

# Status of carnivores in Biscay (N Iberian peninsula)

J. R. Aihartza, I. Zuberogoitia, E. Camacho-Verdejo & J. J. Torres

Aihartza, J. R., Zuberogoitia, I., Camacho-Verdejo, E. & Torres, J. J., 1999. Status of carnivores in Biscay (N Iberian peninsula). *Misc. Zool.*, 22.1: 41-52.

*Status of carnivores in Biscay (N Iberian peninsula).*— The first study on the carnivore community of Biscay was published in 1985. The present study, made twelve years later, was carried out to assess the present situation of these mammals. In this work, data collected from 1990 to 1996 by trapping, sighting, and surveying road and other kills, as well as faeces and tracks are reported. Records of 12 species were obtained, of which American mink *Mustela vison* (Schreber, 1777) is cited for the first time, and the wolf reappears as a non-occasional species. The main trends observed during the last twelve years seem to be related to changes in land use and management of natural resources. The situation has turned favourable for the most opportunistic species, which have become very abundant in some areas, while populations of the most specialist or relictic species show a more restricted distribution. At the same time, the expansion of wolf and European mink, with the appearance of American mink for the first time, reflect a dynamic but very unstable scene.

Key words: Carnivores, Population status, Distribution, Conservation, Iberian peninsula.

(Rebut: 20 I 98; Acc. definitiva: 18 V 99)

J. R. Aihartza<sup>(1)</sup>, *Zoologia eta Animalia Zelulen Dinamika Saila, Euskal Herriko Unibertsitatea, 644 p.k., E-48080, Bilbo, España (Spain).*— I. Zuberogoitia<sup>(2)</sup>, E. Camacho-Verdejo & J. J. Torres, *E. M. Icarus, c/ Pintor Sorolla 6 1º oficina 1, E-26007 Logroño, España (Spain).*

e-mail<sup>(1)</sup>: ggpaiazj@lg.ehu.es

e-mail<sup>(2)</sup>: ggbzuari@lg.ehu.es

## Introduction

The first step in biological resource surveys is to assess species richness at a determined time in a particular location. Only then can we proceed to a second stage, that of biodiversity monitoring, which involves calculating the diversity at the same location at more than one time, in order to evaluate change (WILSON et al., 1996). The first serious attempt to assess the distribution of carnivores in Biscay was the work of CASTIEN & MENDIOLA (1985). These authors combined fieldwork with surveys carried out among trappers and taxidermists, data gathered by the Natural Science Society Aranzadi, and previously published data. The total number of recordings and the frequencies of each species were used to infer their conservation status (CASTIEN & MENDIOLA, 1985).

Twelve years have since passed and during this time, land use and management of biological resources have changed considerably, including the establishing of several Natural Parks. In this paper we compare data published in 1985 with the results of records obtained from 1990 to 1996, and changes in the community of carnivores are discussed.

## Study area

Biscay (2,384 km<sup>2</sup>), located in the western Basque Country (N Iberian peninsula), is a densely populated territory (pop. 1,150,000), with extensive urban and industrial areas. The prevailing geological materials are Cretaceous hard limestone and flyschoid formations, with frequent marls and sandstone.

Moist NW Atlantic winds prevail. The climate is consequently humid with regular rainfall throughout the year, ranging from 1,000 mm on the coast to 1,900 mm in the mountains. A branch of the Gulf Stream, with an annual thermal oscillation of 11 to 12 °C, results in mild temperatures.

The landscape is hilly, with altitudes ranging up to 1,481 m a.s.l. Streams are short and fast, and valleys narrow and incised. Most salt marshes formed at the outlet of the main rivers are highly degraded, as is the riparian vegetation, especially

along the medium and lower water courses. The vegetation was modified long ago and today the lowlands are covered by pine and eucalyptus plantations, and the mountain tops by rough pasture. Most of the native forests have long been cleared, although some beech forests remain on steep mountain slopes (LOIDI, 1987; LOIDI et al., 1994).

During the last twelve years the area has undergone considerable changes in the environment, mainly in relation to the progressive decline in agriculture and to the industrial crisis of the late seventies and the eighties. The former agricultural pattern based on small farms with cattle, fruit and vegetables for urban consumption found it difficult to survive. The number of cattle consequently dwindled and many meadows were planted with eucalyptus and pine. Many farms, especially those near cities, were turned into country homes for town dwellers, and the landscape was further broken up by new roads and highways. At the same time, the industrial crisis sent many industries into bankruptcy. As some of these enterprises were those which caused the greatest amount of pollution, the environmental quality near urban and industrial areas improved, and the level of pollution in some rivers decreased. The water quality was further improved as a result of several water-treatment plants which were established in the area (ORIVE & RALLO, 1997). Nevertheless, canalisation of rivers continued, to the detriment of groves and vegetation along the banks.

## Methods

This study is mainly based on field surveys carried out between 1990 and 1996. The data include records obtained by traps, observation of living animals, dead individuals and recent skeletal remains, and identification of faeces and tracks.

Nocturnal observations were made from 1992 in all the study area, travelling by car along both tar and dirt roads. A total of 64,000 km was covered over 327 nights, including all the 10 x 10 km UTM squares, at an average of 200 km/night. Tracking were made by torch-light and began just after

sunset, at an average speed of 40 km/h. The presence of carnivores was noted only when specific identification was possible. Moreover, all the carcasses found during the tracking were checked and recorded.

Traps were used especially during a genet survey from 1990 to 1993. Ten live-traps were situated in forested areas of five countries (nine 10 x 10 km UTM squares): Karrantza, Artzentales, Loiu, Gamiz-Fika and Urdaibai. These traps were set for two weeks at each point, making a total of 1900 trap-days. In 1996, as a part of the Second Otter Survey of Spain, the main streams of Biscay were checked for tracks following the standard technique by JIMÉNEZ et al. (1990). Lakes, marshes, dams and small rivers were also sampled in search of tracks. To avoid errors, data on wild and common cats, pine marten, stone marten, mink and polecat (see DUNSTONE, 1993), were excluded from track surveys.

Additionally, enquiries were carried out among many colleagues surveying in Biscay, as well as trappers, hunters and farmers. Records thus obtained were filtered or checked by revision of the material (dead animals, skeletal remains, photographs) when possible. Records without reference material were only accepted from qualified specialists, and always after an enquiry about diagnostic features observed.

## Results and discussion

A total of 12 species were obtained in this study, of which the exotic American mink *Mustela vison* (Schreber, 1777) is cited for the first time, and the wolf reappears as a non-occasional species in Biscay. Carnivores were reported in all 10 x 10 km UTM squares, with a mean of 4.97 species per square, and a maximum of nine species (excluding occasional appearances, fig. 1). CASTIEN & MENDIOLA (1985) reported the presence of ten species of carnivores in Biscay.

The distribution patterns of carnivores in Biscay are shown, comparing when possible present and past data, and their status is discussed. Distribution maps on a grid of 10 x 10 km UTM squares are shown in figure 2.

### Family Canidae

#### Wolf *Canis lupus* (Linnaeus, 1758)

The wolf had disappeared completely at the beginning of the century in the Basque Country and was still absent from Biscay in 1985, although young were observed to be entering the area from the neighbouring territory of Burgos (CASTIEN & MENDIOLA, 1985). By last winter, its presence was continuous in

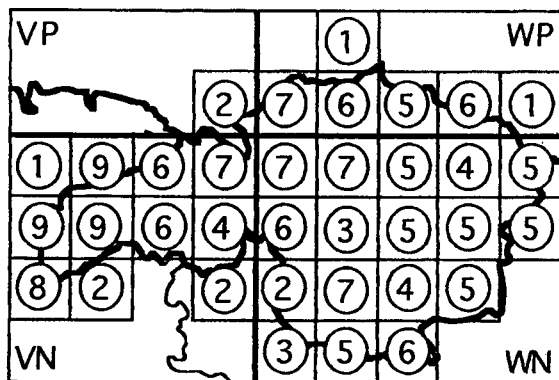
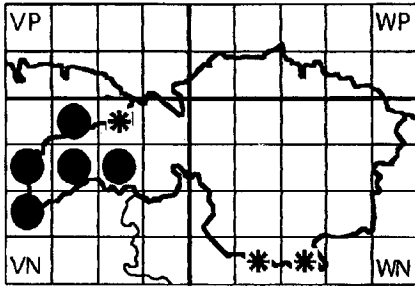


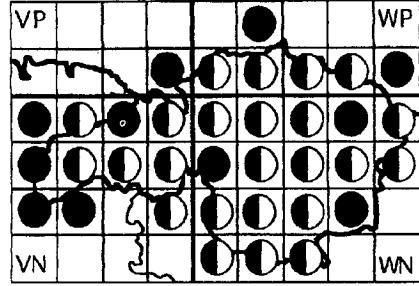
Fig. 1. Species richness in each 10 x 10 km UTM squares during this survey.

Riqueza específica obtenida en este estudio en cada cuadrícula UTM de 10 x 10 km.

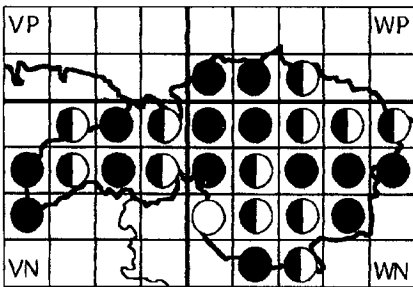
**Wolf *Canis lupus***



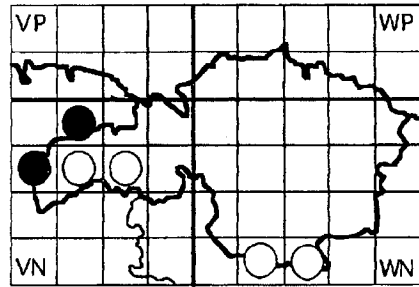
**Red fox *Vulpes vulpes***



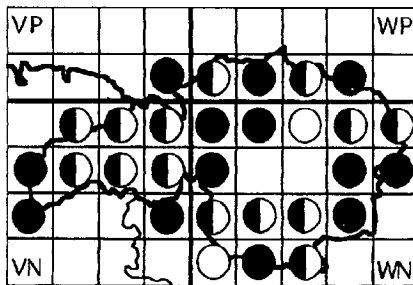
**European badger *Meles meles***



**Pine marten *Martes martes***



**Stone marten *Martes foina***



**Stoat *Mustela erminea***

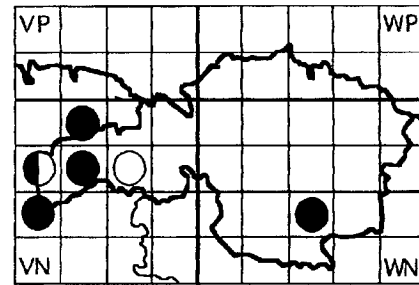
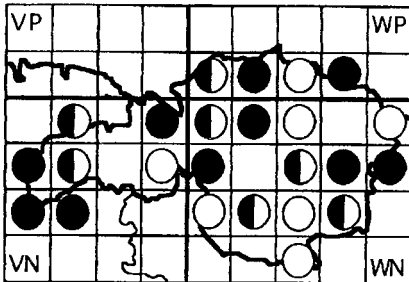
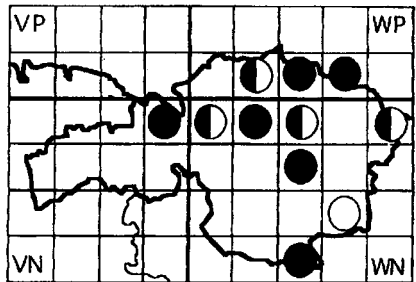


Fig. 2. Distribution maps of different species: white circles indicate presence in the square before 1986 (bibliographic data); black circles, presence after this year (new data); divided circle, presence before and after 1986; asterisk, the occasional appearance of the wolf.

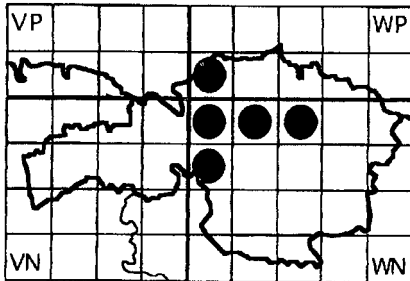
Weasel *Mustela nivalis*



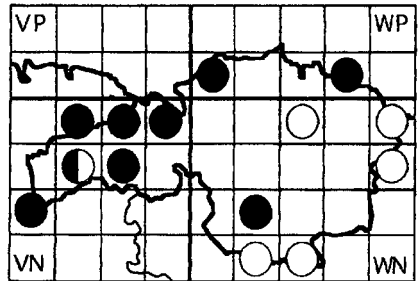
European mink *Mustela lutreola*



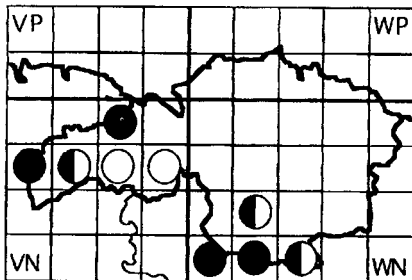
American mink *Mustela vison*



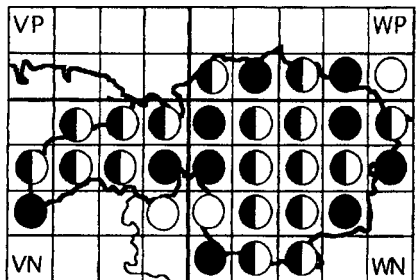
Western polecat *Mustela putorius*



Wild cat *Felis silvestris*



Common genet *Genetta genetta*



Mapas de distribución de las distintas especies: los círculos blancos indican la presencia anterior a 1986 (datos bibliográficos); los círculos negros, la presencia después de esta fecha (datos nuevos); los círculos partidos, la presencia antes y después de 1986; los asteriscos, la presencia ocasional del lobo.

the western tip of our study area. Between 1988 and 1992, farmers shot ten wolves in Karrantza and Artzentales following attacks on livestock. One hundred and six sheep, five goats, five calves and six young horses were killed (Saenz de Buruaga, Campos & Onrubia, pers. com.). This carnivore was present during the summer from 1994 to 1997 and a bitch with breeding signs was killed in Artzentales in summer 1994. Breeding in the area was confirmed in spring 1997 when a cub was killed in Zalla (E. Álvarez, pers. com.).

The increasing presence of wolves in Biscay reflects its general expansion in Europe and in particular its spread towards the south and east of the Iberian peninsula (BLANCO et al., 1990; BLANCO & GONZÁLEZ, 1992; PROMBERGER & SCHRÖDER, 1993). The main reasons for the expansion of wolves in the Iberian peninsula seem related to changes in land use and conservation policy (BLANCO, 1997). On one hand, the progressive abandonment of farmlands has allowed natural forests and shrubs to spread, and resulted in an increase of wild boar *Sus scrofa* (Linnaeus, 1758) and roe deer *Capreolus capreolus* (Linnaeus, 1758). This trend is clear in Biscay, where the migration of wolves from the west and south west coincides with that of wild boar and roe deer. On the other hand, prohibition of poison use in 1983, and increased conservation measures favoured the return of this canid.

#### Red fox *Vulpes vulpes* (Linnaeus, 1758)

The red fox, a widespread mammal in the Iberian peninsula (CASTELLS & MAYO, 1993), was reported to be the most abundant carnivore in the western Basque Country in 1985 (CASTIEN & MENDIOLA, 1985). Present data even suggests an increase in frequency, since foxes have been in all the squares and all kinds of habitats. In 1991, fox densities in central and eastern Biscay were estimated to reach 6.75 ind./km<sup>2</sup>, which is one of the highest values recorded in Europe (REIJA et al., 1991). Thus, the red fox can be considered even as an "overabundant" species in some areas (WAGNER & SEAL, 1992; GARROT et al., 1993). In the present survey, red fox seems to be more frequent in lowlands, outskirts of small villages, and especially near rubbish dumps, where it can find abundant and di-

verse food, and where the risk from hunters and illegal trappers is low.

The previous explanations in accounting for the return of the wolf are also applicable in the trends of other carnivores, the red fox in particular. Moreover, the progressive abandonment of farmlands in Biscay with substitution of croplands by pine or eucalyptus plantations, and the consequent spreading of scrub and bushland causes an increase in potential roosts. The expansion of red fox in Scotland was also correlated with an increase in potential roosts (HEWSON & KOLB, 1973). At the same time, there has been an increase in "security areas" surrounding towns and cities, where hunting is strictly forbidden, and where many small and medium-sized carnivores roam in safety. Nevertheless, its present abundance is threatened by sarcoptic mange (LINDSTRÖM et al, 1995), which is decimating populations of foxes in neighbouring areas of western Pyrenees and Basque Country, and has recently been detected in southern Biscay where eight dead foxes were found and at least 14 sick foxes were seen.

#### Family Mustelidae

##### European badger *Meles meles* (Linnaeus, 1758)

Present data agree with the classification of CASTIEN & MENDIOLA (1985) as a widespread species in Biscay. Although less frequent than other carnivores, it seems to have spread during the last decade. The badger is distributed throughout the territory, but few contacts per square were obtained during the present study. It is found in a great diversity of habitats in the province, with preference for countryside and fields with scattered thick forest patches. The badger also seems favoured by the increase of thick forests due to the expansion of pine plantations.

Nevertheless, its real status is difficult to determine because of the lack of specific research. GRIFFITHS & THOMAS (1993) noted populations and trends of this species in the Iberian peninsula remained unknown. Its presence was reported to be well established in Catalunya (RUIZ-OLMO, 1990), but it seems to be threatened in the central Iberian peninsula (VIRGOS, 1994).

**Pine marten *Martes martes* (Linnaeus, 1758)**

The pine marten is a rare carnivore in Biscay area and its distribution was reported to be limited to the oak and beech forests in the mountains of the south and west (CASTIEN & MENDIOLA, 1985). Five pine martens were located during the present study in two squares of the western tip of Biscay: in Karrantza and Turtzioz three individuals were observed foraging, a fourth (a cub) was captured by a farmer and left in the animal rehabilitation center "El Carpín", in Karrantza, and another was found dead. No individuals were observed however in the southern mountains of the study area (squares WN16 and WN26), where it was recorded by CASTIEN & MENDIOLA (1985).

Although hunting of small carnivores is now illegal, and pressure on pine marten has consequently been reduced, there has not been any noticeable increase in the populations of this mustelid, and it seems it has disappeared from some areas. Other environmental factors must therefore be involved. There is considerable controversy about the feeding of pine marten (ERLINGE, 1986; THOMPSON & COLGAN, 1987). Recent studies in the Cantabrian Mountains showed that the frequency of woodland rodents is high in the pine marten's diet, suggesting that this mustelid forages primarily in beech or oak forests, and less frequently in open habitats (CLEVINGER, 1993). The same author noted that its diet varies according to food availability and degree of competition. Thus, the fragmentation and scarcity of deciduous forests could be a significant handicap for the expansion of pine marten, particularly if high densities of opportunistic carnivores (such as foxes, stone martens or even genets) exert strong competitive pressure in surrounding areas (BRAINERD, 1997).

**Stone marten *Martes foina* (Erxleben, 1777)**

According to our data, the stone marten is one of the most frequent carnivores in Biscay. It was located in all kind of habitats from seashore up to Gorbea Mountain (1,400 m a.s.l.). Records were most frequent in the western tip (Las Encartaciones) and the southern mountains (Gorbea and Urkiola

Natural Parks) where this species seems to be very common. These data agree with the previous work of CASTIEN & MENDIOLA (1985).

**Stoat *Mustela erminea* (Linnaeus, 1758)**

This seems to be a rare carnivore in Biscay. CASTIEN & MENDIOLA (1985) considered it to be restricted to the occidental area of Biscay. Nevertheless, although all our records (12 sightings plus three carcasses) were obtained in four squares of the western tip of the study area (Karrantza and Turtzioz), it was recently recorded by A. Galarza (pers. com.) and G. Ocio (ZUBEROGOITIA et al., 1997) in Gorbea Natural Park (S Biscay). It seems unlikely that the lack of previous recordings could be accounted for by scarce surveying, as this species was highly valuable for trappers and hunters. The stoat therefore may be spreading in Biscay throughout the mountains ranging eastward from Karrantza to Gorbea.

**Weasel *Mustela nivalis* (Linnaeus, 1766)**

Weasels were found in sixteen squares, in all kind of habitats from sea level up to 1,000 m a.s.l., showing preference for countryside. However, its frequency is lower than that of species such as genet, stone marten and badger. The weasel was reported as the most frequent carnivore (CASTIEN & MENDIOLA, 1985), and it was recorded in fourteen squares in Biscay. It has been considered a widespread non-threatened species in the Iberian peninsula (CASTELLS & MAYO, 1993). Nevertheless, there has been a decline in records throughout the study area in recent years. This is surprising since pressure against small carnivores has decreased and habitat availability appears unchanged. Furthermore, there is no evidence of rodent poisoning and other rodent predators such as pine marten, fox, barn owl *Tyto alba* (Scopoli, 1769) or tawny owl *Strix aluco* (Linnaeus, 1758) are abundant (ZUBEROGOITIA & TORRES, 1997). The reason for the decline in weasel populations therefore remains unknown but may be due to competition or predation. Although competition of stoat with weasel has been documented (KING, 1989), the stoat is restricted

only to a small area. Raptors do prey on weasel (MIKKOLA, 1983) however, and during the present work three cases of predation by domestic cats were recorded, as well as one by the barn owl and one by the tawny owl. Although there are no quantitative data to assess the significance of predation by this species, it must be noted that the tawny owl, with more than 1,700 couples located in Biscay, presents one of the highest densities in Europe (ZUBEROGOITIA & TORRES, 1997).

European mink *Mustela lutreola* (Linnaeus, 1761)

Fourteen records of European mink were obtained in Biscay: eight observed alive, and six found dead. Most data were obtained in medium and lower river courses in the north, and the rest in the southern mountains as well, in Gorbea and Urkiola Natural Parks. The present distribution includes the rivers Artibai, Ea, Oka, Bakio, Butroe, Nerbioi, Ibaizabal and Urkiola, ranging from sea level up to 700 m a.s.l. Although several authors (e.g. BLANCO & GONZALEZ, 1992) stated that minks are linked to well conserved streams, in Biscay they can be found even in moderately polluted and perturbed streams.

Commercially valuable fur-bearers are amongst the first species to be recognised by local hunters, trappers and naturalists (YOUNGMAN, 1982). Nevertheless, the European mink was first reported in the Iberian peninsula in 1951 (RODRIGUEZ DE ONDARRA, 1955). It appears likely that this species spread into the Basque Country from coastal France during the mid-1940's, as a result of high population density, according to the many individuals preserved in museums at that time (YOUNGMAN, 1982; PALAZÓN & RUIZ-OLMO, 1992; RUIZ-OLMO & PALAZÓN, 1995). During the following years many data were obtained in the Basque Country and neighbouring regions, confirming its expansion (RODRIGUEZ DE ONDARRA, 1963; BLAS ARITIO, 1970; SENOSIAIN & DONAZAR, 1983).

Although there are no data on population densities, the European mink seems to continue to be increasing both in distribution and frequency in nearby areas such as Araba, Navarra, La Rioja and Burgos (TORRES & ZUBEROGOITIA, 1996; PALAZÓN et al., 1998a).

American mink *Mustela vison* (Schreber, 1777)

The first records in the Iberian peninsula were reported by DELIBES & AMORES (1978) and it was later observed in the Central System DELIBES (1983). In 1987, VIDAL-FIGUEROA & DELIBES (1987) confirmed its presence in SW Galicia and in NW Portugal. RUIZ-OLMO (1987) reported its distribution in diverse regions in Catalunya. BUENO & BRAVO (1990) also noted quick expansion throughout the Central System. Finally, RUIZ-OLMO et al. (1997) extended the area cited to Cantabria and Teruel-Castelló.

The American mink was first observed in Biscay in 1993 in the Butroe River, when some people saw "otter-like" animals. Two years later, the authors captured an American mink at this site. More data were later collected from the same and other nearby rivers such as the Oka and the Asua (three individuals were trapped and 15 direct observations made). Likewise, another individual was trapped in the Nervion river in September 1996 by County Council rangers, and taken to the animal rehabilitation center, El Carpin, in Karrantza.

This population proceeded from escapes and releases over the last decade, when many permits for fur farms were issued in the study area: 18 fur farms were recorded in the Autonomous Community of the Basque Country (where Biscay is included) in 1992, with an estimated total stock of 10,000 females (PALAZÓN et al., 1998b).

An estimate of feral population and distribution is required to know its present status and prevent possible problems: competition with other carnivores such as stone marten, polecat or the European mink, and sexual competition with the latter, as suggested by some authors, although hybridisation does not seem to occur in nature (YOUNGMAN, 1982; MARAN & HENTTONEN, 1995).

Western polecat *Mustela putorius* (Linnaeus, 1758)

The polecat was recorded at 12 sites during this study: Orozko, Santurtzi, Abanto and La Arboleda, a mountain coniferous forest in Karrantza, and in the streams Aguera, Barbadun, Kadagua, Butroe, Lea and



Karrantza. These data include two road kills, the shooting of a family and nine sightings. Some of these records were in highly populated areas. CASTIEN & MENDIOLA (1985) recorded the polecat as a widespread but infrequent species. These authors noted that the scarcity of polecat in the western Basque Country could be due to the little value of its fur. Nevertheless, our data (in which trappers and hunters play a minimal role) confirm its widespread but infrequent status. Interpretation is somewhat difficult as ecology and behaviour of the polecat is poorly understood elsewhere (BLANDFORD, 1987). Habitat destruction was pointed out as an important factor in the decline of the polecat on the continent. Some authors considered that drainage of ponds and marshes, canalisation of rivers and degradation of wetlands, as well as the destruction of deciduous woodland limited the habitat availability for this species in different countries (LODE, 1995). Our data agree with this viewpoint since the polecat occurs mainly in the best preserved areas and streams in Biscay. The scarcity of deciduous woodland and well-conserved river corridors and wetlands in this area also account for its low frequency.

#### Family Felidae

Wild cat *Felis silvestris* (Schreber, 1777)

Eleven records of wild cats were collected during the present study, including two trapped, two road kills, and seven direct observations including one occupied burrow. All were located in the best conserved mountain areas of the west and the south. This agrees with CASTIEN & MENDIOLA (1985), who associated the presence of wild cats with the best preserved forests in the western Basque Country.

Little is known about this carnivore in the Iberian peninsula, apart from its widespread distribution (CASTELLS & MAYO, 1993). Habitat loss was noted as one of main threats both in Spain and in other countries in the European Community (GINN, 1984; BLANCO & GONZALEZ, 1992) while recent studies have reported that hybridisation with feral cats is one of the main reasons to explain the extinction of wild cat populations in some

European countries (HUBBARD et al., 1991; DÖTTERER & BERNHART, 1996).

#### Family Viverridae

Common genet *Genetta genetta* (Linnaeus, 1758)

This is one of the most common carnivores in Biscay. It was found frequently throughout the study area, in all kind of habitats, ranging from sea level, in Urdaibai marsh, to 1,100 m a.s.l. in Gorbea Mountain. It was noted also as a widespread carnivore in the western Basque Country (CASTIEN & MENDIOLA, 1985), and in the Iberian peninsula as well (CASTELLS & MAYO, 1993).

#### **General discussion**

The community of carnivores in Biscay shows a pattern typical of industrial and densely populated areas in SW Europe. The big carnivores such as brown bear (*Ursus arctos*, Linnaeus 1758), wolf [*Canis lupus* (Linnaeus, 1758)] and lynx (*Lynx sp.*) disappeared many decades ago, mainly as a result of direct hunting and loss of habitat (BOUCHET, 1988; KEMPF, 1987). Small and medium-sized furbearers such as the otter (*Lutra lutra*, Linnaeus 1758) disappeared in the same way or became reduced to residual populations (DELIBES, 1990).

The highest species richness was recorded in Karrantza and Turtzioz, in the western tip (VN67, VN68, VN78 and VN79) with eight or nine species. All these squares have a high diversity of habitats, including pristine deciduous forests and well-conserved streams. These characteristics allow the presence of the most specialist or residual species such as the pine marten, wild cat, stoat or polecat. Excepting the wolf, which returned only recently, these species were recorded in the previous work of CASTIEN & MENDIOLA (1985), though not in all squares.

Excluding marginal squares, the lowest richness appears today in some areas of central Biscay with three or four species (red fox, genet, stone marten or badger). In these squares extensive areas are covered by pine and eucalyptus plantations alone, valleys are

highly developed and streams degraded (ORIVE & RALLO, 1997). It is important to analyse highly populated areas near big cities, such as squares VN99, WN09, WN19 and WP00, where seven species were recorded: the most opportunistic and widespread species such as red fox, stone marten, genet or badger, plus weasel and two species of minks.

Finally, comparing data with the previous work of CASTIEN & MENDIOLA (1985), and keeping in mind that our work has a higher sampling effort, a decline in species richness can be observed in squares WN26, WN29 and WN49, from eight, seven and seven species respectively, to six, five and five. This variation is due to the absence of records about pine marten, polecat and weasel during the first work. Possible explanations are given above for each of these species.

In conclusion, the main changes observed in the conservation status of carnivores over the last twelve years seem related to changes in land use and management of natural resources, including conservation efforts and attitudes of hunters and farmers. Nevertheless, these factors do not affect all species in the same way. In short, the most opportunistic species such as red fox, stone marten, genet and even badger are frequent or very frequent. At the same time, populations of the most residual species seem to have declined, i.e. weasel, polecat pine marten and wild cat. This may be related to limited habitat availability or interspecific relations. Other reasons such as pollution, disease, or hunting may also play a role, although there is no consistent evidence of this.

## Resumen

*Estatus de conservación de los carnívoros en Vizcaya (N península ibérica)*

El primer estudio sobre la comunidad de carnívoros en Bizkaia fue publicado en 1985. Doce años más tarde se ha realizado un trabajo en el que se revisa la distribución del grupo y el estatus de cada especie en la provincia. Este estudio se basa en trabajos de campo desarrollados entre 1990 y 1996, incluyendo el uso de trampas, observaciones directas de animales vivos, estudio de cadáveres,

e identificación de excrementos y huellas. Se han obtenidos datos de 12 especies, entre las cuales el visón americano *Mustela vison* se cita por vez primera en Bizkaia, y el lobo reaparece como especie no ocasional (figs. 1, 2). Las principales tendencias observadas están relacionadas con cambios en el uso de la tierra y gestión de los recursos naturales. Las especies más oportunistas han incrementado su presencia llegando a ser muy abundantes en algunas áreas, mientras que las especies más especialistas o con poblaciones relictas se hallan estancadas o en declive. Al mismo tiempo, la expansión del lobo y del visón europeo, junto con el asilvestramiento del visón americano, plantean un escenario dinámico aunque muy inestable.

## Acknowledgements

We wish to thank all those who took part in the field work, especially Esther Bernedo, Luisa Fernanda Campos, Eneko Imaz, Mari Jose Totorika, Julen Zuberogoitia. We also appreciate the collaboration of those colleagues who provided valuable data: Pedro Abad, Lander Astorkia, Arturo Elosegui, Aitor Galarza, Fernando Garitagoitia, Jose Antonio González-Oreja, Javier Gómez-Abrisketa, Jose Antonio Mugica, Fernando Ruiz-Moneo, Edorta Unamuno, Aitor Uriarte. Our sincere appreciation to Drs. E. Castien, A. Elosegui, I. Garin, I. Mendiola and J. Ruiz-Olmo for their critical review of the manuscript.

## References

- BLANCO, J. C., 1997. El lobo en España: apuntes sobre la dinámica de las poblaciones. In: *Primer Seminario sobre el Lobo en los Picos de Europa*: 13-28 (B. Palacios & L. Llana, Eds.). SECEM-Grupo lobo, Mieres.
- BLANCO, J. C., CUESTA, L. & REIG, S. (Eds.), 1990. *El lobo en España. Situación, problemática y apuntes sobre su ecología*. ICONA, Madrid.
- BLANCO, J. C. & GONZALEZ, J. L. (Eds.), 1992. *Libro rojo de los vertebrados de España*. ICONA, Madrid.
- BLANDFORD, P. R. S., 1987. Biology of the Polecat *Mustela putorius*. *Mammal Review*, 17(4): 155-198.

- BLAS ARITIO, L. B., 1970. *Estudio bioecológico de la familia Mustelidae*. SPNC, Madrid.
- BOUCHET, J. C., 1988. Histoire de la chasse à la grande faune dans les Pyrénées françaises du XVI au XX siècle. Ph. D. Thesis, Université de Pau UPPA.
- BRAINERD, S. M., 1997. Habitat selection and range use by the Eurasian Pine Marten (*Martes martes*) in relation to commercial forestry practices in southern boreal Scandinavia. Doctor Scientarium Theses, 22. Synopsis.
- BUENO, F. & BRAVO, C., 1990. Distribución y hábitat del visón americano (*Mustela vison*, Schreber) en el Sistema Central. *Doñana, Acta Vertebrata*, 17(2): 165-171.
- CASTELLS, A. & MAYO, M., 1993. *Guía de los mamíferos en libertad de España y Portugal*. Ediciones Pirámide S. A., Madrid.
- CASTEIN, E. & MENDIOLA, I., 1985. Araba, Bizkaia eta Gipuzkoako Ugaztun Kontinentalen Atlasa. In: *Araba, Bizkaia eta Gipuzkoako Ornodun Kontinentalen Atlasa (Chiroptera ezik)*: 271-336 (J. Alvarez, A. Bea, J. M. Faus, E. Castián & I. Mendiola, Eds.). Estudios Gráficos Zure, S. A., Bilbo.
- CLEVENGER, A. P., 1993. Pine Marten (*Martes martes* Linnè, 1758) comparative feeding ecology in an island and mainland population of Spain. *Zeitschrift für Säugetierkunde*, 58: 212-224.
- DELIBES, M. (Ed.), 1983. Distribution and ecology of the Iberian Carnivores: a short review. *Abs. XV Congreso Internacional de Fauna, Cinegética y Silvicultura, Trujillo*: 359-378.
- 1990. *La nutria (Lutra lutra) en España*. Serie Técnica ICONA, Madrid.
- DELIBES, M. & AMORES, F., 1978. On the distribution and status of the spanish carnivores. *Abs. II. Congr. Theriol. Int.*: 146. Brno, CSSR.
- DÖTTERER, M. & BERNHART, F., 1996. The occurrence of wildcats in the southern Swiss Jura Mountains. *Acta Theriologica*, 41(2): 205-209.
- DUNSTONE, N., 1993. *The Mink*. T. & A. D. Poyser Ltd., London.
- ERLINGE, S., 1986. Specialists and generalists among the mustelids. *Lutra*, 29: 5-11.
- GARROTT, R. A., WHITE, P. J. & VANDERBILT WHITE, C. A., 1993. Overabundance: an issue for conservation biologists? *Conservation Biology*, 7: 946-949.
- GINN, H., 1984. *Conservation of species of wild flora and vertebrate fauna threatened in the Community*. Vol 2. Nature Conservancy Council, London.
- GRIFFITHS, H. J. & THOMAS, D. H., 1993. The status of the badger *Meles meles* in Europe. *Mammal Review*, 23: 17-58.
- HEWSON, R. & KOLB, H. H., 1973. Changes in the numbers and distribution of foxes (*Vulpes vulpes*) killed in Scotland from 1948-1970. *J. Zool. Lond.*, 171: 124-141.
- HUBBARD, A. L., MCORIST, S., JONES, T. W., BOID, R., SCOTT, R. & EASTERBEE, N., 1991. Is survival of European wildcats *Felis silvestris* in Britain threatened by interbreeding with domestic cats? *Biological Conservation*, 61: 203-208.
- JIMENEZ, J., DELIBES, M. & CALLEJO, A., 1990. Método de muestreo y discusión del mismo. In: *La nutria (Lutra lutra) en España*: 9-14. (Delibes, M., Eds.). Colección Técnica, ICONA, Madrid.
- KEMPF, C., 1987. *Le retour des signeurs de nos forêts d'Europe*. Editions Sang de la terre, Paris.
- KING, C. M., 1989. *The natural history of weasels and stoats*. Christopher Helm. London.
- LIDSTRÖM, E. R., BRAINERD, S. M., MELLDIN, J. C. & OVERSKAUG, K., 1995. Pine Marten Red Fox interactions: a case of intraguild predation. *Annales Zoologici Fennici*, 32(1): 123-130.
- LODE, T., 1995. Activity pattern of polecat (*Mustela putorius*, L.) in relation to food habits and prey activity. *Ethology*, 100: 295-308.
- LOIDI, J., 1987. El País Vasco. In: *La vegetación de España*: 47-75 (M. Peinado & S. Rivas-Martinez, Eds.). Universidad de Alcalá de Henares, Alcalá de Henares.
- LOIDI, J., HERRERA, M. & BIURRUN, I., 1994. *Datos sobre la vegetación del País Vasco y zonas limítrofes. (La vegetación del Parque Natural de Valderejo)*. Servicio Central de Publicaciones del Gobierno Vasco, Vitoria-Gasteiz.
- MARAN, T. & HENTTONEN, H., 1995. Why is the European mink (*Mustela lutreola*) disappearing? A review of the process and hypotheses. *Ann. Zool. Fennici*, 32: 47-54.
- MIKKOLA, H., 1983. *Owls of Europe*. T & A. D. Poyser, London.
- ORIVE, E. & RALLO, A., 1997. *Bizkaiko Ibaiak. Los Ríos de Vizcaya*. Lurralde-Azterlanetarako Bizkaiko Irakaskundea, Bizkaiko

- Foru Aldundia, Bilbo.
- PALAZÓN, S. & RUIZ-OLMO, J., 1992. Status of European Mink (*Mustela lutreola*) in Spain. *Semiaquatische Säugetiere Wiss. Beitr. Univ. Halle*, 1992: 337-340.
- PALAZÓN, S., RUIZ-OLMO, J. & CEÑA, J. C., 1998a. El Visón Europeo (*Mustela lutreola*) en España. In: *El Visón Europeo (Mustela lutreola) y el Visón Americano (Mustela vison) en España*: 9-77 (S. Palazón & J. Ruiz-Olmo, Eds.). Colección Técnica. Ministerio de Medio Ambiente, Madrid.
- PALAZÓN, S., RUIZ-OLMO, J., MUNILLA, I., ROMERO, R. & GIMENEZ DE AZCARATE, J., 1998b. Distribución y evolución de las granjas de visón americano. In: *El Visón Europeo (Mustela lutreola) y el Visón Americano (Mustela vison) en España*: 89-90 (S. Palazón & J. Ruiz-Olmo, Eds.). Colección Técnica, Ministerio de Medio Ambiente, Madrid.
- PROMBERGER, C. & SCHRODER, W. (Eds.), 1993. *Wolves in Europe: Status and perspectives*. Ettal, Germany.
- RODRÍGUEZ DE ONDARRA, P., 1955. Hallazgo en Guipúzcoa de un mamífero no citado en la "Fauna Ibérica" de Cabrera. *Munibe*, 4: 201-207.
- 1963. Nuevos datos sobre el visón en España. *Munibe*, 15: 103-104.
- RUIZ-OLMO, J., 1987. El visón americano, *Mustela vison*, Schreber, 1777 (Mammalia, Mustelidae) en Cataluña, N.E. de la Península Ibérica. *Doñana, Acta Vertebrata*, 14: 142-145.
- 1990. El poblament dels grans mamífers a Catalunya. I. Carnívors: distribució i requeriments ambientals. *Butlletí Institució Catalana Història Natural*, 58 (secc. Zool, 8): 87-98.
- RUIZ-OLMO, J. & PALAZÓN, S., 1995. Situation actuelle du vison d'Europe en Espagne et perspectives de recherches. *Cahiers d'Ethologie*, 15(2,3,4): 425-435.
- RUIZ-OLMO, J., PALAZÓN, S., BUENO, F., BRAVO, C., MUNILLA, I. & ROMERO, R., 1997. Distribution, status and colonization of the American Mink *Mustela vison* in Spain. *Journal of Wildlife Research*, 2(1): 30-36.
- SENOSIAIN, A. & DONAZAR, J. A., 1983. Nuevos datos sobre la presencia del visón europeo (*Mustela lutreola* L.) en Navarra. *Doñana, Acta Vertebrata*, 10(1): 219-221.
- THOMPSON, I. D. & COLGAN, P. W., 1987. Numerical responses of martens to a food shortage in northcentral Ontario. *J. Wildl. Manage.*, 51: 824-835.
- TORRES, J. J. & ZUBEROGOITIA, I., 1996. El visón europeo. In: *Mamíferos. Enciclopedia de la fauna de La Rioja*: 102-107 (A. Ceña, Ed.). Caja Rioja, Logroño.
- VIDAL-FIGUEROA, T. & DELIBES, M., 1987. Primeros datos sobre el visón americano (*Mustela vison*) en el suroeste de Galicia y noroeste de Portugal. *Ecología*, 1: 145-152.
- VIRGOS, E., 1994. Consideraciones sobre la situación del Tejón (*Meles meles* L.) en algunas áreas del centro de la Península Ibérica. *Aegypius*, 12: 37-40.
- WAGNER, F. H. & SEAL, U. S., 1992. Values, problems, and methodologies in managing overabundant wildlife populations: an overview. In: *Wildlife 2001: populations*: 279-293 (D. R. McCullough & R. H. Barrett, Eds.). Elsevier Applied Science, New York.
- WILSON, E. D., COOLE, F. R., NICHOLS, J. D., RUDRAN, R. & FOSTER, M. S., 1996. *Measuring and Monitoring Biological Diversity. Standard Methods for Mammals*. Smithsonian Institution Press, Washington.
- YOUNGMAN, P. M., 1982. Distribution and systematics of the European Mink *Mustela lutreola* Linnaeus 1761. *Acta Zoologica Fennica*, 166: 1-48.
- ZUBEROGOITIA, I., CAMPOS, L. F. & TORRES, J. J., 1997. La situación de los mustélidos en Bizkaia. *Sustrai*, 46(3): 45-47.
- ZUBEROGOITIA, I. & TORRES, J. J., 1997. *Aves rapaces de Bizkaia. Colección Temas Vizcainos*. B. B. K., Bilbao.