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# FAUNA

## TERRESTRIAL FAUNA

### CURRENT STATE OF KNOWLEDGE

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#### Taxonomical and faunistic aspects

The *Checklist of Italian Fauna Species* (MINELLI *et al.*, 1993-95) provided an initial assessment of knowledge regarding the specific make up and distribution of animal species present in Italy. Since its making, the picture has consequently been more clearly outlined through scientific research which has added to and corrected the Checklist, as well as through the project CK Map (see box *From the checklist to CKmap: computerizing the Italian fauna*) sponsored by the Ministry of the Environment to better identify and map the knowledge on the geographical distribution of about ten thousand animal species in Italy, particularly freshwater macroinvertebrates and many groups rich in species with a restricted range, which often occur in few areas in the whole Italy. The project ended with a computerised database, usable mainly by means of maps which are based on a cartography with 10 km sides UTM grids; the project is being spread together with a critical essay on the single groups and the whole Italian fauna (RUFFO & STOCH, in print).

Based on current knowledge, Italian terrestrial fauna is the richest in Europe. However, Italy is still far from possessing a complete inventory. For example, in the cases of some dipteran and hymenopteran families, it is reasonable to assume that future discoveries will at least double the present lists. To cite a case, very recent studies performed in a specific locality (Bosco Fontana near Mantova, a well conserved strip of plain forest that covers merely 233 hectares), has led to the finding of more than 200

dipteran species which were previously unknown in Italy (MASON *et al.*, 2002).

Apart from the two orders of insects mentioned above, the greatest knowledge gaps also concern the majority of soil invertebrates (*e.g.* mites, collembolans, nematodes, but also myriapods, spiders and earthworms), and all the groups of helminth parasites, whose knowledge would be extremely important in the management of populations of host species, be they vertebrates or invertebrates.

Moreover, the list of Italian terrestrial vertebrates should not be considered definitive as there is the occasional addition of allochthonous elements and the continual development of criteria (morphological, genetic, molecular) that allow the confines between one species and another to be more clearly defined. An example in case is the Selva di Arvonchi shrew (*Sorex arunchi*) in north-eastern Italy that was only described in 1998, or that of the Valais shrew (*Sorex antinorii*) described in 1840, but re-evaluated as an independent species (with an Italic-Swiss range) only in 2002. The same can be said for many species of frogs, tree frogs, salamanders and Italian cave salamanders whose characterisation or identification has only come about in the last two decades.

As far as defining the geographical distribution of single species is concerned, a great effort has been made to computerise cartography; however, this effort may be of little avail unless it is progressively integrated 1) by extending these cartography projects to groups not yet considered, 2) through the continuous updating of the database and, above all, and 3) with thorough field studies. These studies should be conducted, above all, in areas rich in biodiversity with particular attention given to the many species, which may not be necessarily rare or localised, but whose insertion into the *Checklist* is warranted by the very few specimens that have been found.

## Biological aspects

Fauna lists simply make up the structure upon which knowledge regarding the biology of single species and their population status is organised. It should be noted that very little is known of many Italian terrestrial invertebrates as regards their biological cycle and more generally, their relationship with the physical and biotic environment. In other cases, knowledge of populations outside Italy is available though it cannot be rigidly applied to Italian populations. For example, central European populations may reproduce fewer times per year than Italian populations or may utilise different food sources.

Hence, the praiseworthy effort made in recent decades to study the biology and habitats of many Italian vertebrate and invertebrate populations that are of agricultural, forestry, medical or veterinary interest, must be extended to groups that have been ignored up to now because of the evident priority given to species of great conservation interest.

## Endemism

Of the approximately 42,000 species of terrestrial animals (Table 5.1) identified so far in Italy, more than 4,000 are of particular importance (10% of the total) in that they are endemic to Italy, that is, at the present state of knowledge, these species do not occur outside the Italian borders. Obviously, the distribution of each of these species in Italy is generally restricted to specific areas, for example, to single Alpine or Apennine areas, or to one of the larger islands. Further ahead, entire sections are devoted to the most important zoological groups (terrestrial Molluscs, Coleopterans, Lepidopterans and Vertebrates) whose endemic component is outlined. For the other groups, the situation is summarised below.

The most interesting Italian regions in terms of An-

**Table 5.1** - Taxonomical composition of Italian terrestrial fauna, according to MINELLI *et al.* (1993-95). As regards to Helminth Parasites (Cestoda, Digenea, Monogenea, Nematoda), those species whose definitive host is a terrestrial species have been considered. Those insects with aquatic preimaginal stages have been excluded (and attributed to freshwater species). As regards to birds, the following groups/species attributed to aquatic habitats have been excluded: Procellariiforms, Ciconiiforms, Stercorariids, Larids, Sternids, Alcids, Gaviiforms, Podicipediforms, Anseriforms, Gruiforms except for *Turnix*, the Cormorant, the Pelican, the Gannet, the Flamingo. As regards to Mammals, apart from the Seal and Cetaceans, two *Neomys*, the Otter and the Coypu have been excluded.

	Total no. of species	Endemic species	%
'Turbellari'	6	2	33
Digenei	188		
Cestodi	217		
Nematodi	776		
Acantocefali	7		
Gasteropodi	482	166	34
Policheti	1		
Clitellati	139	18	13
Scorpioni	4		
Palpigradi	9	4	44
Solifugi	2	2	100
Opilioni	120	37	31
Pseudoscorpioni	207	120	58
Ragni	1,405	211	15
Acari	2,516	28	1
Pentastomidi	2		
Isopodi	356	210	59
Chilopodi	155	47	30
Diplopodi	473	277	59
Paupodi	43	4	9
Sinfilii	19	3	16
Collemboli	417	62	15
Proturi	31	3	10
Dipluri	76	36	47
Archeognati	47	14	30
Zigantomi	19		
Mantodei	12		
Ortotteri	333	90	27
Isotteri	2		
Blattari	40	21	52
Fasmodei	8	1	12
Embiidini	5	2	40
Dermatteri	22	7	32
Psocotteri	102		
Ftiratteri	267		
Tisanotteri	213	1	0.5
Eterotteri	1,292	34	2.6
Omotteri	2,147	103	4.8
Coleotteri	11,458	2,007	17.5
Rafidioidei	20	3	15
Planipenni	147	2	1.4
Mecotteri	10	1	10
Sifonatteri	81		
Strepsitteri	21	3	14
Ditteri	4,864	253	5
Lepidotteri	5,058	188	3.7
Imenotteri	7,525	71	0.9
Tardigradi	148	31	21
Anfibi	26	12	46
'Rettili'	49	3	6
Uccelli	326		
Mammiferi	98	4	4
<b>Totale</b>	<b>41,991</b>	<b>3,918</b>	<b>9.33</b>

nelids are the Tyrrhenian area, in which the robust earthworms of the genus *Hormogaster* are found, including the endemic Sardinian species *Hormogaster praetiosa*, and the Prealpine belt of north-eastern Italy, where the gigantic endemic earthworm *Eophila tellinii* (that can reach more than 60 cm in length) and the land leech (*Xerobdella praealpina*) described only in 1973, are found.

Among the Arachnids, Pseudoscorpions are the group that best characterises Italian fauna, with a very high rate of endemism (58%) out of the total of 207 species present, many of which are cave-dwellers with a very restricted range. Many of the 211 endemic spider species (15% of the total) are also cave-dwellers, and are limited to only a few families, above all, to Disderids (41 species out of 61 Italian species), Leptonetids (6 out of 8), Nesticids (4 out of 7), and to few genera, *Lepthyphantes* (17 out of 62) and, above all, to *Troglohyphantes* (25 out of 32 species) among Linyphiids, and to *Tegenaria* among Agelenids (14 out of 33).

There is very high rate of endemism in two groups of invertebrates that represent a fundamental component of ground-occurring macro-arthropods, especially in forest habitats, but also in cave-dwelling habitats with many species (and also genera) that have a very restricted range: 210 endemic Isopods (terrestrial) and 277 Diplopod species, which in both cases make up 59% of the Italian population. The endemic rate is lower among Chilopods that are more vagile and predatory, with 47 species (30% of Italian fauna). Of this group, an extraordinary relict species that was only described in 1982 is worthy of note: *Acanthogeophilus dentifer* that has been observed in Liguria and Puglia and is similar to a species in Algeria and Tunisia.

Among the other groups of wingless arthropods associated with the soil, the endemic rate is quite high in Diplurans (36 species, 47 %), above all, in Japigids, and in Jumping Bristletails (Order Archeognatha) (14 species, 30%), and lower in Proturans, Collembolans, Symphylans and Pauropods and zero in Silverfishes. Italian specimens were used to describe the first recognised species of Proturans (*Acerentomon doderoi*, described in 1907) and, among Arachnids, the first recognised species of Palpigrades (*Eukoenenia mirabilis*, described in 1885).

The rate of endemism among winged insects, which varies greatly in the various orders, is specified in Tables 5.1-5.4.

Worthy of note is the absence of endemic species in the orders that include ectoparasites of mammals or birds (*Phthiraptera*, *Aphaniptera*), which is a situation similar to that of helminth parasites. Moreover, this is the case of

Limoniidi	9	Otitidi	4
Pediciidi	4	Lauxaniidi	5
Tipulidi	27	Agromizidi	12
Blefariceridi	5	Opomizidi	1
Psicodidi	45	Cloropodi	4
Taumaleidi	5	Eleomizidi	1
Simuliidi	17	Sferoceridi	3
Ragionidi	11	Milichiidi	1
Tabanidi	1	Efidridi	17
Acroceridi	1	Scatofagidi	3
Bombiliidi	6	Muscidi	7
Asilidi	15	Calliforidi	5
Dolicopodidi	11	Sarcofagidi	3
Sirfidi	21	Tachinidi	1
Foridi	8	<b>Total</b>	<b>253</b>

Table 5.2 - Number of Dipteran species endemic to Italian fauna, according to MINELLI *et al.* (1993-95). Only the families that include at least one endemic species are listed.

numerous dipterans (Tachinids) and especially of hymenopterans (Chalcidoids, Proctotrupoids, Ichneumonids) which during the larval stage are parasites of other insects.

Regardless of diet type or selected habitats, the rate of endemism is generally high each time the tendency to vagility is reduced, which for insects means when their wings are reduced or disappear. For example, this is true of Orthopterans whose rate of endemism is a high 27%, with considerable contingents of species with restricted ranges – often glacial relict species – occurring at high altitudes on the Alps or the Apennines.

In the context of large insect orders, Coleopterans are worth mentioning (though with enormous differences among the diverse families) because of the large number of endemic species, while these are relatively scarce in other cases (see Tables 5.2 and 5.4 respectively for Dipterans and Lepidopterans).

As regards to Hemipterans (True Bugs), the *Checklist* lists 137 endemic Italian species, though many names are likely to be cancelled from the list following taxonomical and faunistic research that is underway. Instead, additions are expected to be made to the list with recent discoveries of new Italian species for one family of Heteropterans (Myrids) and a group Sternorrhyncha Homopterans (Psyllids).

As regards to Vertebrates, the *Checklist* lists 12 Amphibian species, 3 Reptile species, and 4 Mammal species that are endemic to the Italian territory. However this list, with all the uncertainties and disparities of opinion that accompany these taxonomical assessments, will most likely increase, as already mentioned with regards to Shrews (Table 5.5).

Family	Italy	endemic species	endemic species %
<i>Acanthocnemidae</i>	1		
<i>Aderidae</i>	17	2	12
<i>Agyrtidae</i>	4		
<i>Alexiidae</i>	15	7	47
<i>Anobiidae</i> (incl. <i>Prinidae</i> )	189	10	5
<i>Anthicidae</i>	106	13	12
<i>Anthribidae</i>	22		
<i>Aphodiidae</i>	137	5	4
<i>Apionidae</i>	203	7	3
<i>Attelabidae</i>	38		
<i>Biphyllidae</i>	3		
<i>Bostrychidae</i>	29		
<i>Bothrideridae</i> (incl. <i>Anommatidae</i> )	33	8	24
<i>Brachyceridae</i> (incl. <i>Rhyncophoridae</i> )	19		
<i>Brentidae</i>	1		
<i>Buprestidae</i>	234	13	6
<i>Byrrhidae</i>	38	4	11
<i>Byturidae</i>	2		
<i>Cantharidae</i>	207	64	31
<i>Carabidae</i>	1,277	342	27
<i>Cebrionidae</i>	12	5	42
<i>Cerambycidae</i>	274	14	5
<i>Cerophytidae</i>	1		
<i>Cerylonidae</i>	9		
<i>Cetoniidae</i>	28	2	7
<i>Chironidae</i>	1		
<i>Cholevidae</i>	237	145	61
<i>Chrysomelidae</i> (incl. <i>Bruchidae</i> , <i>Orsodacnidae</i> , <i>Megalopodidae</i> )	883	56	6
<i>Ciidae</i>	48		
<i>Clambidae</i>	15		
<i>Cleridae</i> (incl. <i>Thanerocleridae</i> )	35	2	6
<i>Coccinellidae</i>	126	2	2
<i>Colonidae</i>	25	3	12
<i>Corylophidae</i>	37	2	5
<i>Crowsoniellidae</i>	1	1	100
<i>Cryptophagidae</i> (incl. <i>Hypocopridae</i> )	121	3	2
<i>Cucujidae</i> (incl. <i>Laemophloeidae</i> )	35		
<i>Curculionidae</i>	1,664	415	25
<i>Cybocephalidae</i>	15		
<i>Dascillidae</i>	4		
<i>Dermestidae</i> (incl. <i>Thorictidae</i> )	81	3	4
<i>Derodontidae</i>	3	1	33
<i>Drilidae</i>	4		
<i>Dryopidae</i>	17	1	6
<i>Dynastidae</i>	6	1	17
<i>Dytiscidae</i> (incl. <i>Noteridae</i> )	194	17	9
<i>Elateridae</i>	235	25	11
<i>Elmidae</i>	27	2	7
<i>Endecatommidae</i>	1		
<i>Endomychidae</i> (incl. <i>Merophysiidae</i> )	40	5	13
<i>Erotylidae</i>	20		
<i>Eucinetidae</i>	3		
<i>Eucnemidae</i>	21		
<i>Georissidae</i>	5		
<i>Geotrupidae</i>	21	1	5

<i>Glaphyridae</i>	2	1	50
<i>Gyrinidae</i>	12		
<i>Halipilidae</i>	21	1	5
<i>Helophoridae</i>	25		
<i>Heteroceridae</i>	18		
<i>Histeridae</i>	158	9	6
<i>Hybosoridae</i>	1		
<i>Hydraenidae</i>	151	35	23
<i>Hydrochidae</i>	7		
<i>Hydrophilidae</i>	47		
<i>Hydrosaphidae</i>	2		
<i>Hygrobiidae</i>	1		
<i>Kateretidae</i> (= <i>Brachypteridae</i> )	17		
<i>Lampyridae</i>	21	4	19
<i>Languriidae</i>	3		
<i>Latridiidae</i>	85	4	5
<i>Leioidae</i> (incl. <i>Platysyllidae</i> )	105	7	7
<i>Limnichidae</i>	9		
<i>Lucanidae</i>	9		
<i>Lycidae</i>	6	1	17
<i>Lyctidae</i>	10		
<i>Lymexylidae</i>	2		
<i>Melandryidae</i>	33		
<i>Meloidae</i>	63	3	5
<i>Melolonthidae</i>	85	36	42
<i>Melyridae</i> (incl. <i>Malachidae</i> , <i>Gietellidae</i> , <i>Dasytidae</i> )	225	46	20
<i>Monotomidae</i> (= <i>Rhizophagidae</i> )	26		
<i>Mordellidae</i>	89	10	11
<i>Mycetophagidae</i>	19		
<i>Mycteridae</i>	3		
<i>Nemonychidae</i>	3		
<i>Nitidulidae</i>	180	2	1
<i>Nosodendridae</i>	1		
<i>Ochodaeidae</i>	2	1	50
<i>Oedemeridae</i>	43	4	9
<i>Omalisidae</i>	8		
<i>Orphnidae</i>	4	1	25
<i>Pachypodidae</i>	2	1	50
<i>Passandridae</i>	1		
<i>Pedilidae</i>	1		
<i>Phalacridae</i>	35	1	3
<i>Phloeostichidae</i>	1		
<i>Phloiophilidae</i>	1		
<i>Platypodidae</i>	2		
<i>Prostomidae</i>	1		
<i>Psephenidae</i>	1		
<i>Priliidae</i>	74	1	1
<i>Pyrochroidae</i>	3		
<i>Pythidae</i>	1		
<i>Rhipiphoridae</i>	9	2	22
<i>Rutelidae</i>	15	2	13
<i>Salpingidae</i> (incl. <i>Othniidae</i> )	17		
<i>Scarabaeidae</i>	50	1	2
<i>Scirtidae</i>	42	14	33
<i>Scolytidae</i>	129		
<i>Scraptidae</i>	47	9	19
<i>Scydmaenidae</i>	185	59	32

<i>Silphidae</i>	28		
<i>Silvanidae</i>	35	1	3
<i>Spercheidae</i>	1		
<i>Sphaeridiidae</i>	36		
<i>Sphaeritiidae</i>	1		
<i>Sphaeriusidae</i> (= <i>Microsporidae</i> )	2		
<i>Sphindidae</i>	3		
<i>Staphylinidae</i> (incl. <i>Dasyceridae</i> , <i>Pselaphidae</i> , <i>Micropeplidae</i> , <i>Scaphidiidae</i> )	2,567	647	25
<i>Tenebrionidae</i> (incl. <i>Alleculidae</i> , <i>Lagriidae</i> )	319	70	22
<i>Tetratomidae</i>	8	1	13
<i>Throscidae</i>	11		
<i>Trogidae</i>	10		
<i>Trogossitidae</i>	11		
<i>Urodontidae</i>	8		
<i>Zopheridae</i> (= <i>Colydiidae</i> )	38	8	21
<b>Totale number of species</b>	<b>12,014</b>	<b>2,163</b>	<b>18</b>
<b>Totale number of families</b>	<b>130</b>		
Italy: number of species present in Italy.			
Endemic species: number of endemic species in Italy.			
% Endemic species: percentage of endemic species in Italy compared to the total number of species present.			

### Conservation status

As far as terrestrial (and freshwater) vertebrates of Italian fauna are concerned, two thirds of these species have found their way in the *Libro rosso degli animali d'Italia* (Red Book of Italian Fauna) drawn up by WWF Italia (BULGARINI *et al.*, 1998).

However, the conservation status of invertebrates is very poorly documented: for example, for insects, the *Checklist* only signals two hundred threatened species. If one considers the species connected to sandy beaches and to dunes, those that live in dead wood, and those that feed exclusively on plant species with a limited distribution, it is quite clear that this figure is a great underestimation of the real situation. However, useful indications are emerging from a critical analysis of the distribution data gathered in the context of computerised cartography mentioned earlier in this chapter, though further efforts are both necessary and urgent.

**Table 5.3** - List of Coleopteran families of Italian fauna (MINELLI *et al.*, 1993-95, partly updated to 2002). *Following from previous page*

Superfamily	Families	Genera	Total no. species	Endemic species number	Endemic species %	Threatened species number	Threatened species %
<i>Micropterigoidea</i>	1	1	29	12	41.4		
<i>Eriocranioidea</i>	1	3	5				
<i>Hepialoidea</i>	1	6	10	3	30		
<i>Nepticuloidea</i>	2	15	142	1	0.7		
<i>Incurvarioidea</i>	4	12	57	2	3.5		
<i>Tischerioidea</i>	1	2	7				
<i>Tineoidea</i>	18	126	527	7	1.3		
<i>Gelechioidea</i>	18	178	1,048	45	4.3		
<i>Cossoidea</i>	1	8	9	1	11.1		
<i>Sesioidea</i>	2	9	58				
<i>Choreutoidea</i>	1	5	11				
<i>Zygaenoidea</i>	3	8	45	4	8.9		
<i>Tortricoidea</i>	1	117	605	16	2.6		
<i>Urodoidea</i>	1	1	1				
<i>Schreckensteinoidea</i>	1	1	1				
<i>Epermenioidea</i>	1	3	17				
<i>Alucitoidea</i>	1	2	14				
<i>Pterophoroidea</i>	1	29	92	4	4.3		
<i>Copromorphoidea</i>	1	1	1				
<i>Pyraloidea</i>	2	181	530	7	2.1		
<i>Papilionoidea</i>	9	80	278	50	18	21	7.5
<i>Thyridoidea</i>	1	1	2				
<i>Lasiocampoidea</i>	2	14	28				
<i>Bombycoidea</i>	5	22	34	1	2.9	1	2.9
<i>Drepanoidea</i>	2	14	17				
<i>Axioidea</i>	1	1	1				
<i>Geometroidea</i>	1	190	618	21	3.4		
<i>Noctuoidea</i>	5	406	940	18	1.9	4	0.43
<b>Total</b>	<b>88</b>	<b>1,436</b>	<b>5,127</b>	<b>192</b>	<b>3.8</b>	<b>26</b>	<b>0.5</b>

**Table 5.4** - Italian Lepidopteran families according to MINELLI *et al.* (1993-95). The total number of families, genera, species, endemic species and threatened species is given for each superfamily present in Italy.

<b>AMPHIBIANS</b>
<i>Euproctus platycephalus</i> (GRAVENHORST, 1829)
<i>Salamandra atra aurorae</i> TREVISAN, 1982
<i>Salamandra salamandra gigliolii</i> EISELT e LANZA, 1956
<i>Salamandrina terdigitata</i> (LACÉPÈDE, 1788)
<i>Triturus alpestris apuanus</i> (BONAPARTE, 1839)
<i>Triturus alpestris inexpectatus</i> DUBOIS e BREUIL, 1983
<i>Triturus italicus</i> (PERACCA, 1898)
<i>Speleomantes ambrosii</i> (LAUZA, 1955)
<i>Speleomantes flavus</i> (STEFANI, 1969)
<i>Speleomantes genei</i> (TEMMINCK e SCHLEGEL, 1838)
<i>Speleomantes imperialis</i> (STEFANI, 1969)
<i>Speleomantes italicus</i> (DUNN, 1923)
<i>Speleomantes supramontis</i> (LAUZA, NASCETTI e BULLINI, 1986)
<i>Bombina pachypus</i> (BONAPARTE, 1838)
<i>Discoglossus pictus pictus</i> OTTH, 1837
<i>Pelobates fuscus insubricus</i> CORNALIA, 1873
<i>Hyla</i> sp. inquirenda
<i>Rana italica</i> DUBOIS, 1987
<i>Rana latastei</i> BOULANGER, 1879
<i>Rana lessonae</i> , 2 ssp. inquirendae
<b>REPTILES</b>
<i>Algyroides fitzingeri</i> (WIEGMANN, 1834)
<i>Archaeolacerta bedriagae paessleri</i> (MERTENS, 1927)
<i>Archaeolacerta bedriagae sardoa</i> (PERACCA, 1903)
<i>Podarcis filfolensis laurentiimuelleri</i> (FEJÉRVÁRY, 1924)
<i>Podarcis tiliguerta ranzii</i> (LANZA, 1967)
<i>Podarcis tiliguerta toro</i> (MERTENS, 1932)
<i>Podarcis wagleriana</i> GISTEL, 1868
<i>Chalcides chalcides</i> (LINNAEUS, 1758)
<i>Elaphe longissima romana</i> (SUCKOW, 1798)
<i>Natrix natrix calabra</i> VANNI e LANZA, in LANZA, 1983
<i>Natrix natrix sicula</i> (CUVIER, 1829)
<b>MAMMALS</b>
<i>Sorex samniticus</i> ALTABELLO, 1926
<i>Sorex arunchi</i> LAPINI e TESTONE, 1998
<i>Crocidura russula ichnusae</i> FESTA, 1912
<i>Crocidura russula cossyrensis</i> CONTOLI, in CONTOLI <i>et al.</i> , 1989
<i>Crocidura sicula</i> MILLER, 1901
<i>Talpa romana</i> THOMAS, 1902
<i>Lepus europaeus corsicanus</i> DE WINTON, 1898
<i>Lepus capensis mediterraneus</i> WAGNER, 1841
<i>Eliomys quercinus liparensis</i> KAHMAMM, 1960
<i>Eliomys quercinus sardus</i> BARRETT-HAMILTON, 1901
<i>Microtus savii</i> (DE SÉLYS-LONGCHAMPS, 1838)
<i>Ursus arctos marsicanus</i> ALTABELLO, 1921
<i>Sus scrofa meridionalis</i> FORSYTH MAJOR, 1882
<i>Cervus elaphus corsicanus</i> ERXLEBEN, 1777
<i>Capreolus capreolus italicus</i> FESTA, 1925
<i>Ovis orientalis musimon</i> (PALLAS, 1811)
<i>Capra ibex ibex</i> LINNACUS, 1738

**Table 5.5** - Vertebrate species and subspecies endemic to the Italian Territory, according to MINELLI *et al.* (1993-95).

## Habitats that are more greatly threatened

The habitats most greatly altered by man in the last few decades are those of the sandy coast zones, of which only minuscule fragments still survive. These areas host animals whose survival is not only placed in danger by the ever impending threat of transformation into bathing areas, but also, and more seriously, by their extreme fragmentation and discontinuity, which makes the survival of many populations extremely precarious, including those whose range is reduced to a single spot on a geographical map. Many invertebrate species that occur from the foreshores to the dunes have almost disappeared from most of the coastal tracts where they were numerous in the past. This is true for crustacean and dipteran fauna connected to beached *Posidonia*, as well as for the predatory, coprophagous and detritivorous coleopterans linked to beach habitats, including *Scarabaeus sacer*, the sacred beetle in ancient Egypt. Four or five tiger beetle species (coleopterans) are almost locally extinct and the same fate seems to hold for several coprophagous scarabaeids such as *Ceratophyus rossii* and *Heptaaulacus rasettii*; moreover, these two species exclusive to Italian fauna seem to be confined to very few areas of the coast of Toscana.

Changes to retrodunal systems have also been devastating where reclamation of marshes and hygrophilous woods has led to the near total cancellation of characteristic plant formations and associated fauna, which only survive in strips in military zones and ancient nobiliary large estates. The fragmentation of these habitats, which is not so dramatic for avifauna capable of moving from one 'island' to another, has instead been deleterious for minor fauna, in particular for amphibians, as well as invertebrates (insects, shellfish) linked to marshland and to the stagnant waters of retrodunal areas. The creation of appropriate faunistic corridors could partly alleviate this very serious situation.

Another problem concerns forest management, especially in broad-leaved forests where regular maintenance that removes dead wood has practically cancelled the necessary living conditions of a rich variety of specialised invertebrate fauna, which include numerous sub-cortical coleopteran species belonging to the Zopherid, Bothriderid and Cucujid families. The same type of forest management has also had repercussions on bird fauna. Instead, important entomological xylophagous fauna (including several scarabaeid coleopterans of the genera *Osmoderma*, *Gnorimus* and *Potosia*,



*Cerambyx* and other large Cerambycids – long-horned beetles) have been harmed by the cutting down of ailing secular trees by forest rangers or, upon suggestion of forest consultants, by the local authority maintenance services of public parks.

This situation can clearly be seen in the recent *Libro Rosso degli insetti della Toscana* (SFORZI & BARTOLOZZI, 2001) (Red Book of Insects of Toscana), where 38 aquatic insect species are listed along with 256 terrestrial insect species, the majority of which are linked to coastal habitats or to low-altitude woodland. Even this regional list, though far from being complete, is limited to the most commonly studied groups, in particular, to Coleopterans and Macrolepidopterans.

In a country such as Italy, cave-dwelling fauna are also at particular risk in that karstic systems are practically extended to all regions and host populations that are among the most important not only in Europe. Apart from the usual causes of both direct or indirect destruction and disturbance, cave-dwelling fauna continue to be subjected to exorbitant and indiscriminate taking by collectors that irresponsibly harm the numerically small populations of many of these species.

### Rarefaction and recovery of populations

The causes for variation in range and size of animal populations are largely due to man's intervention. However, in view of effective conservation policies, it is always necessary to identify and separate the causes of variation which may be due to natural factors. For example, on the one hand, increased average temperatures in Italy last century (not only due to man-made causes) have led to the expansion of Mediterranean or subtropical species, such as the jackal among mammals, the bee-eater among birds and the monarch butterfly among invertebrates, while on the other hand, these increased temperatures have caused the rarefaction and even the disappearance from Italy of species connected to cooler habitats, such as the butterfly *Araschnia levana*, that has no longer been observed in Italy for over a century.

There has also been the spontaneous recovery of populations of other animals following changes in man's presence in the selected habitats of certain species, as in the case of the great black woodpecker, the golden eagle, the Alpine chamois, and the marmot.

Generally, there are many causes that lead to the rarefaction of species, especially in animals that conduct an amphibious life, such as the otter, which felt the effects

of changes to freshwater habitats where it feeds (optimisation of water systems, increased water pollution, direct persecution of the species), but also to changes in the surrounding terrestrial habitats, particularly, the destruction of riparian woods, since the otter digs its den at the base of mature trees.



Fig. 5.1 - *Marmota marmota*. Gran Paradiso National Park (Photo by A. Carni).

### Legislation

Recent international and national regulations are now obtaining some positive results. As far as birds are concerned, application of Directive 79/409/EEC has led to the identification of 335 *Special Protection Zones* in Italy that cover nearly 2,500,000 hectares. For example, the entire nesting area of the lesser kestrel (*Falco naumanni*) comes within these areas, as do 60% of red heron nesting pairs.

With the implementation of the 'Habitats' Directive 92/43/EEC, 2,256 *Proposed Sites of Community Importance* have been identified for the Italian territory, covering 14.6% of the national territory (see chapter *In situ conservation*). The completion of procedures leading up to the creation of the Natura 2000 network and the consequent management of this network are other priorities of the Italian policy on fauna conservation.

# MOLLUSCS

[Folco Giusti, Giuseppe Manganelli, Simone Cianfanelli]

## Current knowledge

Knowledge regarding Italian terrestrial molluscs (about 500 species) is somewhat heterogeneous: the taxonomical classification of numerous groups of species is still clearly inadequate, chorological data are even scarcer and fragmented and, above all, lacking almost completely in terms of data on ecology, biology, and population density for single species. Notwithstanding this situation, it is evident that Italian terrestrial malacofauna contains a considerable variety and richness of species which derives from the geographical position, climatic and environmental diversity, and from the complex geological and paleogeographical history of Italy. All this corresponds to a high degree of endemism, even at the genus level (*Toffoletia*, *Lampedusa*, *Muticaria*, *Leucostigma*, *Ichnusotricha*, *Nienhuisiella*, *Ichnusomunda*, *Cernuellopsis*, *Helicotricha*, *Ciliellopsis*, *Tyrrheniellina*, *Falkneria*, *Tyrrheniberus*, *Tacheocampylaea*). Some of these are also present in Corsica and in the islands of Malta, both areas faunistically related to Italy.

Many species have a greatly reduced distribution and are very rare. However, often no precise evidence exists to confirm that their rarity or restricted range can be placed in relation to a recent decline. In fact, though detailed information is lacking as to population density, distribution, ecology, and possible risk factors of single species, one cannot exclude that such a rarity is simply

due to natural causes. Therefore, at the present state of knowledge, these species are opportunely classified at *Lower Risk (near threatened)* IUCN, 1994. However, this does not mean that they should not be kept under observation nor monitored. Only a few species have actually been found to be threatened by non-natural causes such as habitat change, fragmentation, habitat destruction or indiscriminate gathering.

## Conservation status

The most endangered terrestrial biotopes for terrestrial molluscs due to man's intervention include island habitats, coastal dunes, caves, forests and wetlands.

Island habitats, due to their limited area, are often subjected to great anthropic pressure (building developments, reforestation with alien tree species, grazing of domestic ungulates, introduction of animal species that are not indigenous to the island, massive exploitation of water resources, waste dumps, etc), have always been subjected to great changes. Among the many endemic mollusc species of Italy's minor islands (see Table 5.6), five are worthy of mention: *Oxychilus ogilasicola*, *Oxychilus denatale*, *Tyrrheniellina josephi*, *Ciliellopsis ogilae* and *Tacheocampylaea tacheoides*.

The coastal dune is another habitat that is placed under great anthropic pressure due to increased tourism.



Fig. 5.2 - *Chilostoma cingulatum* is a subendemic Italian species (outside Italy, it is only present in the neighbouring areas of Lugano, Switzerland), and is considered among the most important that live in calcareous habitats. The molluscs that live in rocky habitats (*Cochlostoma*, *Chondrina*, *Medora*, *Marmorana*, etc.) are often fragmented into many isolated populations, often morphologically diverse one from the other (Photo by S. Cianfanelli).

Species	Distribution
<i>Hypnophila emiliana</i>	Marettimo (Egades Islands)
<i>Hypnophila incerta</i>	Aeolian Islands
<i>Oxychilus alicurensis</i>	Alicudi (Aeolian Islands)
<i>Oxychilus denatale</i>	Marettimo (Egades Islands)
<i>Oxychilus diductus</i>	Lampedusa (Pelagian Islands)
<i>Oxychilus egadiensis</i>	Favignana & Levanzo (Egades Islands)
<i>Oxychilus lagrecai</i>	Filicudi (Aeolian Islands)
<i>Oxychilus majori</i>	Giannutri (Archipelago of Toscana), Monte Argentario & Ansedonia
<i>Oxychilus nortoni</i>	Ustica
<i>Oxychilus pilula</i>	Capraia (Archipelago of Toscana)
<i>Oxychilus ogilasicola</i>	Montecristo & Pianosa (Archipelago of Toscana)
<i>Limax aeolianus</i>	Aeolian Islands
<i>Lampedusa lopadusae</i>	Lampedusa & Lampione (Pelagian Islands)
<i>Cernuella usticensis</i>	Ustica
<i>Ciliellopsis ogilae</i>	Montecristo (Archipelago of Toscana)
<i>Schileykiella bodonii</i>	Marettimo (Egadi)
<i>Tyrrheniellina josephi</i>	Capraia (Archipelago of Toscana) & Sardegna
<i>Tacheocampylaea tacheoides</i>	Capraia (Archipelago of Toscana)

Table 5.6 - Terrestrial molluscs endemic to small Italian islands.



Some of the species that live in this habitat type have a restricted distribution, such as *Ichnusomunda sacchii*, a recently described species of the sandy dunes found in a limited area along the western Sardinian coast.

Calcareous formations are favourable habitats for many gastropod species suited to living among the xerophile vegetation and/or on bare walls covered only in lichens. Because of their fragmented distribution, calcareous formations generally contain a high level of endemic fauna. Many calciphile species have prosperous populations and do not run the risk of extinction. Instead others, especially if they have a restricted distribution, such as *Cochlostoma canestrinii*, *Renea bourguignatiana*, *Platyla sardoa*, *Xerossecta giustii* and *Cantareus mazzullii*, may well be at risk. Still others can be negatively affected by human activity, particularly, by mining. This last mentioned seems to be the case of *Chondrina oligodonta*.

Deforestation as well as less destructive cultivation practices such as felling or reforestation with conifers has negative effects on malacofauna linked to forest habitats. Forest fires, which frequently affect vast areas of the peninsula, are also particularly destructive for nemoral species. Many terrestrial molluscs need mature, intact habitats that are characterised by basic soils; hence they survive poorly in soils acidified by conifers. In fact, the reduction of tall forests is the likely cause of the decline of species such as *Balea perversa*.

Hygrophilous species, such as those that live near wetland habitats, are among the most endangered due to habitat alteration and/or destruction. Some of these, such

Fig. 5.4 - Two species of the genus *Oxychilus*: *Oxychilus meridionalis* (right) is an epigeous species that is quite common throughout Toscana, and *Oxychilus paulucciae* (left) is a cave-dwelling animal, endemic to the Apuan and Garfagnana Alps. The species of this genus which are edaphic fauna predators, have a high degree of endemism, and therefore are of considerable conservation interest (Photo by S. Cianfanelli).



Fig. 5.3 - *Daudebardia rufa*, a ground-occurring species that lives under marcescent wood or stones in forests as well as in open-area biotopes, is only present in the central-southern regions of Italy, in Sicilia and Sardegna (Photo by S. Cianfanelli).

as *Vertigo moulinsiana*, seem to have been subjected to a recent marked cutback of their Italian range.

Certain species may be endangered by two types of situations: their removal as foodstuff items and their removal as collector items. In the first case, only a few species up to now are of interest as food items in Italy. In this category, we can find the larger species of Hygromiids (*Cer-nuella virgata*) and Helicids (*Theba pisana*, *Eobania vermiculata*, *Cantareus apertus*, *Cantareus aspersus*, *Helix* spp.), which are generally quite common throughout the Italian territory. Only a number of natural populations of *Helix pomatia* have been subjected to a certain decline as a consequence of excessive collection.

Another risk factor involves those species utilised as foodstuffs: the translocation of individuals from one site to another for commercial breeding purposes. Apart from compromising the genetic individuality of autochtho-

nous populations, it can also lead to the introduction of specimens to sites not included in their original range (see the progressive adaptation of *Helix lucorum* in Sardegna, Piemonte and Friuli-Venezia Giulia). At this point it is necessary to say that collecting may not be a harmful practice as long as it is limited to the exclusive collection of shells, though, when the trading interests are particularly high, this is clearly negative for rarer species as perfectly conserved shells are obtained only by killing alive specimens.

Specific measures intended for terrestrial (and freshwater) mollusc conservation are particularly difficult to propose. The most obvious strategies are those of guar-

anteeing protection to each species, through safeguarding their relative habitats. However, this strategy can only be applied to those species with a wide distribution and good dispersive capacity that are linked to habitats that have a certain faunistic interest, such as marshlands that are easily delimited and which are often the object of numerous protection initiatives. Instead, it is much more difficult to propose conservation strategies for species with a very limited distribution. The protection of single sites, unless they are already included in protected areas, can hardly be put in practice, both for administrative and political problems, and for logistic ones (site managing and controlling).

## COLEOPTERANS

[Paolo Audisio, Augusto Vigna Taglianti]

### Current knowledge

Within the animal kingdom, Coleopterans make up the order with the greatest number of known species: in fact, on a world-wide level, there are approximately 400,000 species currently described with plausible taxonomical validity. An estimate of species not yet described is more complex, especially in tropical and subtropical areas; estimations vary enormously depending on the different predictive models utilised, which fluctuate from a few hundred thousand to several million of species.

In any case, Coleopterans form a very significant portion of the entire animal biodiversity that has been estimated on a world-wide scale to be about 25% of the total number of species recognised. In tropical and subtropical areas the percentage tends to increase (around 30%), while it decreases with a certain regularity in temperate areas (around 20% or a little more). In effect, Coleopterans in Italy make up 21.5% of the total fauna. Here we are dealing with the entire order, for reasons of completeness and unity within the diversity and biogeography of the group, though a little percentage of species (about 4%) and families are strictly or at least partially aquatic (an outline on aquatic Coleopterans will be given also in the section devoted to the aquatic entomofauna).

There are about 170 different families world-wide in the entire order (according to some classifications, up to about 190 have been recognised, though in others at least 150). Of these families, three-quarters (about 130) are part of Italian fauna.

In Europe, and in particular, in Italy, the level of general knowledge regarding the entire order is considered average to high for the majority of families. When considering Europe in terms of the recent geographic expansion adopted by the European Union project *Fauna Europaea* (thus, excluding the Asian Turkey and the Eurasiatic circum-caucasian areas, but including the politically European Macaronesian zones), Coleopteran species are in the range of 28,000-30,000 (an updated and reliable catalogue, checked by the best families experts is available at the URL <<http://www.faunaeur.org>>). As far as Italy is concerned, data from the recently published national Checklists (MINELLI *et al.*, 1993-95) indicates that a little fewer than 12,000 species (11,989 including some tens of dubious *taxa*) are present in Italy.

The percentage of Italian species compared to European ones is extremely variable for the various families, in that the endemism rates are substantially different. In short, compared to the total European fauna (see Table 5.3), Italian fauna includes a fraction short of 30% of the families with high endemism (such as many groups of predators, microphages or low vagility saprophages linked to the soil or to underground habitats such as Carabids, Cholevids, Tenebrionids, and some subfamilies of Staphylinids or freshwater groups associated prevalently to rhytal of medium altitude (such as Hydrenid beetles) or in larger groups, in areas with particular bioclimatic characteristics (such as Meloids, particularly abundant in the steppes). Percentages higher than 60% are seen in groups that are mainly phytophagous, coprophagous or saprophagous characterised by higher than average dispersive capacities and by the presence of many species with wider ranges (e.g. Nitidulids, Aphodiids, Halipids, and many others). In any case, an average of 40% (28,000/12,000 = 42%) seems to be a reliable estimate.

The percentage of Italian species compared to those known on a worldwide scale varies considerably, depending on the ecological needs of the different families. For example (see Table 5.7), Carabids make up an important 4 %, Nitidulids about 5 %, and Idrenids are well over 10% of species present in Italy, while others that are almost insignificant, such as Cerambycids (less than 1%). This difference can be explained by the fact that Cerambycids are prevalently xylophagous associated to forest habitats; and so stratocoenoses and plant diversity in forest habitats of tropical or subtropical countries are far superior to those of temperate areas. On the contrary, the great diversification found in temperate areas of some groups that are prevalently orophyle, such as Carabids, Hydrenids, some subfamilies of Curculionids and Staphylinids, makes them proportionally more significant in number. This can be attributed to the marked paleoclimatic variations that have occurred in the northern hemisphere over the last tens of millions of years and to the consequent speciation phenomena.

In any case, an average of 3% seems to be a reliable figure on a world-wide scale for Italian Coleopterans. If this percentage appears low in comparison to the diversity of equatorial and intertropical biomes that host a very great number of phytophagous, xylophagous and phyto-saprophagous specialised species, it is still highly significant for the temperate belt of the northern hemisphere. In effect, on the basis of data currently available, Italy (together with Turkey) is the country in the western Palaearc-

Family	Italy	Variation	Total 2002	%	Endemic	% Endemic	Europe	World	% I/E	% I/W
<i>Carabidae</i>	1,245	+32 (23n, 6ni, 3r)	1,277	+3%	342	27%	3,530	32,600	36%	4%
<i>Cerambycidae</i>	272	+5 (1n, 3ni, 3r, -2e)	277	+2%	14	5%	673	36,000	41%	1%
<i>Cetoniidae</i>	27	+1 (1n (+1?))	28	+4%	2	7%	38	3,600	74%	1%
<i>Dytiscidae</i>	193	+1 (3ni, -2d)	194	+1%	17	9%	381	3,200	51%	6%
<i>Elmidae</i>	27	0	27	0%	2	7%	44	750	61%	4%
<i>Hydraenidae</i>	145	+6 (1n, 3ni, 3r, -1s)	151	+4%	35	23%	397	1,150	38%	13%
<i>Meloidae</i>	63	0	63	0%	3	5%	175	3,000	36%	2%
<i>Melyridae</i>	227	-2 (2n, 1ni, -5s)	225	-1%	46	20%	684	5,500	33%	4%
<i>Nitidulidae</i>	174	+6 (2n, 3ni, 1r)	180	+3%	2	1%	232	3,300	78%	5%
<i>Tenebrionidae</i>	317	+2 (1n, 4ni, -3e, )	319	+1%	70	22%	1,361	19,000	23%	2%

**Italy:** number of species present in Italy up to 1993-1995.

**Variation:** variation in the number of species present in Italy, from 1993-1995 to 2002 (**d**= species considered of dubious presence; **n** = new species to science; **ni** = new species for Italy; **r** = taxa reassessed to the rank of species; **s** = species synonymized with others already included in Italian fauna).

**Total 2002:** number of species present in Italy, updated to 2002.

**%:** increase or decrease in the percentage of species present in Italy in the last decade.

**Endemic:** number of endemic species present in Italy, updated to 2002.

**% Endemic:** percentage of endemic Italian species compared to the total number of species present in Italy in the context of the family under consideration.

**Europe:** number of species present in Europe (in the East up to the Urals; Asian Turkey and Caucasus excluded; the Canary Islands, the Azores and Madeira included); provisional data provided by the *Fauna Europaea* project.

**World:** estimated and updated number of species known worldwide.

**%I/E:** percentage of species present in Italy with respect to the total number of species in Europe.

**%I/W:** percentage of species present in Italy with respect to the total number of species in the world.

**Table 5.7** - Trend of several parameters relative to sample Coleopteran families of Italian fauna (MINELLI *et al.*, 1993-95, updated to 2002).

tic region with the highest diversity of species, and it can be considered the most important 'hot spot' of biodiversity in the entire Mediterranean area (see box *From the detection of causes to the identification of hotspots*).

As far as the level of endemism is concerned, the situation is extremely variable from one family to the next, and often even among different subfamilies and tribes (Table 5.8). In fact, rates slightly higher than 0% are found in groups such as Nitidulids, Monotomids, Coccinellids, Scolitids and many others (mostly comprising phytophagous or saprophagous with high vagility), while figures around 25-30% or higher are found in groups such as Carabids, Cholevids, Hydrenids, Tenebrionids and others (including the majority of predatory, microphagous, rhizophagous or saprophagous species with low vagility).

Overall, approximately 18% of Italian Coleopteran species are endemic: more than 2,100 out of 12,000, at least in reference to the Italian political boundaries. Species endemic to Sardegna-Corsica and to Elba-Corsica are therefore not included, and nor those Alpine-Apennine endemic species that are also present in Switzerland in the Ticino Canton or the SW-Alpines also present in France in the Roja Valley. Hence, bearing in mind that this fig-

ure regards biogeographical endemisms, significantly higher percentages up to 20-25% can be reached.

With the publication of the national checklists, many new species in Italy were discovered and described as new to science. Others, which for various reasons had escaped the 'census', were reintroduced into the national lists; still others, erroneously considered synonyms, were re-assessed to the rank of species. Yet others, studied in greater depth, were found to be synonyms lacking in taxonomic value or were declassified to the subspecies level. Many others, known to occur in bordering areas were observed and reported in the national territory for the first time; while others, especially those belonging to taxonomic groups involved in the international trade of foodstuffs or other materials, which had been accidentally introduced into Italy in recent years, have now permanently acclimatised. While collecting data for the several sample-families over a decade (Table 5.7), there has been an average increase of 2-3%, subdivided among the five diverse typologies described above. Therefore, by the end of 2002 an estimate of around 12,300 Coleopteran species were actually calculated for Italy. A substantially similar trend, or slightly lower, can also be predicted for the next decade. This trend, in effect,

Subfamily	N° of species	?	endemic	% endemism
<b>Cicindelinae</b>	17		1	5
Cicindelini	17		1	
<b>Paussinae</b>	1			
Paussini	1			
<b>Brachininae</b>	18		1	5
Brachinini	18	2	1	
<b>Omophroninae</b>	2			
Omophronini	2			
<b>Carabinae</b>	68		10	14
Carabini	59		9	
Cychrini	9		1	
<b>Nebrinae</b>	58		10	17
Nebrini	48	1	10	
Notiophilini	10			
<b>Loricarinae</b>	1			
Loricerini	1			
<b>Elaphrinae</b>	5			
Elaphrini	5	1		
<b>Siagoninae</b>	1			
Siagonini	1			
<b>Scaritinae</b>	76		34	44
Scaritini	5	1		
Clivinini	71	2	34	
<b>Rhysodinae</b>	3			
Rhysodini	3			
<b>Broscinae</b>	5		2	40
Broscini	5		2	
<b>Apotominae</b>	3			
Apotomini	3			
<b>Trechinae</b>	417		203	48
Trechini	211	6	165	
Bembidiini	195	7	38	
Pogonini	11			
<b>Psydriinae</b>	1			
Psydriini	1			
<b>Patrobinae</b>	3		1	33
Patrobini	3		1	
<b>Pterostichinae</b>	195		47	24
Abacetini	1			
Stomini	5		2	
Pterostichini	119	2	36	
Zabrinini	70	6	9	
<b>Panagaeinae</b>	2			
Panagaeini	2			
<b>Chlaeniinae</b>	17		1	5
Chlaeniini	16		1	
Callistini	1			
<b>Oodinae</b>	2			
Oodini	2			
<b>Licininae</b>	16		2	12
Licinini	16		2	
<b>Harpalinae</b>	176		3	1
Anisodactylini	11			
Stenolophini	46	1	1	
Harpalini	119	7	2	
<b>Platyninae</b>	101		22	21

Sphodrini	51	1	19	
Platynini	50	2	3	
<b>Perigoninae</b>	1			
Perigonini	1			
<b>Odacanthinae</b>	1			
Odacanthini	1			
<b>Cyclosominae</b>	3			
Masoreini	3			
<b>Lebiinae</b>	76		5	6
Apenini	2			
Cymindidini	14		1	
Lionychini	13	2	1	
Dromiini	30	2	4	
Demetriadii	3			
Somotrichini	1			
Lebiini	12			
Calleidini	1			
<b>Dryptinae</b>	8			
Dryptini	2			
Zuphiini	6			
<b>Total</b>	<b>1,277</b>	<b>43</b>	<b>684</b>	<b>27</b>

Table 5.8 - Italian Carabid species, subdivided into different subfamilies (in **boldface**) and tribes (in normal Roman type), with number of species, number of endemic species and percentage of endemism. ? = species of dubious presence.

corresponds to an average increase of 30 species a year; a figure that – though passing through highs and lows due to the publication of large reviews and regional lists on the one hand and to wartime stops or accidental decrease of publications on the other - has substantially been maintained since the publication of the catalogue by LUIGIONI (1929), with 9,979 species confirmed up to today.

The four suborders which make up Coleopterans are all present in Italy (Table 5.9).

The most primitive, Archostemates, is represented by a single species *Crowsoniella relict*, the only member of the family Crowsoniellidae: discovered in the Pre-Apenines of Lazio (Monti Lepini) in 1975, it is the only autochthonous European species of the suborder.

The suborder Adephaga, apart from four families that are predators or, to a minor extent, aquatic phytophagous, includes Carabids, the most numerous terrestrial predator family and one of the most numerous Coleopteran families: 32,561 species described in the world, grouped into 1,859 genera (LORENZ, 1998). In Italy, there are currently 1,277 Carabid species. In the *Checklist* drawn up by VIGNA TAGLIANTI (1993) 1,245 species (apart from 42 dubious species) were reported for Italy: in only 10 years this number has increased by 32 species, with 23 new species to science. This fact may be due to the atten-



SUBORDER and Superfamily	Families present in Italy	Biology	Species in Italy
ARCHOSTEMATA			
	Crowsoniellidae	endogenous, perhaps rhizo-sapro-xylophagous	1
ADEPHAGA			
	Haliplidae, Hygrobiidae, Gyrinidae, Dytiscidae	aquatic predators or, to a lesser extent, phytophagous	229
	Carabidae	prevalently predators	1,277
MYXOPHAGA			
	Hydroscaphidae and sphaeriusidae (=Microsporids)	generally associated with hygropetric and even hot spring habitats	4
POLYPHAGUS			
<i>Hydrophilidea</i>	Hydrophilidae, Hydrochidae, Georissidae, Spercheidae, Sphaeridiidae, Histeridae, Sphaeritidae	prevalently aquatic and/or coprophagous	255
<i>Staphylinidea</i>	Hydraenidae, Ptilidae, Agryrtidae, Silphidae, Cholevidae, Leiodidae, Scydmaenidae, Staphylinidae	prevalently saprophagous, or aquatic microphagous	3,351
<i>Scarabaeidea</i>	Lucanidae, Trogidae, Geotrupidae, Ochodaeidae, Hybosoridae, Scarabaeidae, Aphodiidae, Orphnidae, Glaphyridae, Melolonthidae, Rutelidae, Cetonidae, Dynastidae, Pachypodidae	prevalently phytophagous or coprophagous	372
<i>Scirtidea</i>	Scirtidae, Eucinetidae, Clambidae	often aquatic at least in the larval stage	6
<i>Dascillidea</i>	Dascillidae	prevalently rhizophagous and microphagous in the soil, at least in the larval stage	4
<i>Buprestoidea</i>	Buprestidae	xylophagous or phytophagous	234
<i>Byrrroidea</i>	Elmidae, Dryopidae, Limnichidae, Heteroceridae, Psephenidae, Byrrhidae	prevalently aquatic or hygrophilous	110
<i>Elateridea</i>	Cerophytidae, Eucnemidae, Throscidae, Elaterids, Cebrionidi, Drilidi, Omalisidi, Lycidae, Lampyridae, Cantharidae	generally phytophagous or predators	526
<i>Derodontoidea</i>	Derodontidae	mycetophagous	3
<i>Bostrichidea</i>	Nosodendridae, Dermestidae, Endecatommidae, Lyctidae, Bostrychidae, Anobiidae	prevalently xylophagous or zoosaprophagous; often of economic interest	311
<i>Lymexylidea</i>	Lymexylidae	sapro-xylophagous	2
<i>Cleridea</i>	Phloiophilidae, Trogossitidae, Cleridae, Acanthocnemidae, Melyridae	prevalently predators of other insects or anthophagous	273
<i>Cucujoidea</i>	Sphindidae, Cateretidae, Nitidulidae, Monotomidae, Phleostichidae, Silvanidae, Passandridae, Cucujidae, Phalacridae, Cryptophagidae, Languriidae, Erotylidae, Byturidae, Biphyllidae, Bothrideridae, Cerylonidae, Alexiidae, Endomychidae Coccinellidae, Corylophidae, Latridiidae	prevalently saprophagous or phytophagous	827
<i>Tenebrionoidea</i>	Mycetophagidae, Ciidae, Tetratomidae, Melandryidae, Mordellidae, Rhipiphoridae, Zopheridae, Tenebrionidae, Prostomidae, Edemeridae, Meloidae, Mycteridae, Pythidae, Pyrochroidae, Salpingidae, Anthicidae, Aderidae, Scaptidae	prevalently saprophagous or phytophagous	864
<i>Chrysomelidea</i>	Cerambycidae, Chrysomelidae	xylophagous and phytophagous	1,157
<i>Curculionidea</i>	Nemonychidae, Anthribidae, Attelabidae, Brentidae, Curculionidae, Apionidae, Scolytidae, Platypodidae	xylophagous and phytophagous	2,062

Table 5.9 - Suborders, superfamilies and families of Coleopterans present in Italian fauna.

tion given to this taxonomic group which is of great ecological and biogeographical interest, but above all, it may be due to the role that most of these species play as specialised terrestrial predators, in that they are highly cryptic, with low vagility and display a tendency to become endemic (THIELE, 1977).

The suborder Myxophaga includes a very small group of indistinct families of microscopic and elusive aquatic Coleopterans.

Last of all, the suborder Polyphaga, comprises about 95% of the present families in Italy and slightly less than 90 % (about 10,500) of the known species. This suborder has had the greatest evolutionary success and the most extraordinary adaptive radiation. In fact, most families are characterised by surprisingly varied trophic spectrums that range from predator to parasite species, from strict and specialised phyllophagous, anthophagous, rhizophagous and mycetophagous to microphagous species.

## Distribution

Through an analysis of the Italian Coleopteran population of several homogenous groups and selected families, it is possible to provide some general, though important indications on the division of Italian species per region and per macrohabitat, as regards to the entire order. Several database projects sponsored by the Italian Ministry of the Environment in collaboration with research institutes and public scientific institutions are now capable of providing a very detailed and dynamic picture of the distribution of several thousand terrestrial and freshwater species. Several years of further effort are still necessary before the entire biodiversity of Italian insects and coleopterans are completely mapped and updated on-line by a network of authorised experts. For the moment, we have selected four groups of Coleopterans with extremely different ecologies such as Carabidae Carabini (terrestrial predators), Hydraenidae Hydraenini (benthonic microphagous species that live under stones in flowing waters), Nitidulidae Meligethini (specialised anthophagous species) and Nitidulidae Epuraeini (specialised forest phytosaprophagous species), for which updated and detailed data is available that can be utilised as a basis for general indications.

At a regional level, on a non-administrative basis and on a refined enough scale, we can observe (Figures 5.5-5.8) how the biodiversity peaks often coincide in the four groups, thus identifying a small series of 'hotspots': north-eastern Friuli-Venezia Giulia; the Alpine and Prealpine areas of Trentino-Alto Adige; the Ligurian, Maritime and

Graie Alps between Piemonte and Liguria; upper Toscana between Toscana and Emilia-Romagna; the Apennines of Lazio-Abruzzo; and last of all the Calabrian-Lucano Apennines between Calabria and Basilicata. Instead, in the two major islands, Sicilia and Sardegna, the most important parameter is the high level of endemism.

In terms of macrohabitats, the habitats richest in Coleopterans seem to be mountain and submountain mesophyllous forests, wet and aquatic habitats both in the plains and mountains, rupestrian xeric habitats, and last of all, steppe habitats. Instead, the highest percentage of endemism is found in cave habitats, tiny cracks in the soil, high mountain areas, freshwater benthonic habitats, and coastal dunes.

## Conservation status

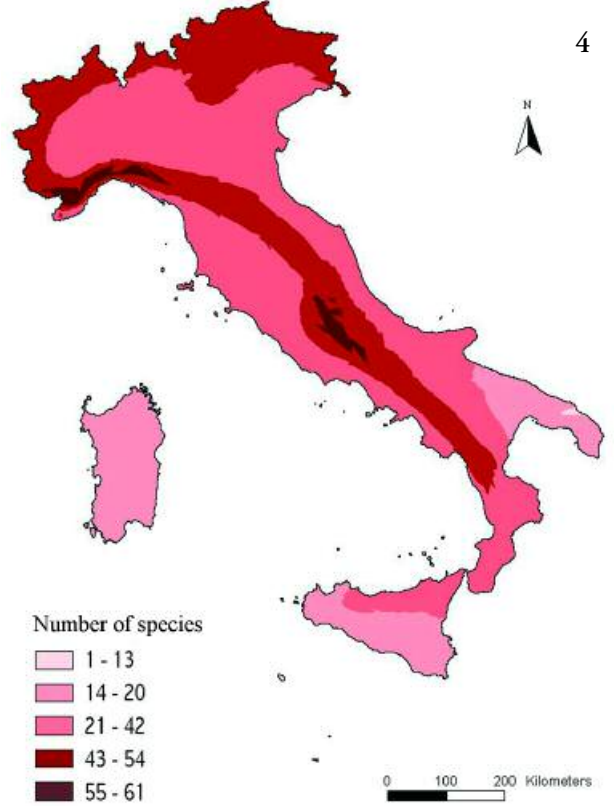
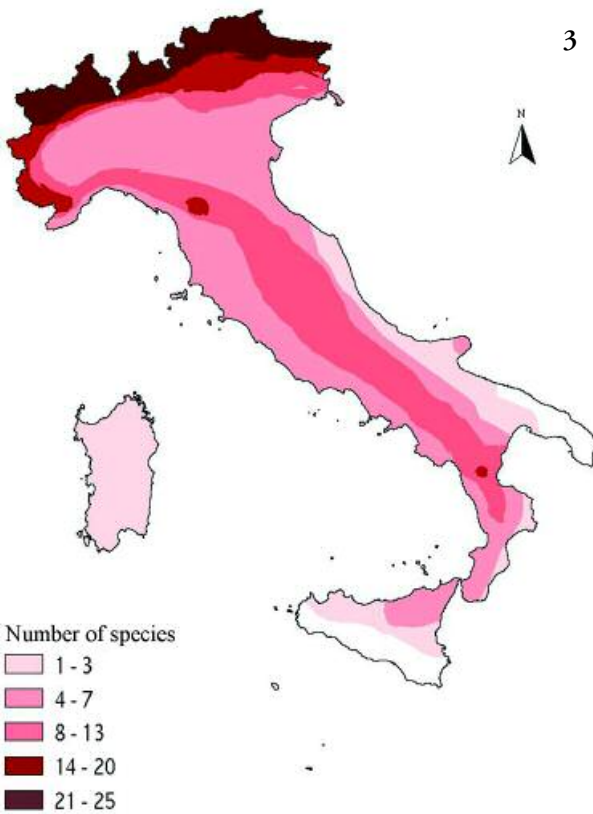
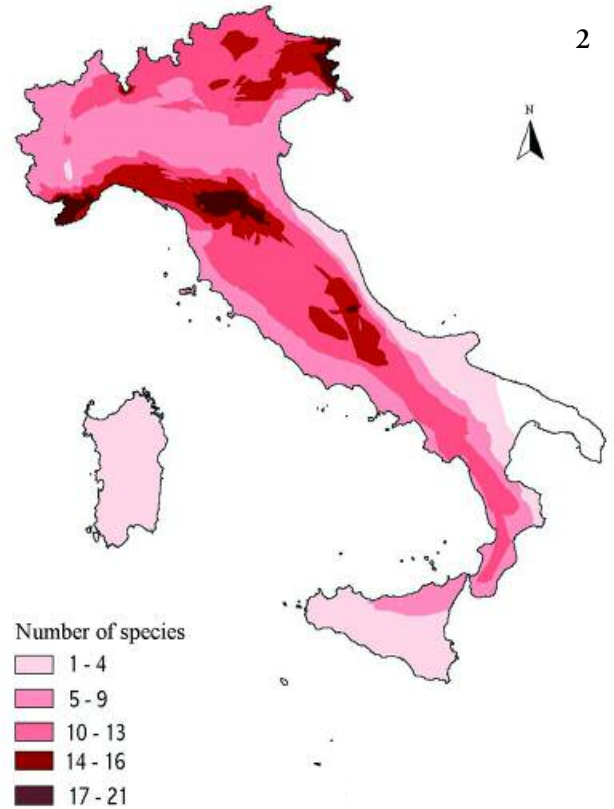
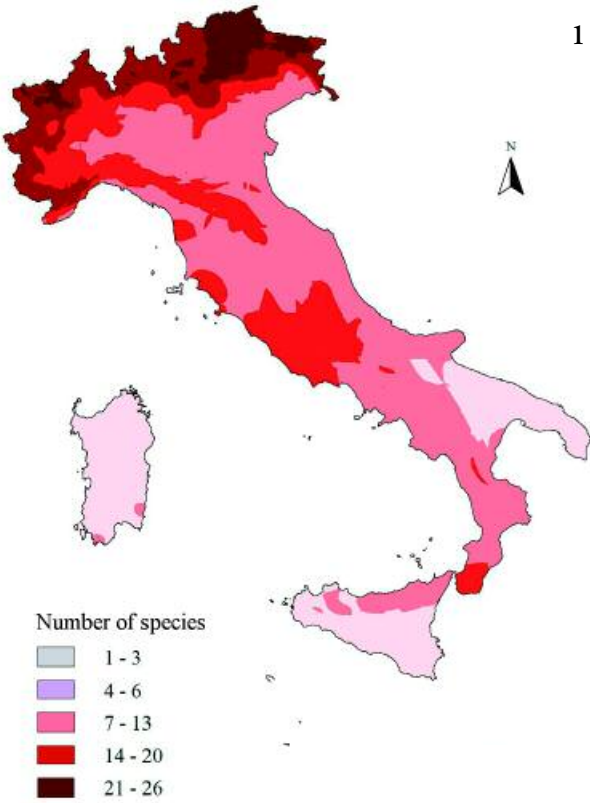
As far as the conservation status of Italian Coleopteran fauna is concerned, mention has only been made below to the Coleopteran species included in the Habitats Directive that are worthy of conservation at a European Community level (Table 5.10). They represent only a very small fraction of the hundreds of endemic or relict species present in Italy, which in many cases, are threatened with either local or total extinction; these are subject of a specific study, which is now underway. This list will indeed involve at least 500 species, many of which are Italian endemites, or have a highly fragmented range or have a great naturalistic value as bioindicators of threatened and relict habitats.

Basing on the available data, the most endangered areas and macrohabitats with a high number of endemic or relict species are most likely:

- the southern and eastern coastal zones of Sicilia,
- the southern areas of Sardegna,
- Lower Toscana and Lazio,
- Basilicata and Ionian Calabria,
- Lagoon of Venice.

Generally speaking, the areas considered at risk which occasionally host endemic species in very restricted spots are relict forests of the plains, wetlands throughout the country, and also springs and small watercourses in the major islands, as they are frequently destroyed or drained, and sometimes host endemites with a very restricted range.

Except for very rare cases, most Coleopteran species that are endemic to high mountain and cacular areas or to those that occur in particular Karst systems are not considered endangered, as invasive or destructive anthropic activity is rarely carried out in these habitats.



<b>Carabidae</b>					
*E <i>Carabus olympiae</i> SELLA, 1855	44.031.0.002.0	N			
<b>Dityscidae</b>					
<i>Graphoderus bilineatus</i> (DE GEER, 1774)	45.054.0.002.0	N	S		
<i>Dytiscus latissimus</i> LINNAEUS, 1758°	45.057.0.005.0	N			
<b>Lucanidae</b>					
<i>Lucanus cervus</i> (LINNAEUS, 1758)	50.006.0.001.0	N	S	Sa?	
<b>Cetoniidae</b>					
[*E <i>Osmoderma cristinae</i> (SPARACIO, 1994) ]	50.135.0.001.0				Si
* <i>Osmoderma eremita</i> (SCOPOLI, 1763)	50.135.0.002.0	N	S		
<b>Buprestidae</b>					
<i>Buprestis splendens</i> FABRICIUS, 1774	52.111.0.001.0	N	S		
<b>Bostrychidae</b>					
<i>Stephanopachys linearis</i> (KUGELANN, 1792)	54.008.0.001.0	N?			
<i>Stephanopachys substriatus</i> (PAYKULL, 1800)	54.008.0.003.0	N			
<b>Cucujidae</b>					
<i>Cucujus cinnaberinus</i> (SCOPOLI, 1763)	55.031.0.001.0		S		
<b>Cerambycidae</b>					
<i>Cerambyx cerdo</i> LINNAEUS, 1758	59.071.0.001.0	N	S		Si, Sa
* <i>Rosalia alpina</i> (LINNAEUS, 1758)	59.074.0.001.0	N	S		Si
<i>Morimus funereus</i> (MULSANT, 1863)	59.100.0.002.0				

Numeric code of the 'Checklist of Italian Fauna Species' (MINELLI *et al.*, 1993-95)

\* = priority species

E = Italian endemic species

N: Present in northern Italy;

S: present in the Italian peninsula;

Si: Present in Sicilia;

Sa: present in Sardegna;

? = Dubious presence;

[ ] = Species separated after 1992 by populations previously attributed to *Osmoderma eremita*, taxon included in the Habitats Directive.

**Table 5.10** - Coleopteran species of European Community interest in Italy whose conservation requires the designation of Special Conservation Zones (Habitats Directive 1992/43, Annex II).

Figures 5.5-5.8: Maps illustrating the trend of species richness of Italian Fauna, in several sample-groups of Coleopterans. Carabidae Carabini (1); Hydraenidae Hydraenini (2); Nitidulidae Epuraeini (3); Nitidulidae Meligethini (4) (Source: Ministry of the Environment – *Project Checklist and distribution of the Italian fauna*).

# LEPIDOPTERANS

[Emilio Balletto]

## State of knowledge

All the superfamilies present in the entire Holartic Region are represented in Italy, that is to say, 71% of the existing superfamilies. According to MINELLI *et al.* (1995), Italian Lepidopteran fauna include 5,127 species, equal to 60.5% of the entire European fauna. As for daytime butterflies, Italian fauna make us two thirds that of Europe (BALLETO & KUDRNA, 1985).

More than half the Italian Lepidopteran species, generally those that are part of the first 19 superfamilies listed in Table 5.4 (with the exception of Hepialoidae, Sesioidea, Cossoidae and Zygaenoidae) have adults that are small or very small in size, and are commonly described as ‘microlepidopterans’ (PARENTI, 2000). They make up 3,087 species (60% of the total) if added to those of Pyraloidea, which include some species of average size. Therefore, only the last nine superfamilies (apart from the above-mentioned Hepialoidae, Sesioidea, Cossoidae and Zygaenoidae) have species that are generally rather large in size and which are generally known as ‘macrolepidopterans’ or ‘butterflies’.

At a taxonomical level, current knowledge regarding Italian Lepidopterans species is quite good. However, detailed analysis is still necessary for many groups in order to evaluate the distribution of the various species throughout the territory and their actual conservation status. As can be seen in Table 5.4, the presence of threatened species seems to be the prerogative of groups which include the most striking species (Papilionoidae, Bombycoidea, and

Noctuoidea). With all probability, this does not reflect the reality, but simply provides a measure of the importance given to human subjectivity when it comes to choosing which group to study.

## Conservation status

The first international Convention in Europe that dealt with Lepidopteran conservation, among other things, was the Bern Convention (1979) which lists 26 European Lepidopterans species in Appendix II (Strictly protected fauna species). This marked a significant change with respect to the first *Red Data Book* published by the IUCN (WELLS *et al.*, 1983), where only 5 European species were listed (four of which are Italian: *Parnassius apollo* and 3 Lycaenids of the genus *Maculinea*: *M. alcon*, *M. arion*, *M. teleus*). The Council Directive 92/43/EEC of 21 May 1992, also known as the ‘Habitats’ Directive, incorporated the entire list of species indicated in the Bern Convention (App. II), listing them either in Annex II (Animal and plant species of Community interest whose conservation requires the designation of special areas of conservation) or Annex IV (Animal and plant species of Community interest in need of strict protection) as indicated in Tables 5.11 and 5.12.

## Flagship species

From the very start, when the first lists of invertebrate species to protect were drawn up, the most striking species were given a privileged position for obvious reasons. The inclusion of *Parnassius apollo* among threatened species, according to WELLS *et al.* (1983), certainly reflects the precarious conservation status of this species in many

Species	Ecology	Global level of thtreat	Present distribution in Europe (class %)	Status in Europe	Italian percentage of the European population	Status in Italy
T <i>Acanthobrahmaea europaea</i>	mesophyle woods and clearings	EN	<1%	EN	100%	CR
T <i>Cardeia hartigi</i>	halophyte: on Chenopodiaceae	EN	<1%	EN	50%	CR
T <i>Diachrysia zosimi</i>	hygrophyte: on <i>Sanguisorba</i>	NT	1-5%	EN	1-5%	VU
(2) <i>Eriogaster catax</i>	xerophyle and subnemoral	DD	20-40%	VU	5-15%	NT
(2) <i>Euplagia quadripunctaria</i>	mesophyle woods and clearings	NT	>60%	NT	5-15%	NT
T <i>Euxoa (Euxoa) segnilis</i>	psammoalophyle retrodunal	NT	5-15%	VU	1-5%	VU
T <i>Hydraecia osseola</i>	planitial hygrophyte	EN	5-15%	VU	20-40%	VU
(4) <i>Hyles hippophaes</i>	xerophyle: on <i>Hippophaë</i>	DD	5-15%	VU	5-15%	NT
(4) <i>Proserpinus proserpinus</i>	xerophyle: on <i>Epilobium</i>	DD	15-25%	NT	5-15%	NT

**Table 5.11** - Bombycoidea and Noctuoidea (moths) Lepidoptera considered threatened in Europe and listed in Annex II and IV of the Habitats Directive (number in parentheses on the left) or in the Checklist of Italian Fauna (MINELLI *et al.*, 1995) [left-hand column: T= ‘threatened’]. The data below are ‘reliable’ estimates of the present situation, according to Alberto Zilli (verbal communication).



	Global level of threat	Level of threat in Europe	Present distribution in Europe (classe %)	Trend in Europe (Classes)	European countries in which the species is present	European countries in which the species is extinct
	VU		1-5%	- 20-50%	10	1
		VU	5-10%	- 20-50%	31	1
		VU	<1%	- 15-20%	7	
(4)		VU	5-15%	- 20-50%	28	3
		VU	<1%	- 15-20%	5	1
		EN	<1%	- 20-50%	3	
		VU	>15%	- 20-50%	28	1
		VU	>15%	- 20-50%	36	
(4)		EN	5-15%	- 50-80%	37	1
(2)		VU	5-15%	- 20-50%	20	1
		VU	5-15%	- 20-50%	27	
	VU	VU	1-5%	- 20-50%	17	1
	VU	VU	<1%	ignoto	2	
(*)	EN	EN	<1%	ignoto	1	
(*)	EN	EN	<1%	ignoto	1	
	CR	CR	<1%	ignoto	1	
		VU	1-5%	- 20-50%	19	2
		VU	5-15%	- 20-50%	12	1
		EN	<1%	- 20-50%	7	
(2)		VU	5-15%	- 20-50%	38	1
		EN	<1%	- 20-50%	3	
		VU	5-15%	- 20-50%	25	
		VU	5-15%	- 20-50%	16	
(4)		VU	>15	- 20-50%	29	3
	EN	EN	<1	- 20-50%	1	
		VU	5-15%	- 20-50%	28	2
(2)		CR	1-5%	-80-100%	14	3
(2)	VU		<1	- 20-50%	2	
		VU	5-15%	- 20-50%	26	2
<b>OTHER PAPILIONOIDEA LISTED IN THE HABITATS DIRECTIVE</b>						
(4)	NT	NT	1-5%	stable	22	2
(4)	NT	NT	5-15%	stable	32	
(2)	NT	NT	<1	stable	2	
(4)	NT	NT	1-5%	stable	9	3
(2)	NT	NT	>15	stable	32	1
(4)	NT	NT	<1	stable	2	
(2)	NT	NT	<1	stable	3	
(2)	NT	NT	<1	stable	1	

countries of northern and central Europe, but also the objective beauty and impressiveness of this butterfly and, not lastly, the ‘charisma’ of its name. Analogous considerations can be made for *Papilio hospiton*, *P. alexanor*, *Zerynthia polyxena*, *Parnassius mnemosyne*, *Lycaena dispar*, *Argynnis elisa* and *Melanargia arge*. Among the Bombicoidei, *Acanthobrahmaea europaee* (Brahmeids), *Hyles hippophaes* and *Proserpinus proserpinus* (Sphingids) and *Euplagia quadripunctaria* (Noctuoidea Arctiids) are part of this category. The case of the last-mentioned species is particular, as it is not in the least threatened in any part of its range, though it was included in the

**Table 5.12** - Papilionoidae (daytime butterflies) species threatened in Europe (VAN SWAAY & WARREN, 1999). *Melanargia pherusa* and *Polyommatus galloi* were not taken into consideration by these authors. The number in parentheses on the left, where present, indicates the Annex in which the species is listed in the Habitats Directive. The species marked by an asterisk are listed in Appendix II of the Bern Convention, though not yet in the Habitats Directive. The present distribution classes in Europe are expressed in terms of percentage per 10x10 sq. km units in which their presence is known.

Habitats Directive for the simple fact that it is the symbol of Rhodes and of its Valley of the Butterflies ('ssp. *rhodosiensis*': see VAN DER MADE & WYNHOFF, 1995; BALLETTTO, 1996).

### 'Umbrella' species

Among the Lepidopterans in this category there is *Par-nassius apollo*, which is a species linked to various types of mountain habitats where its reproduction sites are found. The conservation of these habitats is generally not considered in the case this lepidopteron is not present.

### Keystone species

Going through the several appendices of the various Conventions to which Italy is a Contracting Party or Member State, one has the impression that at the time these lists were drawn up, little consideration was given to biological conservation which, instead, is very important. For example, no mention is made of coprophagous Coleopterans which play a role in the management and maintenance of pastures and the grazing-meadows. However, as far as butterflies are concerned, some species, above all, those belonging to the genus *Maculinea*, are correctly found in this category.

The most important biological feature of these butterflies concerns the relationship of obligatory parasitism that exists between their larvae and several Formicid Hymenopterans, almost all belonging to the genus *Myrmica*. This relationship is often species-specific, with frequent interpopulation variability, though the larvae of this butterfly must be actively transported inside ant nests to terminate their development. Once there, the larvae devour the ant eggs, larvae and prenympths (*Maculinea teleius*, *M. arion*) or, at a later stage, are nourished by ants through trophallaxis (*M. alcon*, *M. rebeli*). Among the species present in Italy, two - *M. alcon* and *M. teleius* - are hygrophilous and are linked to Molinia heathland, while another two species - *M. arion* and *M. rebeli* - are xerophilous and are found in various types of mountain grass formations, such as *Festucion valesiacae* in the Pre-Alps and *Xerobromion* in the Apennines, etc. In the case a real metapopulation structure no longer exists, the survival of *Maculinea* populations depends on the plants that supply nourishment to the larvae, and above all, on the density of ant nests of the host species in the single biotypes, while the survival of ants depends on the temperature and degree of humidity of the soil, which therefore involves both dynamic factors, which include

the height and density of grass cover, as well as static factors, such as the geological substrate and exposure of the slopes. In any case, in order to reach an adequate conservation status for each of these species, the conservation of the entire surrounding ecosystem plays an important role.

### Threatened species

The degree of threat is generally assessed on the basis of criteria published by the IUCN-SSC (1994), that is to say, on the basis of a very small number, a substantial decrease or great fluctuations in the number of individuals, and last of all, by the reduced range of the species and/or by its occupancy within the same range. A discussion on the individual species of Lepidopterans indicated in Tables 5.11-5.13 is impossible here. Detailed information on these lists in the Bern Convention and Habitats Directive are available in BALLETTTO (1996). Another aspect worthy of discussion is the species considered threatened according to VAN SWAAY & WARREN (1999) and the Italian Checklist. Here, reference will be made only to those listed in Tables 5.11-5.14. The conservation status of each of these threatened species in Italy is given, assessed on the basis of the same criteria utilised by these authors (Table 5.13), as well as indicating the principal habitats (with the relative CORINE Land Cover code, etc) in which they live.

### Management

Apart from the 46 species that occur only, or mainly, above the limits of tree vegetation, daytime Italian butterflies are linked to non-climatic habitats. With the exception of *Parnassius phoebus*, *Euchloe simplonia* and *Erebia christi*, all the endangered Italian daytime butterfly species (Table 5.13) come within this last-mentioned category. It is therefore evident that if one wishes to assure conservation within small protected areas intended for this purpose, cyclic management intervention such as controlling tree vegetation must be provided for.

### Examples of types of intervention

#### Mowing

Many plain and mountain meadows, as well as several Mediterranean grass formations need to be periodically mowed. In the case of habitats that are already greatly compromised, controlled burning, carried out in winter, is at times used. In any case, any type of in-

tervention must necessarily be prior and/or follow the periods in which the eggs are laid and larvae develop in order to avoid killing them. The species that emerge from their cocoons in late summer, such as those of the genus *Maculinea*, can survive one or two spring hay seasons and an autumn one. However, if the *Euphydryas aurinia* (the Padana form, sometimes known as ssp. *aurinia*; see BALLETO, 1996) occurs in the same biotope, the spring mowing must not be too radical. The additional presence of *Coenonympha oedippus*, which frequently co-habitats with the previously mentioned species can create further problems in that its adults

leave their cocoons at the beginning of summer (June-July) and the larvae obtain nourishment in July-September. Moreover, these last-mentioned, as in many other Satirids, have nocturnal habits.

#### Grazing

Sheep, horse, or cattle grazing is considered a means of maintaining a sufficiently low cost grass turf in grazing-meadows in many countries of northern and central Europe. In the case of Italy, grazing has proven to be particularly harmful, probably due to high temperatures and excessive water loss of the substrate. Even above the confines of tree vegetation, daytime butterfly communities have

	Species	Present distribution in Europe(class %)	Trend (in Italy)	Percentage of the European population (estimate)	Status in Italy
1	<i>Pyrgus cirsii</i>	<1%		<1%	not threatened
2	<i>Thymelicus actaeon</i>	>15%		1-5%	not threatened
(4) 3	<i>Zerynthia polyxena</i>	5-15%	+ 10-25	5-15%	not threatened
(4) 4	<i>Parnassius apollo</i>	>15%	see text	1-5%	locally threatened
5	<i>Parnassius phoebus</i>	1-5%		1-5%	locally threatened
(4) 6	<i>Parnassius mnemosyne</i>	5-15%		5-15%	locally threatened
(2) 7	<i>Papilio hospiton</i>	1-5%		40-60%	not threatened
(4) 8	<i>Papilio alexanor</i>	<1		1-5%	VU
9	<i>Anthocharis damone</i>	<1%		1-5%	not threatened
10	<i>Euchloe simplonia</i>	1-5%		1-5%	not threatened
(2) 11	<i>Lycena dispar</i>	1-5%	- 15-25	1-5%	not threatened
12	<i>Pseudophilotes vicrama</i>	<1%		<1%	not threatened
13	<i>Scolitantides orion</i>	1-5%		<1%	not threatened
14	<i>Glaucopsyche alexis</i>	>15		1-5%	not threatened
(4) 15	<i>Maculinea arion</i>	5-15%		1-5%	VU
(2) 16	<i>Maculinea teleius</i>	<1%	- 5-15%	<1%	CR
17	<i>Maculinea alcon</i>	<1%	- 15-25%	<1%	CR
18	<i>Maculinea rebeli</i>	1-5%		<1%	VU
19	<i>Plebejus trappi</i>	<1%		40-60%	VU
(*) 20	<i>Polyommatus galloi</i>	<1%		100%	CR
(*) 21	<i>Polyommatus humedasa</i>	<1%		100%	CR
(4) 22	<i>Argynnis elisa</i>	<1%		20-40%	VU
23	<i>Boloria titania</i>	5-15%		1-5%	not threatened
24	<i>Boloria thore</i>	1-5%		<1%	not threatened
(2) 25	<i>Euphydryas aurinia</i>	1-5%		1-5%	VU
26	<i>Euphydryas intermedia</i>	1-5%	- 15-25%	<1%	VU
27	<i>Melitaea aetherie</i>	<1%	- 25-50%	15-25%	EN
28	<i>Melitaea aurelia</i>	1-5%		<1%	not threatened
29	<i>Melitaea britomartis</i>	<1%	- 25-50%	<1%	CR
(4) 30	<i>Lopinga achine</i>	1-5%	- 15-25%	<1%	VU
(2) 31	<i>Coenonympha oedippus</i>	1-5%	- 15-25%	5-15%	VU
32	<i>Coenonympha tullia</i>	<1%		<1%	VU
(2) 33	<i>Erebia christi</i>	<1%		25-50%	VU
34	<i>Erebia medusa</i>	1-5%	+ 125-200%	<1%	not threatened
35	<i>Erebia calcaria</i>	<1%		<1	not threatened
(2) 36	<i>Melanargia arge</i>	1-5%		100%	VU
37	<i>Melanargia pherusa</i>	<1%	- 20-50%	100%	EN
38	<i>Polyommatus exuberans</i>	<1%	- 60%	100%	CR

Table 5.13 - Present distribution, observed trend and degree of threat in Italy of daytime butterfly species listed by VAN SWAAY & WARREN (1999). *Melanargia pherusa* and *Polyommatus galloi* were not taken into consideration by these authors. The percentage of the European population is considered indicative of the importance that Italy holds regarding the conservation of each species at a European level.

HABITATS	Other indications	CORINE code	Palaeartic code	EUNIS code	Threatened species in habitat	No. of species
Sub-montane [ <i>Vaccinium</i> ] - [ <i>Calluna</i> ] heaths		3.2.2.	31.21	F4.21	12	1
Southern Palaeartic mountain dwarf scrub	<i>Juniperus nana</i>	3.2.2.	31.43	F2.23	26,35	2
Mountain <i>Alnus</i> brush	<i>Alnetum viridis</i>	3.2.2.	31.61	F2.31	25,35	2
Alpine and subalpine heaths	<i>Rhododendro-Vaccinion</i>	3.2.2.	31.42	F2.22	25,35	2
Cyrno-Sardinian hedgehog-heaths	<i>Astragalus</i>	3.2.3.	31.75	F7.45	7	1
Endemic oro-Mediterranean heath with gorse	Madonie & Apennine gorse heaths	3.2.3.	31.77	F7.47	4	1
Low ericaceous maquis		3.2.2.	32.32	F5.22	22,36	2
Tall <i>Cistus</i> maquis		3.2.3.	32.33	F5.23	7,14	2
Low <i>Cistus</i> maquis		3.2.3.	32.34	F5.24	2,7,9	3
Semi-natural dry grasslands: <i>Festuco-Brometalia</i>	<i>Mesobromion</i>	3.2.1.	34.32	E1.26	3,14	2
Semi-natural dry grasslands: <i>Festuco-Brometalia</i>	<i>Xerobromion</i>	3.2.1.	34.33	E1.27	2,3,15,18,20,25,36	7
Pseudo-steppe with grasses and annuals	<i>Thero-Bracypodietea</i>	3.2.1.	34.5	E1.3	1,2,7,9,13,22,25,27,36	9
Central-European steppes	<i>Festucion valesiacae</i>	3.2.1.	34.2131	E1.22	8,12,13,14,15,19,21,26,28,38	9
Siliceous alpine & boreal grasslands	<i>Caricetea curvulae</i>	3.2.1.	36.3	E4.34	5,10,33	3
Alpine & subalpine calcareous grasslands	<i>Elyno-Seslerietea</i>	3.2.1.	36.41	E4.41	10	1
Subalpine [ <i>Trisetum flavescens</i> ] hay meadows	<i>Arrhenatheretalia</i>	3.2.1.	36.51	E4.51	3,18,28,29,34	5
<i>Molinia</i> meadows on chalk and clay	<i>Eu-Molinion</i>	3.2.1.	37.31	E3.51	11,32	2
Lowland hay meadows	<i>Alopecurus, Sanguisorba officinalis</i>	3.2.1.	38.2	E2.2	11,14,16,17,25,31	6
<i>Luzulo-Fagetum</i> beech forest	<i>Luzulo Fagetum</i> (N Italy)	3.1.1.	41.11	G1.61	6,23	2
Apennine beech forest with <i>Taxus</i> and <i>Ilex</i>	Apennines & Sicilia	3.1.1.	41.181	G1.68	6, 14	2
Apennine beech forest with <i>Abies alba</i>	Apennines & Sicilia	3.1.1.	41.184	G3.15	6,34	2
Southern Alpine oak-hornbeam forests	<i>Quercio-Carpinion</i>	3.1.1.	41.28	G1.A18	23,30,32	3
<i>Tilio-Acerion</i> forests of slopes, screes and ravines		3.1.1.	41.4	G1.A45	13	1
Hop-hornbeam woods	<i>Ostrya carpinifolia</i>	3.1.1.	41.81	G1.7C1	34	1
<i>Quercus trojana</i> woods		3.1.1.	41.85	G1.78	36	1
Acidophilous spruce forests	<i>Piceetum subalpinum</i>	3.1.2.	42.21	G3.1B	6,23,24,25,34	5
Acidophilous spruce forests	<i>Piceetum montanum</i>	3.1.2.	42.22	G3.1C	6	1
Italic [ <i>Pinus halepensis</i> ] forests		3.1.2.	42.847	G3.747	36	1
<i>Quercus ilex</i> forests		3.1.1.	45.3	G2.121	14	1
<i>Quercus ilex</i> forests (with <i>Ostrya</i> )	supra-Mediterranean holm-oak forests	3.1.1.	45.32	G2.122	1	1
Common reed beds	<i>Phragmites australis</i>	4.1.1.	53.11	C3.21	5	1
[ <i>Eriophorum scheuchzeri</i> ] fens		4.1.1.	54.41	D2.21	5,31	2
Black-white-star sedge fens	<i>Carex fusca</i>	4.1.1.	54.42	D2.22	5	1
Calcareous an calcshist scree	<i>Thlaspietia rotundifolii</i>	3.3.2.	61.2	H2.42	4	1
Western Mediterranean thermophilous screes	screes of the Italian peninsula etc.	3.3.2.	61.3B	H2.6	4	1
Medio-European calcareous scree	Montane level	3.3.2.	61.31	H2.67	4	1
Western Mediterranean thermophilous screes	Alpine thermo-siliceous screes	3.3.2.	61.33	H2.51	4	1

not only been severely impoverished in Apennine meadows, where it could have been expected, but also in Alpine ones. Overgrazing has, in fact, caused a drop of 55% in terms of species abundance and population density, independent of substrate type (calcareous or siliceous) or altitude (CASTELLANO *et al.*, 2002). Though long-term studies have indicated that negative trends can sometimes be inverted, this depends on the metapopulation structure of the various species; in the case they are still present.

### **Urgent conservation needs**

Many suitable areas that could assure the conservation of Lepidoptera species listed in the Habitats Direc-

tive are found in a large number of pSCI. Among these sites, others have been selected and denominated PBAs (Prime Butterfly Areas: see SWAAY & WARREN, 2002; BALLETO *et al.*, 1996).

Therefore, the first step could be to select a few adequately sized PBAs, with the aim of safeguarding the 7 Lepidoptera species listed in Tables 5.11 and 5.13 as 'CR', with reference also made to Table 5.14. Serious and flexible management programmes should be provided for in these reserves that allow the necessary seasonal adjustments to be made. Therefore these reserves should be adequately equipped to reach the set objectives and could be used as laboratories in the wild to study the biological characteristics of these Italian species.

**Table 5.14** - Principal habitats represented in the proposed Italian SCI (PBAs) and their respective CORINE, Palaearctic and EUNIS codes. The column entitled 'Other indications' makes reference to the Italian situation. The numbers in the 'threatened species' column refer to those reported before the name of the species in Table 5.13.



# AMPHIBIANS

[Marco Alberto Bologna, Giuseppe Maria Carpaneto]

## State of knowledge

Italian fauna includes 40 Amphibian species (17 Urodeles, 23 Anurans), 2 of which have been introduced. The particular biological cycle of these animals makes it difficult to place them either among terrestrial or freshwater fauna. The species most linked to water (even in the adult stage) have been dealt with in the section regarding freshwater fauna; while those more closely linked to the land have been indicated below. See Tables 5.15-5.17 for a general overview.

## Conservation status

### Urodeles

The Spectacled salamander (*Salamandrina terdigitata*, Figure 5.9) is one of the most important species of Italian fauna because it is the only representative of an endemic genus of the Italian Apennines. This widespread species lives near clear streams, protected by arboreal vegetation where it reproduces. The Fire salamander (*Salamandra salamandra*) is common in the Alpine region, though rather rare and localised in central Italy; in the Calabrian Apennines it is present with an endemic subspecies (*S. s. giglioli*). Conservation of these populations necessarily means avoiding deforestation along the rivers where the salamander reproduces and not introducing allochthonous species, such as the Rainbow trout, which prey upon its larvae. The Alpine salamander (*Salamandra atra*) and the Large alpine salamander (*Salamandra atra lanza*) also occur in the Alpine Arc. The first lives in the central and eastern Alps, while the second is endemic in the Cozie Alps, on the Italian-French border. Last of all, the Golden alpine salamander (*S. atra aurorae*) is an en-

demic subspecies of the Asiago plateau in Veneto, and has an unusual colouration of yellow marks, similar to that of the Fire salamander. While the Alpine salamander is not under extinction risk because of the integrity of its Alpine habitat, the Large alpine salamander and the Golden alpine salamander are worthy of a monitoring and protection programme due to their restricted range.

Plethodontids only have one European genus (*Speleomantes*) with 7 species, called lungless salamanders that are almost all Italian endemic species. Four of these are endemic to Sardegna. Lungless salamanders need a high level of humidity and spend the daytime hours in rocky cavities (even caves). Deforestation could impoverish the zoocenoses of the invertebrates they feed upon and alter the microclimatic conditions favourable to their night-time activity. The restricted range of these endemic species also indicates that their status should be monitored. These species are extremely interesting from a zoogeographical and phylogenetic point of view, in that they are true Tertiary relict species related to the genera of north American fauna.



Fig. 5.9 - *Salamandrina terdigitata* (Photo by M. Bologna).

Families	Genera	Autochthonous species	Allochthonous species	Total species	% of total European fauna species	Endemic species	Subendemic species
AMPHIBIANS	13	38	2	40	44.44	14	5
URODELES	6	17		17	29.03	9	2
Salamandridae	4	9		9	40.90	3	1
Plethodontidae	1	7		7	100	6	1
Proteidae	1	1		1	100		
ANURANS	7	21	2	23	56.10	5	3
Discoglossidae	2	4		4	40.00	1	1
Pelobatidae	1	1		1	33.33		
Pelodytidae	1	1		1	50.00		
Bufonidae	1	2		2	66.66		1
Hylidae	1	4		4	100	1	
Ranidae	1	9	2	11	57.89	3	1

Table 5.15 - Amphibian orders and families of Italian fauna: number of genera, indigenous species (autochthonous) and those introduced by man (allochthonous); percentage of the number of species with respect to European herpetofauna; number of endemic species (exclusive to the Italian territory) and subendemic species (present almost exclusively in the Italian territory).

URODELE AMPHIBIANS metres a.s.l.	Ao	Pi	Lo	TA	Ve	FV	Li	Em	To	Ma	Um	La	Ab	Mo	Cp	Pu	Ba	Cl	Si	Sa	E
<b>SALAMANDRIDAE</b>																					
<i>Euproctus platycephalus</i>	50-1,800																			L	E
<i>Salamandra atra</i>	800-2,800			D	D	D	D														
<i>Salamandra lanzai</i>	1,300-2,800		L																		S
<i>Salamandra salamandra</i>	0-1,800	L	D	D	D	D	D	L	L	L	L	L	L	L?	D	L	L	D	L		
<i>Salamandrina terdigitata</i>	50-1,900							L	L	D		L	D	D	L	L		D			E
<i>Triturus alpestris</i>	50-3,000	L	L	L	D	D	D	D	L	L		L						L			
<i>Triturus carnifex</i>	0-1,800	L	D	D	L	D	D	L	D	D	L	L	D	D	L	D	L	L	D		
<i>Triturus italicus</i>	0-1,600												L	D	D	D	D	D			E
<i>Triturus vulgaris</i>	0-1,600	L	D	D	L	D	D	L	D	D	L	L	D	L	L	L					
<b>PLETHODONTIDAE</b>																					
<i>Spelomantes ambrosii</i>	0-2,290							L		L											E
<i>Spelomantes flavus</i>	50-1,040																			L	E
<i>Spelomantes genei</i>	0-600																			L	E
<i>Spelomantes imperialis</i>	0-1,170																			L	E
<i>Spelomantes italicus</i>	50-1,600								L	D	L	L		L							E
<i>Spelomantes strinati</i>	0-2,430		L					D													S
<i>Spelomantes supramontis</i>	100-1,360																			L	E
<b>PROTEIDAE</b>																					
<i>Proteus anguinus</i>								L													

L = Localised in up to one third of the territory, D = Widespread, ? = Dubious presence. The altimetric interval is approximate, referring to Italian populations and can vary with latitude. The abbreviations indicated at the top of the columns refer to the administrative regions, except the last which indicates whether the species is endemic (E) or subendemic (S).

Table 5.16 - Regional and altimetric distribution of urodele amphibians in Italy.

### Anurans

Italian Anuran fauna belong to six families: Discoglossids, Pelobatids, Pelodytids, Bufonids, Hylids, and Ranids. Discoglossids are dealt with in the section on freshwater fauna, in that they are linked to water bodies even during their adult stage.

The Pelobatid family is represented by one endemic subspecies: the Common Eurasian spadefoot (*Pelobates fuscus insubricus*), which survives exclusively in some areas of the Padana Plain, where ponds are found within broad-leaved deciduous woodland, in Piedmont peat-bogs and rice paddies. The family Pelodytidae only contains the Common parsley frog (*Pelodytes punctatus*), a western European species which, in Italy, is only found in about twenty sites in western Liguria and Piemonte. Pelobates and pelodytes are the most threatened Italian fauna amphibians and need to be carefully monitored along with their reproduction sites.

Two Bufonid species occur in Italy: the European common toad (*Bufo bufo*) and the European green toad

(*Bufo viridis*), both widespread. However, many populations of the European green toad are in decline and they have disappeared from certain sites where they were once abundant.

The Italian tree frog (*Hyla intermedia*) belongs to the Hylid family and is widespread in all regions with the exception of Sardinia. The Sardinian tree frog (*H. sarda*; Figure 5.10), the Mediterranean tree frog (*H. meridionalis*) and the European green tree frog (*H. arborea*) are more localised. The first is found in Sardegna, in Corsica and in the Tuscan archipelago (the islands of Elba and Capraia); the second, also known as the Stripeless tree frog, is a western Mediterranean species which, in Italy, is only present in Liguria; the third species seems to be limited to the eastern part of Friuli-Venezia Giulia (Tarvisiano and the Province of Trieste). Currently, the main threat for these amphibians is the destruction of the ponds where they reproduce.

Apart from the Green frog (dealt with in the section on freshwater fauna); the Ranid family includes four

ANUROUS AMPHIBIANS	metres a.s.l.	Ao	Pi	Lo	TA	Ve	FV	Li	Em	To	Ma	Um	La	Ab	Mo	Cp	Pu	Ba	Cl	Si	Sa	E
<b>DISCOGLOSSIDAE</b>																						
<i>Bombina variegata</i>	0-1,900			L	D	D	D															
<i>Bombina pachypus</i>	0-1,650							L	L	L	L	L?	L	L	L	L	L	L	D	?		E
<i>Discoglossus pictus</i>	0-1,600																			D		
<i>Discoglossus sardus</i>	0-1,750									L											D	S
<b>PELOBATIDAE</b>																						
<i>Pelobates fuscus</i>	0-400		L	L		L	L		L													
<b>PELODYTIDAE</b>																						
<i>Pelodytes punctatus</i>	0-600?		L					L														
<b>BUFONIDAE</b>																						
<i>Bufo bufo</i>	0-2,200	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D		
<i>Bufo viridis</i>	0-1,200		D	D	D	D	D	L	D	D	L	L	D	L	L	L	D	L	D	D	D	
<b>HYLIDAE</b>																						
<i>Hyla arborea</i>	0-1,400						L															
<i>Hyla intermedia</i>	0-1,550	L	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D		E
<i>Hyla meridionalis</i>	0-600							D														
<i>Hyla sarda</i>	0-1,400									L											D	S
<b>RANIDAE</b>																						
<i>Rana catesbeiana</i>	0-300			L		L		L	L			L?			L							
<i>Rana lessonae</i>	0-1600	L	D	D	D	D	D	D	D												?	
<i>Rana kl. esculenta</i>	0-1,600	L	D	D	D	D	D	D	D												?	
<i>Rana bergeri</i>	0-1,600									D	D	D	D	D	D	D	D	D	D	D	?	E
<i>Rana kl. hispanica</i>	0-1,600									D	D	D	D	D	D	D	D	D	D	D	?	E
<i>Rana ridibunda</i>	0-350						L															
<i>Rana kurtmuelleri</i>	0-500		L					L														
<i>Rana dalmatina</i>	0-1,500		D	D	D			D	L	D	L	L	L	L	L	L	L	L	D	L	?	
<i>Rana italica</i>	0-1,500		L					L	L	D	L	L	D	D	L	D	L	L	D			E
<i>Rana latastei</i>	0-450		L	D		D	D		L													S
<i>Rana temporaria</i>	200-3,000	D	D	D	D	D	D	D	L	L			L									

L = Localised distribution in maximum one third of the territory, D = Widespread distribution, ? = Dubious presence. The altimetric interval is approximate, referring to Italian populations and can vary with latitude. The abbreviations at the top of the columns refer to the administrative regions, except the last which indicates whether the species is endemic (E) or subendemic (S).

indigenous species that are collectively defined as brown frogs or red frogs. The Agile frog (*R. dalmatina*) is principally linked to deciduous forest habitats, where they reproduce in temporary pools of water, in the heart of winter. The Lataste's frog (*R. latastei*) is a subendemic species that lives in hygrophilous broad-leaved forests of the Padano-Veneto basin (up to Istria). Both species are threatened by deforestation and by the lowering of the water table. The European common frog (*Rana temporaria*) is widespread throughout the Alpine Arc and in the Tuscan-Emilian Apennines. Moreover, a relict population is present in the central Apennines, in Monti della Laga, in the same site where there is an equally relict population of the Alpine newt, which may indicate the presence of a community that has survived the last glaciation. Last of all, the Italian frog (*R. italica*) is an endemic species of the Italian peninsula, commonly found in the forest habitats of hills and mountains.

**Table 5.17** - Regional and altimetric distribution of anurous amphibians in Italy.



**Fig. 5.10** - *Hyla sarda* (Photo by G. Carpaneto).

## REPTILES

[Marco Alberto Bologna, Giuseppe Maria Carpaneto]

### State of knowledge

Italian fauna includes 55 Reptile species, of which 3 have most certainly been introduced (allochthonous). In general, reptiles are less vulnerable than amphibians because, as they are not linked to aquatic habitats, they are more uniformly distributed throughout the territory and resist better to man-made habitat change. Moreover, several species have been facilitated by the man's activity of ecotonization such as the creation of clearings in forest landscapes. Finally, several Saurian species have become decidedly sinanthropic and live in large numbers in urban areas. Still, there are numerous endemic species that are either confined to small areas or more vulnerable in that they have strongly felt habitat alterations caused by man.

### Conservation status

#### Chelonians

Freshwater tortoises are dealt with in the section dedicated to these particular habitats. Similarly, marine turtles are included in the section on marine fauna, which though not part of terrestrial fauna, are worthy of mention as protection of their nesting sites (situated along very few beaches) comes within the management of coastal terrestrial habitats.

Testudinids are only present with a single species, the Hermann's tortoise, which is represented by a nominal subspecies (*Testudo hermanni hermanni*), whose primary range includes a large part of the Italian peninsula, Sicily and Sardegna. Today, the principal autochthonous pop-

ulations are found in several coastal areas and subcoastal areas in Lazio and Toscana. This species is in decline throughout the country due to man-made causes, such as arson, the taking of individuals for trade or as collector items, as well as the release into the wild of specimens with viral diseases. Another threat is the introduction of the Mediterranean spur-thighed tortoise (*T. graeca*). Numerous specimens of this species were introduced into the wild from captivity which has given rise to intraspecific mating which produce hybrids, thus reducing the rate of nativity of indigenous species. Another allochthonous species is the Marginated or Margined tortoise (*T. marginata*), endemic to southern Greece that is present, above all, in Sardegna with populations that go back to ancient introductions. Several authors have highlighted the morphological differences between the Sardinian population and the Greek ones; thus, it is opportune to safeguard this species in Sardegna for the zoogeographical and evolutionistic interest that ancient introductions have.

#### Squamates

The order of Squamates includes Saurians (lizards) and Snakes. There are 26 lizard and 20 snake species in Italian fauna. Italian Saurians belong to four families: Gekkonids, Anguids, Lacertids and Scincids.

The Gekkonid family includes 4 Italian species that are generally nocturnal, suited to climbing rocks and trees. The European leaf-toed gecko (*Euleptes europaea*) that occurs in the Tyrrhenian area (above all, in Sardegna and in the Tuscan Archipelago) is interesting from a zoogeographical point of view, even though it is not endemic to Italy. The Kotschy's gecko (*Cyrtopodion kotschy*) is an eastern Mediterranean species that perhaps colonised the coast of Puglia through passive dispersion. Whatever its origins may be,

Families	Genera	Autochthonous species	Allochthonous species	Total species	% of total European fauna species	Endemic species	Subendemic species
<b>REPTILES</b>	<b>30</b>	<b>52</b>	<b>3</b>	<b>55</b>	<b>44.71</b>	<b>3</b>	<b>5</b>
<b>CHELONIANS</b>	<b>7</b>	<b>7</b>	<b>2</b>	<b>9</b>	<b>75.00</b>		
<i>Emydidae</i>	1	1		1	100		
<i>Testudinidae</i>	1	1	2	3	100		
<i>Cheloniidae</i>	4	4		4	80.00		
<i>Dermochelyidae</i>	1	1		1	100		
<b>SQUAMOSALS</b>	<b>23</b>	<b>45</b>	<b>1</b>	<b>46</b>	<b>39.64</b>	<b>3</b>	<b>5</b>
<i>Gekkonidae</i>	4	4		4	57.14		1
<i>Chamaeleonidae</i>	1		1	1	100		
<i>Anguidae</i>	1	1		1	33.33		
<i>Lacertidae</i>	8	17		17	33.33	2	4
<i>Scincidae</i>	1	3		3	42.86		
<i>Colubridae</i>	7	16		16	61.54	1	
<i>Viperidae</i>	1	4		4	33.33		

**Table 5.18** - Reptile orders and families of Italian fauna: number of genera, indigenous species (autochthonous) and those introduced by man (allochthonous); percentage of the number of species with respect to European herpetofauna; number of endemic species (exclusive to the Italian territory) and subendemic species (present almost exclusively in the Italian territory). Sightings also made of other reptile species (*Batrachuridae*, *Agamidae*, etc.) of uncertain naturalisation were not considered in this study.



CHELOTIAN REPTILES	metres a.s.l.	Ao	Pi	Lo	TA	Ve	FV	Li	Em	To	Ma	Um	La	Ab	Mo	Cp	Pu	Ba	Cl	Si	Sa	E
<b>EMYDIDAE</b>																						
<i>Emys orbicularis</i>	0-1,500		L	L		D	D	L	D	L	L		L	L	L	L	L	L	L	D	D	
<i>Trachemys scripta</i>	0-500		L	L		L	L	L	L	L		?	L	L	L	L	L		L	L?		
<b>TESTUDINIDAE</b>																						
<i>Testudo hermanni</i>	0-600						L		L	L			L	L	L	L	L	L	L	L	L	
<i>Testudo graeca</i>	0-200									L			L				L			L	L	
<i>Testudo marginata</i>	0-800									L			L								L	
<b>CHELONIIDAE</b>																						
<i>Caretta caretta</i>																L	L	L	L	L		
<i>Chelonia mydas</i>																						
<i>Eretmochelys imbricata</i>																						
<i>Lepidochelys kempii</i>																						
<b>DERMOCHELYIDAE</b>																						
<i>Dermochelys coriacea</i>																						

L = Localised in up to one third of the territory, D = Widespread, ? = Dubious presence. The altimetric interval is approximate, referring to Italian populations and can vary with latitude. The abbreviations at the top of the columns refer to the administrative regions, except the last which indicates whether the species is endemic (E) or subendemic (S). For the 5 marine turtle species, the regional indications refer to verified nesting sites along Italian beaches.

Table 5.19 - Regional and altimetric distribution of Chelonian reptiles (tortoises and turtles) in Italy.

these populations in Puglia should be protected as they are the object of Mediterranean zoogeographical debate.

The Anguid family is represented in Italy by a single species: the Slow worm (*Anguis fragilis*), widespread both in the plain and mountain areas. It does not seem to run particular risks, apart from pesticides that can be ingested indirectly through the invertebrates that this species feeds upon.

According to recent taxonomic studies, Italian fauna has 17 Lacertid species divided into 8 genera. Some of these species have a wide distribution in almost all Italian regions, others are endemic to insular regions, and others still are present near the borders being western Mediterranean or Balkan species.

The most widespread species are the Western green lizard (*Lacerta bilineata*), the Common wall lizard (*Podarcis muralis*) and the Ruins lizard (*P. sicula*).

The endemic Sardinian or Sardinian-Corsican species are of particular interest: the Tyrrhenian wall lizard (*P. tiliguerta*), a subspecies of the Ruins lizard (*P. sicula cetti*), the Tyrrhenian rock lizard (*Archaeolacerta bedriagae*) restricted to small areas, and the Pygmy Algyroides (*Algyroides fitzingeri*). In Sicilia, we find the Sicilian wall lizard: (*Podarcis wagleriana*). Though endemic, these Sardinian and Sicilian species do not seem to be threatened by any particular factors, nor do they show signs of decline.

Endemic species that occur in small Mediterranean islands. The Aeolian wall lizard (*P. raffonei*; Figure 5.11), whose validity as a species has only recently been recog-

nised does not appear in the *Checklist of the Italian fauna*, though it is worthy of the utmost attention, being the most threatened Italian reptile. The Maltese wall lizard (*P. filfolensis*) is endemic to the Maltese and Pelagian Islands (Linosa and Lampione), where it was perhaps introduced in the very distant past. All microinsular endemic species may be placed in danger by the invasion of competitors or predators unintentionally transported to the islands: this is the present situation for the Aeolian wall lizard, which is now confined to two rocky reefs and to a part of Vulcano Island. Moreover, numerous subspecies should also be monitored, such as *P. muralis* and *P. sicula* that live on small islands and rocky islets, with often greatly reduced populations. One of the most interesting is the Blue lizard of Capri (*Podarcis sicula coerulea*) with its characteristic colouring.



Fig. 5.11 - *Podarcis raffonei* (Photo by M. Capula).

Other species of zoogeographical interest are those of the western Mediterranean, north African and Balkan regions that occur in generally restricted areas near the Italian borders, such as the Ocellated lizard (*Timon lepidus* Figure 5.12) which is present in Liguria, and the Large psammodromus (*Psammodromus algirus*) which is only found on the Isolotto dei Conigli, near Lampedusa. Finally, the most eastern elements reach Italy through Slovenia and Croatia, and are principally found in the Provinces of Trieste and Gorizia: the Horvath's Rock Lizard (*Iberolacerta horvathi*), the Dalmatian Wall Lizard (*Podarcis melisellensis*), and the Dalmatian algyroides (*Algyroides nigropunctatus*).

The Common lizard also known as the Viviparous lizard (*Zootoca vivipara*) lives in beat-bogs, wet meadows and in high-altitude pastures of northern Italy. While, at the two extremes of the Alpine Arc (the Maritime and Tarvisiano Alps), the Sand lizard (*Lacerta agilis*) occurs in rocky meadow habitats.



Fig. 5.12 – *Timon lepidus* (Photo by A. Loy).

Representative of the Scincids family is the Italian three-toed skink (*Chalcides chalcides*) and other two, more localised species: the Ocellated skink (*Chalcides ocellatus*), widespread in Sardegna, Sicilia, the Pelagian Islands and Pantelleria, and the Western three-toed skink (*Ch. striatus*), a western Mediterranean species which occurs from the French border down to western Liguria. None of these species run any particular danger.

Two snake families are included in the Italian fauna: Colubrids and Viperids.

The most common Colubrids are the Western whip snake (*Coluber viridiflavus*), the Aesculapian snake (*Elaphe longissima*), the Italian Aesculapian snake (*E. lineata*; Figure 5.13), the Four-lined snake (*E. quatuorlineata*)



Fig. 5.13 – *Elaphe lineata* (Photo by A. Venchi).

and the Smooth snake (*Coronella austriaca*). The Southern smooth snake (*C. girondica*) is rarer and confined to small areas. Grass snakes are dealt with in the section on freshwater fauna as they prey, above all, on fish and amphibians. In any case, large female adults of *Natrix natrix* avoid the water and feed principally on toads.

Among Colubrids that occur in limited areas of the country, there is the Leopard snake (*Elaphe situla*), an eastern-Mediterranean species which is principally present in Puglia and Sicilia in Italy; the Horseshoe whip snake (*Coluber hippocrepis*), a western-Mediterranean species present in Sardegna and Pantelleria; the Montpellier snake (*Malpolon monspessulanus*), a Mediterranean species which only occurs in western Liguria (where it is common) and in Lampedusa in Italy; and the False smooth snake (*Macroprotodon cucullatus*), a western-Mediterranean species which is only present in Lampedusa. The populations of these species, above all, the Leopard Snake, should be safeguarded and need to be continuously monitored.

Among Viperids, the only widespread species is the European asp (*Vipera aspis*). The southern most populations (Calabria and Sicilia) have been described as a separate subspecies (*V. a. hugyi*), and recently proposed to the rank of species. This last-mentioned specimen, present on the Isola di Montecristo, seems to have descended from specimens introduced into southern Italy in the very distant past. The Common viper or European adder (*V. berus*) is limited to the Alpine Arc, where it prefers mountain and wetland habitats, while the Nose-horned viper (*V. ammodytes*) is found in the north-eastern Alps and in the Trieste karst system. Finally, the Orsini's viper (*V. ursinii*), an interesting species with a relict distribution occurs in high-altitude pastures of the central Apennines, from Monti Sibillini to the National Park of Abruzzo, Lazio and Molise.



SQUAMATA REPTILES	metres a.s.l.	Ao	Pi	Lo	TA	Ve	FV	Li	Em	To	Ma	Um	La	Ab	Mo	Cp	Pu	Ba	Cl	Si	Sa	E
<b>GEKKONIDAE</b>																						
<i>Cyrtopodion kotschy</i>	0-450																D	L				S
<i>Euleptes europaea</i>	0-1,350							L		L											D	
<i>Hemidactylus turcicus</i>	0-800						L	L	L	L	L		L	L	L	L	D	L	D	D	D	
<i>Tarentola mauritanica</i>	0-800						L	D	L	L	L		L	L	L	L	D	L	D	D	D	
<b>CHAMAELEONIDAE</b>																						
<i>Chamaeleo chamaeleon</i>																	L			L		
<b>ANGUIDAE</b>																						
<i>Anguis fragilis</i>	0-2,400	L	D	D	D	D	D	D	D	D	L	D	D	D	L	L		L	L			
<b>LACERTIDAE</b>																						
<i>Algyroides fitzingeri</i>	0-1,800																				D	S
<i>Algyroides nigropunctatus</i>	0-400						L															
<i>Archaeolacerta bedriagae</i>	0-1,800																				L	S
<i>Iberolacerta horvathi</i>	600-1,750					L	L															
<i>Lacerta agilis</i>	1,700-2,300		L				L															
<i>Lacerta bilineata</i>	0-2100	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
<i>Lacerta viridis</i>	0-1,100						L															
<i>Podarcis filfolensis</i>	0-100																			L		S
<i>Podarcis melisellensis</i>	0-550						L															
<i>Podarcis muralis</i>	0-2,300	D	D	D	D	D	D	D	D	D	D	D	D	D	D	L	L	L	L			
<i>Podarcis raffonei</i>	0-100																			L		E
<i>Podarcis sicula</i>	0-2,000		L	L		L	L	L	D	D	D	D	D	D	D	D	D	D	D	D	D	
<i>Podarcis tiliguerta</i>	0-1,800																				D	S
<i>Podarcis wagleriana</i>	0-1,200																			D		E
<i>Timon lepidus</i>	0-650							L														
<i>Psammodromus algirus</i>	0-20																			L		
<i>Zootoca vivipara</i>	200-3,000	L	L	D	D	L	D															
<b>SCINCIDAE</b>																						
<i>Chalcides chalcides</i>	0-1,600		L	L				L	L	D	L	L	D	L	L	D	D	D	D	D	D	
<i>Chalcides ocellatus</i>	0-1,500																			D	D	
<i>Chalcides striatus</i>	0-600							L														
<b>COLUBRIDAE</b>																						
<i>Coluber hippocrepis</i>	0-500																			L	L	
<i>Coluber gemonensis</i>	0-400						L															
<i>Coluber viridiflavus</i>	0-2,000	L	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
<i>Coronella austriaca</i>	0-2,250	D	D	D	D	D	D	L	L	L	L	L	L	L		L	L	L	L	L		
<i>Coronella girondica</i>	0-900	L	L	L			L	D	L	L			L	L								
<i>Elaphe lineata</i>	0-1,600												?	D	D	D	L	D	D	D		E
<i>Elaphe longissima</i>	0-2,000	L	D	D	D	D	D	D	D	D	D	D	D									
<i>Elaphe quatuorlineata</i>	0-1,000									D	L	L	D	D	D	D	D	D	D	?		
<i>Elaphe scalaris</i>	0-400							L														
<i>Elaphe situla</i>	0-1,260																L	L	L	L		
<i>Macroprotodon cucullatus</i>	0-50																			L		
<i>Malpolon monspessulanum</i>	0-700							D												L		
<i>Natrix maura</i>	0-1,000		L	L				D	L													D
<i>Natrix natrix</i>	0-2,300	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
<i>Natrix tessellata</i>	0-1,000		D	D	D	D	D	L	D	D	L	L	D	D	L	D	D	L	L			
<i>Telescopus fallax</i>	0-250						L															
<b>VIPERIDAE</b>																						
<i>Vipera ammodytes</i>	0-1,700				L?	L	D															
<i>Vipera aspis</i>	0-2,800	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
<i>Vipera berus</i>	600-2,500		L	D	D	D	D		?													
<i>Vipera ursinii</i>	1,500-2,400										L	L	L	L								

L = Localised in up to one third of the territory, D = Widespread, ? = Dubious presence. The altimetric interval is approximate, referring to Italian populations and can vary with latitude. The abbreviations at the top of the columns refer to the administrative regions, except the last which indicates whether the species is endemic (E) or subendemic (S).

Table 5.20 - Regional and altimetric distribution of Squamata reptiles (lizards and snakes) in Italy.

## BIRDS

[Francesco Pinchera]

### State of knowledge and conservation status

Birds, similarly to several other faunistic groups, are undergoing a phase of great change, with considerable transformations in terms of chorology and density, as well as composition of local populations.

The populations of several species are currently subjected to the widespread phenomenon of numeric decline. Others show signs of a partial recovery, at times contrary to the trend of recent decades. A smaller percentage of species have benefited from various forms of anthropisation of the territory, with a consequent favourable demographic development.

Contrasting interpretations can be given to the discernible changes in forest species. The great increase of woodland areas and the progressive aging of vegetation are accompanied by the rapid abandonment of traditional forms of management that had maintained high levels of structural heterogeneity. The current lumbering practices regard only a few typologies and generally cover vast areas. Thus, several bird species linked to the final stages of ecological succession have limited or at times declining populations.

Changes in agropastoral practices, along with a great increase of arable areas, have led to a dramatic decline of pasture areas, above all, in the valleys and hills. Mechanised agriculture has in turn been intensified, with the frequent loss of margin habitats, while agriculture in mountain areas has more or less disappeared. Forms of raising livestock by leading them to pasture have survived in mountain areas and in the larger Italian islands, though they are now reduced, and moreover, fewer breeds of livestock are now raised.

Apart from the transformations mentioned above in wetlands and in agro-silvo-pastoral activities, many bird species show a great sensitivity towards specific anthropogenic factors, which at times, are decisive factors in the equilibrium between the birth/death rates. The following list contains some of these factors:

1. killing of non-huntable species (difficulty in effectively contrasting the phenomenon);
2. inadequate planning in the taking of huntable species;
3. uninsulated medium-tension power lines (electrocution) and unmarked high-tension power lines (collision);
4. poisoned bait and carcasses;

5. road traffic (collision, in which Strigiformes are the main victims);
6. aeolian blades (not widespread as yet);
7. sources of high-dispersion illumination along migratory routes (in certain atmospheric conditions this can disorientate flocks of nocturnal migrating Passeriformes).

Italy plays a particularly important role in that migratory species stopover and transit in its territory. An analysis of the effects of habitat change or excessive taking (both legal and illegal) on these species is particularly difficult. Consequently, it is opportune to adjust the intensity of legal capture of migratory species so that it is proportionate to their density. Moreover, there are cases of close resemblance between huntable species and protected ones, which makes the identification of specimens difficult before being shot down.

As regards to the illegal taking of migratory birds and, in general, to the direct persecution of bird species, it is necessary to strengthen the surveillance of vast areas (above all, in mountain regions) which are insufficiently monitored at present.

Basic knowledge of species, the main descriptive parameters of population density, distribution and bird population trends throughout the national territory are insufficient and inhomogeneous in both time and space. Undoubtedly, there is a need to strengthen national monitoring programmes that must provide for permanent forms of control and assessment in terms of quantity and homogeneity with other European countries.

In the second half of last century, the upshot between extinctions and the new nesting species in Italy was very positive (Tables 5.21 and 5.22), with seven extinct species in the national territory compared to 34 new nesting species, principally made up of species that have spontaneously immigrated (5 are introduced and naturalised allochthonous species, and other species may be added to this figure in the near future).

An evaluation of the bird population in Italy is particularly complex due to the large number of species and the diverse phenologies which create different typologies of presence throughout the national territory, from non-migratory species to temporary ones.

The following are only some of the most interesting taxa for the Italian territory, and we have limited ourselves to commenting on some important elements. For an assessment of the population density, trend and distribution, reference should be made to the following sources: BRICHETTI *et al.* (1992), AMORI *et al.* (1993),

		Decade	Last site species observed	Notes
Bearded vulture	<i>Gypaetus barbatus</i>	1960	Sardegna	reintroduced successfully in the Alps
Black vulture	<i>Aegypius monachus</i>	1960	Sardegna	reintroduction project in Sardinia
Northern harrier	<i>Circus cyaneus</i>	1950	Padana Plain	
Wheatear	<i>Oenanthe leucura</i>	1960	Liguria, Toscana and Sicilia (Egades)	

**Table 5.21** - Non aquatic bird species extinct in Italy in the second half of the 20th century.

		Decade and origin	Site	No. pairs (year 2000)
Bearded vulture	<i>Gypaetus barbatus</i>	1990 - reintroduction	Stelvio National Park (Lombardia)	2 ?
Red-footed falcon	<i>Falco tinnunculus</i>	1990 - immigration	Province of Parma	approx. 20
Northern bobwhite	<i>Colinus virginianus</i>	1980 - introduction	Lombardia, Piemonte	4,000-6,000
Lapwing	<i>Vanellus vanellus</i>	1950 - immigration	Province of Venezia	600-1,000
Ring-necked parakeet	<i>Psittacula krameri</i>	1970 - introduction	Genova (Liguria)	30-80
Monk parakeet	<i>Myiopsitta monachus</i>	1980 - introduction	Genova (Liguria)	30-70
Great spotted cuckoo	<i>Clamator glandarius</i>	1960 - immigration	Toscana, Sardegna	less than 10
Ural owl	<i>Strix uralensis</i>	1990 - immigration	Province of Udine	less than 10
Red-rumped swallow	<i>Hirundo daurica</i>	1960 - immigration	Gargano (Puglia)	15-25
Fieldfare	<i>Turdus pilaris</i>	1960 - immigration	Trentino-Alto Adige	5,000-10,000
Strawberry finch	<i>Amandava amandava</i>	1990 - introduction	Molise, Lazio, Veneto etc.	100-500

**Table 5.22** - New nesting bird species in Italy (non-aquatic species that were introduced or reintroduced or immigrated to Italy in the second half of the 20th century).

MESCHINI & FRUGIS (1993), TUCKER & HEATH (1994), HEGEMEIJER *et al.* (1997), PINCHERA *et al.* (1997), BULGARINI *et al.* (1998), BRICHETTI & GARIBOLDI (1999), CALVARIO *et al.* (1999).

### Italian birds: important species and population dynamics

#### Accipitrids

The family Accipitridae is a numerous group, with more than 200 species of which 27 concern Italy and only 13 or 14 are considered as nesting species; some with distinct populations at the subspecies level in the Sardegna-Corsica area (Table 5.23).

All Accipitrid species throughout the national territory have been subjected to decline in terms of density and range. Habitat changes have, without doubt, created the basis for the vast and rapid decline observed, but the direct persecution, often in the form of illegal shooting, and the spreading practice of using poisoned bait continues to be one of the greatest causes of mortality, keeping several populations in a precarious equilibrium, at times impeding a recovery even when suitable environmental conditions exist. Some Accipitrid species are extremely vulnerable to man-made elements in the territory, such as the medium-tension uninsulated long-

distance power lines (but also high-tension long-distance power lines not properly indicated and aeolian blades).

These elements can even make suitable territories fatal for species, setting off a series of episodes of death that firstly involve the resident population and then, progressively, constitute a sort of 'black hole' in the distribution pattern.

The four vulture species have a particularly problematic status (Table 5.24). The vultures still present in the national territory are the Egyptian vulture (*Neophron percnopterus*), the Eurasian griffon vulture (*Gyps fulvus*) and the Bearded vulture (*Gypaetus barbatus*), while the Black vulture (*Aegypius monachus*) is extinct (Table 5.21). All the species have decreased in number, even rapidly, up to the point of extinction, as in the case of the Bearded vulture and the Black vulture. A reintroduction programme for the Bearded vulture was set up in the Alps in 1987, while a reintroduction programme for the Black vulture is being set up in Sardegna. Small contingents of nesting Eurasian griffon vultures and Egyptian vultures survive in limited areas, in the last surviving portions of ranges that once were much vaster. The Eurasian griffon vulture survives in Sardegna (only a few dozen pairs), while the resident populations in Sicilia and in continental Italy are extinct (important resettlement projects in the wild of nesting colonies are currently un-

Corso-sardinian goshawk	<i>Accipiter gentilis arrigonii</i>	60-80	Sulcis-Inglesiente, Sarrabus-Gerrei, Monte Arci, Gennargentu Supramonte, Monti Ferru, Margine-Goceano, Limbara and Planargia	reduced habitat
Eurasian sparrowhawk	<i>Accipiter nisus wolterstorffi</i>	200	widespread in all woodland areas	reduced habitat
Common buzzard	<i>Buteo buteo arrigonii</i>	250-350	widespread throughout most of the island	illegal killing

**Table 5.23** - Endemic Sardinian-Corsican subspecies of Accipitrids: estimated number of pairs, distribution in Sardegna and conservation problems.

derway in the eastern Alps, central Apennines and Sicilia; in some cases with the resettlement of nesting colonies). The Egyptian vulture is still present in southern Italy and in Sicilia with a scarce number of breeding pairs (a captive breeding project for reintroduction is underway in Toscana). Vultures are susceptible to the use of illegal bait, and above all, to poisoned carcasses. Single episodes of intoxication can involve a relatively high number of individuals, placing the survival of the species of an entire geographic area at risk. In certain situations, providing artificial nourishment may be beneficial, in that it reduces the search for food in the territory, and hence, the risk of being poisoned. Further initiatives of introduction in areas suitable for the presence of the species will possibly allow an increase of the Italian sites.

The range of the Golden Eagle (*Aquila chrysaetos*) is not limited to Europe: the species has a holoartic distribution that embraces a large part of the northern hemisphere. It is not considered at risk at a world-wide level, but the European status is generally considered unfavourable. Excluding Russia, Italy with 350-400 pairs hosts the fifth most numerous contingent in Europe (preceded by Spain, Norway, Sweden and England). The national status indicates a substantially stable population, perhaps in slight recovery. But the serious declines of the past have levelled out the contingents to a relatively low density. The Golden Eagle is particularly vulnerable to poisoned carcasses which are a major cause of death; worth mentioning is the finding of individuals dead for swallowing poisoned baits. The species, and

in particular, juveniles in their first year of life, are extremely vulnerable to being shot down directly. Moreover, the large size of this bird of prey makes electrocution on medium-tension power lines possible, as well as collision with high-tension cables. A possible new cause of androgenic mortality could be the recent increase in aeolian installations that produce electricity, in that observations in North America indicate a high rate of mortality in several eagle species.

The Bonelli's eagle (*Hieraetus fasciatus*), a species with a palaearctic-paleotropical geographical distribution that occurs on the continent as well as on the islands, maintains a limited presence in the Mediterranean. In Mediterranean Europe, about 1,000 pairs have been estimated and the dominant trend is towards a further, progressive decline. The areas of presence in Italy are, above all, Sardegna and Sicilia. The Sardinian contingent is now reduced to very few pairs, while Sicilia, the national stronghold for the species, hosts 10-20 pairs. The recruitment of juveniles in reproductive territories is probably insufficient, in that the wandering juveniles are subject to high rates of mortality, substantially increased by man-made causes (direct shooting, poisoned bait and power-lines).

### Falconiforms

This group of small-medium sized daytime birds of prey is present throughout the world. The order is made up of about 60 species. In the western Palaearctic, 12 nesting species of the genus *Falco* have been reported, 7 of which also nest in Italy including the Lanner falcon

Egyptian vulture	<i>Neophron percnopterus</i>	less than 10	Sicilia and southern Italy	reintroduction programmes being planned (Toscana)
Eurasian griffon vulture	<i>Gyps fulvus</i>	several dozen	Sardagna, eastern Alps and central Apennines	reintroduction programmes underway (eastern Alps, central Apennines, Sicilia)
Bearded vulture	<i>Gypaetus barbatus</i>	2?	Alps	reintroduction programmes underway (Alps)
Black vulture	<i>Aegypius monachus</i>	extinct	-	reintroduction programmes being planned (Sardagna)

**Table 5.24** - Italian vultures: estimated number of breeding pairs, areas of presence in Italy and reintroduction projects.

(*Falco biarmicus*), the Eleonora's falcon (*F. eleonorae*) and the Lesser kestrel (*F. naumanni*) (Table 5.25) that constitute important conservation priorities, even at an international level.

The Mediterranean-African range of the Lanner falcon is mainly concentrated in the African continent, while the populations of southern Europe constitute the northern fringe. The Mediterranean range is limited to Greece, Croatia, Turkey and Italy; with Italy hosting the largest part of the European population (160-170 estimated pairs, out of a total of 200-330 European pairs). The Italian contingents are reported to be in slow decline; while in Spain and France the species has been extinct for a long time. Due to the rarity of the species, it is relatively exposed to the illegal taking of nestlings.

The Eleonora's falcon has a global population estimated at around 4,500 pairs that is concentrated in the Mediterranean. Italy, with 400-500 estimated pairs (about 10% of the global population) plays a very important role in the conservation of this species. As a social species with nesting colonies, it has few nesting sites that are mainly located on Mediterranean islands. Ten colonies have been reported for Italy, in the Tyrrhenian and in the Channel of Sicilia. The general trend of these populations is stable, with local, moderate increases, while in the Balearic islands significant increases have been observed. The species is greatly exposed to the taking of nestlings and adults in the nests. Their taking which is less frequent than in the past continues to be an important, negative demographic factor. The extent of possible illegal shooting in autumn, before the migrations towards wintering areas, is unknown.

The Lesser kestrel is the only bird species with a conspicuous nesting contingent in the Italian territory among endangered species according to the IUCN Red List (*Vulnerable* category). This bird of prey has been subjected to a dramatic decrease in western Europe, while the wintering range in South Africa has more than halved in less than 40 years. The estimated decrease in the entire nesting range with a Eurocentralasian-Mediterranean chorology has been more than 20% in the last ten years. The same rate of decline is expected in the next decade.

In Italy, the nesting contingent is estimated at 500-1,000 pairs, distributed in Sardegna (in decline), Sicilia (stable) and Puglia-Basilicata (locally on the increase). The reported increase in some areas of the Italian peninsula has a strategic importance for the possible consolidation of the species in the central Mediterranean area. The species is linked to the presence of steppe-grain formations. Its nests in colonies on walls, even within urban areas (the nesting colony in the historical centre of Matera is numerically important). A conservation programme for the species should carefully monitor the populations during the nesting period and safeguard their sites and hunting areas.

**Tetraonids**

Tetraonids are medium-large sized galliforms with a holoartic-circumpolar distribution, and with relict populations of postglacial origin located in the largest mountain ranges of Eurasia, including the Alps. Four species are present in the Alps: the Hazel grouse (*Bonasa bonasia*), the Rock ptarmigan (*Lagopus mutus*), the Black grouse, (*Tetrao tetrix*) and the Capercaillie (*T. urogallus*).

All the species are or have been in decline in different areas of the European range. The Hazel grouse has a relatively homogeneous distribution along the Alpine Arc, but shows a tendency to decline in most of Europe. The Rock ptarmigan is generally stable, while reduced ranges have been reported along the Italian Alps. The Black grouse has apparently declined in most of its European range, with the sole exception of Sweden. The species fluctuates in number in Switzerland and Italy, while in Austria it is in decline. The number of individuals of Capercaillie has dropped greatly all over Europe, with the exception of Sweden and Romania. The population of the Alpine area (Italy, France, Switzerland, Austria and Slovenia) is considered in slow and steady decline. The causes for this reported decline include hunting which is not always based on criteria of adequate sustainability, and changes in modern selviculture activities which tend to reduce the structural diversity and composition of mountain areas.

Lanner falcon	<i>Falco biarmicus</i>	Italian peninsula and Sicilia	160-170	in slow decline
Eleonora's falcon	<i>Falco eleonorae</i>	islands of the Tyrrhenian Sea and the Channel of Sicilia	400-500	stable
Lesser kestrel	<i>Falco naumanni</i>	southern Italy, Sicilia and Sardegna	500-1,000	stable

**Table 5.25** - The three Falconid species with priority conservation in Italy: areas in which they occur, estimated numbers (pairs) and Italian population trend.

### Phasianids

Italy plays a vital role in the conservation of the Rock partridge (*Alectoris graeca*). Its nesting contingent, estimated around 14,000 pairs, makes up almost the total global figure, with a distribution that goes from the Italian peninsular to the Balkans. The populations of autochthonous species of the genera *Alectoris* and *Perdix* have declined because of habitat change and poor hunting management (Table 5.26).

### Otitids

This family of medium-large sized terrestrial birds is present in Italy with one species, the Little bustard (*Tetrax tetrax*), classified as 'near threatened' by the IUCN, which is next in line to the 'endangered with extinction' categories of the Red List. Unfortunately, there is reason to believe that the species may be listed in these categories in a relatively short period. The Italian contingent, estimated in 200-500 pairs throughout Sardegna and Puglia is in moderate decline. The species was present in Sicily up to the 1950s; on the island there may still be suitable environmental conditions to host the presence of this species. The causes for this regression can be found in the illegal taking of the species and in the intensification of agricultural practices and consequent tilling of pastures.

### Strigiforms

These nocturnal birds of prey include two families (Tytonids and Strigids), both present in Italy: Tytonids with *Tyto alba*, a cosmopolitan species, and Strigids with the genera *Otus*, *Bubo*, *Glaucidium*, *Athene*, *Strix*, *Asio* and *Aegolius*. Strigiforms generally have a wide range, though two of Italian species, the Eurasian scops owl (*O. scops*) and the Tawny owl (*S. aluco*) have a prevalently European distribution (Eurocentralasian-Mediterranean). Today, almost all the species find themselves in unfavourable conditions, with extensive declines in both density and range.

Significant decreases, presumably due to the high mortality rate caused by electrocution on medium-tension long-distance power lines, have seriously reduced the Eurasian eagle owl (*Bubo bubo*) contingent that nests in Italy, confirming a trend found in other southern and eastern European countries. Conversely, the species is in expansion, sometimes even rapidly, in several countries in central-northern Europe, even in areas that are greatly anthropic (urban areas, industrial plants, waste dumps), at times aided by effective reintroduction programmes and by wide-ranging safety programmes of medium-tension power lines.

### Caprimulgiforms

The only species regularly present and nesting in Italy is the European nightjar (*Caprimulgus europaeus*). It is estimated that little more than half of the global range of the species comes within continental Europe where the phenomenon of steady decline has been reported in most nations. The nesting population in Italy is currently estimated at around 5,000-15,000 pairs, which represents less than 5% of the European population.

### Coraciiforms

This relatively homogeneous order is represented in Italy by four families (Alcedinids, Meropids, Coraciids and Upupids), with as many nesting species and whose status is considered unfavourable at a European level (Table 5.27).

Particularly serious is the decline of the Eurasian roller (*Coracias garrulus*), a species that has a predominantly European distribution (Euroturanic-Mediterranean); the rate of decline of the species seems to have slowed down in western and Mediterranean European countries, while it is accelerating rapidly in the eastern European countries. The nesting population in Italy fluctuates between 300-500 pairs, which are about 2% of the European population (this percentage could increase with the collapse of the eastern contingents). The species

Barbary partridge	<i>Alectoris barbara</i>	Sardegna	5,000-10,000	-
Rock partridge	<i>Alectoris graeca</i>	Alps, Apennines and Sicilia	approx. 14,000	3 subspecies: <i>saxatilis</i> (Alps), <i>orlandoi</i> (Apennines) and <i>whitakeri</i> (Sicilia)
Red-legged partridge	<i>Alectoris rufa</i>	hills of north-western Italy	several thousand	-
Grey partridge	<i>Perdix perdix</i>	sites of residual presence	? (repopulation)	ssp. <i>italica</i> presumably extinct in its original connotation

Table 5.26 - Autochthonous Phasianids: areas in which they occur, estimated numbers (pairs) and Italian subspecies.



Common kingfisher	<i>Alcedo atthis</i>	5,000	in decline
European bee-eater	<i>Merops apiaster</i>	2,000-4,000	fluctuating
Eurasian roller	<i>Coracias garrulus</i>	300-500	in decline
Eurasian hoopoe	<i>Upupa epops</i>	several thousand	in decline

Table 5.27 - Status of Coraciiforms in Italy: estimated pairs and trend of Italian populations.

winters in Africa and is present in the Italian territory from March to September. The Eurasian roller is linked to habitats with a great availability of insects, particularly coleopterans and orthopterans which are abundant in untillied areas of the territory, while they tend to become scarce in areas where the land is cultivated. An increase in intensive agricultural practices could negatively influence the species even in the wintering quarters of sub-Saharan Africa.

### Piciforms

Woodpeckers are present in Italy with four genera (*Jynx*, *Picus*, *Dryocopus* and *Picoides*), including 9 nesting species. These birds play an important role in forest communities, contributing, with their intense activity of digging cavities, to the creation of nesting-shelter sites that are also used by many other forest species (Chiropterans, Passeriformes, Strigiforms, Columbiforms, etc.), and which, at times, are strictly dependent on woodpeckers. The Black woodpecker (*D. martius*), a species limited to the Alpine area and to a separate area of the southern Apennines (with unknown status), which creates relatively large hollows throughout its territory, is considered one of the most important *keystone species* of European forests. In Europe, this species is currently in expansion. An increased number of this species in Italy is auspicious because of the favourable effect it has on the distribution of other taxa.

Most populations of the European common wryneck (*J. torquilla*), the Green woodpecker (*Picus viridis*), the Grey-headed woodpecker (*P. canus*), the (*Picoides medius*), the White-backed woodpecker (*P. leucotos*), the Crankbird (*P. minor*) and the Banded three-toed woodpecker (*P. tridactylus*) are in decline in Europe, and a similar trend that is moderately unfavourable or with substantially stable contingents has been reported for Italy. Factors that have led to this decline can be found in modern selviculture practices that tend to reduce the structural diversity and the incidence of deteriorated trees, while the effects of increased woodlands in the country does not seem to have had any effect on the above-mentioned species.

The geographic distribution of the Green woodpeck-

er and the Middle spotted woodpecker is mainly concentrated in Europe. The Green woodpecker, in particular, has a nesting contingent in Italy that is cautiously estimated to be around several thousand pairs, while the Middle spotted woodpecker maintains a localised presence in only a few forest habitats in the south (an estimated few hundred pairs). The White-backed woodpecker, discovered in the 1950s in beech groves of the central Apennines and in Gargano, maintains a small and isolated population of a few hundred pairs. Also the Banded three-toed woodpecker has been reported in Italy in recent times (the 1970s, in the province of Bolzano) and maintains a relatively limited contingent (50-100 pairs) though in connection with other larger transalpine populations. The Great spotted woodpecker, the most common species at a national level, is present in Sardinia with the endemic subspecies (*harterti*) though its population density is presumably estimated at around several thousand pairs.

### Passeriformes

About 150 species, either stable or migratory, of this order, which alone includes over a half of the living bird species, are present in Italy. About 30 other species must be added to this figure as they are found temporarily or migrate on an irregular basis.

The species, in decline, are principally linked to xeric pastures, traditional agricultural areas unaltered by agromonic changes, typical grass formations of wetland areas and mature woods with elevated structural diversity. The protection of these birds is mainly linked to appropriate habitat management of habitats, that is, with possible interventions to extend areas of ecosystems that are currently confined to residual habitats. It is also important to preserve small and/or insular populations, and specific monitoring programmes should thus be carried out (Table 5.28). Safeguarding migratory species takes on particular importance and highlights the need to further strengthen monitoring activities. Even possible intervention such as habitat transformation of strategically important sites and the control of forms of hunting should be extended. A brief mention shall be made below to two families.

Adriatic long-tailed tit	<i>Aegithalos caudatus siculus</i>	Sicilia	limited consistency (scarce data)
Sicilian marsh tit	<i>Parus palustris siculus</i>	Sicilia	limited consistency (scarce data)
Corsican citril finch	<i>Serinus citrinella corsicana</i>	Sardegna and Tuscan archipelago	limited consistency (scarce data)
Woodchat shrike	<i>Lanius senator badius</i>	Sardegna and Tuscan archipelago	limited consistency (presumably in decline)

**Table 5.28** - Endemic or subendemic insular subspecies of Passeriformes, Sites in Italy where they are occur and notes regarding their vulnerability.

All the shrike species of the genus *Lanius* (Laniidae) have unfavourable status and come within the general decline of species linked to pasture habitats. The Lesser grey shrike (*L. minor*) and the Woodchat shrike (*L. senator*) have drastically declined in both range and density in Europe, where their range is concentrated. The Woodchat shrike is present in Sardegna and on the is-

lands of Toscana with the subspecies *L. s. badius*. Among the Corvids, a family that includes several species with a positive growth trend, there is the Chough (*Pyrrhocorax pyrrhocorax*) which however, is in sharp decline at a national level (its consistency is now estimated to be a few hundred pairs), presumably due to agro-pastoral practices in mountain areas.

## MAMMALS

[Francesco Pinchera]

### State of knowledge and conservation status

Italian mammals, in analogy with many other fauna components, are passing through a very dynamic phase, often sustained by direct population manipulation, with considerable changes made to geographical ranges and population density. Many species, and especially Chiropterans have been subjected to a widespread decline. Others, for example, Artiodactyls show significant signs of recovery, reoccupying large sections of their range abandoned in past centuries. Several species, with particularly those that have been introduced, have increased in number, reaching particularly favourable demographic proportions which, at times, have negative effects on autochthonous species.

The vast phenomenon of the progressive abandonment of agropastoral practices in mountain areas, with the consequent recovery of woodland areas, has benefited many species. On the other hand, the abandonment of traditional forms of management which maintained high levels of structural heterogeneity and composition, have led to the decline of other groups (for example, Glirids). Factors that have led to the regressive trend of many species linked to aquatic habitats are: the extensive reclamation of wetlands, water tapping, and water contamination with bioaccumulable toxic substances.

The intensification of agricultural practices in the plains, with a great increase in cultivated areas and the progressive rarefaction of fringe habitats, have greatly reduced population diversity, creating extensive discontinuity in the geographic distribution of many species. In numerous cases, the distributive continuity of vast areas is guaranteed by the Alpine and Apennine ranges, while at times, there are populations that are either partially or completely isolated in the plains.

The road network in Italy interferes with the movement of animals in the territory, thus contributing to the high mortality rate of several particularly vulnerable species in a substantial manner. The road system creates a certain level of 'permeability' in correspondence to viaducts and tunnels in hill and mountain areas, while in the plains it forms barriers that are difficult to cross, often due to traffic. Management schemes that deal with mammal fauna/infrastructure interaction should provide for the complete closure of roads, with adequate fencing off of tracts that cannot be crossed owing to heavy traffic and a central barrier with cement walls.

For several species, hunting management schemes have been proven to be inadequate, with the scarce diffusion of programmed hunting policies with clearly defined objectives. However, the hunting schemes adopted in the Alpine Hunting Districts, as provided for in hunting regulations, has management advantages that could be extended to the Apennines, by setting up similar Districts. The progressive spread of ungulates requires continual adjustments to be made to hunting activity in some areas, which could be assisted by obligatory preparatory courses that are already envisaged in several provincial regulations.

In some areas, poaching ungulates has increased with the increase in population density. Insufficient surveillance in several territories and the economic value of heads killed has, at times, consolidated this illegal activity, that is most likely organised. It is necessary to rapidly increase surveillance in these areas, even at night, utilising an adequate number of well equipped and sufficiently prepared personnel to contrast the phenomenon. The widespread use of poisoned bait and carcasses is a well-rooted reality in some environments, above all, in the mountains.

Knowledge on the principal descriptive parameters such as population density, distribution, and trends is considered insufficient and inhomogeneous in both time and space for several groups, above all, Chiropterans. Without doubt, there is a need for an extensive and permanent monitoring programme which could also provide quantitative assessments according to criteria standardised with other European countries. Particular attention should be given to monitoring insular populations with poorly known status.

In this context, greater attention has necessarily been given to some taxa, with comments made on important aspects, conservation management implications and/or the control of possible effects of other biocoenoses. For an assessment of trends and distribution of the species in question, reference was made to the following sources: AMORI *et al.* (1993), FORNASARI *et al.* (1997), PINCHERA *et al.* (1997), BULGARINI *et al.* (1998), MITCHELL *et al.* (1999), SPAGNESI & DE MARINIS (2002).

### Italian mammals: important species and population dynamics

#### *Insectivores*

This order of small-sized mammals, prevalently predators, is present in Italy with three families: Erinaceids (hedgehogs, with two species), Soricids (shrews, with about

Apennine shrew	<i>Sorex samniticus</i>	species endemic to the Italian peninsular
Sicilian shrew	<i>Crocidura sicula</i>	described as a species in 1901, utilising an introduced name – without description – in 1879, currently believed no different from <i>C. canariensis</i>
Pantellerian shrew	<i>Crocidura cossyrensis</i>	species with a Maghrebi distribution, present in some Mediterranean islands such as Pantelleria, where its numeric consistency is very limited
Sardinian greater white-toothed shrew	<i>Crocidura russula icnusae</i>	the species occurs in Italy with only one population in Sardegna, currently considered a distinct subspecies; though it could be the result of an ancient introduction
Sardinian pygmy white-toothed shrew	<i>Suncus etruscus pachyurus</i>	presently in Sardegna and Asinara, perhaps an ancient unintentional introduction by man

**Table 5.29** - Shrews: Italian species and subspecies and insular populations.

12 species) and Talpids (moles, with three species). More than other groups of mammals, Italian Soricids are of particular interest (with endemic species and differentiated insular populations – Table 5.29) and display elements that suggest the existence of species not yet identified such as *Sorex arunchi*, recently described, which occurs in the eastern Padana area).

### Chiropterans

Chiropterans, or Bats, make up a particularly numerous order. All the European species are present in Italy; that is, 30 species divided into four families: Rhinolophidae, Vespertilionidae, Miniopteridae and Molossidae (excluding those accidentally introduced and those that occur only in the Canary Islands, the Azores islands and eastern Aegean Islands).

Many chiropterans are in dramatic decline and make up the most representative group of mammals found in the global IUCN Red List (Table 5.30), all of them being included in the Annexes II and IV of the Habitats Directive. However, even among the remaining species there is a general tendency of numeric decline in the populations, with a few exceptions. At a national level, the level of knowledge regarding this group that contains such a high percentage of threatened species, is currently insufficient.

The low reproductive rate, the long gestation and weaning period, the tendency of females to aggregate in colonies to give birth and raise the young, are all elements that make this group vulnerable. These elements expose chiropterans of entire geographic areas to disturbance in the sites where their colonies are located. Moreover, given their longevity and source of food (insects), chiropterans

are also exposed to an accumulation of chlorine substances and heavy metals that lead to the loss of entire colonies.

### Lagomorphs

Lagomorphs are present in Italy with 6 species of the Leporid family (Table 5.31). The validity of the Apennine hare (*Lepus corsicanus*) as a species has recently been confirmed, through the use of DNA mitochondrial analyses, even though its first scientific description goes back to 1898. The distribution of this species is apparently fragmented in the Peninsula, where it generally co-exists with the European hare also known as the Brown hare (*L. europaeus*), while in Sicilia, notwithstanding several introductions of the last-mentioned, the Italian endem-

RHINOLOPHIDAE		
Blasius horseshoe bat	<i>Rhinolophus blasii</i>	LR
Mediterranean horseshoe bat	<i>Rhinolophus euryale</i>	V
Greater horseshoe bat	<i>Rhinolophus ferrumequinum</i>	LR
Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>	V
Mehely's horseshoe bat	<i>Rhinolophus mehelyi</i>	V
VESPERTILIONIDAE		
Barbastelle bat	<i>Barbastella barbastellus</i>	V
Greater mouse-eared bat	<i>Myotis myotis</i>	LR
Bechstein's bat	<i>Myotis bechsteinii</i>	V
Long-fingered bat	<i>Myotis capaccinii</i>	V
Pond bat	<i>Myotis dasycneme</i>	V
Geoffroy's bat	<i>Myotis emarginatus</i>	V
Greater noctule bat	<i>Nyctalus lasiopterus</i>	LR
Leisler's bat	<i>Nyctalus leisleri</i>	LR
MINIOPTERIDAE		
Schreiber's bat	<i>Miniopterus schreibersii</i>	Lower Risk

**Table 5.30** - Italian Chiropterans included in the IUCN Red List and their status.

European wild rabbit	<i>Oryctolagus cuniculus</i>	probably introduced in the distant past
Eastern cottontail	<i>Sylvilagus floridanus</i>	American species introduced in the 1960s
Brown hare	<i>Lepus capensis mediterraneus</i>	endemic subspecies - probably originated with an introduction in the distant past
Appenine hare	<i>Lepus corsicanus</i>	endemic species
European brown hare	<i>Lepus europaeus meridiei</i>	indistinguishable autochthonous subspecies, following repopulation with individuals from other populations
Mountain hare	<i>Lepus timidus</i>	boreoalpine species

**Table 5.31 -**  
Lagomorphs present in Italy and their origin.

ic species is probably the only one present. The species' range has regressed compared to its historic distribution, though a clearer definition of its distribution on the mainland is hoped for. The causes for this regression are due to intensive hunting of the species, transformations in the agro-silvo-pastoral ecosystems and the introduction of a large number of European hares, with potential effects caused by competition and transmission of pathologies. An adequate hunting scheme is certainly a primary objective for the conservation of this species. Introduction programmes of the European hare should be suspended at least in the areas where the presence of *L. corsicanus* has been verified.

### Rodents

The order of Rodents, which has by far the highest number of species in the Mammal group, is present in Italy with about 30 species. They include autochthonous species as well as exotic, naturalised species with consolidated populations throughout the national territory (Table 5.32) that are subject of further increases following new occurrences of naturalisation. Several Rodent species included in the IUCN Red List are also part of Italian fauna (Table 5.33).

The presence of the Porcupine (*Hystrix cristata*) characterises Italian fauna in a particular manner: the European distribution of the entire family of Hystricids, of which 8 species are distributed in Asia and Africa, is limited only to Italy. A hypothesis regarding the origins of this species in Italy refer to an introduction dating back to ancient times, but the finding of fossil remains testify that the porcupine was present in Italy as far back as the late Pleistocene. The species has benefited from the abandonment of agricultural practices in hill and piedmont areas. Notwithstanding the fact that the Porcupine is a protected animal, the species is subject to illegal taking, while the most frequent cause of mortality of anthropic origin is probably accidental killing on roads. The population trend of this species in the Italian peninsula is one of growth; increased population density has been reported in several areas, but those of greatest interest are the ones in the northern limit of its range, in Veneto, Lombardia and, above all, in Liguria, where there are areas which have suitable environmental characteristics to further consolidate the presence of the porcupine towards the north-west.

SCIURIDS		
Eastern grey squirrel	<i>Sciurus carolinensis</i>	introduced from the United States in the second half of last century, the Piedmont population is in a phase of rapid expansion
Unstriped ground squirrel	<i>Callosciurus finlaysonii</i>	Asiatic species introduced in the 1980s near Acqui Terme
Siberian chipmunk	<i>Tamias sibiricus</i>	Asiatic species introduced into several areas of northern Italy, a population along the Belluno tract of the River Piave shows the greatest potential for expansion
MICROTIDS		
Common muskrat currently in expansion	<i>Ondatra zibethicus</i>	introduced into Europe in the first half of the 20th century,
MYOCASTORIDS		
Coypu	<i>Myocastor corpus</i>	naturalisation came about in the second half of last century and has led to a rapid colonisation of the hydrographical basins in most of Italy

**Table 5.32 - Rodents:**  
allochthonous taxa introduced in Italy or through spontaneous immigration from other European areas of introduction.

<b>GLIRIDS</b>			
Garden dormouse	<i>Eliomys quercinus</i>	V	<i>E. q. pallidus</i> in the Italian Peninsula and Sicilia; <i>E. q. sardus</i> in Sardegna; <i>E. q. liparensis</i> in Lipari
Forest dormouse	<i>Dryomys nitedula</i>	LR	found in the north-east ( <i>D. n. intermedius</i> ) and in Calabria-Lucania with an isolated population ( <i>D. n. aspromontis</i> )
Fat dormouse	<i>Glis glis</i>	LR	<i>G. g. glis</i> in north-eastern Italy; <i>G. g. italicus</i> in the rest of the Peninsula and in Sicilia; <i>G. g. melonii</i> in Sardegna
Hazel dormouse	<i>Muscardinus avellanarius</i>	LR	<i>M. a. peciosus</i> in the Italian peninsula and in Sicilia
<b>MICROTIDS</b>			
European snow vole	<i>Chionomys nivalis</i>	LR	<i>Ch. n. nivalis</i> in most of the Alps, from Piemonte to the Julian Alps; <i>Ch. n. leucurus</i> in the Ligurian Alps and <i>Ch. n. lebrunii</i> in the northern Alps
<b>MURIDS</b>			
Harvest mouse	<i>Micromys minutus</i>	LR	<i>M. m. soricinus</i> (endemic form of the Padana area and Toscana)
Alpine mouse	<i>Apodemus alpicola</i>	DD	originally described as a subspecies of <i>Apodemus flavicollis</i>
<b>HYSTRICIDS</b>			
Crested porcupine	<i>Hystrix cristata</i>	LR	<i>H. c. cristata</i> (Italian peninsula and Sicilia)

Table 5.33 - Italian Rodents included in the IUCN Red List and subspecies present in Italy.

### Canids

Canids are present in Italy with two species of the genus *Canis* – the Grey wolf (*C. lupus*), the Golden jackal (*C. aureus*) – and with the Red fox (*Vulpes vulpes*). The wolf is the only Italian carnivore included in the IUCN Red List (*Vulnerable* category). In the early 1970s, the Italian population made up of about 100 individuals was spread over a fragmented range in two areas of stable presence: one was essentially in Abruzzo and the other included an area of Calabria, Basilicata and Campania. In the decades that followed, the trend was reversed with a steady demographic increase of the species. The distribution range has progressively been extended and this has led to a greater continuity of the species to southern Italy. Along the Tuscan-Emilian Apennines, a further expansion of its range has been reported towards the north-west up to the Alpine Arc and to France and, in recent years, to Switzerland. The causes of death for the wolf in Italy (about 10% of the population) are essentially produced by man, through direct or indirect persecution and accidental killing on roads. The Swiss authorities have given authorisation to kill the wolf in its first stages of colonisation in that country. Clashes with animal breeders are particularly serious in areas where there is no way of preventing the wolf from preying on domestic livestock, that is, in areas of recent colonisation. The illegal persecution of the wolf has led to the widespread use of poisoned bait and carcasses, with similar dramatic effects on several vertebrate species. Hence, an adequate monitoring programme of the phenomenon is necessary. The Golden jackal is present in north-eastern Italy with a relatively scarce number of individuals

from the Dalmatian population, which in the second half of last century, already had a steady trend of expansion towards the north.

### Ursids

The Brown bear (*Ursus arctos*) is present in Italy in two separate areas: in the central and eastern Alpine sector, where the nominal subspecies *U. a. arctos* is present, and in the central Apennine sector, where the bear is represented by the subspecies *U. a. marsicanus*. The presence of a historic group in Trentino (Adamello-Brenta) is now practically extinct (only three non-reproductive specimens were present at the end of last century) and now this species is the object of a repopulation programme with Slovenian specimens (the first cubs were documented in the spring of 2002). There is another Alpine presence in the Friuli-Veneto Alps, with individuals in spontaneous migration from Slovenian territories and presumably in progressive consolidation; the protection of the species in this area should be guaranteed by extending the continuity of the range towards the Slovenian and Austrian borders. In the Apennines, the species is present with a small population that is probably in decline, presumably made up of about fifty specimens. Knowledge regarding the dynamics of this small isolated population is poor. The causes of death are mainly produced by man: either direct or indirect killing, at times accidental, during legal or illegal wild boar hunts (utilising either dogs or traps); the illegal use of poisoned carcasses to exterminate carnivores; death on railway tracks (the railway line from Sulmona to Castel di Sangro is particularly dangerous) and on roads. The sudden



and rapid proliferation of wild boar in the Apennines, caused by massive introduction scheme, may effect the availability of food sources, with the possible spatial dislocation of bears. Hence, a monitoring programme extended to all areas of presence, both in and outside the Protected Nature Areas of the Apennines should be adopted. Until a precise study has been conducted regarding the population status of the bear, immediate protection measures should be taken with the aim of containing the causes of death of anthropic origin, adopting specific regulations for hunting wild boar in territories potentially interested by the presence of the bear, increasing surveillance of the territory to repress the phenomenon of poison bait and carcasses, and adequate fencing off roads and railways lines at risk.

### Mustelids

Mustelids make up the most representative family of Italian Carnivores with 8 species. One of the species present, the American mink (*Mustela vison*) has allochthonous origins: its naturalisation is not yet certain, though it is likely. Among the species in long-standing and wide-ranging decline in other European countries, there is the European polecat (*Mustela putorius*), the European otter (*Lutra lutra*) and the Pine marten (*Martes martes*). In the 1960s and 1970s the otter rapidly declined throughout most of its European range; the Italian dis-

tribution is concentrated in the central-Mediterranean sectors of the peninsula. The cause for the decline has principally been the dispersion of toxic substances into watercourses.

### Felids

Felids are present in Italy with two species, the Wild cat (*Felis silvestris*) and the Lynx (*Lynx lynx*). The Wild cat occurs in southern Europe and in northern Europe up to the Carpathian Mountains and Scotland. Felids are present in Italy with two subspecies, the European wild cat (*F. s. silvestris*) and the African wild cat (*F. s. libyca*), with an Italian distribution limited to Sardegna, as well as the Domestic cat (*F. s. catus*) which often goes wild again. The wild populations have presumably been subjected to introgression following hybridisation with the domestic form, and the origins of the Sardinian population are perhaps due to the going wild of the already domesticated form in past times. The Lynx has a limited presence in some Alpine sectors, where it is currently in a phase of resettlement due to expansion of transalpine populations (particularly from Switzerland, Austria and Slovenia), where the species was reintroduced with the release of specimens from the Carpathian Mountains. More recently, its reappearance has been reported in the central Apennines following illegal introductions.

SUIDS		
Feral pig or Wild boar	<i>Sus scrofa</i>	the genetic divergence between the claimed Maremma subspecies ( <i>S. s. majori</i> ) and the introduced European one ( <i>S. s. scrofa</i> ) is slight; the Sardinian population seems to have originated from domesticated forms
CERVIDS		
Red deer	<i>Cervus elaphus</i>	autochthonous populations in the <i>Bosco della Mesola</i> (Ferrara) ( <i>C. e. elaphus</i> ) and in Sardegna ( <i>C. e. corsicanus</i> )
Gazelle	<i>Dama dama</i>	species already introduced in the Neolithic period, though assumptions have been indicating made the presence of the species in Italy already at the end of the last glaciation
Roe deer	<i>Capreolus capreolus</i>	autochthonous populations of the ssp. <i>C. c. italicus</i> have survived in isolated geographic habitats (Castelporziano, Gargano and Orsomarso in Calabria)
BOVIDS		
European mouflon	<i>Ovis [orientalis] musimon</i>	probably derived from sheep in the first stages of domestication, today, the Sardinian mouflon is considered by several authors as a subspecies of <i>O. orientalis</i>
Wild goat	<i>Capra aegagrus</i>	population deriving from an ancient introduction of semi-domesticated forms of the Asiatic wild goat, with further introductions of domestic goats
Ibex	<i>Capra ibex</i>	the genetic distance with the <i>C. pyrenaica</i> may imply a distinction at the subspecies level between the two forms
Abruzzo chamois	<i>Rupicapra pyrenaica ornata</i>	<i>R. pyrenaica ornata</i> is one of the three subspecies of the Southern chamois otherwise present in the Pyrenees and in north-western Spain
Chamois	<i>Rupicapra rupicapra</i>	species that spread during the last glacial period, following <i>R. pyrenaica</i> , in the Alps and in the northern Apennines

Table 5.34 - The Italian ungulates.



Fig. 5.14 – *Capra ibex*; Gran Paradiso Nature Park (Photo by A. Carni).

### ***Artiodactyles***

Artiodactyles are present in Italy with three families and 9 species (Table 5.34). At the end of the 19<sup>th</sup> century, there was only a small population of deer in Italy in the *Bosco della Mesola* (Ferrara), and in Sardegna with a population described as a distinct subspecies (*Cervus elaphus corsicanus*). After World War II a new phase of expansion began, with specimens from the Swiss, Slovenian and Austrian Alps. Reintroductions have been carried out in the western Alps and in the northern, central and southern Apennines. The species, still in a phase of expansion, is currently estimated at 44,000 heads (34,000 in the Alps, 7,000 in the Apennines and less than 3,000 in Sardegna). The present contingents in the Alpine districts are hunted (in 1998-99, about 3,800 heads) while the other populations are not. The vast phenomenon of the abandonment of the agro-pastoral ecosystems in mountain areas has created large areas where the species can expand. Further reintroductions would be beneficial to the species, especially in northern Sardegna and in the central-southern Apennines. A ban on hunting the Apennine

populations should be maintained for several years still. Reintroduction interventions for the Sardinian population should be stepped up in the parts of the island where the species has become extinct.

A similar recovery of the historical distribution is underway for the Roe deer. This phase of expansion has been assisted by several reintroductions and the spontaneous immigration of specimens from Europe (subspecies *capreolus*). Autochthonous populations have remained in isolated areas (Castelporziano, Gargano and Orsomarso in Calabria). The increased numbers have particularly concerned populations of the European form or those derived from a possible cross-breed between the two forms (Maremma). The survival of the Italian roe deer can only occur in isolated habitats, away from the large Alpine and Apennine populations; the Castelporziano population and that of Gargano are found in sufficiently isolated habitats, while the Orsomarso population could cross breed with the European form that has already been reintroduced in Sila. The species is still scarce or absent in many potentially suitable areas of the central-southern

Italy, while it is undergoing a phase of expansion starting from groups reintroduced within the central Apennines protected areas. The northern and southern Apennines ranges are expected to merge in the next few years, with the progressive colonisation of areas that are still available in the Provinces of L'Aquila, Rieti and Terni. The species is hunted in the Alpine districts and in some northern Apennine provinces as well as in the Maremma (about 30,000 heads in 1998-99).

The Ibex (*Capra ibex*) is an endemic European species, distinct from others forms of Ibex present in Asia and Africa (*C. nubiana*, *C. sibirica* and *C. waliae*). Its genetic distance from *C. pyrenaica*, which is widespread throughout the Iberian Peninsula, could suggest a distinction at the subspecies level between the two forms. The demographic vicissitudes of the Alpine ibex led to a period of sharp decline with widespread extinctions in a large part of its range and the survival of a small nucleus in the current area of the Gran Paradiso National Park (less than 100 heads in 1821). Its protection, first of all, in the Royal Hunting Reserve and then in the National Park has led to a recovery of the population. Numerous reintroduction initiatives have supported the new settlement of the species in several Alpine areas. The Ibex is subjected to selective hunting in Switzerland, Austria and Slovenia, while it is totally protected in France, Germany and Italy. The Italian contingent, in expansion, is estimated at 13,000 heads, mainly concentrated in the western Alps and con-

stitutes the second most important European population, after Switzerland.

The Abruzzi chamois (*R. pyrenaica ornata*) is one of the three subspecies of the Southern chamois, a species also present in the Pyrenees with the subspecies *R. p. pyrenaica* and in north-western Spain with the subspecies *R. p. parva*. The Apennine population, present within a restricted range, has probably been isolated for a long time, perhaps due to the spread of *R. rupicapra* in the Alps and western Apennines during the last glacial period. In the first half of last century, the subspecies was reduced to a few dozen specimens; successive phases of recovery, assisted by the establishment of the Abruzzi National Park allowed a slow but steady increase in the population. These phases have left their mark on the genetic patrimony of the population, now characterised by elevated rates of homozygosis. The present population, mostly concentrated in the National Park of Abruzzo, Lazio and Molise, estimated at more than 800 heads, is increasing slowly at a rate of about 2% annually. Two reintroduction interventions have led to the establishment of small but expanding populations in the Gran Sasso and Maiella Mounts; other interventions have been planned in the Sibillini and Velino-Sirente Mounts. The Apennine population is found on the IUCN Red List in the *Endangered* category: therefore, further reintroduction projects could lower the present risk. The incidence of poaching is unknown.