



Ministero dell'Ambiente e della  
Tutela del Territorio e del Mare

**DPN** DIREZIONE PER LA  
PROTEZIONE  
DELLA NATURA



# The italian fauna

*from knowledge  
to conservation*

COUNTDOWN  
**2010**  
save biodiversity loss





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*from knowledge  
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## **The Italian Fauna**

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Produced by the *National Focal Point* for the *Global Taxonomy Initiative*, under the auspices of the *Scientific Committee for the Italian Fauna*.

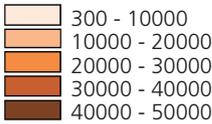
Profound thanks go to prof. Marco Bologna who read the manuscript with critical appraisal.

# Introduction

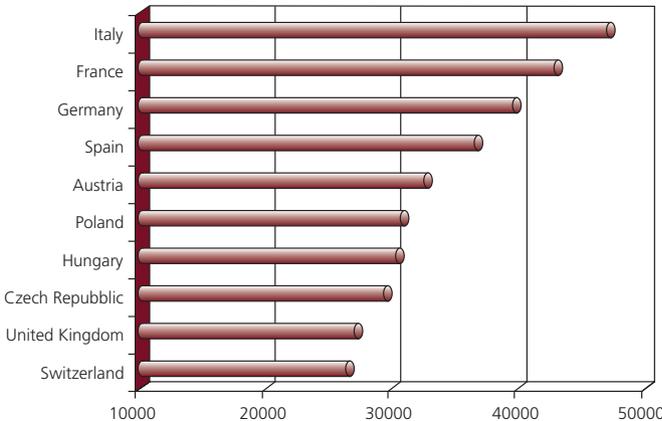
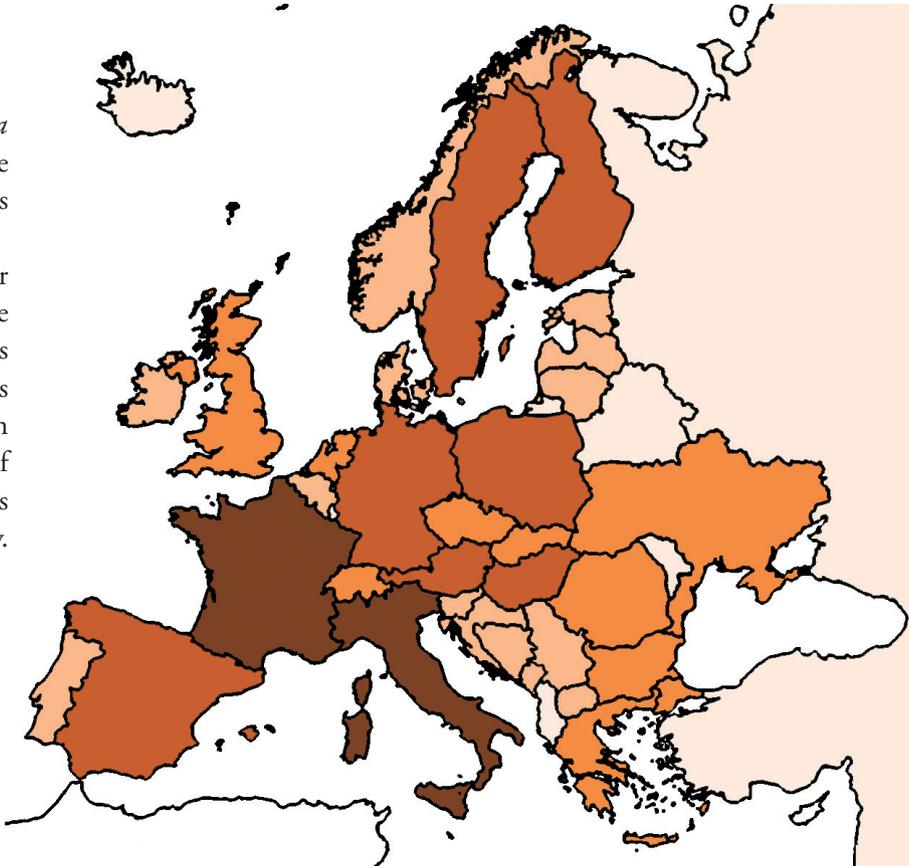
## The Italian fauna

The recently compiled *Fauna Europaea* shows Italy as having the largest number of animal species in Europe.

This remarkable primacy however poses serious questions about the best way of conserving this irreplaceable heritage, which is further enhanced by the high percentage (about 30%) of endemic species, or rather species that live wholly or mostly in Italy.



Number of land and freshwater species in Europe (data source *Fauna Europaea*)



The *Checklist of the Species of the Italian Fauna*, which lists some 56,000 animal species, and the *CKmap* database, with about 538,000 entries on the distribution of over 10,000 land and fresh water species provide the basis upon which to plan the conservation of the Italian fauna.

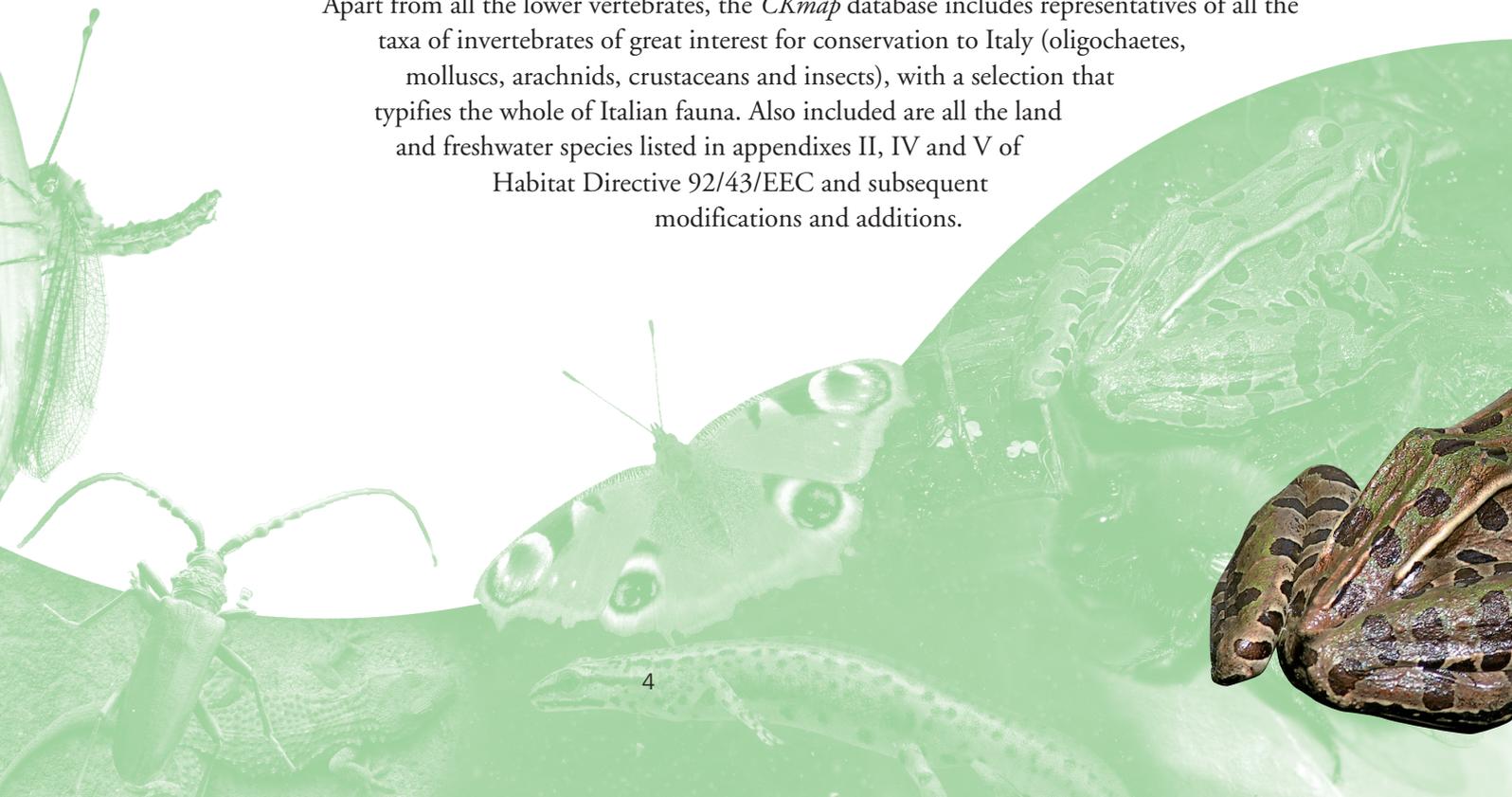
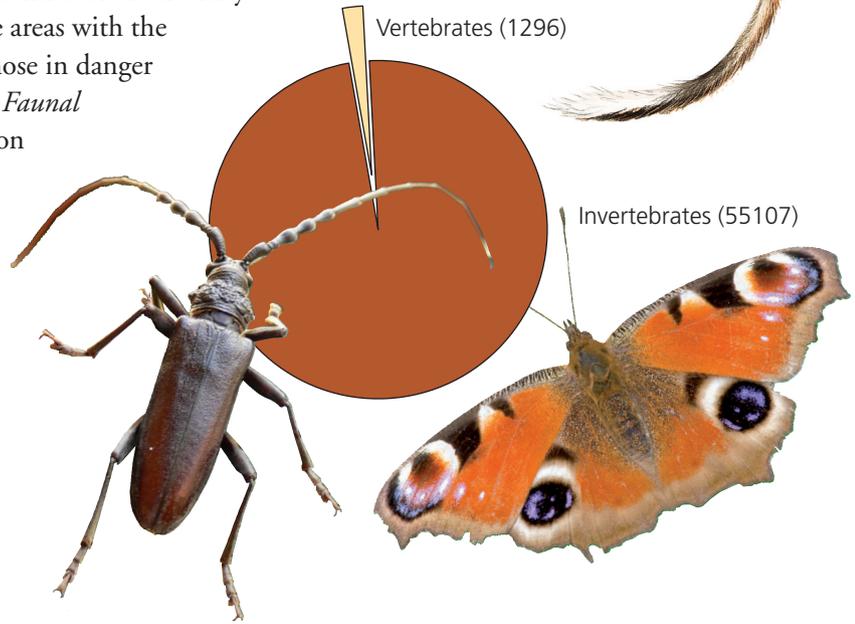
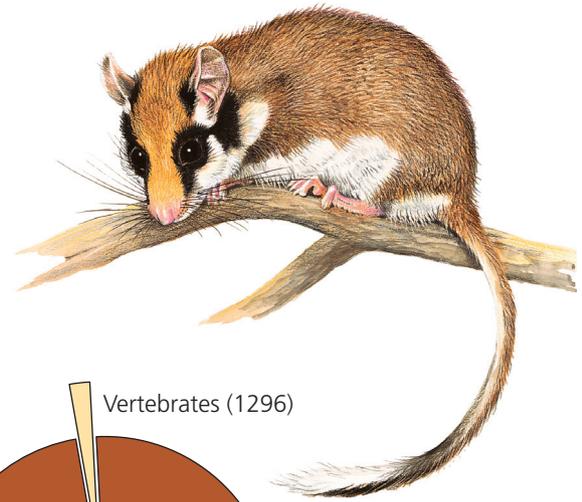
## Introduction

### Lower fauna and conservation

The potential of this comprehensive data exceeds way beyond that of simply compiling atlases; the *CKmap* database is the most detailed source of information regarding the fauna of any country currently available in Europe. It identifies the centres of biodiversity (hotspots), rarity and endemism, as well as the areas with the greatest numbers of non-native species, and those in danger of extinction. Identifying the IFAs (*Important Faunal Areas*) allows the different zones to be graded on a scale of conservation priorities.

These are important conservation areas for fauna improperly classified as “minor” or “lower” (invertebrates, fish, amphibians, reptiles and micro-mammals, including chiropterans) due, generally speaking, simply to habit and size. Most Italian fauna (almost 98% if we consider marine fauna as well, and over 99% land and freshwater) is made up of invertebrates. Vertebrates, the best known and most studied taxonomic group, therefore only make up 1-2% of the entire range of species in the country. Most of the species in question are arthropods (almost 46,000 land and marine species), prevalently insects (37,300 species). Dominant among these are beetles (12,000 species), followed by hymenopterans (7,500), dipterans (6.600) and butterflies (5,100).

Apart from all the lower vertebrates, the *CKmap* database includes representatives of all the taxa of invertebrates of great interest for conservation to Italy (oligochaetes, molluscs, arachnids, crustaceans and insects), with a selection that typifies the whole of Italian fauna. Also included are all the land and freshwater species listed in appendixes II, IV and V of Habitat Directive 92/43/EEC and subsequent modifications and additions.

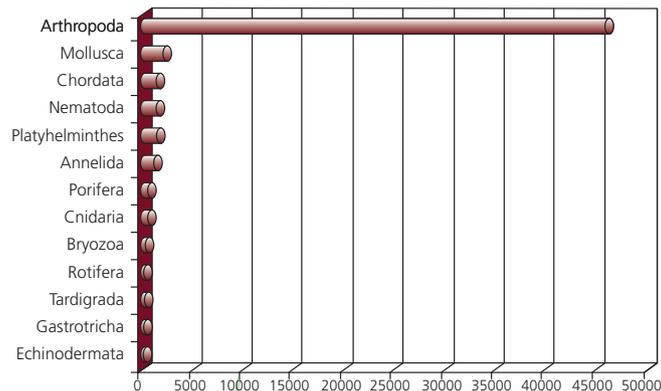
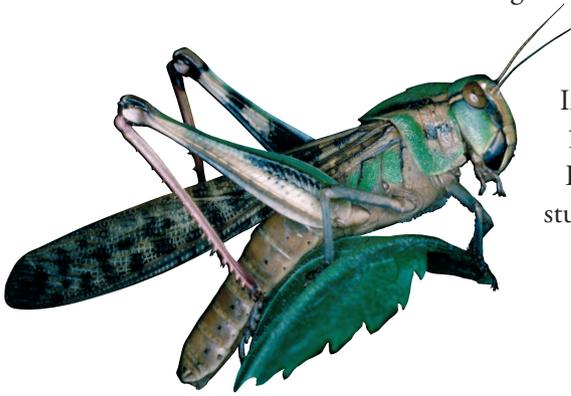


## Introduction

### Biogeography, taxonomy and conservation

Including invertebrates for the first time makes it possible to assess the logic of the conservation areas (Protected Areas, Sites of Community Importance, Special Protection Areas) with the biodiversity patterns present in Italy and their capacity to safeguard endemic, rare and threatened species. All of these combined make it easier to take on the challenge we are faced with: to stop or at least reduce the loss of biodiversity by 2010, as established at the World Conference on Sustainable Development held in Johannesburg in 2002. Having all the information on the taxa in Italian fauna currently available online and handing this down to future generations will also help create the continuity in the formation of new taxonomists and faunists that is desperately needed.

Indeed we know that overcoming what the Darwin Declaration defined as the “taxonomic impediment” is one of the great challenges laid down for the future at the Rio de Janeiro Convention on Biological Diversity via the Global Taxonomy Initiative. The Convention was ratified by Italy in 1994 together with 180 other countries. With more species than any other country in Europe and with a long-standing tradition of taxonomic and faunal studies, Italy will be required to commit itself without reserve.



## The project Checklist and distribution of the Italian fauna

### From Checklist to CKmap

In 1995, when the *Checklist of the Species of the Italian fauna* was completed, Italy became the first country to have a comprehensive list of its animal species.

A census was taken of 55,656 species (excluding protozoans); over 47,000 of these (85%) live on land and in continental waters.

The significant development of databanks and the information openly available online has turned the species *Checklist* into a database. The *CKmap* (or “CheckList mapping”) was created between 2001 and 2005 by the Directorate for Nature Protection, Scientific Committee for the Italian Fauna, Natural History Museum of Verona, and the Ecology Department of the University of Calabria. Over 10,000 terrestrial and freshwater species considered to be good biogeographic indicators were taken from the *Checklist* and, thanks to over a hundred taxonomists, the relevant ecology and distribution data were collected. All the 538,000 elements of data were geo-referenced; this led to the realization of a GIS (Geographic Information System) and the distributional maps presented in this study.

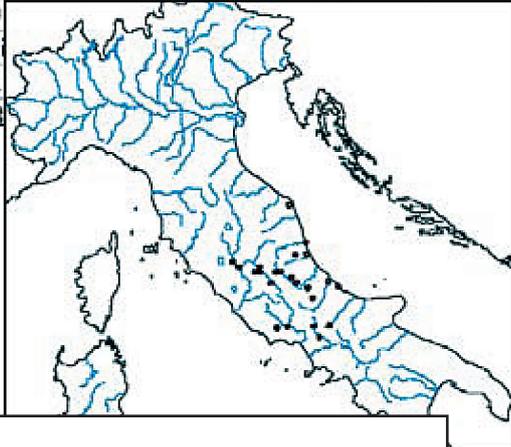


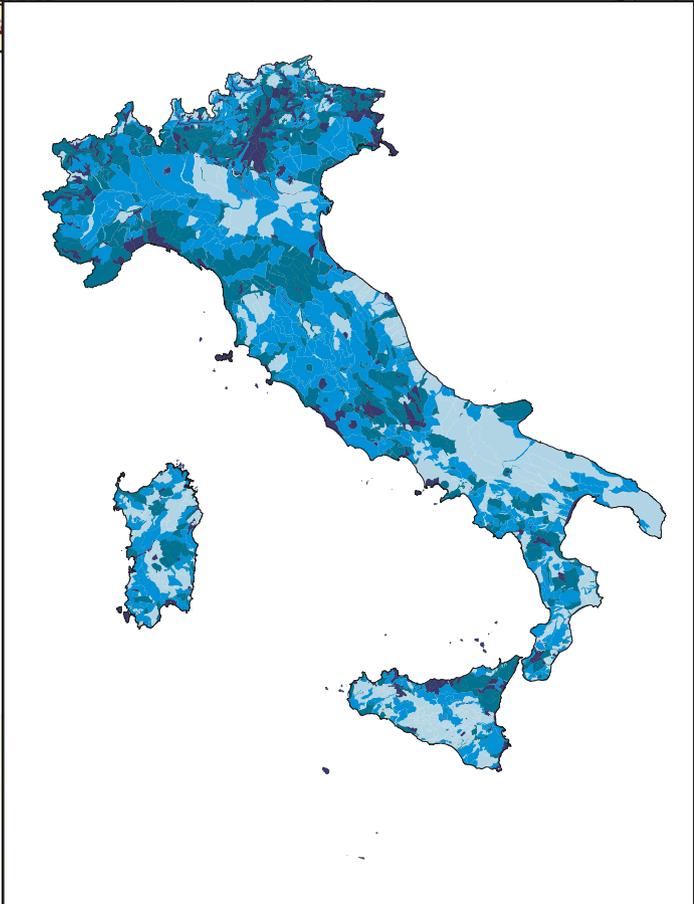
**CK2000**  
Checklist of Italian Fauna

AUTORE	ANNO
Adami G.B.	1876
Adami G.B.	1886
Alzona C.	1971
Bodon M., Giovannelli M.M.	1995
Coll. A. Pirona	
Coll. C. Alzona	
Coll. E. D.	
Coll. F. G.	
Coll. G.B.	
Coll. M. B.	

**CHECKLIST HOME**

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- The Checklist
- Species richness
- Endemic species
- Endangered species
- Species distribution
- Parasites and hosts
- Literature
- Authors
- Protozoans
- Invertebrates
- Vertebrates





## The project Checklist and distribution of the Italian fauna

### From *CKmap* to *IFAs*

The first thematic map that can be obtained from the *CKmap* database is the distribution of species richness. However this is not the only, nor in many cases the most important, criterion available when selecting the areas of major scientific and conservation interest. Some areas

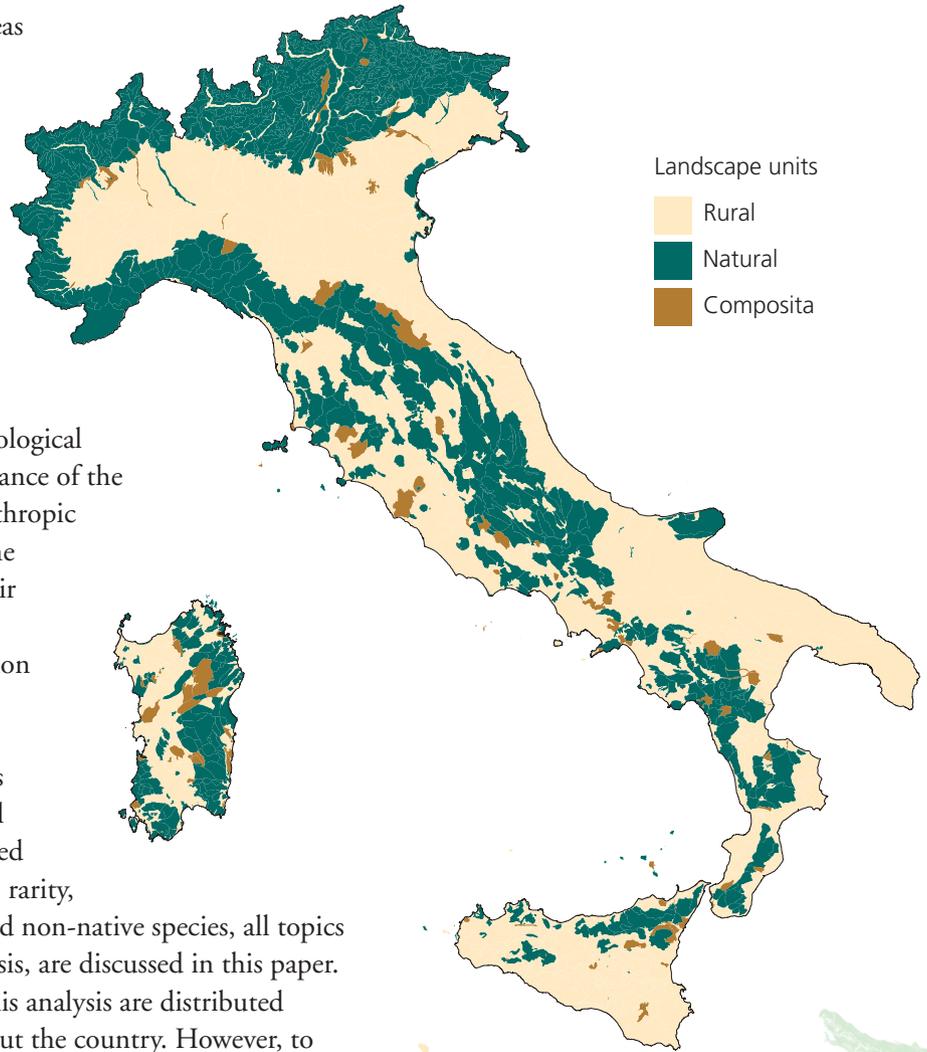
may for instance be rich in common and widespread species, while others, where biodiversity is lower, may be home to species of great interest.

As the Habitat Directive states, further criteria include endemism and rarity, phenomena caused by the interaction of historical and ecological factors. To the intrinsic importance of the biogeography can be added anthropic pressure, which can threaten the more sensible species when their habitat is either altered or destroyed, or via the introduction of non-native species.

The *CKmap* contains all the necessary details to create maps that illustrate the distributional pattern of biodiversity (expressed as species richness), endemism, rarity, and incidence of threatened and non-native species, all topics that, subject to statistical analysis, are discussed in this paper.

The patterns emerging from this analysis are distributed without interruption throughout the country. However, to render the maps easier to read we have divided Italy into clearly identifiable units. For each of these, indexes have been calculated representing the phenomena described. The units selected are drawn from Landscape Units (*Map of the Landscapes of Italy*, compiled by DISTAF, Florence University).

The maps showing endemism, rarity and threat have been grouped together in a single map that shows the importance of the fauna in the various units. This benchmark makes it possible to select the *IFAs*, *Important Faunal Areas*, where safeguarding of the invertebrate and lower vertebrate fauna of Italy is most urgent.



## History of Italian fauna

### The origin of Italian fauna

Italian fauna originated from a series of colonisations that followed the country's formation and the great paleogeographic and paleoclimatic events that influenced its evolution.

The following events contributed to the formation of the Italian fauna: the emersion from the sea; the movement of tectonic plates, in particular the paleoegeic, paleotyrrhenic and African plates; the Messinian salinity crisis; the ingression and regression of the sea partly due to glacial eustasy; quaternary glacialism. A new aspect to consider is, finally, man's presence, which caused landscape anthropisation and global climate change.

Some species derive from a pre-Miocenic fauna (already in existence over 23 million years ago) that originated in paleo-areas traditionally called Tyrrhenid and Aegeid; some arrived from Asia and Eastern Europe over the last million years; others have been introduced by man. Every paleogeographic and paleoclimatic event has left clear tracks that can still be seen in the current distribution of species in Italy.

The oldest faunal group is made up of paleoendemics, i.e. species mainly originating from the Tyrrhenid (and to a lesser degree from the Aegeid, currently the Balkans). The Tyrrhenid is a crustal plate that began to detach itself from what is nowadays the Provençal and Catalan coast during the Oligocene; this plate, migrating and turning Eastwards, led to the formation of Corsica, Sardinia and numerous small landmasses scattered between Tuscany and Sicily. Each micro-plate brought with it the ancestors of some of today's species. These are consequently of great help in reconstructing this complex paleogeographic event, the traces of which are in fact revealed by the current distribution of these remaining paleo-Tyrrhenic species. The map of paleoendemics is based on the *CKmap* data and illustrates the density of these species in the country. The mapped areas are of great scientific interest since they provide the opportunity to reconstruct the most distant history of Italy's geography. This makes them of primary conservation interest.



## History of Italian fauna

### Plio-pleistocenic faunas

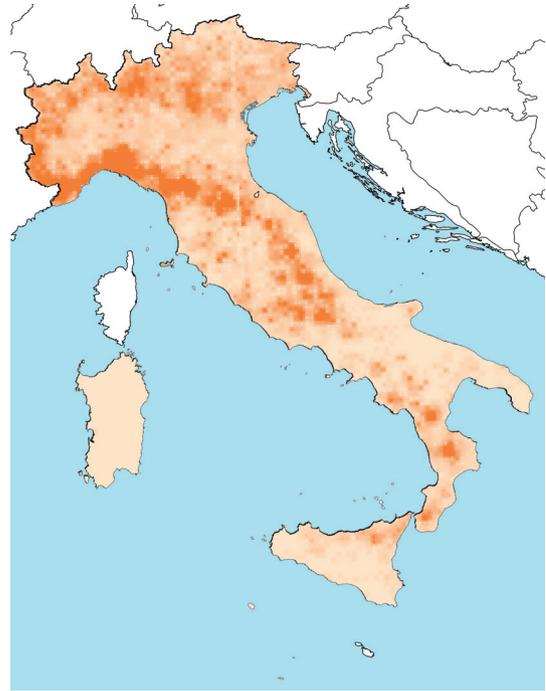
Various faunal units added themselves to the original group of paleoendemics, the most notable of which is made up of species from Eastern Europe and Western Asia. These began to enter Italy during the Pliocene (5-3 million years ago), in steppic climactic conditions and favoured in their colonisation process by the fact that the Alps and Apennines were no longer separated.

Here too the traces of these events appear on a map showing the density of the endemic species, distributed among the Italian Alps and Apennines. In the southern Apennines and in Sicily we still find these relicts of cold climates, located on the main mountain massifs.

This northern contingent, further increased by Asian and Siberian elements, was

scattered even further southwards during the glacial acmes of the Quaternary. It then withdrew progressively after post-glacial climactic changes. As it withdrew it left behind several relicts on the major mountain ranges, in particular the Apennines. This withdrawal was accompanied by a penetration, especially from the South, of another faunal contingent made up of Mediterranean elements, with numerous species whose distribution is limited by the warm climates that characterise the southern Apennines and the main islands.

The map illustrates the density of species distributed in the Mediterranean zone of Italy. These species appear mostly in the Tyrrhenian islands and coastal areas, where they partly follow the distribution of the Mediterranean bioclimactic zone, but with significant, more localised presences in internal Apennine areas, especially in xerothermic oases.

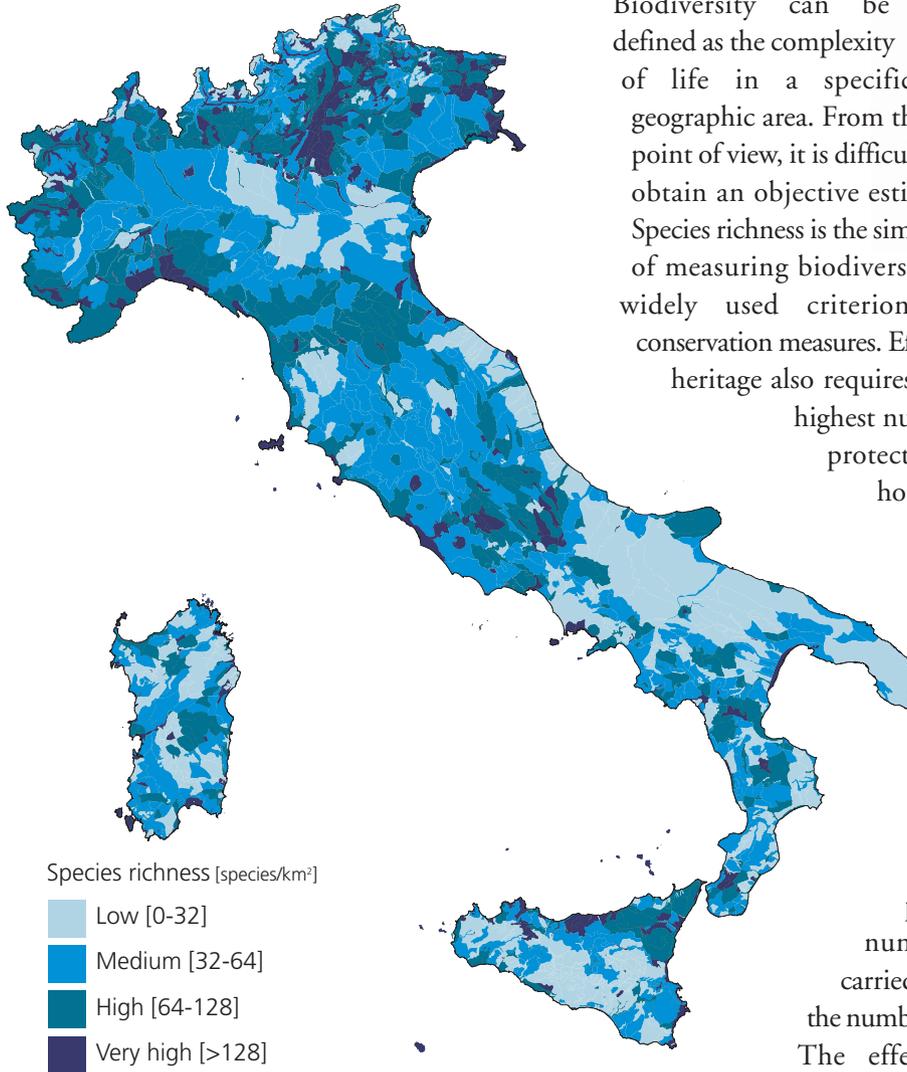


## Species richness

### Biodiversity and species richness



Biodiversity can be defined as the complexity of life in a specific geographic area. From this point of view, it is difficult to obtain an objective estimate. Species richness is the simplest way of measuring biodiversity and it is a widely used criterion when planning conservation measures. Effective handling of the faunal heritage also requires identifying the areas with the highest numbers of species which deserve protection: these areas are defined as hotspots.



### Biodiversity hotspots

The number of species residing in an area is, predictably, positively correlated to the number and accuracy of studies carried out. These can be estimated by the number of records held in the database. The effect of a lack of sampling homogeneity, unfortunately always considerable when studies are conducted over vast areas, can be reduced by considering

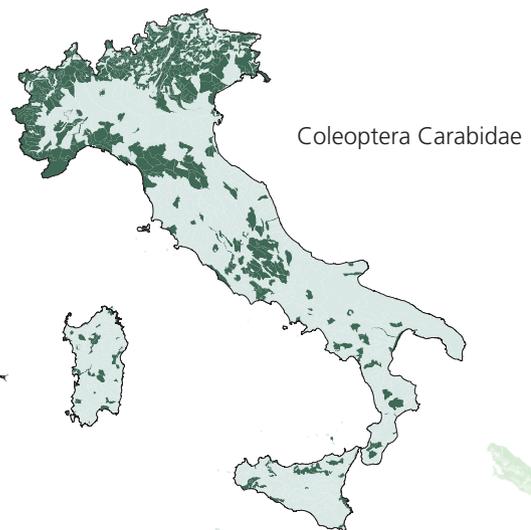
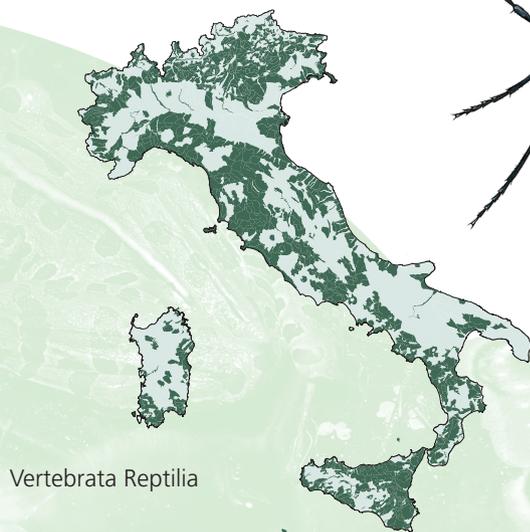
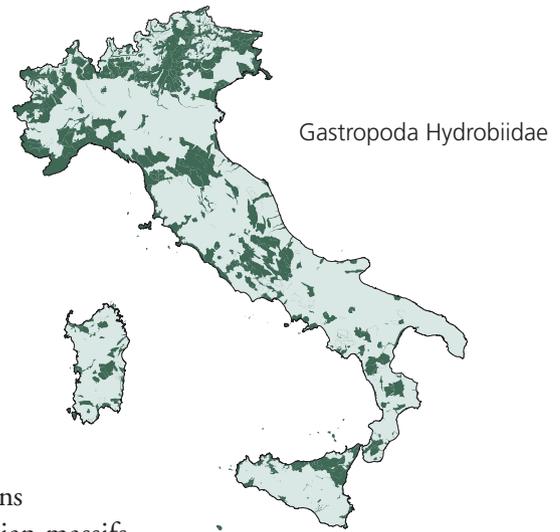
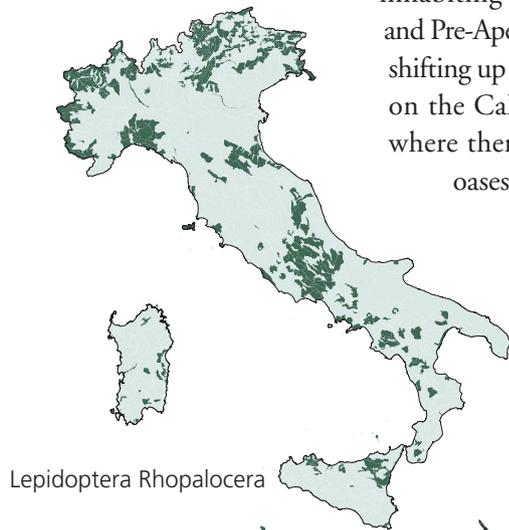
large, geographically homogeneous surfaces and by normalising the species richness estimates according to the area considered and/or number of samples collected in that area. This is why here, from the basic areas used on the *CKmap* (UTM grid cells 10 x 10 km) we changed to Landscape Units. Application of this method allowed us to identify the main biodiversity hotspots in Italy, defined herein as the Landscape Units which, on the basis of present knowledge, display the higher species density. Among these can be singled out the Alpine and Prealpine areas, the Apennines of Liguria, Tuscany and Emilia, Abruzzo and Latium. The general lower species richness in the southernmost regions and the larger islands may be due to insularity and the peninsular effect, as well as reduced faunal research. The hotspots in these regions include Gargano, the Calabrian massifs, the mountain belts of North-Eastern Sicily and central Sardinia.

## Species richness

### Distribution of the single taxa

Distribution of the different taxa that make up Italian fauna is illustrated in the maps that record the top 10% areas by species density. Recognisable are patterns of scarce mobility, which were influenced by the effect of glaciations (aquatic snails of the family Hydrobiidae), or that re-colonised the glacialised areas, even from relict areas (Carabid beetles). The hotspots of more mobile taxa lie on the main mountainous areas of the peninsula (such as the butterflies),

or shelter from the more rigid climates of the highest areas, inhabiting the Pre-Alpine and Pre-Apennine zones but shifting up to higher elevations on the Calabrian and Sicilian massifs, where there are plenty of xerothermic oases.



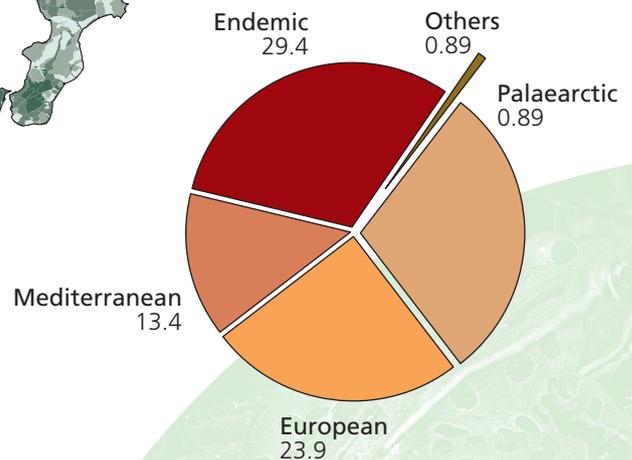
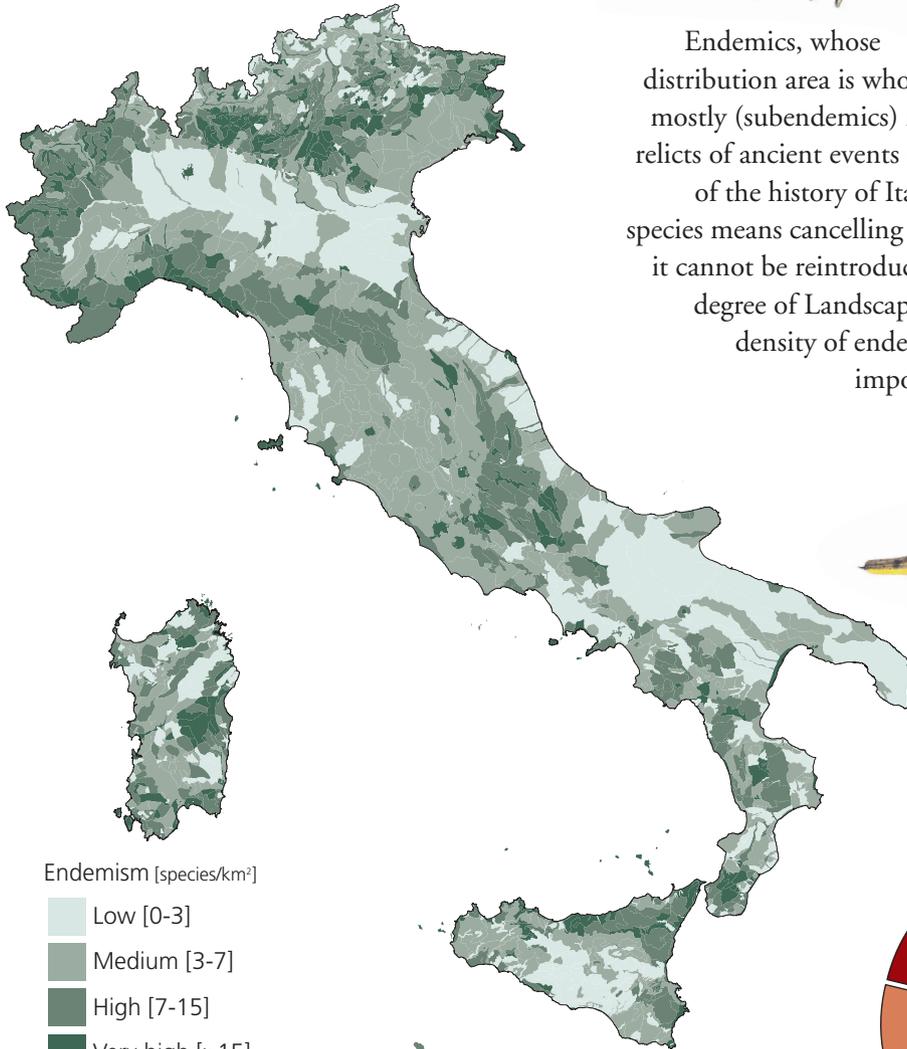
These patterns do however have various common features, a fact also apparent on the species richness distribution map: a limited presence in the Po Valley and inland regions of Apulia, Basilicata and Sicily, due most likely to anthropic factors, and in Sardinia. As regards Sardinia, the reasons may be largely historical and linked to the long period of isolation of the island.

## Endemic species

### Endemics



Endemics, whose distribution area is wholly or mostly (subendemics) in Italy, are relicts of ancient events that make up part of the history of Italian fauna. Losing an endemic species means cancelling it from the face of the earth, as it cannot be reintroduced. This is why the map of the degree of Landscape Unit endemism (expressed as density of endemic species per km<sup>2</sup>) is of great importance as regards conservation.



### Chorotypes

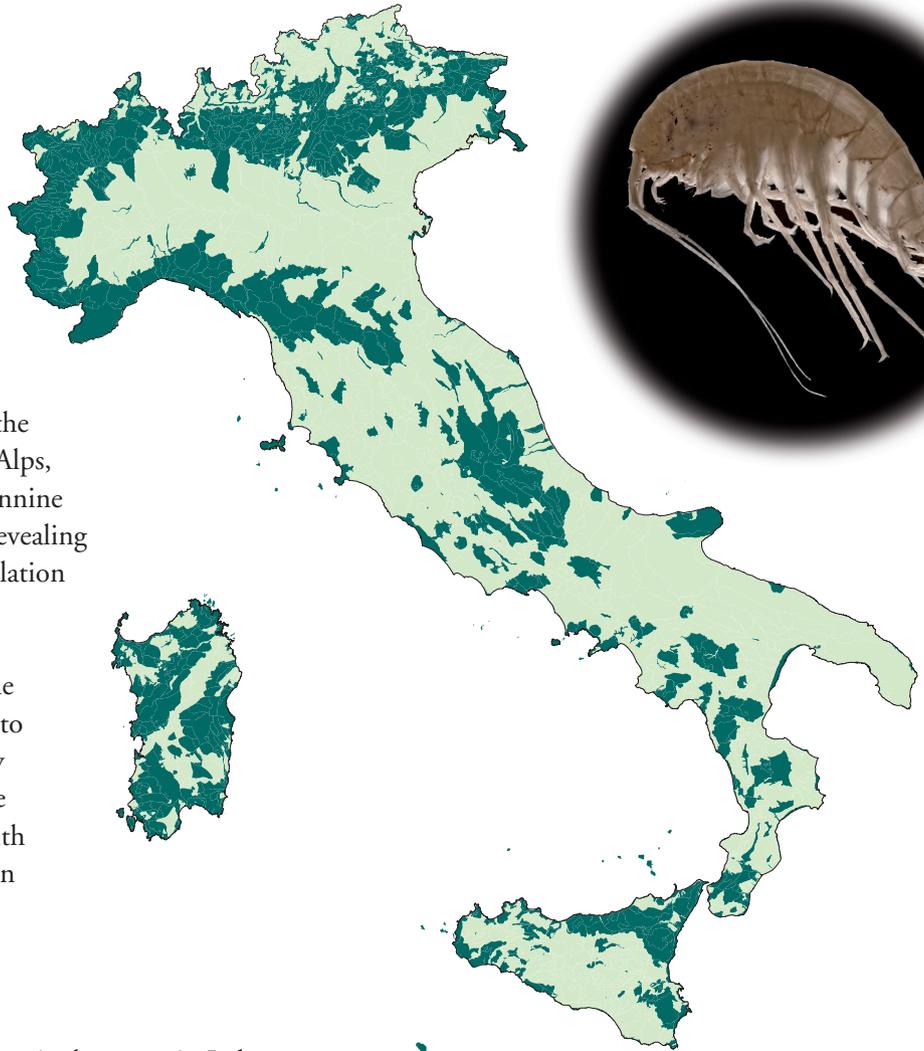
Species of Italian fauna can be grouped together according to the distribution model they belong to, known as a chorotype. The pie chart shows how our fauna is composed, showing the incredible richness of endemics (almost 30% of the 10,000 species considered). Non-endemic species are grouped into three chorotypes. Palaeartic species (28%) include northern elements that colonised Italy in the Quaternary and especially in the post-glacial era. The species that are widely distributed in Europe (24%) are mostly northern and Alpine, while the Mediterranean ones (13%) include tertiary relicts or species that spread widely in the postglacial period.

## Endemic species

### Endemic species hotspots

The zones where endemic species are mostly concentrated must be priority conservation areas if we are to preserve the most evidence possible concerning the history of Italian fauna.

Endemic species hotspots are especially well represented in the pre-alpine zones, the western Alps, isolated massifs along the Apennine chain and the major islands, revealing how important geographic isolation is to the process of speciation. The lowest values of endemic species density are found in the highest parts of the Alps (due to the impoverishment caused by quaternary glaciations), on the plains (of recent origin and with high anthropic pressure) and in other areas depleted by man.

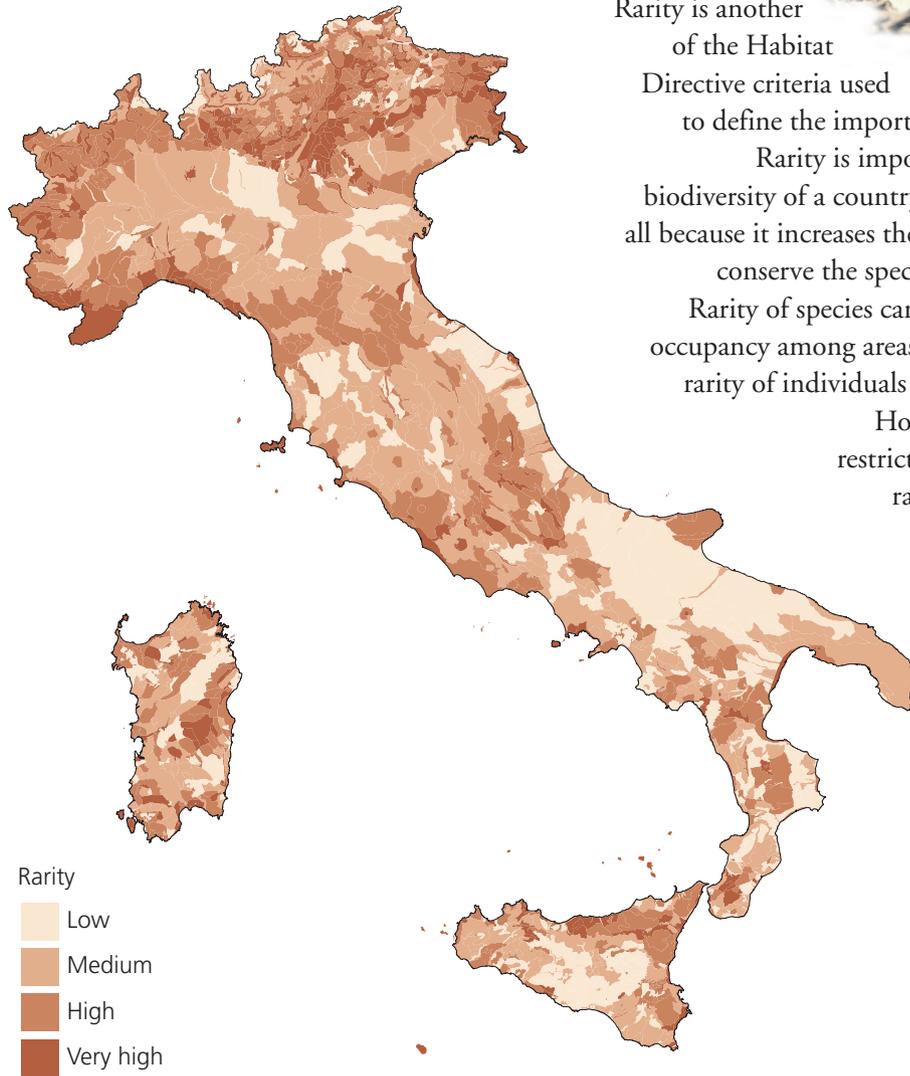


The most extensive endemic species hotspots in Italy are:

- Julian Pre-Alps and Classic Karst
- Western, Central and Eastern Pre-Alps
- Maritime Alps and Ligurian Apennines
- Apuane Alps, Monte Cimone and Corno delle Scale
- Casentinesi Forests, Monti Nerone and Catria, Monti Sibillini
- Mountain massifs of the Latium and Abrutian Apennines
- Tuscan Archipelago and Monte Argentario
- Campanian Archipelago (Pontine, Ischia, Capri, Sorrentine Peninsula)
- Pollino, Sila and Aspromonte massifs
- Peloritani, Nebrodi and Madonie massifs
- Gennargentu Massif, islands and minor massifs of Sardinia

## Rare species

### Rarity



Rarity is another  
of the Habitat

Directive criteria used

to define the importance in conserving a species.

Rarity is important when dealing with the biodiversity of a country, for several reasons. First of all because it increases the number of sites required to conserve the species richness in a certain area.

Rarity of species can be defined both as rarity of occupancy among areas (range-size rarity) as well as rarity of individuals within areas (density rarity).

However, species with relatively restricted geographical distribution ranges do not always have low local abundances (and vice versa), and the two criteria do not necessarily coincide.

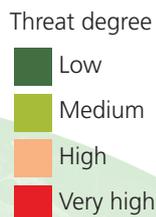
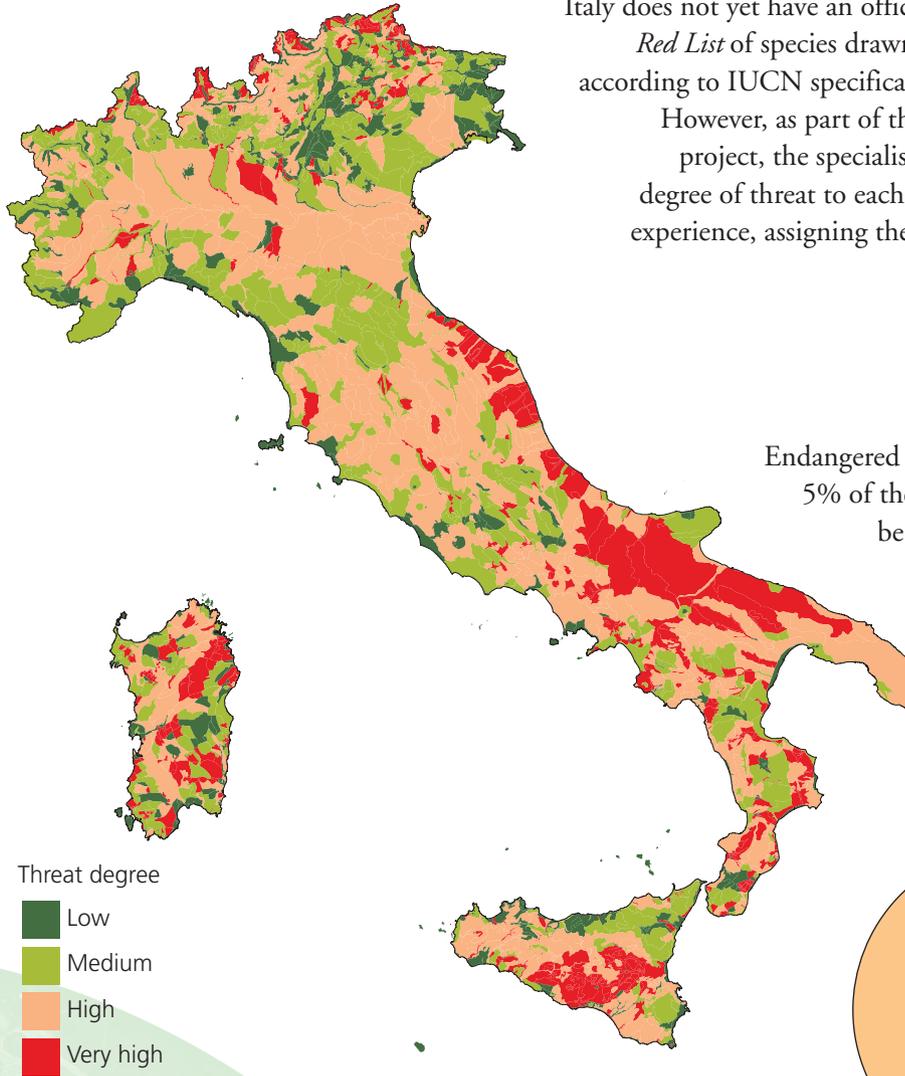
### Rarity hotspots

In the map shown here, the rarity of a Landscape Unit has been quantified simply as the sum total of the rarity of all the species in the area (rarity = the number of cells in the UTM grid occupied by the species), normalised by area. Rarity defined as such depends on the ecological requirements of the species, on their historical biogeography and on anthropic changes in the territory, as well as on the thoroughness of inventories.

One notes how rarity hotspots are localised on the islands, the Alpine and Pre-Alpine arch, and in some isolated areas of Apulia and Apennines. The high incidence of rare species may be explained by bearing in mind endemism (the presence of endemics in a restricted area, and therefore rare), and marginality (the presence in a small, peripheral part of Italy of a species more widely distributed in central Europe, the Balkans, the Iberian Peninsula and Provence, or North Africa).

## Endangered species

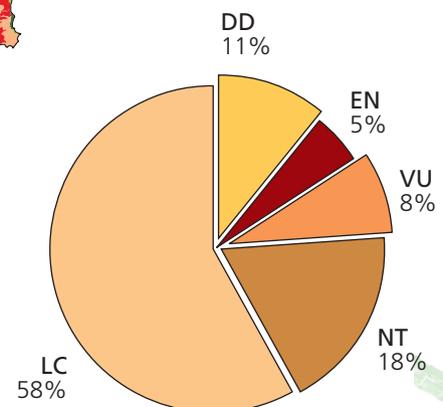
### Endangered species



Italy does not yet have an official *Red List* of species drawn up according to IUCN specifications.

However, as part of the *CKmap* project, the specialists evaluated the degree of threat to each of the species on the basis of experience, assigning the following IUCN categories: EN (*Endangered*); VU (*Vulnerable*); NT (*Nearly Threatened*); LC (*Least concern*); DD (*Data Deficient*).

Endangered species (EN) represent about 5% of the 10,000 considered; 8% can be considered vulnerable (VU).



### Highly threatened areas

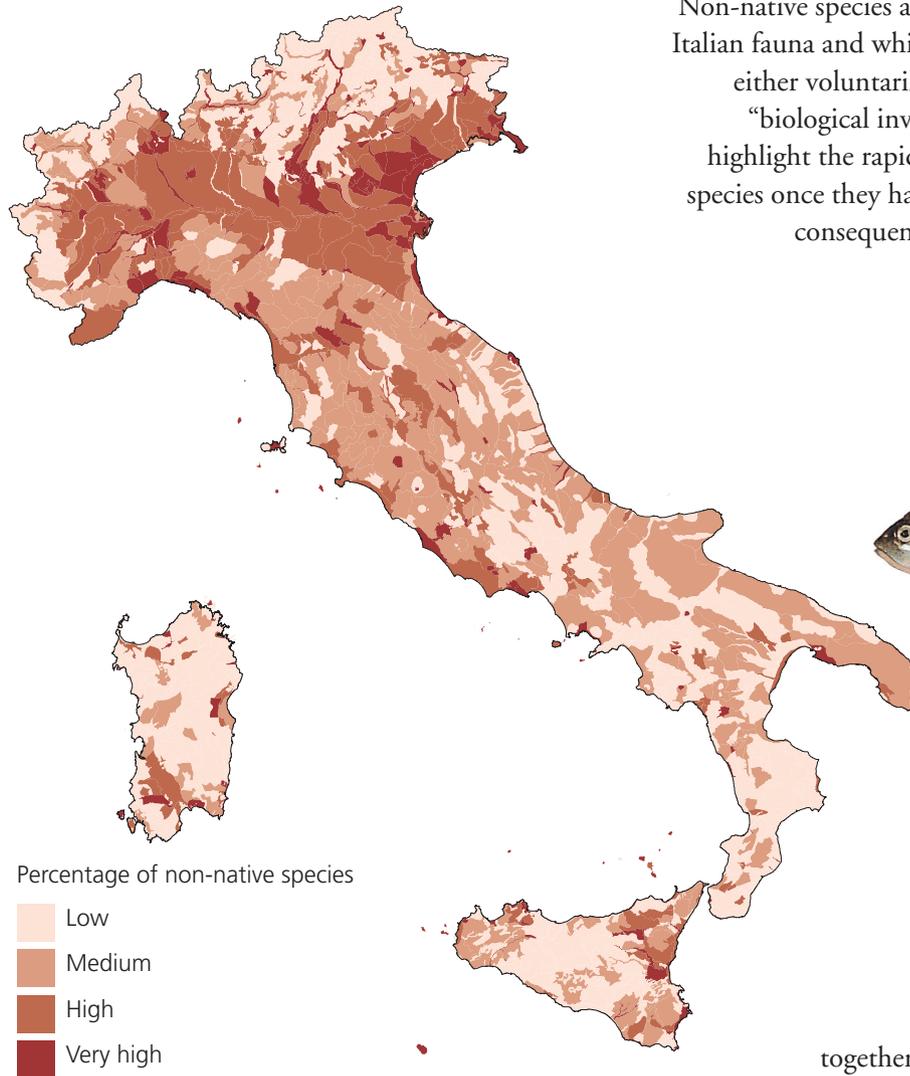
This map shows the incidence of species classified as endangered out of the total number of species present in each Landscape Unit.

The areas where the incidence of threatened, or endangered, species is greater are concentrated around the Po Valley-Venetian area and in the zones where anthropic pressure is greater, for example along the coasts, in certain Alpine valleys and in Apulia.

The high numbers of threatened species on the islands can be explained by the presence of endemics in a restricted area. These endemics, highly sensitive to anthropic and climatic changes, have been classified as endangered despite the fact that they do not live in zones that are markedly deteriorated.

## Non-native species

### Non-native species



Non-native species are those originally foreign to Italian fauna and which were introduced by man, either voluntarily or involuntarily. The term “biological invasions” is sometimes used to highlight the rapid expansion of some of these species once they have been introduced, and the consequent negative effects that ensue.



The introduction of non-native species, especially when invasive, is currently considered one of the major threats to conservation of biodiversity, together with the breaking up of the environment and destruction of original habitats. It is also known that the presence of these species has negative effects on many other aspects of man’s life - economic, social, health and educational.

The map shows the percentages of non-native species within the different Landscape Units. The pattern that emerges is very clear: non-native species are extremely common in the Po Valley and in some strongly anthropised areas (such as the coasts of Latium and Adriatic, Salento, and the Campidano plain in Sardinia).

## Non-native species

### Non-native terrestrial and aquatic species

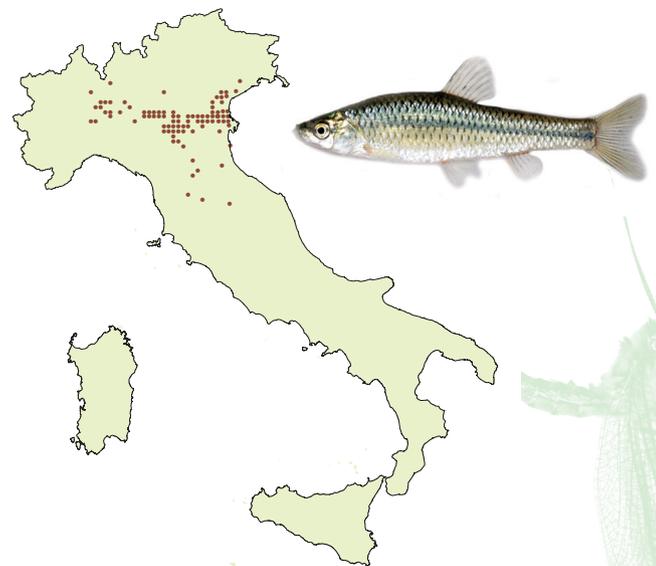
At present the number of non-native species is slightly less than 1% of the 10,000 species taken into consideration. This percentage is not constant throughout the different taxonomic groups though.

Among the terrestrial species, non-native species are known at least among nematodes, gastropods, arthropods and vertebrates; most (80-90%) are insects. Of these, most of the species were introduced in very recent times when commercial plants, seeds and soil were brought in, or through the biological control activity in agriculture. Among amphibians and reptiles some ten or so certain cases of introduction are known; the most problematic species is the American red-eared terrapin (*Trachemys scripta*), which competes with the indigenous European pond terrapin (*Emys orbicularis*). The non-indigenous mammals are mostly rodents. Especially worrying is the case of the nearctic eastern grey squirrel (*Sciurus carolinensis*), in that it is feared that this species, currently widespread in the provinces of Turin and Cuneo, will rapidly expand towards and beyond the Alps, where it will seriously threaten the survival of the indigenous Eurasian red squirrel (*Sciurus vulgaris*). Another notoriously invasive species is the neotropical coypu or nutria, (*Myocastor coypus*), introduced by the fur trade in the 1920s and now responsible for serious changes to the riparian ecosystems.

Some fifty cases are currently known among freshwater invertebrates. Of these, over two thirds are crustaceans, such as the Louisiana crayfish, *Procambarus clarkii*, which originated in the South-eastern United States and was imported into Italy for aquaculture. In constant expansion, this species is worrying due to its invasiveness. However, the most critical situation is to be found with fish: of the 67 species that make up the freshwater ichthyofauna of Italy, almost 60% is non-native. Unfortunately the percentage is constantly on the rise: introduction to the natural environment of non-native species for commercial purposes or sport, although forbidden by law, is still happening and it is perverting the Italian ichthyofauna, putting conservation of endemic species greatly at risk.



Distribution of the coypu  
(*Myocastor coypus*, rodent)



Distribution of the topmouth gudgeon  
(*Pseudorasbora parva*, cyprinid)

## Important Faunal Areas

### IFAs (Important Faunal Areas)



*Important Faunal Areas (IFAs)* can be defined as priority conservation areas since they include high numbers of endemic, rare and endangered species of our lower invertebrates and vertebrates. The IFAs represented in the enclosed map complement the *IBAs (Important Bird Areas)* and areas for the protection of large mammals (particularly carnivores and ungulates). The object is to define the best strategies for conserving Italian fauna using the same methods applied for *IPAs (Important Plant Areas)*. Since the IFAs aims to safeguard the so-called “minor fauna” which, as previously stated, represents about 99% of all land and freshwater fauna in Italy, its contribution to the Countdown 2010 strategy to stop the loss of biodiversity is clearly decisive.

### Faunal importance

A number of algorithms have been applied to the *CKmap* data to identify the *IFAs*. The importance to the conservation of each species has been calculated by adding three indexes together (expressed using values normalised between 0 and 1).

**Endemism.** Every endemic species has been assigned a value relating to the extension of its area in km<sup>2</sup>; the more restricted the area of an endemic species, the more the species is susceptible to anthropic threat, and this makes it important for conservation.

**Rarity.** In this case, the value is determined by the reciprocal number of sites (represented as UTM grid cells) where the species has been found in Italy.

**Threat.** The value increases progressively from LC to EN according to the opinion of the taxonomists. The priority of a Landscape Unit for conservation has been calculated by summing the indexes of all the species in the unit itself and normalising the result on the basis of the area.

## Important Faunal Areas

### *IFAs and natural features*

The distribution pattern of species richness, endemism, non-native species density and *IFAs* is closely connected to the naturalness of the landscape. The map shows the Landscape Units where natural values are conserved according to the indications of the *Corine Landcover 2000* project. Anthropisation of the Po Valley, the coasts, much of Apulia and central-southern Sicily at least partly explains the reduced faunal diversity found in these areas.



### *IFAs and conservation areas*

The distribution in Italy of conservation areas (Protected Areas, Sites of Community Importance, Special Protection Areas), reported on the map, shows how the *IFAs* are well covered. Nevertheless, more could be done concerning the Alps, central-eastern Pre-Alps, the Maritime and Ligurian Alps, and the Tuscan-Emilian Apennines, where the established conservation areas are highly fragmented.



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