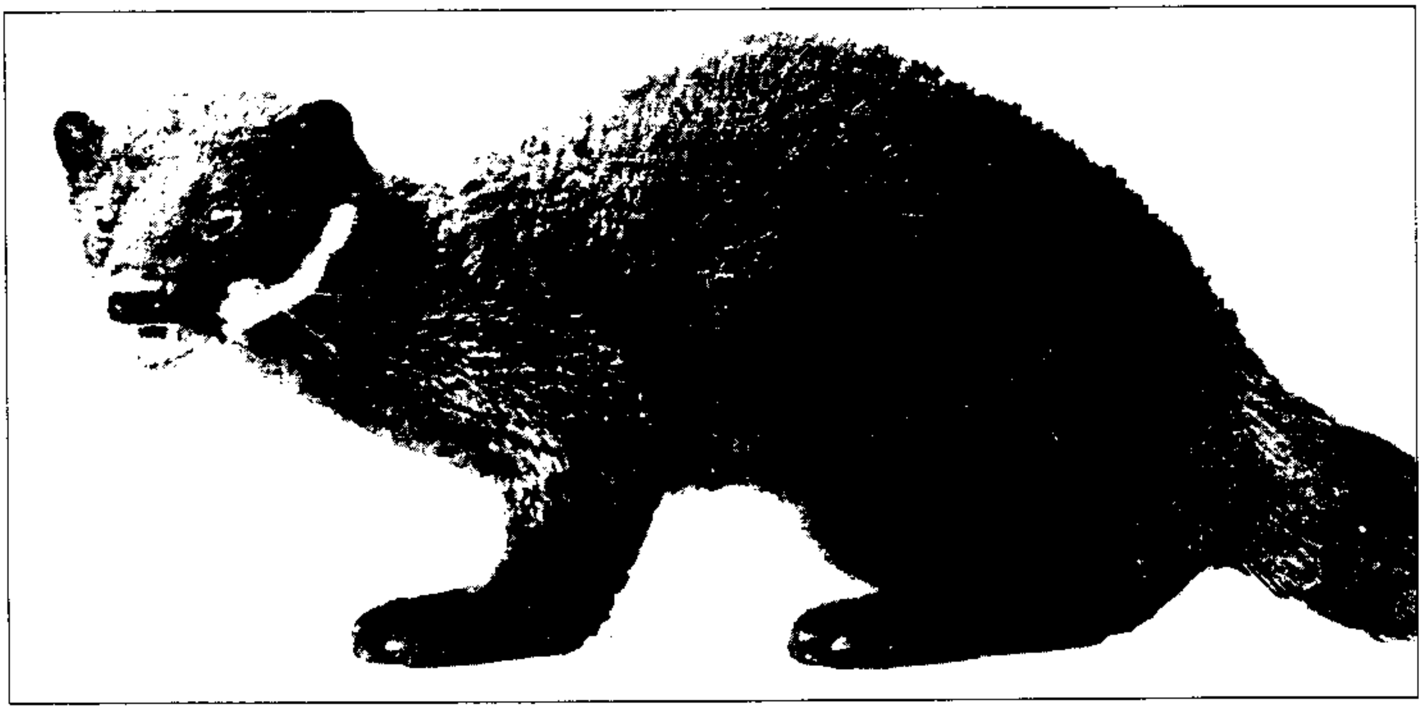
Roland Wirth & Harry Van Rompaey



Гhe conservation status of the badger *Meles meles* (L.) in Europe

Huw I. GRIFFITHS

Although the Badger is one of the most familiar components of the European mustelid fauna, remarkably little is known of its population status or distribution. Although the species has been extensively researched, much of this work has been either eco-ethological or coupled to medical and veterinary studies of the role of the badger as a reservoir of rabies or bovine tuberculosis.

Attitudes to the badger vary widely throughout Europe (Fig. 1). In the UK and Ireland, the animal is viewed very positively and protected for its own intrinsic value, despite being very abundant. Similarly, the species is vigorously protected in the Benelux countries, although there it is rare. A number of other states protect badgers, including most of the Mediterranean countries, Hungary and most recently, Albania. Elsewhere they may be regarded either as a game species (e. g. France, Germany, and Fennoscandinavia) or as a pest (e. g. Austria and Denmark). Most countries that permit the hunting of badgers do attempt to regulate hunting through the operation of a closed season, although protection is minimal or absent in Portugal, Finland, Bulgaria, and parts of Austria (Griffiths, 1991).

In some parts of eastern and northern Europe the badger is still regarded as a commodity species (Griffiths, *in press*). Badger pelts are of poor quality when compared to those of most other mustelids. Despite this they are extremely tough and make excellent rugs and floor coverings. Badger leather is still used in some areas for the production of hunting bags and knapsacks. The use of hair for making brushes is well known (although now uncommon). Less commonly the hairs are woven into cloth (as in Romania). There is widespread use of badger fat and lard for the production of folk medicines and ointments and for water-proofing shoes. In parts of Albania, Yugoslavia, Czechoslovakia, and Finland the flesh is eaten, a practice only recently discontinued in Germany and the Low Countries.

There are no reliable estimates of the number of badgers in Europe west of the Soviet border, although it must exceed 1,500,000 animals. As many countries have little idea of the size of their badger populations, this is almost certainly an underestimate. Of these animals, over 50% appear to inhabit either the UK and Ireland or Fennoscandinavia (all of which are rabies-free). Many populations in mainland Europe are currently depressed following the passage of the rabies epizootic and attempts at its control. Badgers are a significant secondary host of the virus and highly susceptible to infection (Steck, 1982). In the early days of rabies control, the gassing of fox earths and badger setts, coupled with the placing of poisoned baits (e. g. eggs dosed with strychnine) had a profound effect upon populations, some of which were also intensively hunted. In Wallonia (Belgium) and parts of Germany, badger population levels fell to 10% of their former levels (Libois, 1983). Similarly the Czechoslovak badger game-bag decreased by over 60% during the mid 1970's (Hell, 1987). The French badger population is currently estimated at about 80,000 animals, although it is known that in the early 1960's annual game-bags were in the order of 60,000 animals/year. Fortunately the success of fox vaccination programs has now removed the need to use gas in most countries. As the rabies virus disappears from the fox population, it is also lost from secondary host species. At present only Switzerland and Belgium have succeeded in almost completely eradicating rabies from within their frontiers. However, the current political climate augurs well for increased co-operation and efficacy of rabies management programs.

The badger is not an invasive species and has been termed contractionist by Kruuk & Macdonald (1984). Populations develop slowly and are slow to recolonize their former ranges. Studies by Anderson & Trewhella (1985) estimated the mean nett annual rate of badger population increase as 20%. This figure is obviously labile and derived from natural and anthropogenic mortality of both adults and cubs. Whether there is any density dependant regulation of populations remains the source of some debate. Outside of the context of studies of rabies and tuberculosis, there is little information available on possible causes of badger mortality. The species is certainly host to a wide variety of parasites and pathogens (Hancox, 1980), and many of these may cause morbidity or mortality under the appropriate conditions. Non-disease mediated mortality is even less well understood. A study of 1,050 badger skulls showed that about 1% of the animals had almost certainly died from dental abnormality or loss (often with associated infection)(Hancox, 1988). Badgers are also frequent victims of road traffic. In the UK road and rail kills are estimated to account for 47,000 animals/year. Similarly, in the Netherlands the annual road-kill almost equals the annual production of cubs. As a result, the main thrust of Dutch badger conservation efforts is the protection of badgers from road traffic (Vereniging Das & Boom, 1990). It is extremely difficult to assess the effect of road-kills on badgers throughout Europe, although it is known to be a problem in many countries.

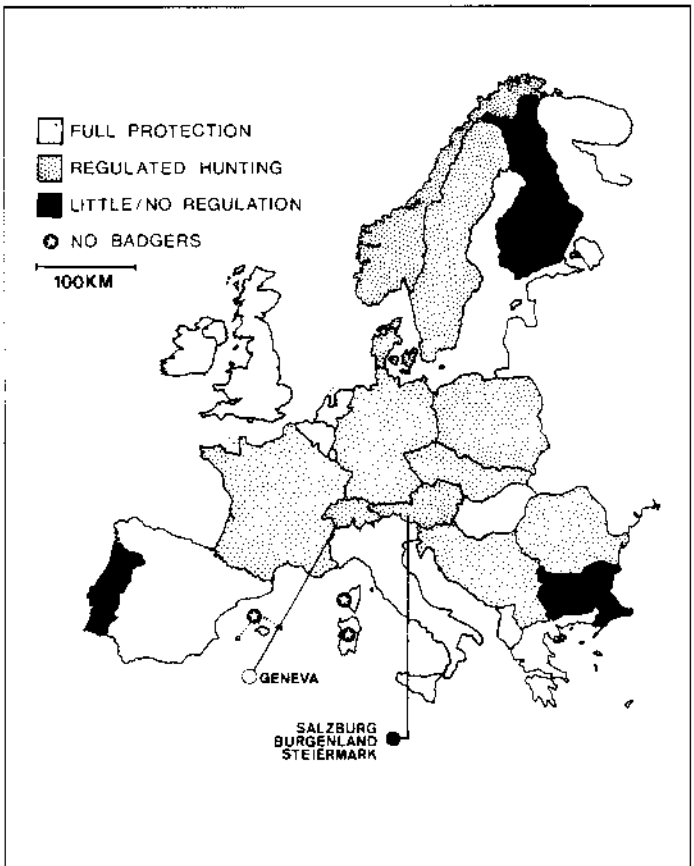


Fig. 1. The legislative status of the badger in Europe.

To these may be added mortality derived from permitted or illicit hunting. Hunting data can be difficult to obtain and countries that forbid the hunting of badgers obviously keep no game-bag statistics. There is little doubt that at least 120,000 badgers are hunted in Europe each year and the genuine total is probably higher.

It is interesting to compare badger statistics from the UK and the Netherlands. Both have badger populations that are well-researched, protected in law and free from immigration from neighbouring states. Britain is estimated to host about 250,000 animals. Annually about 9,000 are illegally hunted, 47,000 run over and 700 killed to control bovine TB (Cresswell *et al.*, 1989; RSNC, 1990). In the Netherlands there are about 1,200 animals, of which 250-300 are run over and about 50 poached (Vereniging Das & Boom, pers. comm.). By calculation, both populations appear to be close to stasis through the action of anthropogenic causes of mortality. The British population (being more than two orders of magnitude larger) is effectively buffered against other random causes of mortality. This is not so for the Dutch badgers, to whom the advent of rabies or any other epizootic could prove catastrophic. The most recent Dutch badger survey appears to show a slight population increase (Wiertz, pers. comm.). This has only been achieved through the payment of state incentives to game-keepers and land-owners not to disturb setts, the operation of a compensation fund, and an active reintroduction program.

In most of the rest of Europe, badger populations are in recovery from the effects of rabies. Population levels are still lower than in the pre-rabies period, but appear to be increasing. Most European countries have now ratified the Bern Convention with the result that they are obliged to safeguard and to monitor badger populations. Various non-selective and inhumane types of hunting are also forbidden. Where populations are competently monitored a surplus may be revealed for harvest (in those countries that so wish). However, most countries are hunting "blind" and monitor their populations exclusively through game-bag returns. Certainly there are difficulties associated with undertaking badger censuses, the short-comings of population monitoring through hunting statistics are equally evident. Hunting outside of the closed season, by prescribed methods and in forbidden places will obviously not be declared. Many legitimate kills will also fail to be reported by hunters unless there is some active incentive to do so.

Perhaps the most important improvement in European badger conservation would be the development of appropriate game-management strategies by those states that wish to continue to hunt. In all countries (except possibly Sweden) badgers are a minority game species. For example, compare the 14,000 badgers killed in Germany in 1990 with the 2,100,000 roe deer hunted in the same year. Nevertheless, this does not represent a justifiable source of complacency. Populations in Lithuania and Albania are certainly decreasing. Finland, Romania, and possibly Sweden all hunt at levels that may not prove sustainable. Germany, Austria, and Norway also take comparatively high numbers of badgers without any real idea of the size of the populations under their jurisdictions. A moratorium upon hunting in some areas would appear wise, at least until populations re-attain their pre-rabies levels.

Overall, the status of the badger in Europe is not a cause for concern, with the exception of those countries previously mentioned. According to the Mustelid & Viverrid Group acti (Schreiber *et al.*, 1989) only the endemic sub-species of Cre Rhodes are a cause for real concern. Complacency is unjusti however, as the status of the populations of much of mainla Europe remains suboptimal.

Ackowledgements

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Mustelids in Ladakh, India

David MALLON

This report is based on information collected as part of a continuing survey of the ecology of Ladakh. Fieldwork was carried out on 7 visits, totalling 21 months, between 1980-1989. The survey has mainly concentrated so far on the larger mammals, but records of mustelids were also collected (Mallon, 1991). The study area covered ca 15,000 km^2 in south-central Ladakh (Fig. 1). Records from outside the study area were collected from local informants and from the literature. Ladakh is situated at the northernmost tip of India in the state of Jammu and Kashmir, and lies on the northern, rainshadow side of the Himalaya. The area is entirely mountainous in character, with an arid-montane environment typical of Transhimalayan areas. There are close ecological affinities with Tibet and Central Asia. Altitudes range from ca 2,800 m to over 6,400 m. Most of the land lies above 3,000 m. The high plains and hills of eastern Ladakh form part of the western rim of the Tibetan plateau. The climate is arid, with large annual and diurnal variations in temperature.

Martes foina Stone or Beech marten

Distribution and status: Distributed widely but thinly in mountainous areas, with records from many parts of the study area. No population estimate available. No evidence was found of a population decline or change in status during the years 1980-1989.

Habitat: It appears to favour rocky valley beds at 3,750-4,000 m with some vegetation, water, and rocks and scree. Pikas *Ochotona* or their tracks were usually found nearby and probably form an important prey item.

Notes: Martens enter buildings where they may consume stored apricots, especially in autumn, and one set of droppings examined was composed almost entirely of the remains of apricots. There were also some local reports of martens entering monasteries and eating butter which had been left in offering lamps.

Conservation: Possibly hunted illegally for its fur, especialy in western Ladakh, but few confirmed occurrences were found. No other obvious threats. Large areas of its range lie in remote terrain with low levels of human activity. Occurs in the Hemis National Park (4,100 km^2), and probably occurs in other proposed reserves.

Mustela altaica Mountain weasel

Distribution and status: The commonest mustelid in Ladakh, with records from all areas. No evidence found of reduction in range or decline in numbers.

Habitat: Found in all habitats: gardens and fields; flat, alluvial plains; riverine thickets; mountain valleys, rocky slopes and passes up to 5,100 m. There is one record from 5,400 m on the Lanak La pass in eastern Ladakh.

Notes: Diurnal and frequently seen, especially around field terraces and stone walls. Seen to prey on pikas *Ochotona*, and birds caught in nets. Also presumed to prey on small rodents.

Conservation: Not hunted. Occurs in the Hemis National Park, and several other proposed reserves.

Mustela erminea Stoat

Distribution and status: Recorded at only three localities on the southern edge of Ladakh, along the northern slopes of the main Himalayan range, at altitudes of 3,000-4,000 m. It is more common in neighbouring areas on the southern side of the Himalaya. Local people do not have a name for this species and it is evidently rare, and occurs in Ladakh only at the edge of its range.

Mustela eversmanni Steppe polecat

Distribution and status: There is one specimen in the British

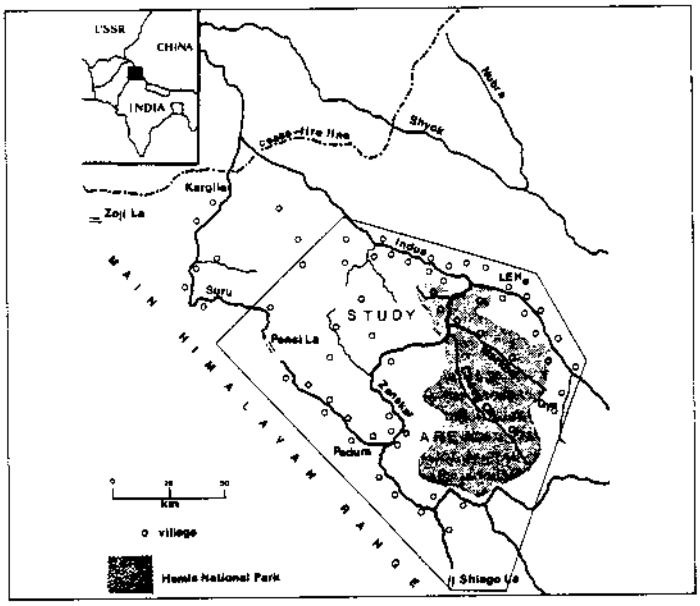

Fig 1. Location of the study area

Museum (Natural History) obtained in Ladakh in 1879. None of my local informants knew this species.

Lutra lutra Eurasian otter

Distribution and status: Sign was found very sparsely along the Indus River to a point 15 km above Leh (local reports suggested it may occur some 50 km further upstream); and along the Zanskar River to above Nierak. Local people said it did not occur in the upper Zanskar Valley, and no sign was found there. It was also reported in the Suru Valley of western Ladakh, and in the Nubra and Shyok Rivers. All local informants agreed that it was uncommon or rare.

Conservation: Possibly subject to illegal hunting for its fur, which is valued in Ladakh. No instances of otter hunting were found in the study area during field surveys. A short section of its range lies inside the Hemis National Park. A further section of its range will be included if a recommended extension to the park is confirmed (Mallon & Bacha, 1989). Otters should also occur in the proposed Karakoram Wildlife Sanctuary in the Nubra-Shyok Valley.

Conservation

All mammals, including mustelids, are protected under the Jammu and Kashmir Wildlife Protection Act of 1978. A small amount of illegal hunting takes place, especially in western Ladakh. No detailed studies of mustelids in Ladakh have been carried out, so no population estimates are available. No specific conservation measures have been drawn up for mustelids, but the three most widespread species are known to occur in the most important protected area in Ladakh, Hemis NP. Several other proposed reserves probably contain mustelids, though their exact boundaries have not yet been delineated.

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Badgers and otters - pesticides and pollution: A European perspecti

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Rachel Carson's 1962 "Silent spring" raised the alarm over pollution, a concern not diminished nearly thirty years later with reports of DDT in both the Arctic and Antarctic in fish, penguins, seals, and skuas; DDE and PCB's in otters even in the remote Hebrides; and organochlorine/PCB/mercury levels in beluga whales, dolphins, and seals such that they could be classified as "toxic waste".

Despite the ubiquitous nature of pesticides, the real impact of pollution is surprisingly hard to assess for any given species however, the clearest evidence coming from the organochlorine-related decline of golden eagle, peregrine, sparrowhawk, and otter, and to a lesser extent, owing to its broader dietary niche, of buzzards in Britain. Both barn owl and kestrel populations were shown to be vulnerable via rodent prey feeding on even supposedly less harmful autumn sown corn, while only the woodland foraging tawny owl amongst raptors was relatively unaffected by the widespread use of pesticides in the late 1960's (Chanin, 1985; Jefferies *et al.*, 1973; Mellanby, 1970). Woodpigeons could acquire a lethal dose of dieldrin in just five hours feeding and three to five such pigeons could kill a fox or peregrine; some 1300 foxes died in the 1959-1960 winter alone, whereas the relatively few badger cases recorded (Table 1) perhaps resulted from most deaths occurring underground, and a greater tolerance to dieldrin: mean lethal liver level 34 ppm (parts per million net weight) contrasted with 24 for *Apodemus*, 17 for kestrel, and only 5 ppm for fox (Jefferies, 1968, 1973). The greater fat stores of badgers also provide a buffer effect since thrushes tolerate 63 ppm of dieldrin in fat, 17 ppm in brain or liver being fatal (Jefferies *et al.*, 1973). The inert storage of organochlorines and PCB's may lead to sudden death of birds or mammals however under conditions of physiological stress such as breeding, moult, migration, overwintering or even circadian roosting.

Early studies suggested the concentration of pesticides through the food chain, fish and aquatic invertebrates being particularly prone to bioaccumulation since oxygen must be "respired" from high volumes of water with a concentration of only 9 cc/liter (at 5°C) compared to 210 cc/liter in air, and thence on to piscivores such as otter or heron. Earthworm specialists such as badger, mole, common shrew, turdids, and waders are also vulnerable to high levels of toxic chemicals variously concentrated in worms according to species, including organochlorines, dioxins and heavy metals: up to 25 ppm of dieldrin or 10 ppm of the even more toxic endrin in worms and slugs associated with soft fruit spraying; and even though under a fifth of the heptachlor from worms was assimilated by American woodcock they suffered a three to four fold concentration (Jefferies, 1986; Ma, 1987; Ma & Broekhuizen, 1989; Satchell, 1983).

Fatalities may result rapidly from prey with acute poisoning, and often showing abnormal anti-predator behaviour e. g. in fish shoals or bird flocks, from very localised sources: a minute's feeding on some 11 contaminated worms being sufficient to kill American robins following DDT spraying of orchards or for Dutch elm disease, or via the abrupt metabolisation of fat stores. The importance of sublethal effects of chronic poisoning is even harder to assess however, but is potentially of greater significance via impaired fecundity. The organochlorines, PCB's, and heavy metals have all been implicated in otter population declines (Table 1). PCB's may be a particularly toxic "new hazard" to mustelids sucl as the badger and otter, with reproductive failure in mink at 50 ppn in fat, and a level of 62 ppm in an unweaned otter cub in th Minsmere reintroduction area despite some improvement in othe pesticide burdens, as well as impaired fecundity and immuno suppresive vulnerability of seals in the distemper viral epidemi (Anon., 1988; Aulerich & Ringer, 1977; Jefferies *et al.*, 1985 1988).

In a world where humans and human breast milk may b "unfit for human consumption" due to pesticide residues, perhap 1992 and E. C. setaside and de-intensification of agricultural an sylvicultural practices are long overdue, together with muc greater regulation of industrial pollution of air, water, and land.

Table 1.

Categories of toxic chemicals and their importance

1. Pesticides

Insecticides, etc. can be passed to young in the milk.
Badger: deaths from dieldrin (Jefferies, 1969; Wilson, 1972). organochlorine (Baines, 1986); impaired spermatogenesis suspected (Neal, pers. comm.); poor cub production suspected in 1962-1969 in English intensive arable areas: Sussex, Herts., E. Anglia (Harris, 1989, 1990; Neal, 1986); selective feeding on DDT sprayed experimental oats plots (Ibbotson, 1955). Despite phasing out of worst organochlorines, the less persistent current organophosphorus insecticides are still a hazard post-spraying.
Otter: deaths and impaired fecundity in Britain especially during 1963-1973 (perhaps also in N. America); dieldrin & heptachlor rather than DDT; eels, a favourite prey, concentrate poisons more than other fish species (Jefferies, 1985; Mason, 1986).

Rodenticides
Badger: rat and mouse control: local deaths from thalium in Denmark (Clausen & Karlog, 1974), in Germany (Wijngaarden & Peppel, 1964). Irresponsible use of e. g. alphachloralose, endrin, fluoracetamide or difenacoum for warfarin-resistant rats pose threat to wild predators, dogs, raptors, etc. (Mellanby, 1970). Grey squirrel control via warfarin taken by non-target species including badgers (Wood, 1977).

Other "vermin" control
Badger: deaths from strychnine-worms in mole control (Ratcliffe, 1974); eggs or other baits laced with strychnine, herbicides (illegally), etc., occasional deaths in Belgium, Britain, Holland (Howes, 1988; Wiertz & Vinck, 1986; Wijngaarden & Peppel, 1964). Often difficult to distinguish between deliberate poisoning or accidental pesticide contamination cases: Essex (Batty & Cowlin, 1969), Gloucester (Gallagher & Nelson, 1979), Hants. (Barker, pers. comm.; own observation, 1970).
Otter: similarly cases of "incidental" poisoning e. g. at fish farms in W. Scotland.

Molluscicides
Metaldehyde or methiocarb slug pellets irresponsibly used on crops or gardens lead to some deaths of wild carnivores, dogs, etc.