THE STATUS AND DISTRIBUTION OF MEDITERRANEAN MAMMALS

Compiled by Helen J. Temple and Annabelle Cuttelod

MEDITERRANEAN

The IUCN Red List of Threatened Species™ – Regional Assessment

SSC Species Survival Commission
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MAVA
CENTRE FOR Mediterranean COOPERATION

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IUCN SSC Chiroptera Specialist Group
IUCN SSC Deer Specialist Group
IUCN SSC Equid Specialist Group
IUCN SSC Hippo Specialist Group
IUCN SSC Hyaena Specialist Group
IUCN SSC Lagomorph Specialist Group
IUCN SSC Large Carnivore Initiative for Europe
IUCN SSC Otter Specialist Group
IUCN SSC Pig Specialist Group
IUCN SSC Pinniped Specialist Group
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Executive summary

Aim

The Mediterranean Biodiversity Assessment is a review of the conservation status of a wide range of Mediterranean species – mammals, reptiles, amphibians, freshwater and marine fishes, freshwater molluscs, dragonflies, freshwater crabs and crayfish, and selected groups of vascular plants. This Red List publication summarizes results for Mediterranean terrestrial mammals, and provides the first overview of the conservation status of these species to follow IUCN regional Red Listing guidelines. It identifies species that are threatened with extinction at the regional level – in order that appropriate conservation action can be taken to improve their status.

Scope

All terrestrial mammal species native to the Mediterranean or naturalized since before 1500 A.D. are included in this report. One marine and coastal species, the Mediterranean Monk Seal *Monachus monachus* is also included. Mediterranean cetaceans (dolphins and whales) are covered in a separate publication. For the purposes of this mammal assessment, the Mediterranean region was defined politically to include the following countries: Albania, Algeria, Andorra, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Lebanon, Libyan Arab Jamahiriya, FYR Macedonia, Malta, Monaco, Montenegro, Morocco, Occupied Palestinian Territories, Portugal (including Madeira), San Marino, Serbia, Slovenia, Spain (including the Canary Islands), Switzerland, Syrian Arab Republic, Tunisia, Turkey and Western Sahara.

Status assessment

The status of all species was assessed using the IUCN Red List Criteria (IUCN 2001), which are the world's most widely accepted system for measuring relative extinction risk. All assessments followed the *Guidelines for Application of IUCN Red List Criteria at Regional Levels* (IUCN 2003). Information on each species was compiled by a small team, in collaboration with IUCN Specialist Groups and other experts. Regional assessments were carried out at an assessment workshop and through correspondence with relevant experts. More than 250 mammal experts from a large number of different countries in the Mediterranean and elsewhere actively participated in the data compilation, assessment and review process.

Results

One in six (16.5%) Mediterranean mammals included in this report are threatened with extinction at the regional scale, with a further 8% assessed as Near Threatened. By comparison, 56% of Mediterranean endemic freshwater fishes (Smith & Darwall 2006), 56% of dolphins and whales (Reeves and Notarbartolo di Sciara 2006), 42% of sharks and rays (Cavanagh & Gibson 2007), 36% of crabs and crayfish (Cuttelod *et al.* 2008), 29% of amphibians (Cox *et al.* 2006), 19% of dragonflies and damselflies (Riservato *et al.* 2009), 13% of reptiles (Cox *et al.* 2006) and 5% of birds (Cuttelod *et al.* 2008) are considered to be threatened. One mammal species, the Sardinian Pika *Prolagus sardus*, has become globally extinct since 1500 A.D. and a further seven species, including the Lion *Panthera leo* and Tiger *P. tigris* have been extirpated from the Mediterranean region.

More than one-quarter (27%) of Mediterranean mammals have declining populations, 31% are stable, while for a further 40% the population trend is unknown; only 3% of species populations are increasing. A number of these increases are due to successful species-specific conservation action. Terrestrial mammal biodiversity is greatest in mountainous parts of the region, with particularly high concentrations of threatened species found in the mountains of Turkey, the Levant, and north-west Africa. The Maghreb holds a large number of endemic species, which are unique to the Mediterranean and found nowhere else in the world. Although the Sahara has relatively low species richness, a high proportion of Saharan species are threatened.

Many of the threatened mammal species are endemic to the region, highlighting the responsibility that Mediterranean countries have to protect the entire global populations of these species. Of the 49 threatened species, 20 (41%) are unique to the region and occur nowhere else in the world.

The greatest threat to Mediterranean mammals is destruction and degradation of habitat, caused by a variety of factors including agricultural intensification, urbanization, pollution, and climate change. Human disturbance, overexploitation and invasive species are also major threats.

Conservation recommendations

For **bats**, the main recommendations are to improve the legal protection framework, to better enforce existing legislation, and to encourage more environmentally friendly practices in agriculture and when restoring buildings. Further research

is needed on a number of issues including habitat and foraging requirements, population size and trends, impacts of pesticide use on prey species, and methods to minimize impacts of wind farms.

For **non-volant** (flightless) **small mammals** more sustainable agricultural practices are needed to prevent habitat loss and degradation both from agricultural intensification and land abandonment. Legislation and enforcement of existing measures are needed to prevent the introduction of alien invasive species such as the American Mink *Neovison vison*. Measures to raise public awareness of the diversity, importance and threats to small mammals are needed in order to modify their "pest" image and explain their ecological importance.

For **large mammals**, recommendations include improvement of management of protected areas and of the wider environment, better enforcement of existing laws and regulations controlling hunting (including new legislation in some cases), and development and implementation of species-specific management plans for the most threatened species. Restoring habitats and wild prey populations at the landscape level is essential for the conservation of threatened large carnivores; large herbivores similarly require landscape-level actions to ensure the maintenance of grazing systems. The conservation of large carnivores can be controversial – understanding people's attitudes towards predators and gaining their acceptance is crucial to the success of conservation and management programmes.

The Barbary Macaque *Macaca sylvanus* is Endangered (EN) and in decline as it is threatened by the loss and degradation of its habitat. It is the only surviving primate in Africa north of the Sahara desert and the only native species of primate to occur in Europe. It was previously widespread throughout North Africa but its current distribution is limited to small patches of forest and scrub in Algeria and Morocco. A semi-wild population lives on Gibraltar, where it was introduced in historical times. Photograph © Ricardo Rocha.

1. Background

1.1 The Mediterranean context

The Mediterranean Basin, stretching west to east from Portugal to the Levant, covers three continents (Europe, Asia and Africa). The region is characterized by its climate, where cool and wet winters alternate with long, hot, dry summers. In some areas, for example in Libya and Egypt, annual rainfall can be as low as 50mm per year, whereas in the well-watered regions, such as the Adriatic coast of the Balkan countries, rainfall is over 1,000mm. With almost 5,000 islands and islets, the Mediterranean comprises one of the largest groups of islands in the world. The islands are of high value to global biodiversity due to their wealth of species, relatively high levels of endemism, long history of isolation, and tolerance of many kinds of disruptions, as well as their role as a natural laboratory for evolutionary studies.

Besides the variety of these climatic, geological and hydrological features, the Mediterranean has experienced intense human development and impact on its ecosystems for thousands of years, and various forms of human settlements have existed there for at least 8,000 years. This has created a mosaic of natural and cultural landscapes, with thousands of habitats, ranging from high mountains to large rivers, from wetlands and forests to deserts, which favor the differentiation and existence of numerous species, leading to the high level of endemism found in the region. It is therefore not surprising that the Mediterranean Basin is one of the world's richest places in terms of animal and plant diversity and has been recognized as one of 34 Biodiversity Hotspots (Mittermeier *et al*. 2004).

However, this ancient, rich and diverse region is now facing severe pressure. The Mediterranean-rim countries hold around 400 million people, and 135 million of them live on the Mediterranean coast. The Blue Plan estimates that the population of the northern-rim nations will grow by around 4 million between 2000 and 2025; the population of the southern- and eastern-rim nations will grow by around 98 million over the same period. Considerable economic disparities exist within the region, with the GNI per capita of the Mediterranean EU countries (USD 20,800) being ten times that of the North African ones (USD 2,100) (World Bank 2006). Poor people depend heavily on natural resources and the loss of biodiversity is undermining the potential for economic growth, affecting the security of populations (food, health, etc.) and limiting their options. On the other hand, economic development increases the pressures on the environment and hence conservation challenges and options in the region are driven by these economic inequities. Mediterranean countries are also an international travel destination for nearly 250 million visitors per year – 31% of all international tourists – the majority of whom visit the coastal zone (Blue Plan 2008). Many visitors to the region are drawn by its natural beauty, but heavy pressure from visitors and residents alike is causing severe environmental degradation.

Furthermore, low rainfall combined with unsustainable farming practices has also led to desertification, erosion, salinization and land degradation in many areas, with for example 30% of Greece being declared "threatened" and 60% of Portugal facing a moderate risk of desertification. Forests have always played, and still play, an important role in the daily life of the Mediterranean peoples. Although Mediterranean forests provide low direct economic returns on wood products in comparison to the Northern European forests, they play a crucial role in maintaining key ecosystem components for securing human welfare and life in the region. Previously, exploitation of the natural landscape was long, slow and relatively sustainable. In the past decades, that balance between nature and humankind has been lost. Urbanization, coastal development, pollution, agricultural intensification, unsustainable exploitation of natural resources and climate change are just some of the many human activities that are leading an ever-increasing number of Mediterranean species to be facing a high risk of extinction.

1.2 Mediterranean mammals: diversity and endemism

Mammals are a well-known class of vertebrates, including many familiar domesticated species and pets, as well as our own species *Homo sapiens*. All mammals are warm-blooded, and all female mammals possess mammary glands (mammae), which are used to suckle the young with milk. Mammals are further distinguished by the possession of hair or fur, although this is limited to early developmental stages in cetaceans (whales and dolphins). The vast majority of mammals give birth to live young, the exception being the egg-laying Monotremata (a small group of mammals including the Duck-billed Platypus and the echidnas or spiny anteaters), which do not occur in the Mediterranean (Nowak 1999).

The mammal fauna of the Mediterranean is largely derived from the Eurasian and African biogeographic zones and therefore exhibits relatively low levels of endemism, as most species tend to have very wide ranges. Within the study region, there are 319 terrestrial mammal species, of which 89 species (28%) are endemic, and 15 species of marine mammal, of which none are endemic (Reeves and Notarbartolo di Sciara 2006) (Tables 1 & 2). Of these 334 species, 320 were included in the present study: all terrestrial species plus the Mediterranean Monk Seal *Monachus monachus*. Mediterranean cetaceans are covered in a separate report (Reeves and Notarbartolo di Sciara 2006).

Table 1. Diversity and endemism in mammalian orders and families in the Mediterranean region (excluding cetaceans, but including the Mediterranean Monk Seal)*

Order	Family	Number of species	Number of endemic species	Percentage endemic
Carnivora	Canidae	7	0	0%
	Felidae	11	1	9.1%
	Herpestidae	2	0	0%
	Hyaenidae	2	0	0%
	Mustelidae	13	1	7.7%
	Phocidae	1	0	0%
	Ursidae	1	0	0%
	Viverridae	1	0	0%
Cetartiodactyla	Bovidae	19	3	15.8%
	Cervidae	4	1	25.0%
	Hippopotamidae	1	0	0%
	Suidae	1	0	0%
Chiroptera	Emballonuridae	2	0	0%
	Hipposideridae	2	0	0%
	Molossidae	2	0	0%
	Nycteridae	1	0	0%
	Pteropodidae	1	0	0%
	Rhinolophidae	6	0	0%
	Rhinopomatidae	2	0	0%
	Vespertilionidae	45	7	15.6%
Eulipotyphla	Erinaceidae	6	1	16.7%
	Soricidae	34	14	41.2%
	Talpidae	9	5	55.6%
Hyracoidea	Procaviidae	1	0	0%
Lagomorpha	Leporidae	8	4	50.0%
	Prolagidae	1	1	100.0%
Macroscelidea	Macroscelididae	1	1	100.0%
Perissodactyla	Equidae	2	0	0%
Primates	Cercopithecidae	1	1	100.0%
Rodentia	Calomyscidae	2	1	50.0%
	Castoridae	1	0	0%
	Cricetidae	36	15	41.7%
	Ctenodactylidae	3	2	66.7%
	Dipodidae	7	2	28.6%
	Gliridae	9	3	33.3%
	Hystricidae	2	0	0%
	Muridae	62	24	38.7%
	Sciuridae	8	2	25.0%
	Spalacidae	3	0	0%
	Total	320	89	27.8%

* This table includes species that are native or naturalized since before 1500 A.D.; species introduced after this date are not included. Extinct and Regionally Extinct species are included. Species of marginal occurrence in the Mediterranean are included.

Terrestrial mammals native to the Mediterranean belong to ten major groups: Carnivora (carnivores), Cetartiodactyla (even-toed ungulates, dolphins and whales), Chiroptera (bats), Eulipotyphla (shrews, moles and hedgehogs), Hyracoidea (hyraxes) Lagomorpha (rabbits, hares and pikas), Macroscelidea (elephant shrews), Perissodactyla (odd-toed ungulates), Primates (primates) and Rodentia (rodents).

Marine mammals native to the Mediterranean belong to two taxonomic orders, the Cetartiodactyla and Carnivora. Mediterranean marine carnivores are represented by a single species, the Mediterranean Monk Seal *Monachus monachus.* Fourteen species of whales and dolphins regularly occur in the Mediterranean region (Table 2), with a further eight species recorded as vagrants (Reeves and Notarbartolo di Sciara 2006).

The majority of Mediterranean mammal species are small non-volant and volant mammals belonging to the orders Rodentia (rodents), Chiroptera (bats), and Eulipotyphla (shrews, moles and hedgehogs) (see Table 1). The largest mammal family in the Mediterranean, and also the largest and most diverse family at the global level, is the Muridae (rats and mice), with 62 species. Murid subfamilies present in the Mediterranean include the Deomyinae (spiny mice), the Gerbillinae (gerbils and jirds) and the Murinae (Old World rats and mice). Other families with a particularly large number of representatives in the Mediterranean region include the Vespertilionidae (evening bats and vesper bats – 45 species) and Cricetidae (hamsters and voles – 36 species).

Just over one-quarter of terrestrial mammal species are endemic to the Mediterranean. Endemism is particularly high in the small non-volant mammals (Rodentia and Eulipotyphla). Larger terrestrial mammals and bats tend to be more mobile and wide-ranging, and the majority of these species have ranges extending outside the region. However, among larger mammal species there is a high proportion of endemism in the lagomorphs (hares, rabbits and pikas – 5 out of 9 species present are endemic to the Mediterranean). The Barbary Macaque is endemic to the Mediterranean, and consequently 100% of primate species occurring in the region are endemic.

The Iberian Lynx *Lynx pardinus* is the world's most threatened felid species. It is endemic to Spain and Portugal, and currently categorised by IUCN as Critically Endangered (CR) as a result of the fragmentation of its natural habitat by agricultural and industrial development. Photograph © Programa de Conservación Ex situ del Lince Ibérico.

Although mammals are one of the better known taxonomic groups, there are still new discoveries to be made regarding mammalian diversity and endemism in the region: two new species endemic to Mediterranean islands, the Sardinian Long-eared Bat *Plecotus sardus* and the Cyprus Mouse *Mus cypriacus* have been described in recent years (Mucedda *et al.* 2002, Bonhomme *et al*. 2004, Cucchi *et al.* 2006).

Table 2. Diversity and endemism in cetacean (whale, dolphin and porpoise) families in the Mediterranean region*

Order	Family	Number of species	Number of endemic species	Percentage endemic
Cetartiodactyla	Balaenopteridae	3	0	0%
	Delphinidae	8	0	0%
	Phocoenidae	1	0	0%
	Physeteridae	1	0	0%
	Ziphiidae	1	0	0%
	Total	14	0	0%

* Cetacean families are listed for the sake of completeness, but were not included in the assessment process reported here and are not covered in subsequent sections of this publication. This list does not include species considered to be vagrants in the region by Reeves and Notarbartolo di Sciara (2006).

1.3 Species threatened status

The threatened status of plants and animals is one of the most widely used indicators for assessing the condition of ecosystems and their biodiversity. It also provides an important tool underpinning priority-setting exercises for species conservation. At the global scale the best source of information on the conservation status of plants and animals is the *IUCN Red List of Threatened Species* (see www.iucnredlist.org). The Red List provides taxonomic, conservation status, and distribution information on taxa that have been evaluated using the *IUCN Red List Categories and Criteria: Version 3.1* (IUCN 2001). This system is designed to determine the relative risk of extinction, with the main purpose of cataloguing and highlighting those taxa that are facing a higher risk of extinction (i.e., those listed as Critically Endangered, Endangered and Vulnerable).

1.4 Objectives of the assessment

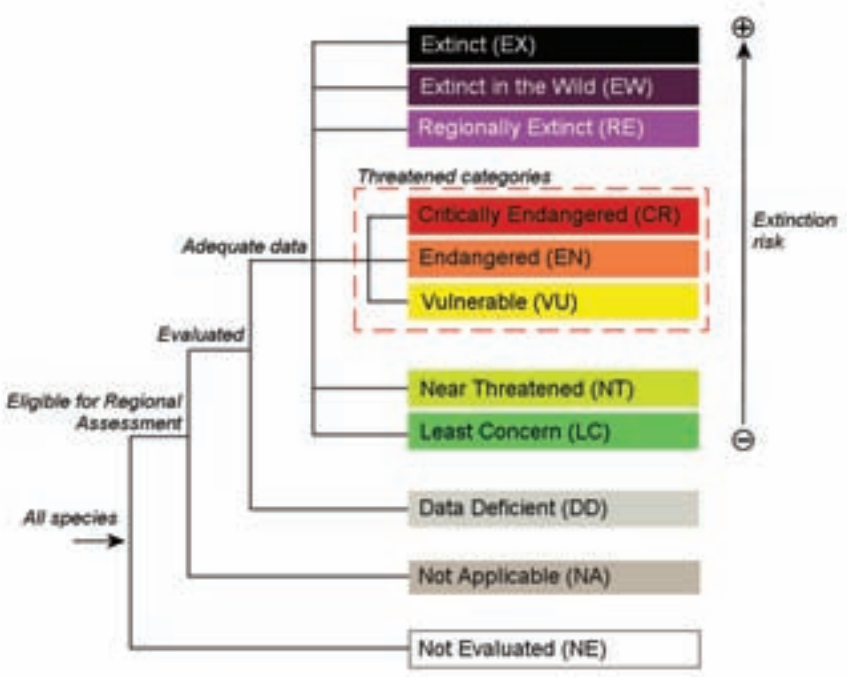
This assessment of mammals in the Mediterranean basin has two main objectives:

- To assist in regional conservation planning by assessing the status and distribution of all species occurring within the region; and
- To develop a network of regional experts to support future assessments and the updating of the information on these species.

The assessment provides two main direct outputs:
A report on the status of the mammals of the Mediterranean basin, including a Red List assessment of all the species, an identification of the main threats for each species, and a spatial representation of the centres of species richness and threats;
A database that provides a baseline for monitoring the status of Mediterranean mammals.

The data presented in this report and the booklet provides a snapshot based on available knowledge at the time of writing. The database will continue to be updated and made freely and widely available. IUCN will ensure wide dissemination of this data to relevant decision makers, NGOs, and scientists to inform the implementation of conservation actions on the ground.

Figure 1. IUCN Red List Categories at the regional level (IUCN 2003)



2. Assessment methodology

2.1 Global versus regional assessment

The present study was an assessment of the regional conservation status of all Mediterranean mammal species (excluding the cetaceans), following the *Guidelines for Application of IUCN Red List Criteria at Regional Levels* (IUCN 2003). It complements and contributes to the global status assessments of Mediterranean mammal species carried out through the Global Mammal Assessment (GMA) (see Schipper *et al*. 2008). A regional approach to identifying threatened species complements global conservation status assessments, and provides information at an appropriate scale for international conservation policies and legislation that have a regional focus. The information provided here will help to put national conservation priorities into a Mediterranean context, thus maximising the effectiveness of local and national conservation measures, and facilitating the development of integrated regional conservation strategies.

2.2 Geographic scope

The Mediterranean basin was defined politically to include the following countries and territories[1]: Albania, Algeria, Andorra, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Lebanon, Libyan Arab Jamahiriya, FYR Macedonia, Malta, Monaco, Montenegro, Morocco, Occupied Palestinian Territories, Portugal (including Madeira), San Marino, Serbia, Slovenia, Spain (including the Canary Islands), Switzerland, Syrian Arab Republic, Tunisia, Turkey and Western Sahara (Figure 2).

2.3 Taxonomic scope

All mammal species native to the Mediterranean or naturalized before 1500 A.D. were included in the assessment, with the exception of the cetaceans (whales, dolphins and porpoises) that are assessed at the regional level through a separate initiative led by the IUCN SSC Cetacean Specialist Group (Reeves and Notarbartolo di Sciara 2006). Domesticated species are not eligible for classification according to the IUCN Red List Categories and Criteria, and were excluded from the assessment. Species introduced to the Mediterranean region by man after 1500 A.D., as well as species that are vagrant or of marginal or uncertain occurrence, were classed as Not Applicable. The Mediterranean mammal assessment uses the third edition of *Mammal Species of the World* (Wilson and Reeder 2005) as its default taxonomy for most taxonomic groups, although it departs from this in a few justified circumstances. Distinct subpopulations and subspecies of mammals within the Mediterranean were not individually assessed as part of this project.

Expert participants at the Mediterranean Mammal Red List workshop held in Málaga, Spain, 29 October – 2 November 2007. Photograph © Sandra Simoes.

[1] As listed by United Nations

Figure 2. The Mediterranean mammal assessment region

2.4 Assessment protocol

For every mammal species native to the Mediterranean or naturalized before 1500 A.D., the following data were compiled; Species' taxonomic classification, Geographic range (including a distribution map), Red List Category and Criteria, Population information, Habitat preferences, Major threats, Conservation measures (in place, and needed), Species utilization, Other general information and Key literature references.

These data were compiled in collaboration with the IUCN Global Mammal Assessment (GMA) and European Mammal Assessment (EMA). For detailed information on the GMA and EMA data compilation processes, see Schipper et al. (2008) and Temple & Terry (2007). Many Mediterranean mammal species had already been preliminarily reviewed during at least one other regional or taxon-focused workshop, including the Africa Small Mammals workshop (24-30 January 2004, United Kingdom), the European Mammal Assessment workshop (18-22 May 2006, Austria), and the Southwest Asia Mammals Workshop (22-25 November 2005, Turkey).

2.5 Review workshop (2007) and evaluation of assessments

Mammal experts from the Mediterranean were invited to attend a five-day review workshop held from 29 October – 2 November 2007 in Malaga, Spain. Focused working groups were organized to efficiently review taxonomic sets of species (large mammals, bats, and small non-volant mammals).

Preliminary species summary reports, distribution maps and global assessments were distributed to all the participants before the workshop to allow them to review the data presented and prepare any changes to the data.

New information was added to the species summaries and maps, and corrections to existing data were made. Red List assessments for each species were then made at the Mediterranean regional level (according to regional Red Listing guidelines; IUCN 2003).

Facilitating staff from the IUCN Species Programme evaluated the assessments to check they complied with the guidelines for application of the IUCN Red List Categories and Criteria and included the most up-to-date, comprehensive information.

Following the review workshop, the data were edited, and outstanding questions were resolved through communications with the workshop participants. The post-workshop assessments were also made available on an FTP site to allow the participating scientists to make any final edits and corrections.

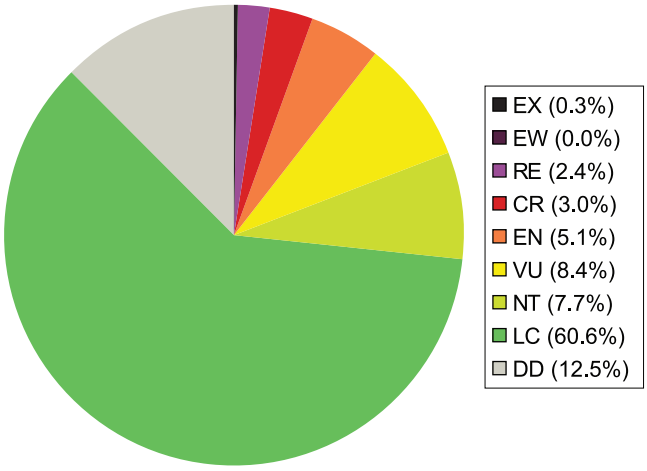
The resulting finalized IUCN Red List assessments are a product of scientific consensus concerning species status and are backed by relevant literature and data sources.

3. Results

3.1 Threatened status of mammals

Approximately one-sixth (16.5%) of mammal species assessed were found to be threatened with extinction in the Mediterranean, of which 3.0% were Critically Endangered, 5.1% were Endangered and 8.4% were Vulnerable (Table 3 and Figure 3). A further 7.7% were considered Near Threatened, and 2.7% were already Extinct or Regionally Extinct. A relatively high proportion of species, 12.5%, were considered to be Data Deficient. Species classed as threatened (Critically Endangered, Endangered and Vulnerable) are listed in Table 4.

Figure 3. Red List status of mammals in the Mediterranean



3.2 Extinctions

One endemic Mediterranean mammal species, the Sardinian Pika *Prolagus sardus*, is known to have gone extinct since 1500 A.D. A further seven species (2.4% of the total number of species assessed) have been extirpated from the Mediterranean as a result of human activities and are considered Regionally Extinct (Table 6).

3.3 Status by taxonomic group

Terrestrial mammals native to the Mediterranean belong to ten major groups or taxonomic orders: Carnivora (carnivores), Cetartiodactyla (even-toed ungulates, dolphins and whales), Chiroptera (bats), Eulipotyphla (shrews, moles and hedgehogs), Hyracoidea (hyraxes) Lagomorpha (rabbits, hares and pikas), Macroscelidea (elephant shrews), Perissodactyla (odd-toed ungulates), Primates (primates) and Rodentia (rodents). Considerable differences exist among these groups in both species numbers as well as threatened status (see Table 5).

Rodents, bats, shrews, hedgehogs and moles constitute the majority of Mediterranean mammals. Ungulates, primates, carnivores and lagomorphs (rabbits and hares) are particularly threatened, and eight species from these groups have already gone extinct in the Mediterranean region.

Table 3. Summary of numbers of mammal species within each category of threat

	IUCN Red List categories	No. species	No. endemic species
	Extinct (EX)	1	1
	Extinct in the Wild (EW)	0	0
	Regionally Extinct (RE)	7	7
Threatened categories	Critically Endangered (CR)	9	1
Threatened categories	Endangered (EN)	15	7
Threatened categories	Vulnerable (VU)	25	12
	Near Threatened (NT)	23	3
	Least Concern (LC)	180	48
	Data Deficient (DD)	37	17
	Total number of species assessed*	297	89

*Excluding 23 species that are considered Not Applicable as they are of marginal occurrence in the region.

Table 4. Threatened Mediterranean mammal species

Order	Family	Scientific name	Common name	Red List Category	Endemic?
CARNIVORA	CANIDAE	*Lycaon pictus*	African Wild Dog	CR	
CARNIVORA	FELIDAE	*Leptailurus serval*	Serval	CR	
CARNIVORA	FELIDAE	*Lynx pardinus*	Iberian Lynx	CR	Yes
CARNIVORA	FELIDAE	*Panthera pardus*	Leopard	CR	
CARNIVORA	MUSTELIDAE	*Mustela lutreola*	European Mink	CR	
CARNIVORA	PHOCIDAE	*Monachus monachus*	Mediterranean Monk Seal	CR	
CETARTIODACTYLA	BOVIDAE	*Gazella subgutturosa*	Goitered Gazelle	CR	
CETARTIODACTYLA	BOVIDAE	*Nanger dama*	Dama Gazelle	CR	
PERISSODACTYLA	EQUIDAE	*Equus africanus*	African Wild Ass	CR	
CARNIVORA	FELIDAE	*Acinonyx jubatus*	Cheetah	EN	
CARNIVORA	FELIDAE	*Lynx lynx*	Eurasian Lynx	EN	
CETARTIODACTYLA	BOVIDAE	*Gazella cuvieri*	Cuvier's Gazelle	EN	Yes
CETARTIODACTYLA	BOVIDAE	*Gazella dorcas*	Dorcas Gazelle	EN	
CETARTIODACTYLA	BOVIDAE	*Gazella leptoceros*	Slender-horned Gazelle	EN	
CETARTIODACTYLA	BOVIDAE	*Oryx leucoryx*	Arabian Oryx	EN	
CETARTIODACTYLA	BOVIDAE	*Ovis orientalis*	Urial	EN	
CHIROPTERA	VESPERTILIONIDAE	*Nyctalus azoreum*	Azores Noctule	EN	Yes
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus maderensis*	Madeira Pipistrelle	EN	Yes
CHIROPTERA	VESPERTILIONIDAE	*Plecotus teneriffae*	Canary Long-eared Bat	EN	Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura canariensis*	Canary Shrew	EN	Yes
PERISSODACTYLA	EQUIDAE	*Equus hemionus*	Asiatic Wild Ass	EN	
PRIMATES	CERCOPITHECIDAE	*Macaca sylvanus*	Barbary Macaque	EN	Yes
RODENTIA	MURIDAE	*Gerbillus hesperinus*	Western Gerbil	EN	Yes
RODENTIA	MURIDAE	*Meriones dahli*	Dahl's Jird	EN	
CARNIVORA	CANIDAE	*Vulpes cana*	Blanford's Fox	VU	
CARNIVORA	HYAENIDAE	*Hyaena hyaena*	Striped Hyaena	VU	
CARNIVORA	MUSTELIDAE	*Vormela peregusna*	European Marbled Polecat	VU	
CARNIVORA	URSIDAE	*Ursus arctos*	Brown Bear	VU	
CETARTIODACTYLA	BOVIDAE	*Ammotragus lervia*	Aoudad	VU	
CETARTIODACTYLA	BOVIDAE	*Capra aegagrus*	Wild Goat	VU	
CETARTIODACTYLA	BOVIDAE	*Capra nubiana*	Nubian Ibex	VU	
CETARTIODACTYLA	BOVIDAE	*Gazella gazella*	Mountain Gazelle	VU	
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus euryale*	Mediterranean Horseshoe Bat	VU	
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus mehelyi*	Mehely's Horseshoe Bat	VU	
CHIROPTERA	VESPERTILIONIDAE	*Myotis capaccinii*	Long-fingered Bat	VU	
CHIROPTERA	VESPERTILIONIDAE	*Plecotus sardus*	Sardinian Long-eared Bat	VU	Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura zimmermanni*	Cretan White-toothed Shrew	VU	Yes
EULIPOTYPHLA	TALPIDAE	*Galemys pyrenaicus*	Pyrenean Desman	VU	Yes
LAGOMORPHA	LEPORIDAE	*Lepus castroviejoi*	Broom Hare	VU	Yes
LAGOMORPHA	LEPORIDAE	*Lepus corsicanus*	Corsican Hare	VU	Yes
RODENTIA	CRICETIDAE	*Arvicola sapidus*	Southwestern Water Vole	VU	Yes
RODENTIA	CRICETIDAE	*Dinaromys bogdanovi*	Balkan Snow Vole	VU	Yes
RODENTIA	CRICETIDAE	*Mesocricetus auratus*	Golden Hamster	VU	Yes
RODENTIA	CRICETIDAE	*Prometheomys schaposchnikowi*	Long-clawed Mole Vole	VU	
RODENTIA	DIPODIDAE	*Allactaga tetradactyla*	Four-toed Jerboa	VU	Yes
RODENTIA	GLIRIDAE	*Myomimus roachi*	Roach's Mouse-tailed Dormouse	VU	Yes
RODENTIA	MURIDAE	*Gerbillus hoogstraali*	Hoogstraal's Gerbil	VU	Yes
RODENTIA	MURIDAE	*Meriones sacramenti*	Buxton's Jird	VU	Yes
RODENTIA	SCIURIDAE	*Spermophilus citellus*	European Ground Squirrel	VU	

3.4 Spatial distribution of species

3.4.1 Species richness

Information on the species richness of mammals within orders and families has already been given in Section 1.2 and Tables 1 and 2. The geographic distribution of mammal species richness in Mediterranean basin countries is presented in Figure 4. The mountainous parts of the region clearly stand out as areas of high species richness. In the European part of the Mediterranean, this includes the Pyrenees, Massif Central, Alps, Apennines, Carpathians, and the mountains of the Balkan peninsula. In Asian and African parts of the Mediterranean, this includes the mountains of Turkey, the Levant region, and the Atlas, Anti-Atlas and Rif ranges in north-west Africa. Looking at mammalian diversity from a country perspective, the top five countries in terms of species richness are (in descending order): Turkey, Morocco, Italy, Israel and France (see Table 7). Turkey has a particularly high species richness as it is a large country that spans several biogeographic regions. Although the Balkan region has very high species richness, the individual countries in this region are small and none of them appear in the top five.

3.4.2 Distribution of threatened species

A map showing the distribution of threatened mammals in the Mediterranean (Figure 5) reveals somewhat different patterns from depictions of overall species diversity. North-west Africa, Turkey and the Levant all hold important concentrations of threatened species. Although overall species richness in the Sahara is low, the proportion of threatened species there is high, in part as a result of the heavy pressure placed on the few species of desert antelopes by over-hunting.

Table 5. Red List Status (Mediterranean Regional level) by taxonomic order

Order	Total*	EX	RE	CR	EN	VU	NT	LC	DD	% threatened	% Extinct or Regionally Extinct
CARNIVORA	36		2	6	2	4	4	17	1	33.3	5.6
CETARTIODACTYLA**	25		5	2	5	4		8	1	44.0	20.0
CHIROPTERA	55				3	4	11	29	8	12.7	0.0
EULIPOTYPHLA	45				1	2	1	33	8	6.7	0.0
HYRACOIDEA	1							1		0.0	0.0
LAGOMORPHA	8	1				2	1	4		25.0	12.5
MACROSCELIDEA	1							1		0.0	0.0
PERISSODACTYLA	2			1	1					100.0	0.0
PRIMATES	1				1					100.0	0.0
RODENTIA	123				2	9	6	87	19	8.9	0.0
Total	**297**	**1**	**7**	**9**	**15**	**25**	**23**	**180**	**37**	**16.5**	**2.7**

* Does not include species classed as Not Applicable (NA).
** Terrestrial species only; excluding dolphins and whales.

Table 6. Mediterranean mammal species considered Extinct or Regionally Extinct

Order	Family	Scientific name	Common name	IUCN Red List category
LAGOMORPHA	PROLAGIDAE	*Prolagus sardus*	Sardinian Pika	Extinct
CARNIVORA	FELIDAE	*Panthera leo*	Lion	Regionally Extinct
CARNIVORA	FELIDAE	*Panthera tigris*	Tiger	Regionally Extinct
CETARTIODACTYLA	BOVIDAE	*Addax nasomaculatus*	Addax	Regionally Extinct
CETARTIODACTYLA	BOVIDAE	*Alcelaphus buselaphus*	Hartebeest	Regionally Extinct
CETARTIODACTYLA	BOVIDAE	*Oryx dammah*	Scimitar-horned Oryx	Regionally Extinct*
CETARTIODACTYLA	CERVIDAE	*Dama mesopotamica*	Mesopotamian Fallow Deer	Regionally Extinct
CETARTIODACTYLA	HIPPOPOTAMIDAE	*Hippopotamus amphibius*	Common Hippopotamus	Regionally Extinct

* This species is extinct as a wild species in the region, although there are still some populations in fenced enclosures.

Figure 4. Species richness of Mediterranean mammals

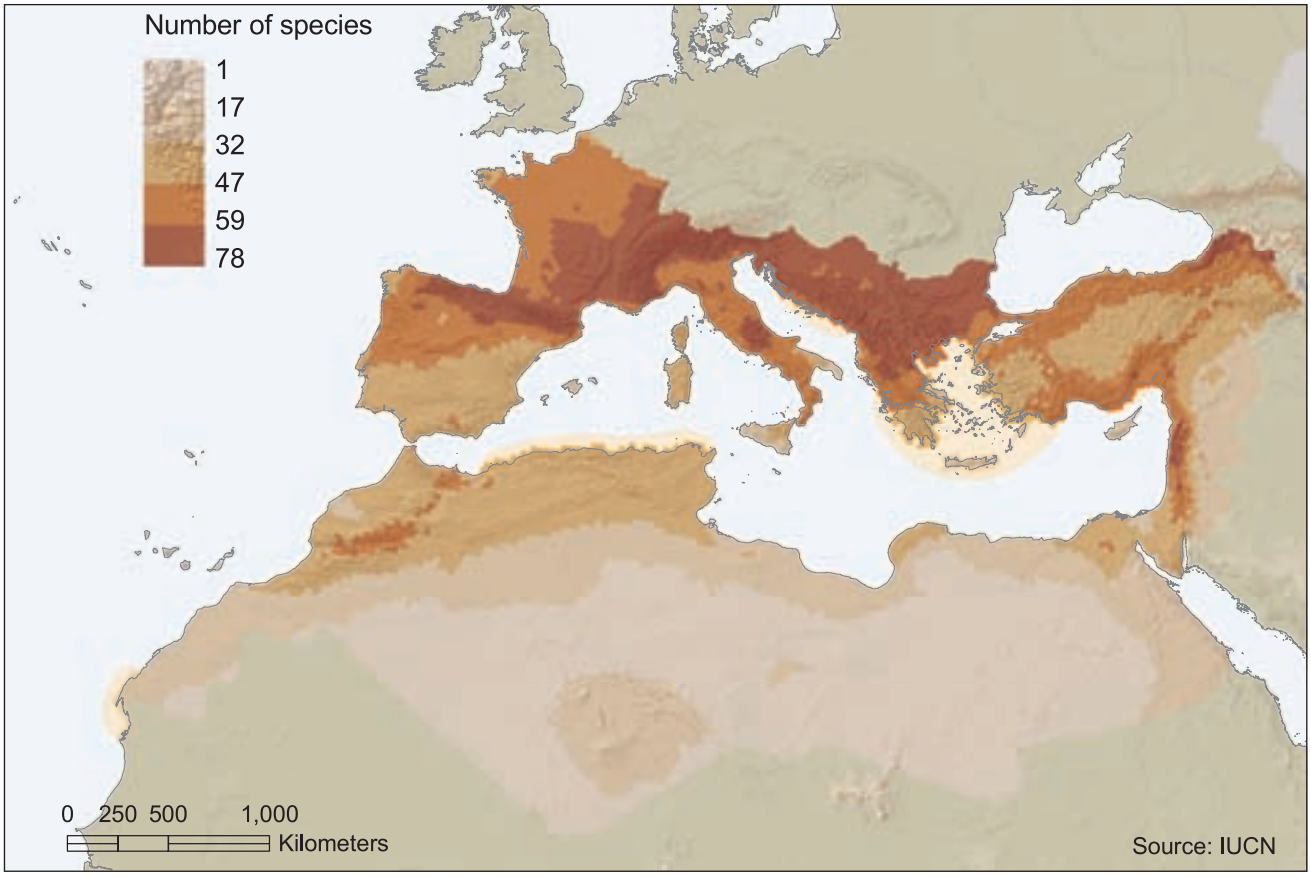
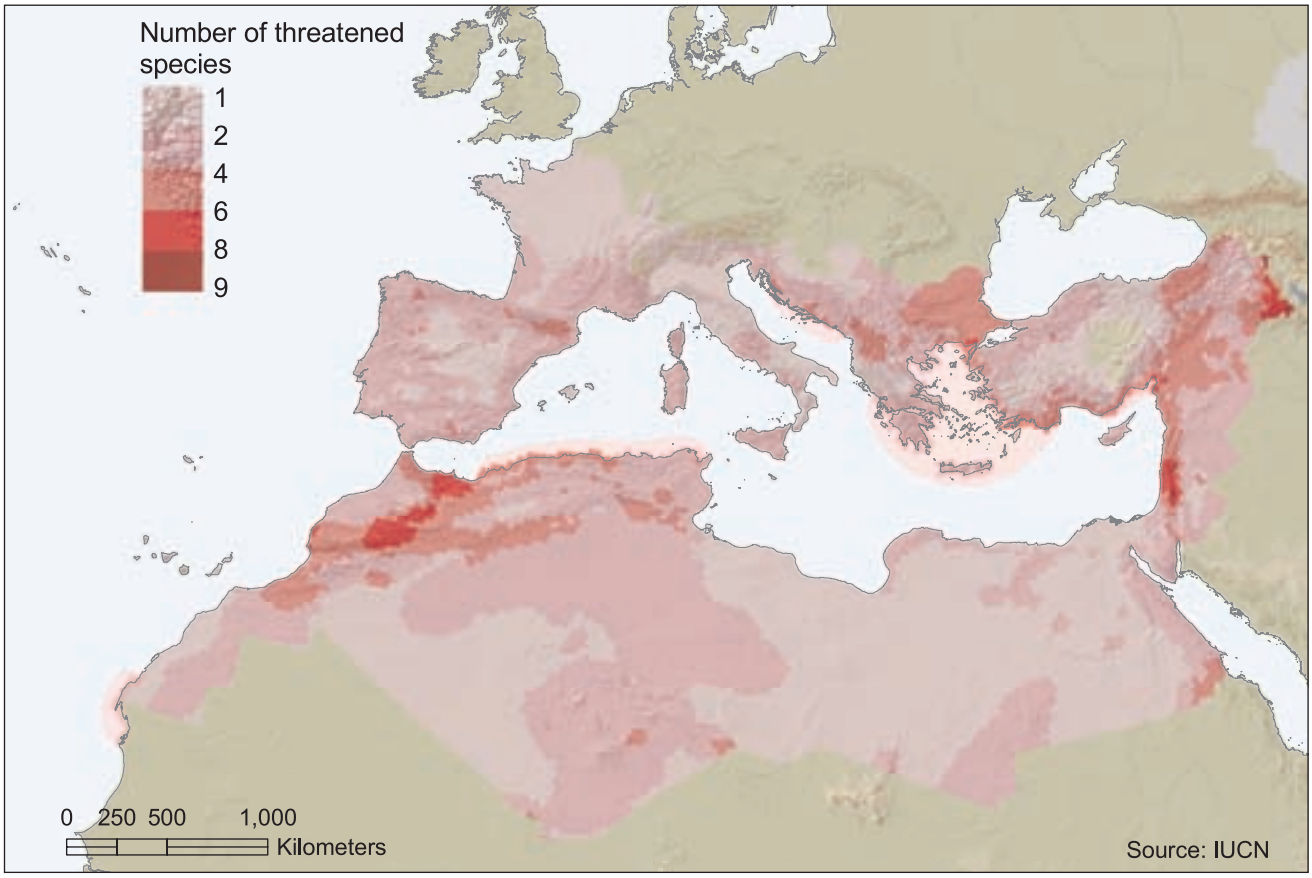


Figure 5. Distribution of threatened mammals in the Mediterranean



3.4.3 Endemic species richness

Figure 6 shows the distribution of endemic mammal species (ie, those that are unique to the Mediterranean and are found nowhere else in the world, see Table 1). Endemic species richness is particularly high in the Maghreb, although the Iberian and Italian peninsulas also hold important concentrations of endemic mammals, as do the Mediterranean islands.

Table 7. Number of mammal species in the countries and territories included in the Mediterranean assessment region

Name	Total number of species*	Number of endemic species*	Number of threatened species*
Albania	69	4	5
Algeria	95	19	14
Andorra	47	5	4
Bosnia and Herzegovina	78	4	7
Bulgaria	91	3	10
Croatia	88	3	9
Cyprus	26	2	3
Egypt	92	13	15
France	96	14	8
Greece	91	10	9
Israel	98	5	16
Italy	100	15	8
Jordan	78	1	14
Lebanon	63	2	9
Lybia	80	20	10
Macedonia, FYR	77	6	8
Malta	19	4	1
Monaco	28	1	1
Montenegro	86	6	9
Morocco	105	22	16
Palestinian Territories	27	1	5
Portugal	64	13	8
San Marino	27	1	2
Serbia	93	7	9
Slovenia	82	0	6
Spain	90	20	14
Switzerland	84	4	5
Syria	89	3	15
Tunisia	75	18	14
Turkey	144	11	17
Western Sahara	34	4	5

* Including species classed as Not Applicable (marginal occurrence). Including native and reintroduced species; excluding introduced species. Including extant, possibly extinct and extinct species (since 1500 A.D.); excluding species classed as "presence uncertain". This list includes all terrestrial mammal species plus the Mediterranean Monk Seal; it excludes cetaceans (dolphins and whales).

3.5 Major threats to terrestrial mammals in the Mediterranean

The major threats to each species were coded using the IUCN-Conservation Measures Partnership (CMP) Unified Classification of Direct Threats. In addition to the direct threats identified as actual or potential drivers of population change, accompanying non-exclusive stresses were coded with each threat to highlight how a threat impacts upon a population. A summary of the relative importance of the different threatening processes and the stresses that they cause is shown in Figures 7 and 8.

The threats to Mediterranean mammals are many and varied: agriculture, hunting and trapping, and invasive species are the most severe, respectively affecting 31 (65%), 29 (60%) and 24 (50%) threatened species. These create stresses on mammal populations in a range of ways, the most common being habitat destruction and degradation, which affect 43 (90%) threatened species (Figure 8).

The Balkan Snow Vole *Dinaromys bogdanovi* is considered to be Vulnerable (VU). It is endemic to the Mediterranean region, where it has a very limited and fragmented range. Photography © Boris Krystufek.

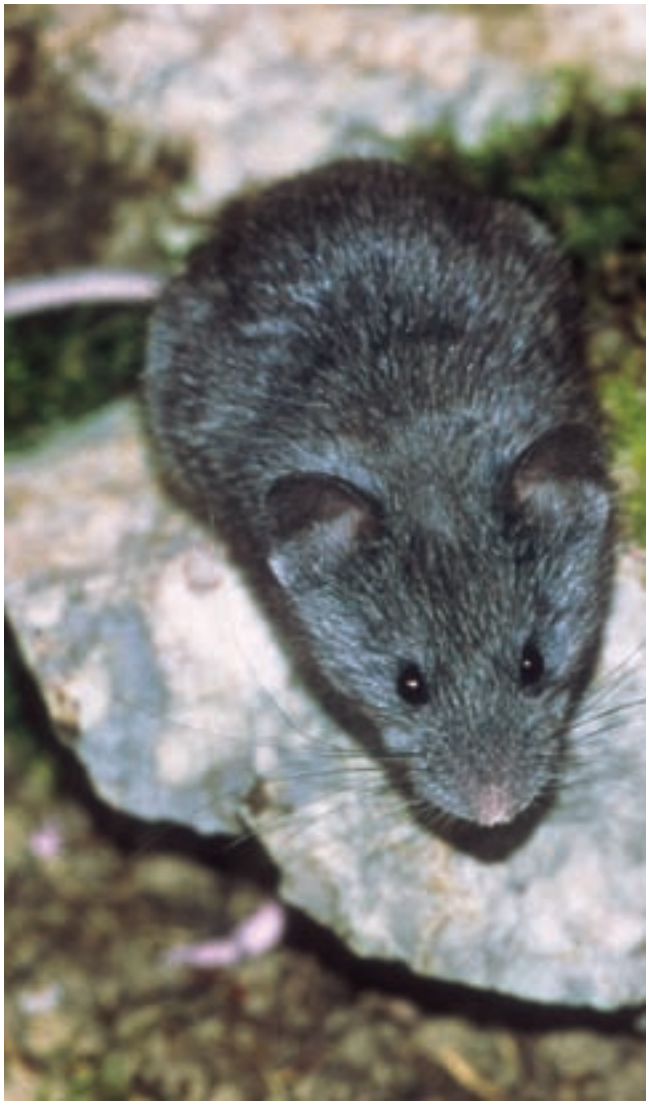


Figure 6. Endemic species richness of mammals in the Mediterranean

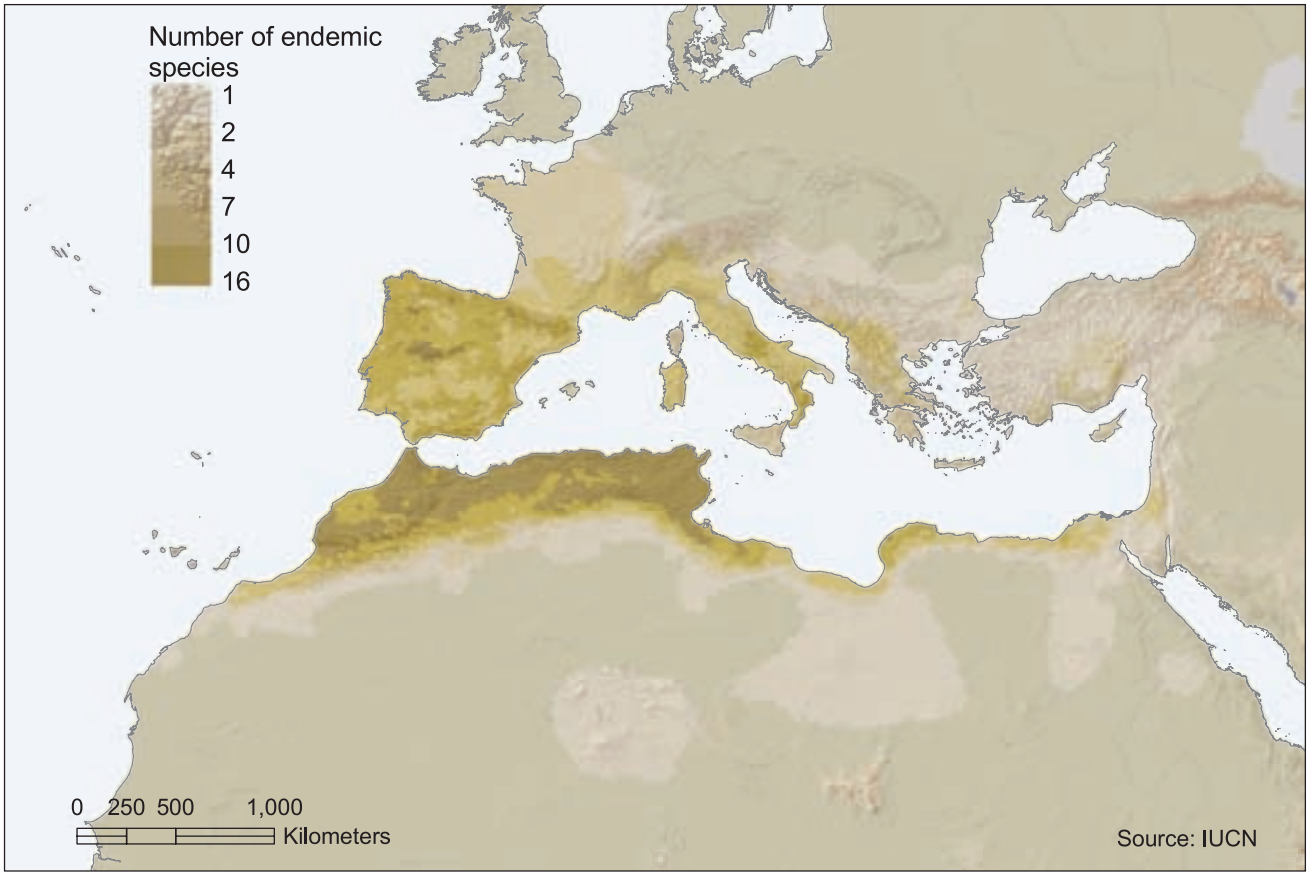
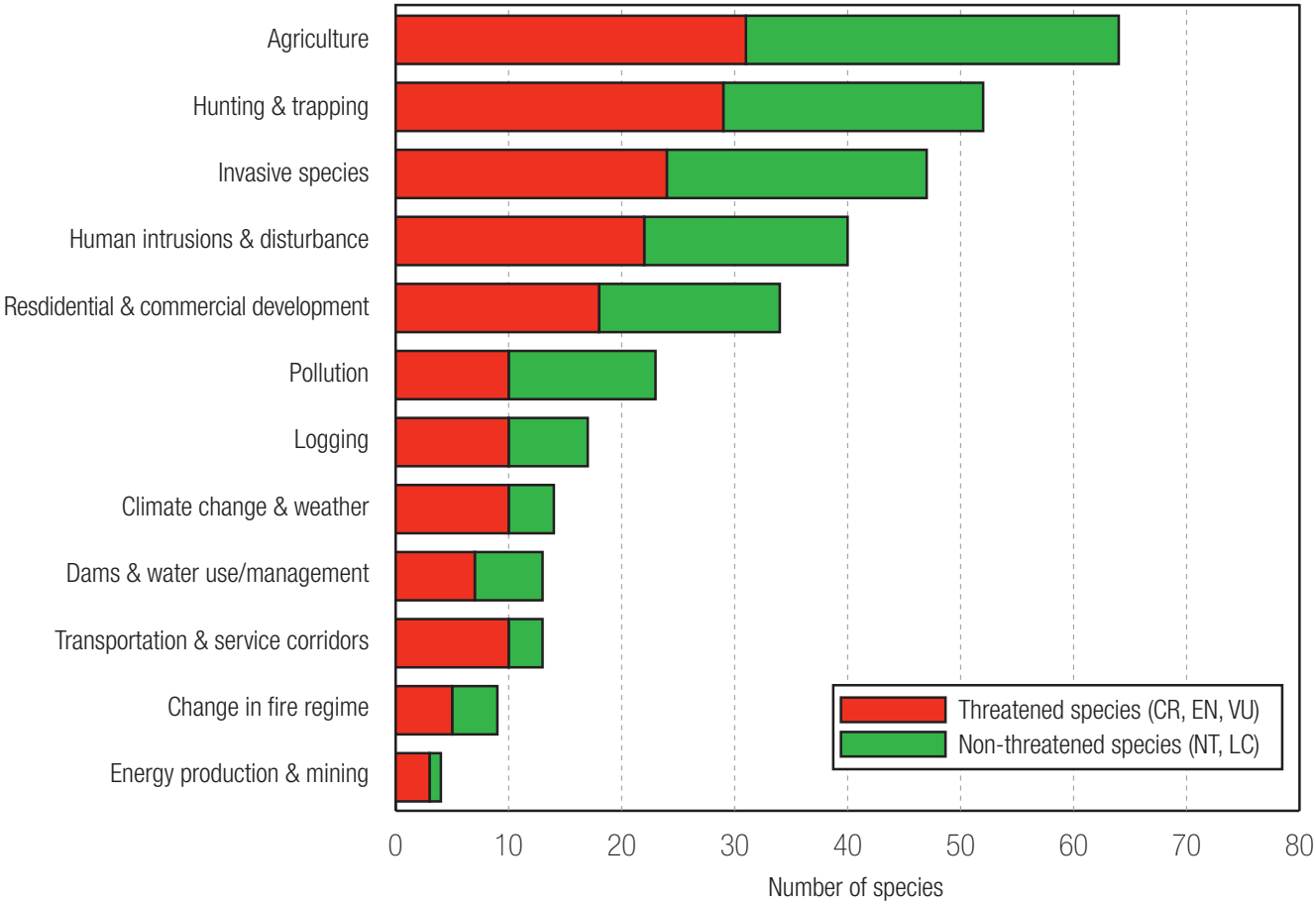


Figure 7. Main threats to terrestrial mammals in the Mediterranean region



3.6 Demographic trends

Documenting population trends is a key to assessing species status, and an effort was made to determine which species are believed to be declining, stable, or increasing. More than one-quarter (27%) of Mediterranean mammals are declining in population. A further 31% are stable, and only 3% are increasing (see Figure 9). A number of these increases are due to successful species-based conservation action (for example in the cases of the Iberian Wild Goat *Capra pyrenaica*, the Alpine Ibex *Capra ibex* and the Eurasian beaver *Castor fiber*). However, because trend information is not available for 40% of species, the percentage of species in decline may actually be considerably higher.

Figure 8. Main stresses on terrestrial mammals in the Mediterranean region

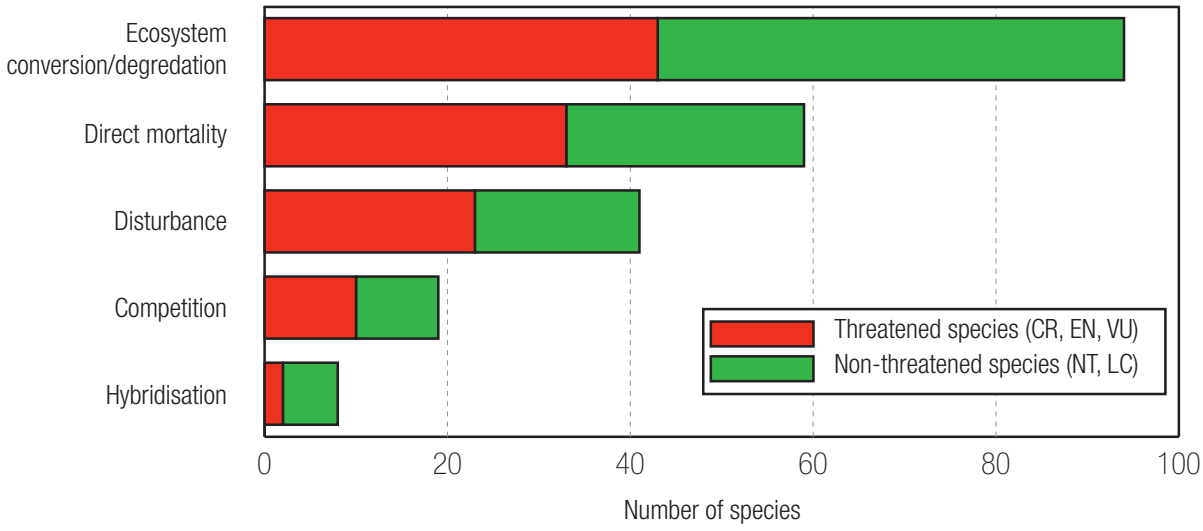
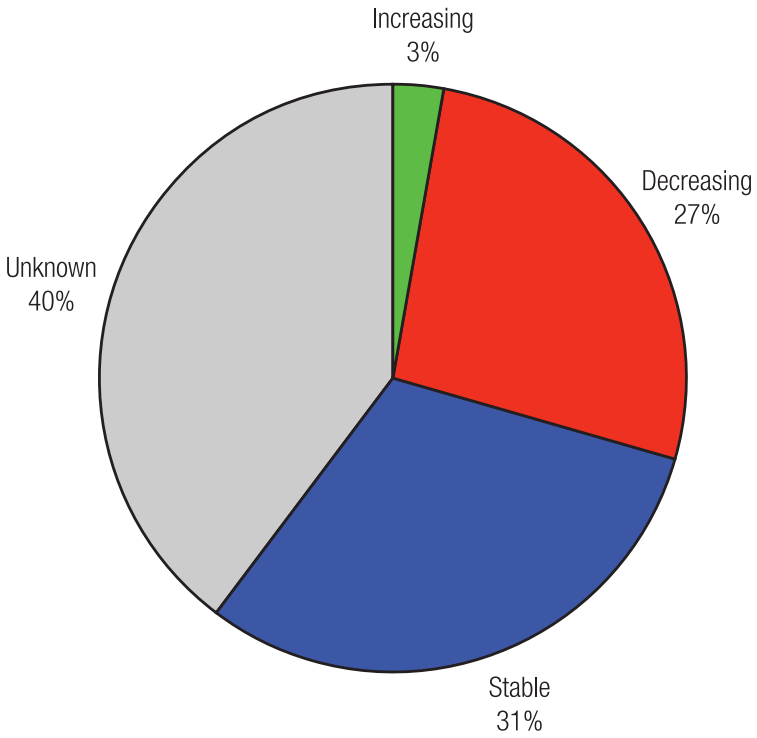


Figure 9. Population trends of Mediterranean mammals



4. Discussion

4.1 Status of Mediterranean mammals

The status of Mediterranean mammals was assessed at the regional level according to the IUCN Red List Categories and Criteria (IUCN 2001), the world's most widely used system for classifying species according to their extinction risk, and the *Guidelines for Application of IUCN Red List Criteria at Regional Levels* (IUCN 2003). All native species except cetaceans (whales and dolphins) were included. Overall, one-sixth (16%) of the 298 mammal species covered in this assessment were found to be threatened with extinction in the Mediterranean[2]. Of that total, 3% were Critically Endangered, 5% Endangered and 8% Vulnerable. A further 8% were considered Near Threatened, and 3% were already Extinct or Regionally Extinct.

By comparison with other Mediterranean species groups assessed to date, this is an intermediate level of threat. Previous assessments have shown that 56% of Mediterranean endemic freshwater fishes (Smith & Darwall 2006), 56% of dolphins and whales (Reeves and Notarbartolo di Sciara 2006), 42% of sharks and rays (Cavanagh & Gibson 2007), 36% of crabs and crayfish (Cuttelod *et al.* 2008), 29% of amphibians (Cox *et al.* 2006), 19% of dragonflies and damselflies (Riservato *et al.* 2009), 13% of reptiles (Cox *et al.* 2006) and 5% of birds (Cuttelod *et al.* 2008) are at risk of extinction.

Two small groups of mammals – odd-toed ungulates (Order Perissodactyla; represented in the region by the African Wild Ass and the Asiatic Wild Ass) and primates (Order Primates; one species, the Barbary Macaque) – show extremely high levels of threat with 100% of species threatened in each case. Equally alarming is the status of the even-toed ungulates (Order Cetartiodactyla), a well-known group including such species as antelopes, ibex, and wild sheep and goats. Of the 25 species from this group that are native to the Mediterranean, 11 (44%) are threatened with extinction and a further 5 (20%) are already extinct in the region. The threatened list includes all except one of the antelope species found in the region. Mediterranean carnivores and lagomorphs (rabbits and hares) also show a very high proportion of species to be threatened with extinction or already extinct.

Many of the threatened mammal species are endemic to the region, highlighting the responsibility that Mediterranean countries have to protect the entire global populations of these species. Of the 49 threatened species, 20 (41%) are unique to the region and occur nowhere else in the world.

4.2 Extinctions

By comparison with other taxonomic groups covered in the Mediterranean regional assessment (Cuttelod *et al.* 2008), a relatively high proportion of Mediterranean mammal species have been driven extinct or Regionally Extinct since 1500 A.D. as a result of human activities. This stands as a warning of the fate that may befall other Mediterranean mammals if effective conservation actions are not urgently implemented.

One endemic Mediterranean mammal species, the **Sardinian Pika** *Prolagus sardus*, is known to have gone extinct since 1500 A.D. It lived on the islands of Sardinia and Corsica until its extinction, which probably occurred in the late 1700s or early 1800s. It is thought that habitat loss, predation, and competition with alien invasive species were responsible for its extinction.

A further seven species (2.4% of the total number of species assessed) have been extirpated from the Mediterranean as a result of human activities and are considered Regionally Extinct.

The **Lion** *Panthera leo* formerly ranged from northern Africa through southwest Asia (where it disappeared from most countries within the last 150 years), west into Europe, where it apparently became extinct almost 2,000 years ago, and east into India (Nowell and Jackson 1996, Sunquist and Sunquist 2002). Lions were driven to extinction in North Africa by hunting and habitat loss; they perhaps survived in the High Atlas Mountains up to the 1940s (Nowell and Jackson 1996, West and Packer in press).

The **Tiger** *Panthera tigris* once ranged widely across Asia, from Turkey in the west to the eastern coast of Russia (Nowell and Jackson, 1996), but over the past 100 years they have disappeared from many areas and lost 93% of their historic range (Sanderson et al. 2006). Tigers in the Mediterranean region belonged to the extinct subspecies *P. t. virgata* (Caspian Tiger). Caspian Tigers and their large ungulate prey were found in the sparse forest habitats and riverine corridors west (Turkey) and south (Iran) of the Caspian Sea and west through Central Asia into Xinjiang, China (Nowell and Jackson 1996, Abdukadir and Breitenmoser 2008). Their extinction can be attributed to hunting of both tigers and their prey, habitat loss and conversion, and increased vulnerability of small populations (Sunquist et al. 1999). The last Caspian Tiger was seen in the early 1970s, and there are none in captivity

[2] Excluding species assessed as Not Applicable.

The Iberian Wild Goat *Capra pyrenaica* is a species native to Spain and considered as Least Concern (LC). It is abundant in its range and currently expanding as a result of conservation actions and habitat changes resulting from rural abandonment. Hunting reservations and protected areas have played a crucial role in this species' recovery. Photograph © Pedro Regato.

(Nowell and Jackson 1996). The last definite record from the Mediterranean region is from an individual killed in 1970 and photographed in Uludere in Hakkari province (south-east Turkey) (Baytop 1973).

Addax *Addax nasomaculatus* were formerly widespread in the Sahelo-Saharan region of Africa, west of the Nile Valley, and present in suitable habitats in all countries sharing the Sahara Desert (including the Mediterranean countries of Egypt, Libya, and Algeria) (Newby in press). As with other ungulates of the Sahelo-Saharan fauna, the Addax has undergone an unprecedented reduction in geographical range over the past century as a result of hunting and habitat loss, and today the only known remaining population survives in the Termit/Tin Toumma region of Niger.

Hartebeest *Alcelaphus buselaphus* formerly ranged from North Africa and the Middle East throughout the savannas, grasslands and miombo woodlands of Africa down to the tip of southern Africa. In North Africa, the Bubal Hartebeest (subspecies *A. b. buselaphus*) occurred in Morocco, Algeria, southern Tunisia, Libya, and parts of the Western Desert in Egypt (the precise southern limits of distribution are not known). Bubal Hartebeest are now Extinct, the last animals having been shot between 1945 and 1954 in Algeria (De Smet 1989). The last report from southern Morocco was possibly around 1945 (Panouse 1957).

The **Scimitar-horned Oryx** *Oryx dammah* was formerly widespread across North Africa, at least in arid and Saharan areas, but it is now Extinct in the Wild over all its range, and Regionally Extinct in the Mediterranean. An estimated 500 Oryx survived at least until 1985 in Chad and Niger, but by 1988 only a few dozen individuals survived in the wild and since then there have been no confirmed reports (Morrow in press). Captive herds are kept in fenced protected areas in Tunisia, Senegal and Morocco (Sous Massa National Park; probably outside the known historical range) as part of long-term reintroduction programmes. Overhunting and habitat loss, including competition with domestic livestock, have been reported as the main reasons for the extinction of the wild population of Scimitar-horned Oryx (Mallon and Kingswood 2001, Devillers and Devillers-Terschuren 2005, Morrow in press).

The **Persian Fallow Deer** *Dama mesopotamica* formerly occurred in Iran, Iraq, Israel, Jordan, Lebanon, Occupied Palestinian Territories, Syria and eastern Turkey (Hemami

The Long-eared Hedgehog *Hemiechinus auritus* is a solitary, nocturnal species that hibernates in winter and lives in burrows. It is listed as Least Concern (LC) in the Mediterranean region. Photograph © Ahmet Karatas.

and Rabiei 2002). By 1875 it was restricted to south-western and western Iran, having disappeared from the rest of its range. It was considered extinct, but a small population was rediscovered in south-western Iran in 1956. The only surviving indigenous wild populations are in Dez Wildlife Refuge and Karkeh Wildlife Refuge in south-western Iran. There is a small reintroduced population in Israel, but these animals are hybrids with the European Fallow Deer *D. dama*. Poaching and habitat destruction are two of the main threats that led to the Persian Fallow Deer's long decline and disappearance from the Mediterranean region.

The **Common Hippopotamus** *Hippopotamus amphibius* was formerly found in Egypt, although it was already rare by the time of the Renaissance. From the end of the Roman Empire up until towards 1700 at the latest, the hippo was still present in two disjunct zones in the Nile Delta and in the upper Nile. Through the 1700s, records become increasingly scarce, and the latest definite records are from the early 1800s (Manlius 2000). Common Hippos remain widespread in sub-Saharan Africa, but they have undergone significant declines in recent years as a result of illegal and unregulated hunting for meat and ivory (found in the canine teeth) and habitat loss. These same threats are probably responsible for the disappearance of the species from the Mediterranean region.

The **Red Gazelle** *Eudorcas rufina* is listed in some sources as an extinct species, but here it is classed as Data Deficient owing to uncertainty about whether it is a valid species. The **African Wild Ass** *Equus africanus* is considered to be extinct in the Western Palaearctic by some authors (e.g., Aulagnier *et al.* 2008), but it is here listed as Critically Endangered as there have not yet been exhaustive searches to confirm that the last individuals have disappeared from the region; however it is likely that this species is already extinct in the Mediterranean.

4.3 Major threats to Mediterranean mammals

The most significant threat to mammals in the Mediterranean region is the destruction and degradation of the ecosystems and habitats on which they depend. Main causes of habitat loss and degradation include expansion and intensification of agriculture, urbanization, infrastructure development, pollution and climate change.

Looking at the information on threats in more detail, it becomes apparent that although there are many similarities and common patterns that can be drawn, there are also some important differences between different species of mammals in terms of which threats are causing population declines and consequently which kind of conservation measures need to be put in place.

For **bats**, as for many mammal species, loss of natural and semi-natural foraging habitats is a major problem. Specifically, the expansion and intensification of agricultural activities combined

with poor land management practices has led to a significant reduction in the amount of suitable foraging habitat, as well as to declines in prey species (for example, insects, which have decreased in abundance as a result of the widespread use of insecticides). Destruction of riverside vegetation is a particular problem, as many bat species forage along watercourses.

Many bat species congregate to roost and breed, in a variety of sites (depending on the species) including caves, hollow trees and buildings. The disturbance and destruction of roosting and breeding sites has a negative impact on many species. This disturbance and destruction can occur as a result of a variety of human activities, for example:

- Tourism and activities of speleologists in caves
- Caves being used by herders (used as shelters for livestock and lighting of fires)
- Placing inappropriate gates across cave entrances
- Wood treatment in roofs of buildings
- Conversion of attics
- Restoration of buildings and bridges
- Removal of old trees from forests, parks and gardens

In addition to the loss, fragmentation and degradation of the habitats they rely on, bats suffer direct mortality as a result of deliberate persecution – they are sometimes considered as pests and are killed by fruit farmers, or their colonies in buildings are destroyed. In parts of the Mediterranean region, some cave-dwelling species are still hunted for traditional medicinal purposes. Mortality due to wind farms is an increasing threat.

For **non-volant (flightless) small mammals**, habitat loss is again by far the most important threat. Species often depend upon a specific habitat type, and consequently they are particularly vulnerable to any change in land use that results in significant change to that habitat. For example, many small mammals depend upon open grassland or steppe habitats. These are under threat in the Mediterranean region owing to a combination of factors. In some areas, agricultural encroachment and intensification is the main problem, as natural steppe grassland is replaced by intensive arable fields. In other areas, the problem is the abandonment of traditional non-intensive agriculture – land that is no longer grazed or mowed rapidly undergoes succession from open grassland to scrub, which is less suitable for a number of small mammal species.

It is a general pattern that excessive use of pesticides and insecticides is harmful to small mammal species, particularly species that feed upon insects and other invertebrates and that consequently may be accidentally poisoned as a result of eating contaminated prey. Additionally, deliberate persecution may cause localized declines, and some small mammal species are hunted and eaten as food.

For **large mammals** (especially cats, canids, antelopes and deer), habitat loss and degradation has significant negative effects on many species, but is overtaken in importance by direct mortality deliberately caused by humans – overexploitation, poaching and persecution. In addition to deliberate killing and capture, large mammals are accidentally killed (for example, through indiscriminate and uncontrolled use of poisoned bait or as a result of collision with cars). Habitat fragmentation is a particular problem for large mammal species that depend upon the availability of relatively large expanses of suitable habitat. Competition with expanding numbers of domestic livestock is another threat, as is the attendant habitat degradation through overgrazing that livestock may cause.

Finally, an important threat to all mammal species in the region is desertification and decreased availability of and access to water. This is already a major problem in some drier areas, and its scope and severity is set to increase in future as human populations in the region continue to grow, as agriculture becomes more intensive and demanding in terms of the amount of water used for irrigation, and as the impacts of climate change increase.

4.4 Protection of habitats and species in the Mediterranean

At the international level, Mediterranean countries are signatories to a number of important conventions aimed at conserving biodiversity that have particular relevance for mammals, including the 1979 Bern Convention on the Conservation of European Wildlife and Natural Habitats, the 1979 Bonn Convention on Migratory Species, the 1995 Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and, most importantly, the 1992 Rio Convention on Biological Diversity.

The Bern Convention supports the conservation and sustainable use of species and habitats. The Convention is a binding legal treaty covering the majority of states considered to belong to the Mediterranean region for the purposes of this assessment, including North African countries and Turkey. Considerable work has been undertaken within the Convention for the protection of mammal species, especially large carnivores. Apart from numerous workshops and seminars, the Convention has adopted recommendations and developed Action Plans for certain species (e.g., certain large carnivore and bat species).

Under the framework of the Convention on Migratory Species (CMS), there are several key regional agreements or initiatives for mammals:

- **Conservation of populations of European Bats** (EUROBATS)
- **Conservation of the Cetaceans of the Mediterranean Sea, Black Sea and Contiguous Atlantic Area** (ACCOBAMS)
- **Conservation of Sahelo-Saharan Antelopes**

Under the Barcelona Convention, specific Action Plans have been developed for Mediterranean cetaceans and the Mediterranean Monk Seal.

The European mink *Mustela lutreola* is listed as Critically Endangered (CR) due to an ongoing population reduction caused by habitat loss and the effects of introduced species. There is considerable uncertainty about the numbers remaining today and further research is necessary to assess the current population status and rate of decline. Photograph © Tiit Maran.

Mediterranean countries have committed themselves to a more effective and coherent implementation of the three objectives of the Convention on Biological Diversity. More specifically, they have made the important commitment "to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth". European countries and the EU have gone even further, with a commitment to halt the loss of biodiversity within Europe by 2010. This means that population declines should be stemmed and ideally reversed, and that extinctions should be prevented. This assessment indicates that a large number of species show a long term decline, with a proportion of threatened species that exceeds levels identified for other Mediterranean species groups such as reptiles and birds. Nine Mediterranean mammals are Critically Endangered, standing on the brink of regional or even global extinction. On the basis of this evidence, it seems unlikely that the 2010 target will be met, and a significant increase in conservation activity and investment is needed to ensure that rates of biodiversity loss are reduced in future.

4.5 Anthropochorous taxa and conservation priorities

Anthropochorous taxa have been defined as "introduced populations that have been formally described taxonomically" (Gippoliti and Amori 2002). The Mediterranean Basin, one of the 34 global biodiversity hotspots recognized by Mittermeier *et al*. (2004), probably has more anthropochorous taxa than any other part of the world (Gippoliti and Amori 2006). Human civilizations have been continually present in this region for at least 9,000 years, causing widespread damage and destruction of natural habitats, and intentionally or unintentionally transporting animals and plants between different island and mainland locations. Mediterranean islands once were home to an array of unique endemic mammals, including dwarf elephants and hippos (Kotsakis 1990, Vigne 1992, Palombo 1996), but in part as a result of human activities almost all of these endemic mammal species are now extinct (Vigne *et al*. 1997, Simmons 1999, Gippoliti and Amori 2006), and it has been contended that as few as three ancient endemic species still survive (two shrews and one mouse: Gippoliti and Amori 2006). The modern mammal fauna of Mediterranean islands consists largely of populations introduced in ancient or modern times by man, although some of these populations have been isolated for so long that they are phenotypically distinct from mainland forms and have been recognized at the subspecific or even specific level. Two examples of anthropochorous taxa found on Mediterranean islands are the agrimi and the mouflon. These taxa are listed on Annexes II and IV of the Habitats Directive (consequently requiring strict protection and the designation of protected areas), under the names "*Capra aegagrus* (natural populations)", "*Ovis gmelini musimon* (*Ovis ammon musimon*) (natural populations – Corsica and Sardinia)", and *Ovis orientalis ophion (Ovis gmelini ophion)*. A number of genetic and archaeozoological studies suggest that they are feral populations of ancient domestic livestock (e.g., Groves 1989, Vigne 1994, Hiendleder *et al.* 1998, Manceau *et al.* 1999, Kahila bar-Gal *et al.* 2002), and should be included in the respective domestic species (Gentry *et al.* 1996, Gentry *et al.* 2004), although this view is not universally accepted. By contrast, two out of the three Mediterranean island species identified as genuine palaeoendemics by Gippoliti and Amori (2006), namely *Crocidura zimmermanni* and *Mus cypriacus*, are not listed on the Habitats Directive Annexes.

There has been a historical tendency in the Mediterranean region and worldwide for conservation interventions to focus on large mammals and birds. In some areas, including the Mediterranean (which, it should be remembered, qualifies as a hotspot as a consequence of the high endemism of its vascular plants and the high rate of habitat loss), there is evidence to suggest that a

disproportionate focus on large mammal conservation may have a detrimental effect on other biodiversity values (see Gippoliti and Amori 2004, 2006 and references therein for examples). For example, mouflon continue to be introduced to Mediterranean islands (including protected areas) because they are considered typical of the region (Gippoliti and Amori 2006), even though there is evidence that overgrazing has a significant negative impact on native plants (Fabbri 1966, Greuter 1979, Gippoliti and Amori 2004), and many small Mediterranean islands are regarded as conservation priorities because of the lack of anti-grazing adaptations in the endemic plants (Greuter 2001). It is important that any conservation strategy aimed at maintaining biodiversity and its evolutionary potential takes into account the history (including recent history) of the regional biota, and makes an effort: (1) to identify and direct attention towards ancient endemic species that escaped previous extinction events and are the repository of unique phylogenetic information; and (2) to strike an appropriate balance between conserving large, charismatic mammals (that may in some cases be relatively recent additions to the regional fauna) and protecting other forms of native biodiversity.

4.6 Conservation measures needed

Species frequently require a combination of conservation responses to ensure their continued survival. These responses include legislation, monitoring, research, management of populations, restoration of balance between prey/predator populations, habitat conservation and restoration, land acquisition and management, and even captive breeding and benign introductions for some of the Mediterranean region's most threatened mammal species. For species threatened across their range, limited or local actions are unlikely to be sufficiently strong or coherent to prevent extinction, and coordinated action is required at the regional level. Although this Red List assessment focused on the status of individual species, effective conservation action needs to focus not just on species but also on sites in the wider landscape, considering the heterogeneous and dynamic nature of large territories on which the survival of species depends (the ability to meet species requirements inside and outside protected areas, among different land uses, integrating use and protection across the landscape). In this way, efforts to protect Mediterranean mammals can benefit all Mediterranean species.

As discussed in Section 4.3, a variety of threatening processes are driving species decline and extinction, and the relative importance of these threats varies across different taxa (although there are some important commonalities such as the primary role of habitat loss and degradation in causing species decline). Consequently, the specific conservation measures to be recommended vary between different species and groups of species. The following text gives further detail on the types of measures that are required. This list is by no means exhaustive; further information on the conservation needs of particular species and taxonomic groups (e.g. canids) can be found in the "Conservation Actions" section of each individual species factsheet[3], in the series of Conservation Action Plans produced by IUCN Species Survival Commission's Specialist Groups[4], and in the Action Plans produced under the Bern Convention for certain priority species in the region.

3 Available online at www.iucnredlist.org

4 IUCN SSC Conservation Action Plans have been produced for a wide range of Mediterranean species and are freely available for download from the following website, where a complete list can be found: www.iucn.org/about/work/programmes/species/publications___technical_documents/publications/species_actions_plans/

The Edible Dormouse *Glis glis* is widely distributed from northern Spain through central and eastern Europe and assessed as Least Concern (LC) in the Mediterranean region. This species was traditionally hunted for subsistence and trade. Photograph © Boris Krystufek.

For **bats**, the main recommendations on the conservation measures needed are to improve the legal protection framework – all bat species should be legally protected in the Mediterranean region – and to better enforce the existing legislation, for example on the illegal destruction of roosts sites. Another major conservation need relates to the encouragement of more environmentally friendly practices, in particular in agriculture – promoting organic farming (or at least a limited use of pesticides), maintaining old trees, and preserving riparian vegetation, hedgerows and linear habitats to promote connectivity – but also when restoring buildings, through taking into consideration bats' requirements and using non-toxic chemicals for treating timber in roofs. Additionally, dispelling myths about bats and increasing awareness of their ecological importance would improve the image of these species and be a first step towards stopping their persecution. Further research is needed on a number of issues including habitat and foraging requirements, population size and trends, impacts of pesticide use on prey species (such as locusts), and methods to minimize impacts of wind farms; such research would help in targeting conservation actions more effectively.

For **non-volant** (flightless) **small mammals** more sustainable agricultural practices are again needed, especially in temperate grassland (steppe) habitats, to prevent habitat loss and degradation both from agricultural intensification and land abandonment. Specific legislation and enforcement of existing measures is needed to prevent the introduction of alien invasive species (as pets or for commercial purposes), as several well-known cases such as that of the American Mink *Neovison vison* have demonstrated the negative impacts of such imports. Conservation actions should also be aimed at actively raising public awareness of the diversity, importance and threats to small mammals in order to modify their "pest" image and explain their ecological importance. As a number of non-volant small mammals are associated with freshwater ecosystems, measures targeted towards water management (groundwater extraction, artificial banks, dam construction, etc.) should take into consideration the ecological requirements of these species. Finally, further research should be encouraged, including on taxonomy which remains poorly resolved for a number of species.

For **large mammals**, recommendations include the improvement of management of protected areas (especially through well-trained, empowered and motivated staff) and of the wider environment to ensure that it is wildlife-friendly and that connectivity between different populations of the same

The Middle East Blind Mole Rat *Spalax ehrenbergi* is considered as Data Deficient (DD). It inhabits dry steppes, semi-desert and cultivated fields in coastal north-east Libya and central coastal Egypt. It is widespread in the eastern Mediterranean and ranges north into Turkey. Photograph © Boris Krystufek.

species are ensured (for example through corridors). Illegal, uncontrolled, or inadequately regulated hunting is a major problem that has already driven a number of large mammal species to extinction or near-extinction in the Mediterranean region – better enforcement of existing laws and regulations is needed to counter this threat and new legislation may be required in some cases. Several legislative frameworks are addressing large mammals, but efforts should be made to improve the enforcement of these agreements. Species-specific management plans (including the reintroduction of animals in the wild, following IUCN Guidelines for Re-Introductions (IUCN 1998)) have proven to be powerful tools. Additional field studies and monitoring are also needed, in particular in North Africa and the Middle East.

Restoring habitats and wild prey populations at the landscape level is a key component for the conservation of threatened large carnivores, requiring significant efforts in trans-boundary cooperation. In the case of large herbivores spatial planning, policy and management efforts for the maintenance of managed grazing systems (i.e. preventing rural abandonment and the conversion of grasslands into scrubland) and the altitudinal gradient of habitat requirements is a key conservation measure. Furthermore, education and public involvement programmes among national, regional or local governmental officials (and also among the general public) are needed to raise awareness on the value and best practice for management of large mammals. Large carnivores are very controversial from both a social and an economic standpoint (many people feel frightened by wolves and bears, and large carnivores are frequently blamed for killing livestock), and therefore their conservation is as much a socio-political issue as a biological one. Understanding people's attitudes towards predators and gaining their acceptance is crucial to the success of conservation and management programmes. Innovative ways to manage livestock and compensation payments to cover farmers' losses may be a useful means of gaining local people's acceptance about the current trend of natural re-colonization of large carnivores over large territories in northern Mediterranean countries. Tourism is a growing activity which, when properly managed, has a high potential to raise awareness and demonstrate socio-economic benefits of the maintenance of the large mammal populations that are iconic features of the Mediterranean region's rich and beautiful landscapes.

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Appendix 1. Red List status of Mediterranean Mammals

Order	Family	Scientific name	IUCN Red List Category (Mediterranean)*	IUCN Red List Criteria	Endemic to the region?
CARNIVORA	CANIDAE	*Canis aureus*	Least Concern		
CARNIVORA	CANIDAE	*Canis lupus*	Least Concern		
CARNIVORA	CANIDAE	*Lycaon pictus*	Critically Endangered	C2a(i);D	
CARNIVORA	CANIDAE	*Vulpes cana*	Vulnerable	D1	
CARNIVORA	CANIDAE	*Vulpes rueppellii*	Least Concern		
CARNIVORA	CANIDAE	*Vulpes vulpes*	Least Concern		
CARNIVORA	CANIDAE	*Vulpes zerda*	Least Concern		
CARNIVORA	FELIDAE	*Acinonyx jubatus*	Endangered	D	
CARNIVORA	FELIDAE	*Caracal caracal*	Near Threatened		
CARNIVORA	FELIDAE	*Felis chaus*	Data Deficient		
CARNIVORA	FELIDAE	*Felis margarita*	Near Threatened		
CARNIVORA	FELIDAE	*Felis silvestris*	Least Concern		
CARNIVORA	FELIDAE	*Leptailurus serval*	Critically Endangered	C2a(i)	
CARNIVORA	FELIDAE	*Lynx lynx*	Endangered	C2a(i)	
CARNIVORA	FELIDAE	*Lynx pardinus*	Critically Endangered	C2a(i)	Yes
CARNIVORA	FELIDAE	*Panthera leo*	Regionally Extinct	A2abcd	
CARNIVORA	FELIDAE	*Panthera pardus*	Critically Endangered	C2a(i)	
CARNIVORA	FELIDAE	*Panthera tigris*	Regionally Extinct	A2bcd+4bcd; C1+2a(i)	
CARNIVORA	HERPESTIDAE	*Herpestes ichneumon*	Least Concern		
CARNIVORA	HERPESTIDAE	*Ichneumia albicauda*	Not Applicable		
CARNIVORA	HYAENIDAE	*Hyaena hyaena*	Vulnerable	C1	
CARNIVORA	HYAENIDAE	*Proteles cristata*	Least Concern		
CARNIVORA	MUSTELIDAE	*Ictonyx libyca*	Least Concern		
CARNIVORA	MUSTELIDAE	*Lutra lutra*	Near Threatened		
CARNIVORA	MUSTELIDAE	*Martes foina*	Least Concern		
CARNIVORA	MUSTELIDAE	*Martes martes*	Least Concern		
CARNIVORA	MUSTELIDAE	*Meles meles*	Least Concern		
CARNIVORA	MUSTELIDAE	*Mellivora capensis*	Near Threatened		
CARNIVORA	MUSTELIDAE	*Mustela erminea*	Least Concern		
CARNIVORA	MUSTELIDAE	*Mustela eversmanii*	Not Applicable		
CARNIVORA	MUSTELIDAE	*Mustela lutreola*	Critically Endangered	A2ce	
CARNIVORA	MUSTELIDAE	*Mustela nivalis*	Least Concern		
CARNIVORA	MUSTELIDAE	*Mustela putorius*	Least Concern		
CARNIVORA	MUSTELIDAE	*Mustela subpalmata*	Least Concern		Yes
CARNIVORA	MUSTELIDAE	*Vormela peregusna*	Vulnerable	A2c	
CARNIVORA	PHOCIDAE	*Monachus monachus*	Critically Endangered	A2abc;C2a(i);E	
CARNIVORA	URSIDAE	*Ursus arctos*	Vulnerable	C2a(i)	
CARNIVORA	VIVERRIDAE	*Genetta genetta*	Least Concern		
CETARTIODACTYLA	BOVIDAE	*Addax nasomaculatus*	Regionally Extinct	A2cd;C1+2a(ii)	
CETARTIODACTYLA	BOVIDAE	*Alcelaphus buselaphus*	Regionally Extinct		
CETARTIODACTYLA	BOVIDAE	*Ammotragus lervia*	Vulnerable	C1	
CETARTIODACTYLA	BOVIDAE	*Capra aegagrus*	Vulnerable	A2cd	
CETARTIODACTYLA	BOVIDAE	*Capra ibex*	Least Concern		
CETARTIODACTYLA	BOVIDAE	*Capra nubiana*	Vulnerable	C1+2a(i)	
CETARTIODACTYLA	BOVIDAE	*Capra pyrenaica*	Least Concern		Yes
CETARTIODACTYLA	BOVIDAE	*Eudorcas rufina*	Data Deficient		
CETARTIODACTYLA	BOVIDAE	*Gazella cuvieri*	Endangered	C2a(i)	Yes
CETARTIODACTYLA	BOVIDAE	*Gazella dorcas*	Endangered	A2cd	

Order	Family	Scientific name	IUCN Red List Category (Mediterranean)*	IUCN Red List Criteria	Endemic to the region?
CETARTIODACTYLA	BOVIDAE	*Gazella gazella*	Vulnerable	A1abd	
CETARTIODACTYLA	BOVIDAE	*Gazella leptoceros*	Endangered	C2a(i)	
CETARTIODACTYLA	BOVIDAE	*Gazella subgutturosa*	Critically Endangered	C2a(i)	
CETARTIODACTYLA	BOVIDAE	*Nanger dama*	Critically Endangered	C2a(i);D	
CETARTIODACTYLA	BOVIDAE	*Oryx dammah*	Regionally Extinct		
CETARTIODACTYLA	BOVIDAE	*Oryx leucoryx*	Endangered	D	
CETARTIODACTYLA	BOVIDAE	*Ovis orientalis*	Endangered	B2ab(iii,v)	
CETARTIODACTYLA	BOVIDAE	*Rupicapra pyrenaica*	Least Concern		Yes
CETARTIODACTYLA	BOVIDAE	*Rupicapra rupicapra*	Least Concern		
CETARTIODACTYLA	CERVIDAE	*Capreolus capreolus*	Least Concern		
CETARTIODACTYLA	CERVIDAE	*Cervus elaphus*	Least Concern		
CETARTIODACTYLA	CERVIDAE	*Dama dama*	Least Concern		Yes
CETARTIODACTYLA	CERVIDAE	*Dama mesopotamica*	Regionally Extinct	D	
CETARTIODACTYLA	HIPPOPOTAMIDAE	*Hippopotamus amphibius*	Regionally Extinct		
CETARTIODACTYLA	SUIDAE	*Sus scrofa*	Least Concern		
CHIROPTERA	EMBALLONURIDAE	*Taphozous nudiventris*	Least Concern		
CHIROPTERA	EMBALLONURIDAE	*Taphozous perforatus*	Least Concern		
CHIROPTERA	HIPPOSIDERIDAE	*Asellia tridens*	Least Concern		
CHIROPTERA	HIPPOSIDERIDAE	*Hipposideros caffer*	Data Deficient		
CHIROPTERA	MOLOSSIDAE	*Tadarida aegyptiaca*	Least Concern		
CHIROPTERA	MOLOSSIDAE	*Tadarida teniotis*	Least Concern		
CHIROPTERA	NYCTERIDAE	*Nycteris thebaica*	Data Deficient		
CHIROPTERA	PTEROPODIDAE	*Rousettus aegyptiacus*	Near Threatened		
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus blasii*	Near Threatened		
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus clivosus*	Data Deficient		
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus euryale*	Vulnerable	A2ac	
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus ferrumequinum*	Near Threatened		
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus hipposideros*	Near Threatened		
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus mehelyi*	Vulnerable	A4c	
CHIROPTERA	RHINOPOMATIDAE	*Rhinopoma hardwickii*	Least Concern		
CHIROPTERA	RHINOPOMATIDAE	*Rhinopoma microphyllum*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Barbastella barbastellus*	Near Threatened		
CHIROPTERA	VESPERTILIONIDAE	*Barbastella leucomelas*	Not Applicable		
CHIROPTERA	VESPERTILIONIDAE	*Eptesicus bottae*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Eptesicus nilssonii*	Not Applicable		
CHIROPTERA	VESPERTILIONIDAE	*Eptesicus serotinus*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Miniopterus schreibersii*	Near Threatened		
CHIROPTERA	VESPERTILIONIDAE	*Myotis alcathoe*	Data Deficient		
CHIROPTERA	VESPERTILIONIDAE	*Myotis aurascens*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Myotis bechsteinii*	Near Threatened		
CHIROPTERA	VESPERTILIONIDAE	*Myotis blythii*	Near Threatened		
CHIROPTERA	VESPERTILIONIDAE	*Myotis brandtii*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Myotis capaccinii*	Vulnerable	A4bce	

Order	Family	Scientific name	IUCN Red List Category (Mediterranean)*	IUCN Red List Criteria	Endemic to the region?
CHIROPTERA	VESPERTILIONIDAE	*Myotis dasycneme*	Not Applicable		
CHIROPTERA	VESPERTILIONIDAE	*Myotis daubentonii*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Myotis emarginatus*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Myotis myotis*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Myotis mystacinus*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Myotis nattereri*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Myotis nipalensis*	Not Applicable		
CHIROPTERA	VESPERTILIONIDAE	*Myotis punicus*	Near Threatened		Yes
CHIROPTERA	VESPERTILIONIDAE	*Myotis schaubi*	Data Deficient		
CHIROPTERA	VESPERTILIONIDAE	*Nyctalus azoreum*	Endangered	B1ab(iii)	Yes
CHIROPTERA	VESPERTILIONIDAE	*Nyctalus lasiopterus*	Near Threatened		
CHIROPTERA	VESPERTILIONIDAE	*Nyctalus leisleri*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Nyctalus noctula*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Nycticeinops schlieffeni*	Not Applicable		
CHIROPTERA	VESPERTILIONIDAE	*Otonycteris hemprichii*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus ariel*	Data Deficient		
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus deserti*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus hanaki*	Data Deficient		Yes
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus kuhlii*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus maderensis*	Endangered	B1ab(iii,v)	Yes
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus nathusii*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus pipistrellus*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus pygmaeus*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus rueppellii*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus savii*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Plecotus auritus*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Plecotus austriacus*	Least Concern		
CHIROPTERA	VESPERTILIONIDAE	*Plecotus christii*	Data Deficient		
CHIROPTERA	VESPERTILIONIDAE	*Plecotus kolombatovici*	Least Concern		Yes
CHIROPTERA	VESPERTILIONIDAE	*Plecotus macrobullaris*	Near Threatened		
CHIROPTERA	VESPERTILIONIDAE	*Plecotus sardus*	Vulnerable	B2ab(iii)	Yes
CHIROPTERA	VESPERTILIONIDAE	*Plecotus teneriffae*	Endangered	B1ab(v)	Yes
CHIROPTERA	VESPERTILIONIDAE	*Vespertilio murinus*	Not Applicable		
EULIPOTYPHLA	ERINACEIDAE	*Atelerix algirus*	Least Concern		Yes
EULIPOTYPHLA	ERINACEIDAE	*Erinaceus concolor*	Least Concern		
EULIPOTYPHLA	ERINACEIDAE	*Erinaceus europaeus*	Least Concern		
EULIPOTYPHLA	ERINACEIDAE	*Erinaceus roumanicus*	Least Concern		
EULIPOTYPHLA	ERINACEIDAE	*Hemiechinus auritus*	Least Concern		
EULIPOTYPHLA	ERINACEIDAE	*Paraechinus aethiopicus*	Data Deficient		
EULIPOTYPHLA	SORICIDAE	*Crocidura aleksandrisi*	Least Concern		Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura arispa*	Least Concern		Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura canariensis*	Endangered	B1ab(ii,iii)	Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura floweri*	Data Deficient		Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura katinka*	Data Deficient		
EULIPOTYPHLA	SORICIDAE	*Crocidura leucodon*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Crocidura lusitania*	Not Applicable		
EULIPOTYPHLA	SORICIDAE	*Crocidura olivieri*	Not Applicable		
EULIPOTYPHLA	SORICIDAE	*Crocidura pachyura*	Least Concern		Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura pasha*	Not Applicable		
EULIPOTYPHLA	SORICIDAE	*Crocidura ramona*	Least Concern		Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura religiosa*	Data Deficient		Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura russula*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Crocidura sicula*	Least Concern		Yes

Order	Family	Scientific name	IUCN Red List Category (Mediterranean)*	IUCN Red List Criteria	Endemic to the region?
EULIPOTYPHLA	SORICIDAE	*Crocidura suaveolens*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Crocidura tarfayensis*	Data Deficient		
EULIPOTYPHLA	SORICIDAE	*Crocidura viaria*	Not Applicable		
EULIPOTYPHLA	SORICIDAE	*Crocidura whitakeri*	Least Concern		Yes
EULIPOTYPHLA	SORICIDAE	*Crocidura zimmermanni*	Vulnerable	B1ab(i,ii,v) +2ab(i,ii,v)	Yes
EULIPOTYPHLA	SORICIDAE	*Neomys anomalus*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Neomys fodiens*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Neomys teres*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Sorex alpinus*	Near Threatened		
EULIPOTYPHLA	SORICIDAE	*Sorex antinorii*	Data Deficient		Yes
EULIPOTYPHLA	SORICIDAE	*Sorex araneus*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Sorex arunchi*	Data Deficient		Yes
EULIPOTYPHLA	SORICIDAE	*Sorex coronatus*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Sorex granarius*	Least Concern		Yes
EULIPOTYPHLA	SORICIDAE	*Sorex minutus*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Sorex raddei*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Sorex samniticus*	Least Concern		Yes
EULIPOTYPHLA	SORICIDAE	*Sorex satunini*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Sorex volnuchini*	Least Concern		
EULIPOTYPHLA	SORICIDAE	*Suncus etruscus*	Least Concern		
EULIPOTYPHLA	TALPIDAE	*Galemys pyrenaicus*	Vulnerable	A2ac+3c+4ac	Yes
EULIPOTYPHLA	TALPIDAE	*Talpa caeca*	Least Concern		Yes
EULIPOTYPHLA	TALPIDAE	*Talpa caucasica*	Least Concern		
EULIPOTYPHLA	TALPIDAE	*Talpa davidiana*	Data Deficient		
EULIPOTYPHLA	TALPIDAE	*Talpa europaea*	Least Concern		
EULIPOTYPHLA	TALPIDAE	*Talpa levantis*	Least Concern		
EULIPOTYPHLA	TALPIDAE	*Talpa occidentalis*	Least Concern		Yes
EULIPOTYPHLA	TALPIDAE	*Talpa romana*	Least Concern		Yes
EULIPOTYPHLA	TALPIDAE	*Talpa stankovici*	Least Concern		Yes
HYRACOIDEA	PROCAVIIDAE	*Procavia capensis*	Least Concern		
LAGOMORPHA	LEPORIDAE	*Lepus capensis*	Least Concern		
LAGOMORPHA	LEPORIDAE	*Lepus castroviejoi*	Vulnerable	B1ab(iii) +2ab(iii)	Yes
LAGOMORPHA	LEPORIDAE	*Lepus corsicanus*	Vulnerable	A2bcde+3bcde	Yes
LAGOMORPHA	LEPORIDAE	*Lepus europaeus*	Least Concern		
LAGOMORPHA	LEPORIDAE	*Lepus granatensis*	Least Concern		Yes
LAGOMORPHA	LEPORIDAE	*Lepus microtis*	Not Applicable		
LAGOMORPHA	LEPORIDAE	*Lepus timidus*	Least Concern		
LAGOMORPHA	LEPORIDAE	*Oryctolagus cuniculus*	Near Threatened		Yes
LAGOMORPHA	PROLAGIDAE	*Prolagus sardus*	Extinct		Yes
MACROSCELIDEA	MACROSCELIDIDAE	*Elephantulus rozeti*	Least Concern		Yes
PERISSODACTYLA	EQUIDAE	*Equus africanus*	Critically Endangered		
PERISSODACTYLA	EQUIDAE	*Equus hemionus*	Endangered	D	
PRIMATES	CERCOPITHECIDAE	*Macaca sylvanus*	Endangered	A2bcd+4bcd	Yes
RODENTIA	CALOMYSCIDAE	*Calomyscus bailwardi*	Data Deficient		
RODENTIA	CALOMYSCIDAE	*Calomyscus tsolovi*	Data Deficient		Yes
RODENTIA	CASTORIDAE	*Castor fiber*	Least Concern		
RODENTIA	CRICETIDAE	*Arvicola amphibius*	Least Concern		
RODENTIA	CRICETIDAE	*Arvicola sapidus*	Vulnerable	A2ace+4ace	Yes
RODENTIA	CRICETIDAE	*Arvicola scherman*	Least Concern		
RODENTIA	CRICETIDAE	*Chionomys gud*	Least Concern		
RODENTIA	CRICETIDAE	*Chionomys nivalis*	Least Concern		
RODENTIA	CRICETIDAE	*Chionomys roberti*	Data Deficient		
RODENTIA	CRICETIDAE	*Cricetulus migratorius*	Least Concern		
RODENTIA	CRICETIDAE	*Cricetus cricetus*	Not Applicable		

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RODENTIA	CRICETIDAE	*Dinaromys bogdanovi*	Vulnerable	B2ab(i,ii,iv)	Yes
RODENTIA	CRICETIDAE	*Ellobius lutescens*	Least Concern		
RODENTIA	CRICETIDAE	*Mesocricetus auratus*	Vulnerable	B1ab(iii)	Yes
RODENTIA	CRICETIDAE	*Mesocricetus brandti*	Near Threatened		
RODENTIA	CRICETIDAE	*Mesocricetus newtoni*	Near Threatened		
RODENTIA	CRICETIDAE	*Microtus agrestis*	Least Concern		
RODENTIA	CRICETIDAE	*Microtus anatolicus*	Data Deficient		Yes
RODENTIA	CRICETIDAE	*Microtus arvalis*	Least Concern		
RODENTIA	CRICETIDAE	*Microtus brachycercus*	Least Concern		Yes
RODENTIA	CRICETIDAE	*Microtus cabrerae*	Near Threatened		Yes
RODENTIA	CRICETIDAE	*Microtus daghestanicus*	Least Concern		
RODENTIA	CRICETIDAE	*Microtus dogramacii*	Least Concern		Yes
RODENTIA	CRICETIDAE	*Microtus duodecimcostatus*	Least Concern		Yes
RODENTIA	CRICETIDAE	*Microtus felteni*	Data Deficient		Yes
RODENTIA	CRICETIDAE	*Microtus gerbei*	Least Concern		Yes
RODENTIA	CRICETIDAE	*Microtus guentheri*	Least Concern		Yes
RODENTIA	CRICETIDAE	*Microtus levis*	Least Concern		
RODENTIA	CRICETIDAE	*Microtus liechtensteini*	Least Concern		
RODENTIA	CRICETIDAE	*Microtus lusitanicus*	Least Concern		Yes
RODENTIA	CRICETIDAE	*Microtus majori*	Least Concern		
RODENTIA	CRICETIDAE	*Microtus multiplex*	Least Concern		Yes
RODENTIA	CRICETIDAE	*Microtus savii*	Least Concern		Yes
RODENTIA	CRICETIDAE	*Microtus schidlovskii*	Least Concern		
RODENTIA	CRICETIDAE	*Microtus socialis*	Least Concern		
RODENTIA	CRICETIDAE	*Microtus subterraneus*	Least Concern		
RODENTIA	CRICETIDAE	*Microtus thomasi*	Least Concern		Yes
RODENTIA	CRICETIDAE	*Myodes glareolus*	Least Concern		
RODENTIA	CRICETIDAE	*Prometheomys schaposchnikowi*	Vulnerable	D2	
RODENTIA	CTENODACTYLIDAE	*Ctenodactylus gundi*	Least Concern		Yes
RODENTIA	CTENODACTYLIDAE	*Ctenodactylus vali*	Data Deficient		Yes
RODENTIA	CTENODACTYLIDAE	*Massoutiera mzabi*	Least Concern		
RODENTIA	DIPODIDAE	*Allactaga elater*	Not Applicable		
RODENTIA	DIPODIDAE	*Allactaga euphratica*	Near Threatened		
RODENTIA	DIPODIDAE	*Allactaga tetradactyla*	Vulnerable	B2ab(iii)	Yes
RODENTIA	DIPODIDAE	*Allactaga williamsi*	Near Threatened		
RODENTIA	DIPODIDAE	*Jaculus jaculus*	Least Concern		
RODENTIA	DIPODIDAE	*Jaculus orientalis*	Least Concern		Yes
RODENTIA	DIPODIDAE	*Sicista subtilis*	Not Applicable		
RODENTIA	GLIRIDAE	*Dryomys laniger*	Data Deficient		Yes
RODENTIA	GLIRIDAE	*Dryomys nitedula*	Least Concern		
RODENTIA	GLIRIDAE	*Eliomys melanurus*	Least Concern		
RODENTIA	GLIRIDAE	*Eliomys munbyanus*	Least Concern		Yes
RODENTIA	GLIRIDAE	*Eliomys quercinus*	Least Concern		
RODENTIA	GLIRIDAE	*Glis glis*	Least Concern		
RODENTIA	GLIRIDAE	*Muscardinus avellanarius*	Least Concern		
RODENTIA	GLIRIDAE	*Myomimus roachi*	Vulnerable	B2ab(iii)	Yes
RODENTIA	GLIRIDAE	*Myomimus setzeri*	Data Deficient		
RODENTIA	HYSTRICIDAE	*Hystrix cristata*	Least Concern		
RODENTIA	HYSTRICIDAE	*Hystrix indica*	Least Concern		
RODENTIA	MURIDAE	*Acomys airensis*	Not Applicable		
RODENTIA	MURIDAE	*Acomys cahirinus*	Least Concern		
RODENTIA	MURIDAE	*Acomys cilicicus*	Data Deficient		Yes

Order	Family	Scientific name	IUCN Red List Category (Mediterranean)*	IUCN Red List Criteria	Endemic to the region?
RODENTIA	MURIDAE	*Acomys dimidiatus*	Least Concern		
RODENTIA	MURIDAE	*Acomys minous*	Data Deficient		Yes
RODENTIA	MURIDAE	*Acomys nesiotes*	Data Deficient		Yes
RODENTIA	MURIDAE	*Acomys russatus*	Data Deficient		
RODENTIA	MURIDAE	*Acomys seurati*	Least Concern		Yes
RODENTIA	MURIDAE	*Apodemus agrarius*	Least Concern		
RODENTIA	MURIDAE	*Apodemus alpicola*	Least Concern		
RODENTIA	MURIDAE	*Apodemus epimelas*	Least Concern		Yes
RODENTIA	MURIDAE	*Apodemus flavicollis*	Least Concern		
RODENTIA	MURIDAE	*Apodemus mystacinus*	Least Concern		
RODENTIA	MURIDAE	*Apodemus sylvaticus*	Least Concern		
RODENTIA	MURIDAE	*Apodemus uralensis*	Not Applicable		
RODENTIA	MURIDAE	*Apodemus witherbyi*	Least Concern		
RODENTIA	MURIDAE	*Arvicanthis niloticus*	Not Applicable		
RODENTIA	MURIDAE	*Gerbillus amoenus*	Least Concern		Yes
RODENTIA	MURIDAE	*Gerbillus andersoni*	Least Concern		Yes
RODENTIA	MURIDAE	*Gerbillus campestris*	Least Concern		
RODENTIA	MURIDAE	*Gerbillus cheesmani*	Not Applicable		
RODENTIA	MURIDAE	*Gerbillus dasyurus*	Least Concern		
RODENTIA	MURIDAE	*Gerbillus floweri*	Least Concern		Yes
RODENTIA	MURIDAE	*Gerbillus gerbillus*	Least Concern		
RODENTIA	MURIDAE	*Gerbillus grobbeni*	Data Deficient		Yes
RODENTIA	MURIDAE	*Gerbillus henleyi*	Least Concern		
RODENTIA	MURIDAE	*Gerbillus hesperinus*	Endangered	B1ab(iii) +2ab(iii)	Yes
RODENTIA	MURIDAE	*Gerbillus hoogstraali*	Vulnerable	B1b(iii)c(iv)	Yes
RODENTIA	MURIDAE	*Gerbillus jamesi*	Data Deficient		Yes
RODENTIA	MURIDAE	*Gerbillus latastei*	Least Concern		Yes
RODENTIA	MURIDAE	*Gerbillus mackillingini*	Least Concern		
RODENTIA	MURIDAE	*Gerbillus maghrebi*	Least Concern		Yes
RODENTIA	MURIDAE	*Gerbillus mesopotamiae*	Least Concern		
RODENTIA	MURIDAE	*Gerbillus nanus*	Least Concern		
RODENTIA	MURIDAE	*Gerbillus occiduus*	Data Deficient		Yes
RODENTIA	MURIDAE	*Gerbillus perpallidus*	Least Concern		Yes
RODENTIA	MURIDAE	*Gerbillus pyramidum*	Least Concern		
RODENTIA	MURIDAE	*Gerbillus simoni*	Least Concern		Yes
RODENTIA	MURIDAE	*Gerbillus tarabuli*	Least Concern		
RODENTIA	MURIDAE	*Lemniscomys barbarus*	Least Concern		Yes
RODENTIA	MURIDAE	*Mastomys erythroleucus*	Not Applicable		
RODENTIA	MURIDAE	*Meriones crassus*	Least Concern		
RODENTIA	MURIDAE	*Meriones dahli*	Endangered	B1ab(iii)	
RODENTIA	MURIDAE	*Meriones grandis*	Least Concern		Yes
RODENTIA	MURIDAE	*Meriones libycus*	Least Concern		
RODENTIA	MURIDAE	*Meriones persicus*	Least Concern		
RODENTIA	MURIDAE	*Meriones sacramenti*	Vulnerable	B1ab(iii)	Yes
RODENTIA	MURIDAE	*Meriones shawi*	Least Concern		Yes
RODENTIA	MURIDAE	*Meriones tristrami*	Least Concern		
RODENTIA	MURIDAE	*Meriones vinogradovi*	Least Concern		
RODENTIA	MURIDAE	*Micromys minutus*	Least Concern		
RODENTIA	MURIDAE	*Mus cypriacus*	Least Concern		Yes
RODENTIA	MURIDAE	*Mus macedonicus*	Least Concern		
RODENTIA	MURIDAE	*Mus musculus*	Least Concern		
RODENTIA	MURIDAE	*Mus spicilegus*	Least Concern		

Order	Family	Scientific name	IUCN Red List Category (Mediterranean)*	IUCN Red List Criteria	Endemic to the region?
RODENTIA	MURIDAE	*Mus spretus*	Least Concern		Yes
RODENTIA	MURIDAE	*Nesokia indica*	Least Concern		
RODENTIA	MURIDAE	*Pachyuromys duprasi*	Least Concern		
RODENTIA	MURIDAE	*Psammomys obesus*	Least Concern		
RODENTIA	MURIDAE	*Psammomys vexillaris*	Data Deficient		Yes
RODENTIA	MURIDAE	*Sekeetamys calurus*	Least Concern		
RODENTIA	MURIDAE	*Tatera indica*	Not Applicable		
RODENTIA	SCIURIDAE	*Atlantoxerus getulus*	Least Concern		Yes
RODENTIA	SCIURIDAE	*Marmota marmota*	Least Concern		
RODENTIA	SCIURIDAE	*Sciurus anomalus*	Least Concern		
RODENTIA	SCIURIDAE	*Sciurus vulgaris*	Least Concern		
RODENTIA	SCIURIDAE	*Spermophilus citellus*	Vulnerable	A2bc	
RODENTIA	SCIURIDAE	*Spermophilus taurensis*	Least Concern		Yes
RODENTIA	SCIURIDAE	*Spermophilus xanthoprymnus*	Near Threatened		
RODENTIA	SCIURIDAE	*Xerus erythropus*	Not Applicable		
RODENTIA	SPALACIDAE	*Spalax ehrenbergi*	Data Deficient		
RODENTIA	SPALACIDAE	*Spalax leucodon*	Data Deficient		
RODENTIA	SPALACIDAE	*Spalax nehringi*	Data Deficient		

* Species were considered to be Not Applicable (NA) if they were introduced after 1500 A.D. or if they were considered to be of marginal occurrence in the region. Species were considered to be of marginal occurrence if it was estimated that less than 1% of their global population occurs in the Mediterranean region. In the absence of population data, terrestrial species were considered of marginal occurrence if less than 1% of their range lies within the region. Native species of marginal occurrence are listed in the table above; introduced species assessed as Not Applicable are listed in Appendix 2.

Appendix 2. Introduced species assessed as Not Applicable (NA) in the Mediterranean region

Order	Genus	Species	Status	Justification
Carnivora	*Herpestes*	*auropunctatus*	NA	Introduced after 1500 A.D.
Carnivora	*Neovison*	*vison*	NA	Introduced after 1500 A.D.
Carnivora	*Nyctereutes*	*procyonoides*	NA	Introduced after 1500 A.D.
Carnivora	*Procyon*	*lotor*	NA	Introduced after 1500 A.D.
Cetartiodactyla	*Axis*	*axis*	NA	Introduced after 1500 A.D.
Cetartiodactyla	*Cervus*	*nippon*	NA	Introduced after 1500 A.D.
Cetartiodactyla	*Hydropotes*	*inermis*	NA	Introduced after 1500 A.D.
Cetartiodactyla	*Odocoileus*	*virginianus*	NA	Introduced after 1500 A.D.
Lagomorpha	*Sylvilagus*	*floridanus*	NA	Introduced after 1500 A.D.
Rodentia	*Callosciurus*	*erythraeus*	NA	Introduced after 1500 A.D.
Rodentia	*Callosciurus*	*finlaysonii*	NA	Introduced after 1500 A.D.
Rodentia	*Myocastor*	*coypus*	NA	Introduced after 1500 A.D.
Rodentia	*Ondatra*	*zibethicus*	NA	Introduced after 1500 A.D.
Rodentia	*Rattus*	*norvegicus*	NA	Introduced after 1500 A.D.
Rodentia	*Sciurus*	*carolinensis*	NA	Introduced after 1500 A.D.

* This list may be incomplete.

Appendix 3. Methodology for spatial analyses

Data were analyzed using a geodesic discrete global grid system, defined on an icosahedron and projected to the sphere using the inverse Icosahedral Snyder Equal Area (ISEA) Projection (S39). This corresponds to a hexagonal grid composed of individual units (cells) that retain their shape and area (~22,300 km^2) throughout the globe. These are more suitable for a range of ecological applications than the most commonly used rectangular grids (S40).

The range of each species was converted to the hexagonal grid for analysis purposes. Coastal cells were clipped to the coastline. Patterns of species richness (Figure 4) were mapped by counting the number of species in each cell (or cell section, for species with a coastal distribution). Patterns of threatened species richness (Figure 5) were mapped by counting the number of threatened species (categories CR, EN, VU at the Mediterranean regional level) in each cell or cell section. Patterns of endemic species richness were mapped by counting the number of species in each cell (or cell section for coastal species) that were flagged as being endemic to the Mediterranean region as defined in this project (Figure 6).

IUCN Red List of Threatened Species™ – Regional Assessments

The Status and Distribution of Freshwater Biodiversity in Eastern Africa. Compiled by William R.T. Darwall, Kevin G. Smith, Thomas Lowe, Jean-Christophe Vié, 2005

The Status and Distribution of Freshwater Fish Endemic to the Mediterranean Basin. Compiled by Kevin G. Smith and William R.T. Darwall, 2006

The Status and Distribution of Reptiles and Amphibians of the Mediterranean Basin. Compiled by Neil Cox, Janice Chanson and Simon Stuart, 2006

The Status and Distribution of European Mammals. Compiled by Helen J. Temple and Andrew Terry, 2007

Overview of the Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea. Compiled by Rachel D. Cavanagh and Claudine Gibson, 2007

The Status and Distribution of Freshwater Biodiversity in Southern Africa. Compiled by William R.T. Darwall, Kevin G. Smith, Denis Tweddle and Paul Skelton, 2009

European Red List of Amphibians. Compiled by Helen J. Temple and Neil Cox, 2009

European Red List of Reptiles. Compiled by Neil Cox and Helen J. Temple, 2009

The Status and Distribution of Dragonflies of the Mediterranean Basin. Compiled by Elisa Riservato, Jean-Pierre Boudot, Sonia Feirrera, Milos Jovic, Vincent J. Kalkman, Wolfgang Schneider and Boudjéma Samraoui, 2009

THE IUCN RED LIST
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