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Review article
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A Red List of Italian Saproxylic Beetles: taxonomic overview, ecological features and conservation issues (Coleoptera)

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Abstract
The main objectives of this review are: 1) the compilation and updating of a reference database for Italian saproxylic beetles, useful to assess the trend of their populations and communities in the next decades; 2) the identification of the major threats involving the known Italian species of saproxylic beetles; 3) the evaluation of the extinction risk for all known Italian species of saproxylic beetles; 4) the organization of an expert network for studying and continuous updating of all known species of saproxylic beetle species in Italy; 5) the creation of a baseline for future evaluations of the trends in biodiversity conservation in Italy; 6) the assignment of ecological categories to all the Italian saproxylic beetles, useful for the aims of future researches on their communities and on forest environments. The assessments of extinction risk are based on the IUCN Red List Categories and Criteria and the most updated guidelines. The assessments have been carried out by experts covering different regions of Italy, and have been evaluated according to the IUCN standards. All the beetles whose larval biology is sufficiently well known as to be considered saproxylic have been included in the Red List, either the autochthonous species (native or possibly native to Italy) or a few allochthonous species recently introduced or probably introduced to Italy in historic times. The entire national range of each saproxylic beetle species was evaluated, including large and small islands; for most species, the main parameters considered for evaluation were the extent of their geographical occurrence in Italy, and the number of known sites of presence. 2049 saproxylic beetle species (belonging to 66 families) have been listed, assigned to a trophic category (Table 3) and 97% of them have been assessed. On the whole, threatened species (VU + EN + CR) are 421 (Fig. 6), corresponding to 21 % of the 1988 assessed species; only two species are formally recognized to be probably Regionally Extinct in Italy in recent times. Little less than 65% of the Italian saproxylic beetles are not currently threatened with extinction, although their populations are probably declining. In forest environments, the main threats are habitat loss and fragmentation, pollution due to the use of pesticide against forest pests, and habitat simplification due to economic forest management. In coastal environments, the main threats are due to massive touristic exploitation such as the excess of urbanization and infrastructures along the seashore, and the complete removal of woody materials as tree trunks stranded on the beaches, because this kind of intervention is considered an aesthetic amelioration of seaside resorts. The number of species whose populations may become impoverished by direct harvest (only a few of large forest beetles frequently collected by insect traders) is very small and almost negligible. The Red List is a fundamental tool for the identification of conservation priorities, but it is not a list of priorities on its own. Other elements instrumental to priority setting include the cost of actions, the probability of success,

and the proportion of the global population of each species living in Italy, which determines the national responsibility in the long-term conservation of that species. In this scenario, information on all species endemic to Italy, to Corso-Sardinia, to the Tuscan-Corsican areas, and to the Siculo-Maltese insular system are given. A short analysis on relationships among beetle species traits, taxonomy, specialist approaches, and IUCN Categories of Risk is also presented.

Key words: Italian fauna, Coleoptera, Red List, community ecology, dead wood, EU Habitats Directive, Biodiversity Conservation, species traits and extinction risk.

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1 Introduction

1.1 Beetle Diversity: the Italian context

The remarkable altitudinal gradient of Italy (from sea level to 4810 m of Mont Blanc, the highest peak in Europe), the long north-south extension of the peninsula (47°2 ‘N 35°29’N), together with its geological complexity, determine a wide variety of climatic conditions and natural habitats. Moreover, due to its geographical position in the middle of the Mediterranean basin, recognized as one of the main hot spots of the world’s biodiversity (Blasi et al. 2005; Cuttelod et al. 2008; Audisio 2013), Italy was colonized by species arising from different biogeographic subregions and ecoregions, and therefore harbors marginal populations of species whose geographic ranges are mainly extended in the Balkans, North Africa, in the westernmost part of Europe, or in central and northern Europe. In consequence of these complex past biogeographic events that characterized the Italian peninsula and thanks to its current mild climate, Italy shows the highest number of species among all the European countries. Overall about 10% of Italian fauna is endemic, i.e. present only within the political borders of the country (Stoch 2008; Audisio 2013). Unluckily, many endemic species are threatened by extinction, owing to the high rate of conversion of natural habitats or to the small extension of their range (Myers et al. 2000; Audisio 2013).

With over 1,000,000 acknowledged species worldwide, more than 50% of global biodiversity consists of insects (Purvis & Hector 2000; IISE 2012; Zhang et al. 2013), and over a third belongs to the beetles (order Coleoptera). Therefore, scientific knowledge and the consequent preservation of biodiversity must necessarily pass through the knowledge and preservation of beetles (about 400,000 species described to date worldwide: Audisio et al. 2015) that make up the largest order of the animal kingdom (Zhang et al. 2013). Of the more than 200 families of beetles worldwide (excluding those known only as fossil records) (Bouchard et al. 2011), about two-thirds are represented in the Italian fauna. A number of 28,000-30,000 species of beetles was estimated to live in Europe, within the geographical borders recently adopted by the European Union project "*Fauna Europaea*" (http://www.fauna-eu.org; Audisio et al. 2015). According to the Italian official database named "Checklist of the Species of the Italian Fauna" (Minelli et al. 1993-1995; Minelli 1996), almost 12,000 species of Coleoptera occur within the political borders of Italy (corresponding to 21.5 % of Italian fauna). However, as a result of recent taxonomic changes, the description of new species and the acclimatization of alien species (which led to increases at a mean rate of about a hundred of species per year: Audisio 2013), by the end of 2002, the Italian beetles became not less than 12,300 species (Audisio & Vigna Taglianti 2005), which means an increase of 3.2% compared to the previous database.

The percentage value of beetle species occurring in Italy, compared to Europe, varies among different families, depending on their levels of endemism and ecological features. Overall, the Italian fauna includes a little less than 40% of the species occurring in Europe, with lower percentages (20-30 %) in families characterized by high tendency to produce endemic species, e.g. many groups of predators and scavengers (often linked to soil) with low dispersal capabilities, such as Carabidae, Leiodiidae, Tenebrionidae, some groups of Staphylinidae, and freshwater Hydraenidae that are mainly associated with rhithral habitats of middle altitude streams. By contrast, percentages up to 60% can be detected in many other groups, such as other scavengers, coprophagous and phytophagous species (including pests), characterized by higher dispersal capabilities (e.g. Nitidulidae, Silphidae, Geotrupidae, Scarabaeidae, Haliplidae and many others).

On the other side, the percentage of species occurring in Italy, compared to those known on a global scale, depends on many factors, including the ecological requirements of the taxonomic groups: for example, higher values were calculated for Carabidae (about 4%), Nitidulidae (about 5%) and especially Hydraenidae (over 10%), whereas lower values were observed in other families, e.g. Cerambycidae (less than 1%). These differences can be explained considering that Cerambycidae are mainly represented by xylophagous species associated with forest environments whose plant diversity is much higher in tropical and subtropical ecosystems than in temperate ones. By contrast, the high richness observed in temperate areas for some orophilous groups of weevils (Curculionidae) and rove beetles (Staphylinidae) can be explained by the drastic paleoclimatic and paleogeographic changes that involved the Northern Hemisphere over the last tens of millions of years, and induced countless speciation events during the Cenozoic Era (Audisio 2013). In any case, we must consider that an equal comparison between temperate and tropical faunas is still impossible, because of a gap of knowledge which only time and the intensification of research in the tropics will be able to fill. On the other hand, more than a few beetle species are discovered each year even in the European continent, often randomly, not directly found by specialists but during faunistic surveys. An example of this is given by the discovery of *Allecula suberina*, a new species collected for the first time during recent ecological samplings of saproxylic beetles in central Italy and then described by Novak et al. (2012). As regards the level of endemics, it is extremely variable among families and often also between different subfamilies, genera and tribes, passing from values slightly above zero in groups such as Nitidulidae, Monotomidae, Coccinellidae, Cryptophagidae and many others (including mostly phytophagous species or scavengers with high dispersal ability), up to values around 25-30% or more in groups such as Carabidae, Hydraenidae, Leiodiidae Cholevinae, ground dwelling Tenebrionidae, etc. Overall, approximately 18% of the species of Italian beetles are endemic to the Italian territory as defined by its political borders. However, if we consider the endemics in "biogeographic" instead of "political" terms, for example by including geographical areas belonging to the Italian continental shelf, such as Corsica, the Var River valley, the Ticino Valley, the Maltese Islands, etc., the percentage of endemic species would reach values even higher than 20%. For this reason, in this paper, we decided to indicate with different abbreviations some peculiar categories of endemic species whose ranges are exclusive of Sardinia or Sicily, or represent a combination among them and Corsica, circumsardinian islands, circumsicilian islands, the Maltese Islands, and some nearby areas of the Tyrrhenian coast (Table 3).

The beetles include four suborders with different levels of species richness, all present in Italy. The most primitive order is represented by the Archostemata, which include fewer than 50 known species worldwide, almost all saproxylic, and organized into five families. The only species of this order which occurs in Italy is *Crowsoniella relicta* Pace, 1975, an Italian endemic and the only known member of the family Crowsoniellidae. This minute beetle (about 1.7 mm; Fig. 1) was discovered in 1975, in a partially wooded area of the Lepini Mountains (Lazio Region) (Pace 1975; Crowson 1975; Ge et al. 2010), and no other specimens have been found since its description. Up today it is the only native European species of the suborder Archostemata.

The suborder Adephaga includes four families of terrestrial and aquatic predators and, to a lesser extent, of aquatic phytophagous beetles. The most important representatives of this order are the ground beetles (Carabidae),

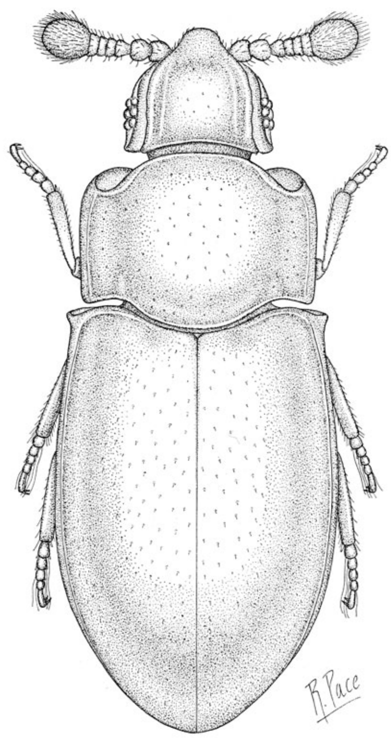

Fig. 1 – *Crowsoniella relicta* Pace, 1975 (Crowsoniellidae), a mysterious member of the suborder Archostemata, collected only once some forty years ago in the Lepini Mts, SE of Carpineto Romano (Rome), washing deep calcareous soil among roots of a large hawthorn tree, in a degraded pasture (R. Pace, personal communication to P. Audisio 2008; Bolla 2009). Very likely, it is a saproxylophagous (s.l.) beetle (DD – Data Deficient). Drawing by Roberto Pace.

i.e. the largest family of terrestrial predators and one of the largest among the beetles.

The discussed suborder Myxophaga brings together some 70 species of microscopic and elusive aquatic or semi-aquatic beetles which feed on algae.

Finally, the suborder of Polyphaga comprises about 95% of the beetle families occurring in Italy and just under 90% (almost 11,000) of the known Italian species. This suborder had the most successful and most spectacular evolutionary adaptive radiation (Audisio et al. 2015): the more than 200 families currently included in the Polyphaga are characterized by a trophic spectrum extraordinarily varied, including predators, parasites, microphagous, necrophagous, phyllophagous, xylophagous, anthophagous, rhizophagous, carpophagous, mycophagous, myrmecophilous etc. Almost all the Italian species of saproxylic beetles belong to the latter suborder.

Although a very high percentage of global biodiversity is made up of insects, and in particular by beetles, very few species of beetles are currently included in the Habitats Directive 92/43/EEC and are therefore under protection at the European Community level. Despite the high number of endemic or relict species occurring in Italy, in many cases threatened with local or total extinction (Trizzino et al. 2013; Audisio et al. 2014a), only 15 species of beetles are protected by the Habitats Directive, and 10 of them are saproxylic. These species are of particular importance in relation to their possible role as bio-indicators of threatened habitats, such as old-growth forests with hollow trees. Among the saproxylic beetles of forest ecosystems, the most threatened are especially the species linked to hygrophilous deciduous woodlands located in coastal lowlands, and probably those of the original primary forests, now present only in some patches (Blasi et al. 2010). Finally, we remark the few but very interesting species associated with the trunks stranded along sandy beaches, environmental conditions that have become infrequent due to the increasing procedures of beach cleaning by the use of scrapers.

The richness of animal and plant species in Italy is threatened by human activities. The average density of human population in Italy is about 202 inhabitants/km^2, a value higher than the average of the densely populated Europe. The conversion rate of land use is also high (about 50% in the years 1960-1990 and 25% in the years 1990-2000) (Falcucci et al. 2007). Although the abandonment of rural areas following urbanization has favored the re-naturalization of some regional areas, the consumption of natural resources by the urban population also grew. In fact, intensive agriculture in the most favorable areas has reduced or eliminated the natural habitats of the most fertile and easily cultivated plains and hills, thereby drastically reducing their suitability for wildlife.

To face the increased pressures on biodiversity, Italy responded in terms of surveillance and conservation actions. The percentage of protected areas at national level has grown to about 12%, in line with the objectives of international conventions (Maiorano et al. 2006; 2007). In response to the European Habitats Directive (92/43 / EEC) and Birds Directive (79/409 / EEC), Italy has identified a system of Sites of Community Interest (SCI) and Special Protection Areas (SPAs), collectively known as the Natura2000 network, which cover about 21% of the national territory. Nevertheless, conservation actions at global level are still largely insufficient to counter the increase in human pressure on plant and animal species, with the consequent deterioration of the general state of biodiversity (Butchart et al. 2010), and many species are on the way of a slow but progressive decline (Hoffmann et al. 2010) .

1.2 Forests, dead wood and saproxylic beetles

Forests are extremely complex and dynamic ecosystems, where the action of man on the natural arboreal component has brought profound changes over the centuries. Trees are the key stone species of the forest ecosystems because they provide the resources for the development of a very diverse fauna that is able to exploit all the parts and products of the plants throughout their life cycle. Living, decaying or dead trees, standing or fallen trunks, fallen branches, stumps and stubs, roots, green and dead leaves, fresh and rotten fruits, woody debris in trees hollows and wood chips scattered in the soil, all these different resources are colonized by a huge number of living organisms as fungi, mosses and animal species, mainly beetles, that carry out a transformation of the wood with the end of releasing organic matter to the soil. In each form and phase of a woody plant life cycle, the saproxylic organisms find the optimal substrate and microclimatic conditions to live and reproduce, their preferred food resources, and suitable shelters to protect themselves from predators.

Therefore, woody plants give the most significant contribution to forest complexity and biodiversity, in both direct and indirect way: the tree species provide various microhabitat types for many species of other plants, fungi and animals; the insects associated with the cycle of wood biomass represent a huge variety of food types for many predators, both invertebrates and vertebrates, especially birds and mammals; the synergy between trees and saproxylic insects allows the completion of the cycle of nutrients, promoting the production of humus and then a successful process of forest renewal; the trees reduce the damage caused by natural catastrophes like the landslide risk and its various consequences, from flooding to desertification. Last but not least is the role of the wood, on a global scale, as an important reservoir of carbon sequestered, with a relevant effect on the total budget of atmospheric carbon dioxide. Changes in the state of the wood have a decisive influence on the biological communities that colonize this substrate, but the amount and the rate of wood decay in a forest in turn depend on many factors such as temperature, humidity, insolation, the specific composition of the tree layer, the age and spatial structure of tree populations, and the type and frequency of natural and anthropogenic disturbances. The wood is therefore an important and irreplaceable driving force for biodiversity, which helps to increase the complexity and therefore the stability of forest ecosystems (Dudley & Vallauri 2004; New 2010).

Despite the name apparently funeral, the dead wood is a microhabitat where countless life forms support the entire forest ecosystem. These are saproxylic organisms, i.e. organisms related to the rotting wood in some way. As it will discussed in more detail below, the saproxylic organisms are a wide trophic category that includes not only saproxylophagous (= the dead wood-eaters) species, but also fungi that live on dead wood, predators, parasites and parasitoids of all the organisms living together in the same microhabitat, as well as several sap-feeding insects associated with yeasts and bacteria on living trees wounded by xylophagous insects.

In the terminology of the Global Forest Resources Assessment (2005), dead wood is all the non-living woody biomass, whether standing, on the ground or in the soil, but not yet incorporated in the litter. It should be noted, however, that the concept of dead wood used by most of the ecologists who are working on this microhabitat includes both tree trunks non longer alive and the decaying parts of still alive trees, as dead branches and woody debris accumulated in hollow trees or scattered in the litter.

For practical reasons of study and management, we distinguish a Standing Dead Wood (SDW) and a Lying Dead Wood (LDW). The first category (SDW) includes the standing, dead or dying trees (SDT, usually named "snags"), often missing a top or most of the smaller branches, the tree stumps and the crashed trees, partly or completely dead but more or less firmly anchored to the ground. The second category (LDW) refers to fallen trees (usually named "logs", with or without roots) and portions of stems or branches, which together can be indicated as dead wood fragments or Dead Woody Debris. The latter are divided into Coarse Woody Debris (CWD), with a diameter equal to or greater than 10 cm, and Fine Woody Debris (FWD), with a diameter of less than 10 cm (Densmore et al. 2004; Morelli et al. 2007).

The size of the woody debris is a very important variable in forest ecology. As shown by some studies (Ranius & Jansson 2000; Grove 2002), all the dead wood is important, but more is the size of the debris, higher is the environmental suitability for saproxylic insects (bigger is better: Grove 2002). Several hypotheses can be invoked to explain this phenomenon. First, a larger diameter (and therefore a greater volume), or a combination of a large diameter with a significant length of the fragment (e.g. 2-3 meters or more), allow a higher heterogeneity of available microhabitats, and then a larger number of potential ecological niches, which means that more specialized organisms can occupy the same space (in this case, the same fragment) at the same time. In addition, large size fragments take longer time to decompose and maintain a more stable microclimate inside them, in terms of temperature and humidity. Finally, fragments with greater surface and volume can support more diversified and consistent fungal communities (Grove 2002), to which numerous species of saproxylic insects are linked. However, some studies evidenced that high quality and abundant decaying parts of still alive trees, such as relatively small woods as dead branches of still standing trees, can also host a peculiarly rich saproxylic fauna, sometimes even richer than that of large fallen trees and logs. Some recent studies on the saproxylic beetle communities carried out in central Italy with different trap methods (Redolfi et al. 2014a; Cocciufa et al. 2014) indicate that the role of biodegraders cannot be attributed to single species but to the whole assemblage detected in each plot, because no species is numerically dominant but many species co-operate in modifying dead wood. These and other researches outside Italy (e.g. Alinvi et al. 2007) also showed that it is important to use more than one trap type to catch complementary subunits of the community, owing to the very complex structure and life history of this functional group.

It has been estimated that dead wood-related biodiversity alone represents about 30% of the global forest biodiversity (Vallauri et al. 2005), reaching 50% in some groups such as in beetles (Bütler et al. 2006; Lachat & Bütler 2007). If we consider together all the Italian ecosystems, out of the more than12,000 species of beetles, about 2,000 (ca. 15%) are more or less closely related to the dead wood (Table 3).

The most important component of wildlife related to dead wood consists of saproxylic insects, especially beetles, which are, together with fungi, the leading actors in the process of wood decomposition. Speight (1989) gave the first definition of saproxylic invertebrates as the set of "species that are dependent, during some part of their life cycle, upon the dead or dying wood of moribund or dead trees (standing or fallen), or upon wood-inhabiting fungi, or upon the presence of other saproxylics".

In the Proceedings of the International Symposium "Dead wood: a key to Biodiversity", held in Mantua, Mason et al. (2003) introduced a slightly revised version of that definition, drawing attention to the aging of trees and therefore to the different phases of their life cycle, rather than conditions linked to the state of dead or dying: "A species dependent, at some stages of its life cycle, upon the dead wood of senescent trees or fallen timber, or upon other saproxylics". Along the same line of thought is the subsequent definition of Alexander (2010) who emphasized the activity of wood-inhabiting fungi in the role of first chemical processors of wood, making it attractive to saproxylic insects and involving still healthy trees: "Saproxylic organisms are species which are involved in or dependent on the process of fungal decay of wood, or on the products of that decay, and which are associated with living as well as dead trees". From the condition of dead or dying tree in the original definition of Speight (1989), to the state of senescent tree suggested by Mason et al. (2003) and of living tree indicated by Alexander (2010), there is a way of 25 years of scientific research aimed at better understanding the complexity of roles that organisms play in forest ecosystems. It is a story of critical thinking that brought ecologists to change the old, negative view of traditional forestry (focused only on wood production) for which dead wood and its inhabitants were only an expression of death and decay, hostile to forest health and renewal.

In the new definition, which involves trees still healthy or with small signs of organic decay (e.g. with a terminal branch dead and attacked by fungi and insects, or with loss of fermented sap from the trunk), the set of saproxylic organisms will turn into a complex food chain with many different ecological roles and a meaning of real community. The complexity of saproxylic insect biocenoses depend upon the high level of heterogeneity in dead wood microhabitats. The exploitation of dead wood as food resource requires many diversified levels of specialization in order to reduce competition. For instance, many categories of saproxylic beetles can be observed at work in forest ecosystems: primary xylophagous species attack healthy plants and make wood suitable for the settlement of the secondary xylophagous species (i.e. the saproxylophagous species, which feed on decaying wood); mycetophago-

Fig. 2 – The frontal view of head and mandibles of *Morimus funereus* (Mulsant, 1862) (Cerambycidae), a taxonomically problematic saproxylic species formally protected by the EU Habitats Directive. It is present in NE Italy, mostly associated with old-growth beech forests (VU – Vulnerable). Photo by Pierfilippo Cerretti.

Fig. 3 – An old-growth pedunculate oak at the Nature State Reserve of Castelporziano (Rome); in this single large hollow tree were observed, among several other saproxylic beetles, *Osmoderma eremita* (Scopoli, 1763), *Gnorimus variabilis* (Linnaeus, 1758), *Protaetia speciosissima* (Scopoli, 1786), *P. affinis* (Andersch, 1797), *P. cuprea cuprea* (Fabricius, 1775) (Scarabaeidae), and remains of *Eurythyraea quercus* (Herbst, 1780) (Buprestidae). Photo by Paolo Audisio.

us species eat fungal spores and /or mycelia; myrmecophilous and termitophilous species live in association with these social insects in hollow trees; zoophagous species eat other invertebrates and act as more or less specialized predators, or facultative and obligate parasites (or parasitoids).

Very strong mandibles occur in primary xylophagous species which have to dig into the hard wood of live trees (Buprestidae, Cerambycidae, etc.; Fig. 2). A very flat and thin body is often observed by the species which live under the bark that cover dead or decaying trees, and eat fungi or small invertebrates (e.g. Silvanidae, Laemophloeidae, Lyctidae, Tenebrionidae, Nitidulidae, Cucujidae, Histeridae, Trogossitidae, etc.). A very elongated and cylindrical body is a peculiar adaptation that can be observed in both predators and their prey which live in galleries (e.g. Curculionidae Scolytinae, Ptinidae Anobiinae, Bostrichidae, Lymexilidae, Buprestidae, Cleridae, Monotomidae, as well as some Zopheridae, Nitidulidae, Trogossitidae, Tenebrionidae, etc.). Small anatomic structures named mycangia, similar to very small pits on body surface, can be seen in some beetles (e.g., Curculionidae Scolytinae and Platypodinae, some Nitidulidae) which have a symbiotic relation with fungi, and are used to transport the spores to their underbark tunnels and make small fungus cultivations (Pesarini 2003).

The larvae of saproxylophagous beetles usually have a large body and strong mandibles, e.g. Lucanidae, Scarabaeidae Cetoniinae, some Buprestidae and many Cerambycidae. Some of them need a wood that was already attacked and weakened by fire some months before. Many saproxylophagous beetles live inside the tree hollows where they eat the wood mould, i.e. the mass of fine debris accumulated within tree cavities (Fig. 3). A tree cavity may be generated by the fall of a broken branch after a meteorological event or produced by man. A special cavity produced by human management of trees is usually seen in pollarded trees (especially willows, mulberry and chestnut trees), at the divergence point of the main branches (Fig. 4). The typology of tree cavities is various and hard to clas-

Fig. 4 – A senescent pollarded willow in Valtellina (Lombardy). The special cavities produced by human management of trees by pollarding represent an important source of suitable habitats for saproxylophagous beetles associated with hollow trees. Photo by Paolo Audisio.

sify because of wide variation in the area and shape of the entrance hole, as well as in the internal volume, the height from the soil, the aspect, the quality and amount of wood debris, the presence of bird nests or mammal dens, etc.

Unlike saproxylic beetles that occur in peripheral dead wood (e.g. under the bark, between the trunk and bracket fungi), species that live in deep cavities of hollow trees form a community with unique characteristics. In fact, inside of these cavities, there is a more or less abundance of wood mould, consisting of rotting wood debris and leaves, fungi, the remains of dead animals, excrement of insects (frass) and, often, the ruins of bird nests (Ranius & Wilander 2000; Ranius 2001; Ranius et al. 2005). In a large oak tree or a centuries-old pollarded chestnut, the volume of wood mould can get also to hundreds of liters, and in some cases, the larvae of several insect species take turns in the same cavity, following the physical and biotic changes in the structure of the wood mould over the decades (Johannesson & Ek 2005). Larger and deeper are the cavities, more abundant and diversified are the supply of nutrients and the stability of micro-climatic conditions for saproxylic organisms respect than in peripherical dead wood (Ranius 2001). Consequently, the species associated with this micro-habitat have generally a lower dispersal ability than species that live in more ephemeral dead wood resources (Ranius 2006). As large hollow trees have become rare and sparsely distributed throughout Europe because of forestry management procedures, also the saproxylic organisms related to this microhabitat are going toward a decline of their populations (Johannesson & Ek 2005). In particular, such a decline is affecting several species of beetles belonging to Scarabaeidae Cetoniinae, Elateridae, Staphylinidae and Tenebrionidae, which represent the largest and ecologically most important insect families that live in this microhabitat.

Among the 66 families of saproxylic beetles in Italy (Table 4) we can observe a great variation in the percent value of saproxylic species with respect to the total number of species present in Italy. These values are very low in Leiodiidae (just over 5%), mainly represented by saprophagous and mycophagous species, and very high (up to 100%) in other families (e.g. Rhysodidae, Cerylonidae, Ciidae, Lucanidae, Melandryidae, Sphindidae, Trogossitidae, etc.). Among the most numerically important families of xylophagous and saproxylophagous beetles, the percent values range from over 60% in Buprestidae and Cleridae up to over 80% in Cerambycidae.

1.3 Beetles and the IUCN Red Lists

The International Union for Conservation of Nature (IUCN), founded over 60 years ago, has a mission to "influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable". The IUCN has over 1,000 members including states, government agencies, non-governmental and international organizations. In Italy, IUCN members are: the Directorate for Nature Protection of the Ministry of Environment, the main non-governmental organizations for environmental protection, research institutes and some protected areas. IUCN is affiliated to a network of over 10,000 scientists who contribute as volunteers in science and conservation. Maintenance and periodic update of the IUCN Red List of Threatened Species (http://www.iucnredlist.org) is the most influential activity conducted by the Species Survival Commission of IUCN. Since 50 years, the IUCN Red List is the most comprehensive inventory of the species threatened by extinction at global level. Initially the IUCN Red List was based on the opinions of the major experts for each taxonomic group, but such kind of assessment was biased by a high degree of subjectivity. Since 1994, the estimates are based on a system of categories defined by quantitative and scientifically rigorous criteria, whose latest version was approved in 2001 (IUCN 2001; 2012a).

These categories and criteria, used by experts of each taxonomic group to establish the species conservation status, are theoretically applicable to all species except microorganisms, and represent the worldwide standard for assessing the risk of extinction. For the application at local scale, i.e. at regional and national level, there are apposite guidelines (IUCN 2003, 2012b).

The recent Red List of European Saproxylic Beetles (Nieto & Alexander 2010) was the first attempt to draw up a list of species belonging to this ecological group, highlighting the methodological difficulties in applying the IUCN criteria. Such a list provided a useful point of reference for many species widely known and interesting new perspectives for their conservation, e.g. it emphasized the importance of the ecological knowledge about saproxylic species for assessing their risk level and planning their protection. However, the above list included only 426 species (253 of them occurring in Italy), and therefore represents only a preliminary approach to this topic (there are more than 3,500 species of saproxylic beetles in Europe). Moreover, it was based on a few families of beetles ecologically related to dead wood, selected by questionable criteria and with the omission of many species of great importance, even in the few families treated.

1.4 Aim and Objectives

The major aims of the Italian Red List of Saproxylic Beetles, which follows the useful but largely incomplete European Red List of Saproxylic Beetles (Nieto & Alexander 2010), and updates our previous Italian version (Audisio et al. 2014b), are to present a first inventory of saproxylic beetles and lay the foundations for a long-term monitoring of their conservation in Italy.

The main objectives of the present study are:

1. to prepare a reference database for Italian saproxylic beetles, with an indication of their most relevant ecological features, useful to assess the trend of their populations and communities in the next decades;
2. to identify the major threats for the Italian species;
3. to evaluate the risk of extinction for all Italian saproxylic beetles, with the identification of the most endangered species at national level;
4. to organize an expert network for studying and continuous updating of all known species of saproxylic beetle species in Italy;
5. to create a baseline for future evaluations of trends in biodiversity conservation in Italy;
6. to assign ecological categories to all the Italian saproxylic beetles, useful for the aims of future researches on their communities and forest environments.

2 Methods

2.1 IUCN Categories and Criteria

The assessment of extinction risk has been made according to the IUCN Red List Categories and Criteria, Version 3.1, Second Edition (IUCN 2012a); the Guidelines for Application of IUCN Red List Criteria at Regional Levels, Version 3.0 (IUCN 2003) and Version 4.0 (IUCN 2012b); and the Guidelines for Using the IUCN Red List Categories and Criteria, Version 10 (IUCN 2013).

For "regional level" the IUCN guidelines refer to any level other than global one. Therefore, the Guidelines for Application of IUCN Red List Criteria at Regional Levels could be applied to any geographic scale (from biogeographic realms, ecoregions and continents to single islands) and to any level of political and administrative rank (federations, countries, states, provinces, districts, etc.). According to IUCN guidelines, 11 categories are available for assessing the extinction risk of species at regional level (in our case we refer to a national level) (Fig. 5): Between the Extinction categories (EX, EW, RE) and the Near Threatened (NT), there are the Threatened categories (CR, EN, VU) that indicate a decreasing cline of extinction probability (extremely high, very high and high, respectively). These three categories (CR, EN, VU) are assigned to the species that are expected to go extinct within a very short, short or medium time interval, and therefore they represent three decreasing levels of conservation priority. In fact, they will probably go extinct in a region without specific actions focused to neutralize the threats which are determining the decline of their populations.

Even though the Threatened categories follow a decreasing risk of extinction, the quantitative criteria used for defining them may contain a certain degree of uncertainty. In fact, every assessment of the extinction risk of a species is based on the assumption that the environmental conditions which a species experiments (such as human population density, interactions between man and the species, the conversion rate of the habitat, the climatic changes, etc.) remain stable in the future. This is very unlikely because the assignment of a species to one of the IUCN Threatened categories may have the effect of producing actions favorable to its conservation, which can reduce the extinction risk.

A species may be classified as Near Threatened (NT) when it is close to qualifying for or is likely to qualify for one of the Threatened categories in the near future. Alternatively, a species is Least Concern when it has been evaluated against the criteria and does not qualify for Critically

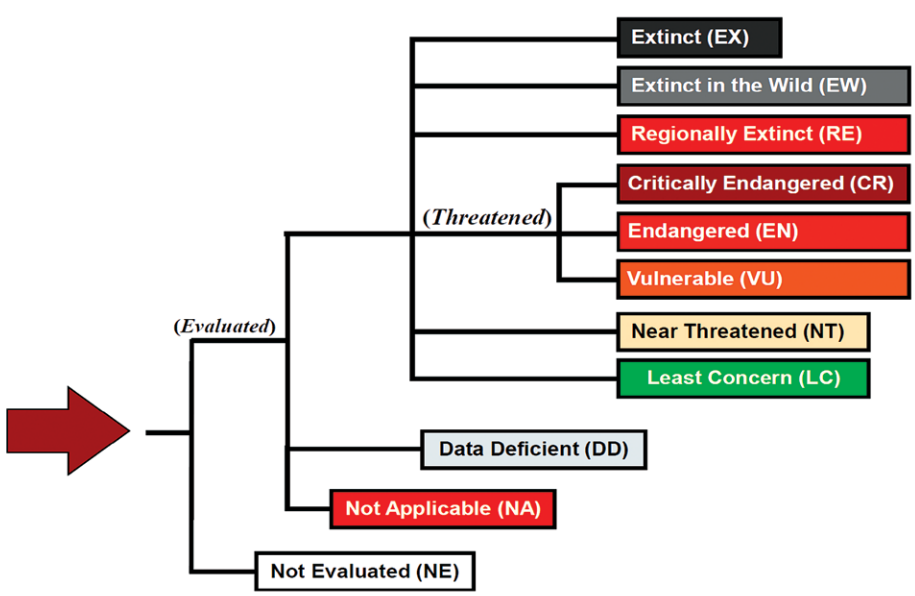

Fig. 5 – The IUCN categories of risk at regional level.

Endangered, Endangered, Vulnerable or Near Threatened. Many widespread and abundant taxa are considered LC, which represents the last and less problematic of the Extinction Risk categories.

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat (IUCN 2012).

The species temporarily classified as DD must be considered as species of great concern because they represent the objects of research priorities. Indeed, the concentration of species assigned to DD within one area or one taxonomic group is an indicator of the research projects where funds should be allocated.

During an evaluation at regional level (= not global), two categories have been added: Regionally Extinct (RE), used for the species extinct in the study area, but still present elsewhere, and Not Applicable (NA), used when a species cannot be evaluated for some reasons (e.g. it was introduced into the study area, or its presence in the study area is too peripheral).

In the current version (IUCN 2001, 2012a), there are five criteria for assigning a species to a red list category (Table 1). Each criterion is divided into subcriteria (see IUCN 2001, and Table 2) defined by increasing quantitative values for the most threatened species.

Criterion A is based on the rate of decline of the population of the species concerned, regardless of its initial consistency. To be included in the category of lowest threat (Vulnerable) the decline of a species must be greater than 30% in a period of 10 years or 3 generations, while to be included in the category of highest threat (Critically Endangered) it has to be above 80% in the same period. These speed reduction rate are extremely high for animal and plant populations and, although most of the species in the world is more or less in decline, the number of species that decline so rapidly is relatively low.

Criterion B is based on the size of the geographic distribution range of the species. To be considered threatened by this criterion, the geographic range of a species must be very small (less than 20,000 km^2, i.e. less of the surface of Sardinia, for the inclusion of a species in the Vulnerable category, with lower thresholds for Endangered and Critically Endangered). Furthermore, the small size of geographic range is an insufficient condition: in fact it is necessary that the geographic range is in contraction, that the populations within it are reduced to more or less isolated fragments, and / or that the habitat quality for the species is deteriorating.

Criterion C is conceptually similar to B, except that it applies to very small populations (less than 10,000 individuals for the inclusion of a species in the Vulnerable category, even lower values for Endangered and Critically Endangered), dispersed in isolated fragments and with a clear reduction or dramatic fluctuations in population density.

Criterion D applies only to species with extremely reduced populations and range (less than 1000 individuals or less than 20 km^2 of occupancy area for the inclusion of a species in the Vulnerable category, with lower thresholds for Endangered and Critically Endangered).

Criterion E is qualitatively different from all previous ones in that it is based on the probability of extinction estimated quantitatively for a specific time interval. According to Criterion E, a species is vulnerable if its probability of extinction is estimated more than 10% in 100 years, Endangered if more than 20% in 20 years or five generations, Critically Endangered if more than 50% in 10 years or three generations. These probability estimates can be obtained through models, such as the viability analysis of the population based on simulations of the demographic trend.

The data for the application of the criteria A, C, D and E, are however available for a very small number of species of insects, because the size of their populations is very difficult to estimate in the absence of specific and demanding monitoring programs (Komonen et al. 2008). Not surprisingly, the majority of the Italian species of saproxylic beetles have only been assessed on the basis of the Criterion B. It should also be noted that, in using the criterion B, obvious problems of scale make it difficult to apply to insects some evaluation parameters such as the AOO (Area of Occupancy), i.e. the area actually occupied by the species within its whole geographic range (Table 2) (Cardoso et al. 2011; Trizzino et al. 2015).

Table 1 – Criteria for inclusion of each species in a IUCN Category of Risk.

Criteria	
A	Declining population (past, present and/or projected)
B	Geographic range size, and fragmentation, decline or fluctuations
C	Small population size and fragmentation, decline, or fluctuations
D	Very small population or very restricted distribution
E	Quantitative analysis of extinction risk (e.g., Population Viability Analysis)

Table 2 – Summary of the five criteria (**A-E**) used to evaluate if a taxon belongs in a IUCN Red List Threatened Category (**Critically Endangered**, **Endangered** or **Vulnerable**).

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased.

A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) *[(a) cannot be used for A3]*.

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

- **(a)** direct observation *[except A3]*
- **(b)** an index of abundance appropriate to the taxon
- **(c)** a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality
- **(d)** actual or potential levels of exploitation
- **(e)** effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)

	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km^2	< 5,000 km^2	< 20,000 km^2
B2. Area of occupancy (AOO)	< 10 km^2	< 500 km^2	< 2,000 km^2
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented **OR** Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** area, extent and/or quality of habitat; **(iv)** number of locations or subpopulations; **(v)** number of mature individuals			
(c) Extreme fluctuations in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** number of locations or subpopulations; **(iv)** number of mature individuals			

C. Small population size and decline

	Critically Endangered	Endangered	Vulnerable
Number of mature individuals	< 250	< 2,500	< 10,000
AND at least one of C1 or C2			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:			
(a) **(i)** Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(a) **(ii)** % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals			

D. Very small or restricted population

	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	**D1.** < 1,000
D2. *Only applies to the VU category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	-	-	**D2.** typically: AOO < 20 km^2 or number of locations ≤ 5

E. Quantitative Analysis

	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

2.2 Global and Local Assessments

The IUCN criteria described above are sufficient to carry out the assessment of species or subspecies globally. For assessing a species at non-global level, i.e. local ("regional" in the IUCN terminology, which can include all levels of scale, from entire continents to small islands, including the political / administrative levels, such this Italian red list), the evaluators must perform a second step to adjust the criteria. If the estimated population (in this case the Italian one) has not contacts with other populations of the same species which live out of the national borders, the assessment based on overall criteria is correct. By contrast, if there are contacts with populations of neighboring countries two different cases may occur. In the case where the local population is a 'sink', i.e. receives immigrants from a foreign population that represents a 'source', an assessment may be too pessimistic or too optimistic in relation to the state of the population out of the national borders. In the case where the population source is stable or increasing, the Italian population will continue to receive the intake of individuals from outside, and its actual risk of extinction will be lower than that estimated on the basis of the criteria. By contrast, if the source population is declining, it is possible that in the future the Italian population will not receive benefits in terms of immigrant beetles from neighboring countries. In this case, the risk of extinction of the actual national population will be higher than that estimated according to the criteria. When such cases occur we can make an adjustment of the risk assessment for a species at the national level, increasing or decreasing of one or more categories of threats, e.g. from VU to EN or viceversa). For the above reasons, the risk of extinction of the local population of a species may be different from the global one (Figs 7-8). As local populations of a species are a fraction of its global consistency, their risk of extinction can be higher (the smaller the area where the evaluators are working, the more likely that criteria B, C and D are applied). On the other hand, there are species in rapid decline globally (so globally threatened according to criterion A) but locally stable (therefore locally classified as Least Concern). Therefore, in the red lists, the non-global assessments are also accompanied by the category of risk of global extinction. Even the local assessments are very difficult to be applied to insects, for the same above problems (problems of scale, the number of species to be treated, difficulties in sampling, level and dissemination of knowledge, very often due to a low number of specialists able to recognize the species).

The concept of sink for saproxylic beetles seems to apply only in the cases of alien species (Audisio 2013). In fact, the number of alien saproxylic beetles is on the rise, although not as much as the number of crop pests damaging agriculture. They are usually cosmopolitan species or widespread in subtropical and temperate areas, and continue to invade the Italian territory by producing direct or indirect damage to native species. Some of them are parasitoids, introduced for the biological control of crop and/or forest pests and can damage the populations of non-target species, as those of saproxylic beetles. Even in the absence of sound scientific data on the subject, we can only expect a negative role for alien species on the biological cycle of the native species, through a competition for food and shelter. On the other hand, cases of native species of conservation concern that received demographic or ecological benefits from foreign sources are likely to be quite marginal, at least in the short and medium term, and moreover are very difficult to understand and assess with existing monitoring tools of beetles.

2.3 The Assessed Area

The study area covered by this review consists of all the territory included in the boundaries of the Italian Republic, amounting to 301,338 km^2. For "mainland" we mean all Italian peninsula from the Alps to Calabria and Apulia, whereas for "major islands" we mean Sardinia and Sicily; other islands (such as those of the Tuscan Archipelago, the Aeolian, the Egadi, the Tremiti, the Pelagie islands) are indicated as "minor islands". For each species examined, we considered - and where possible evaluated - the whole set of Italian known populations (Italian mainland, major and minor islands). The great climatic differences, mainly due to the altitude of mountain ranges, suggest that the demographic parameters of the populations of the same species can vary on a substantial way (see chapter 3.3).

2.4 The species assessed

We evaluated all the saproxylic beetles occurring in Italy, both autochthonous (native) and parautochthonous (introduced and then become naturalized in ancient times, before 1500 AD, following Genovesi 2007 and Genovesi et al. 2015). All information available or at least deducible from the literature, on biology and ecology of the Italian beetles, was analyzed to identify which species could be considered as strictly, mainly or occasionally saproxylic. The last category was considered only for species belonging to taxonomic groups characteristic of forest habitats (especially old-growth forests). We also included the majority of species associated with healthy trees and shrubs, where their trophic activity was assessed as directly functional to the dynamics of the saproxylic communities (see the discussion of criteria described in section 2.5). The basic reference for taxonomy and faunistics of all species treated was the Checklist of Italian Fauna of the Ministry for the Environment, Land and Sea, reinforced by the biogeographical database produced by the Italian CKmap Project. Much information was also obtained from the monographs of the series Fauna of Italy (Edizioni Calderini, Bologna). Changes and additions have been made when necessary to update taxonomy and regional distribution of the species, through recent literature and unpublished data from specialists, museums and entomological forums. Updates in nomenclature, taxonomy and biogeography were also made by using the database of Fauna Europaea (http://www.fauna-eu.org), as well as the recent catalogues edited by Löbl & Smetana (2003-2013).

A great problem concerned the choice of the higher classification of beetles as unitary work of reference; in fact, the division into families and subfamilies of this huge order is subjected to continuous changes. Some authors tend to divide larger and heterogeneous families in groups of smaller and homogeneous families (trend of splitters), while others merge or combine related or apparently related families (trend of lumpers). The last work of synthesis in chronological order is that of Bouchard et al. (2011), who recognized 211 families on a global scale. This classification has been accepted by many specialists, but at least in part criticized by others. After an extensive discussion in the working group, we therefore chose to follow the classification of Bouchard et al. (2011) because it is the last comprehensive work, although considering it open to criticism from various points of view (basing on cladistic, molecular and paleontological data), at least for some families and subfamilies.

The priority aim of a Red List of Italian Saproxylic Beetles is to provide an assessment of the extinction risk in the country, at the species level. Evaluations at the subspecies level have been produced when the experts deemed it appropriate, e.g. in case of well distinct subspecies and/or with very small ranges. The list of all species evaluated with their category of risk of extinction in Italy, as well as the criteria adopted and the European IUCN category are shown in Table 3. Data sheets for over 400 species containing the extinction risk assessment and the data used for the evaluation, will be soon available at IUCN Italy (www.iucn.it). These data sheets include all VU, EN and CR, some NT and DD the experts retained of particular importance, and some LC (only the species that are listed in the Annex II and / or IV of the Habitats Directive).

As more extensively discussed below in chapter 3.6, changes in the taxonomic status at species level, due to splitting or lumping events, may represent a problem in assessing the Evolutionarily Significant Units or believed subspecies, and need a rearrangement in nomenclature. For instance, the status of *Osmoderma cristinae*, endemic to Sicily, was recently validated at species rank, separated by *O. eremita* (Audisio et al. 2009), while *Morimus asper* and *Morimus funereus* were ascribed to a single, albeit genetically and morphologically variable species (Solano et al. 2013). In the first case, the Sicilian endemic chafer beetle acquired the protected position of the species from which was separated; in the second case, *Morimus asper* became the valid name of a protected species (*M. funereus*) which became its synonyme (although in Table 3 we maintained a conservative approach, still tentatively considering the two taxa as being distinct).

2.5 Assessment Protocol

2.5.1 Criteria for inclusion/exclusion

We considered as 'saproxylic beetles' the species that can be assigned, most probably, to the trophic categories shown in Table 3, also according to Gordon (2011). Like all beetles, the adults of saproxylic species may have lifestyles and feeding habits almost identical, similar, or completely different from those of their larvae. For instance, many species have larvae occurring in dead wood, fungi or under tree bark, but adults that live on flowers or in the forest canopy. Both larvae and adults may be detritivorous, lignivorous, fungivorous or carnivorous, regardless of the microhabitat in which they live, but they often change the diet after metamorphosis. On the other hand, the presence of an adult beetle on a flower does not necessarily mean that it feeds on petals, nectar or pollen, because many floricolous beetles are predators of other insects. Moreover, we cannot forget that there is a large number of species living in the soil of forests or bushlands, whose ecological position is placed in a "grey area" between the real saproxylic organisms, often xylosaprophagous species associated with the woody fragments in the litter, and the phytosaprophagous species that develop at the expense of humus (this layer contains a mixture of very fine woody fragments, decomposing leaves and other plant debris, together with their natural decomposers, such as bacteria and fungi).

We have decided to exclude the majority of species with this type of ecological requirements (e.g. many Bothrideridae, Latridiidae, Scraptiidae, Staphylinidae, Tenebrionidae Alleculinae, Curculionidae living in the soil, etc.), as well as a large number of mycetophagous species associated exclusively or mainly to subterranean fungi, slime moulds in the forest litter, or fruiting bodies of fungi not regularly associated with stumps or logs (e.g. many Leiodiidae, especially *Leiodes*, many Staphylinidae, some Cryptophagidae, Nitidulidae and Endomychidae), that exploit also other trophic niches. The same criterion of exclusion has been applied to many species (e.g. the small Scarabaeidae Cetoniinae of the genera *Oxythyrea* and *Tropinota*, some Cleridae and Oedemeridae, etc.) associated mainly with decomposing stems or roots of herbaceous plants, although sometimes also present in saproxylic microhabitats. Their inclusion would have resulted in a massive and probably wrong expansion of the list, in favor of species that still would not be returned closely in trophic categories listed in Table 3. For some genera comprising almost exclusively mycetophagous species (such as in families as Cryptophagidae, Latridiidae, Erotylidae, Endomychidae, Alexiidae and Leiodidae Agathidiini) we used a more "inclusive" criterion, as they are often generalist species but always in association with mycelia, frequently within tree cavities, stumps and rotting logs, under bark, in arboreal mushrooms, then in closely saproxylic microhabitats. Were instead excluded many predatory species of forest habitats (e.g. Carabidae and Staphylinidae of different subfamilies including many Pselaphinae and Scydmaeninae) which, despite being frequently associated with stumps and fallen logs (especially Carabidae during hibernation, or some rare Omalisidae which eat terrestrial gastropods), under no circumstances can be considered as predators exclusive, specialized, or at least preferential of saproxylic organisms. By contrast, the choice of including almost all species of primary xylophagous species is tied to their role as "engineering species", because they start the process of wood decay and favor the subsequent establishment of secondary xylophagous species, which are the true saproxylic ones (Buse et al. 2008). Nevertheless, we excluded some Cerambycidae and Buprestidae that attack the living twigs of trees and shrubs, which do not seem to become a vital substrate for the colonization of xylosaprophagous species. As regards the unstable alien xylophagous, xylosaprophagous, saprophytophagous, and sap-feeding species, due to the frequent entry of new taxa and their actual or potential impact in terms of biodiversity conservation, we decided to include them in the list, but postponing their detailed discussion to the database in preparation by ISPRA (http://www.naturaitalia.it/nnb/; Zapparoli 2010; Zapparoli & Carnevali 2014).

In this category we have also included a few species that, despite having been described on material collected in Italy, are certainly referred to exotic genera or species groups, accidentally introduced into Italy. Several saprophagous or xylophagous alien species, otherwise, are frequently captured even in old-growth forests, with methods that are commonly used to collect true saproxylic indigenous species (pitfall traps baited with vinegar or alcoholic substances, window traps, funnel traps, beetle-boxes, etc.); information on these species could be therefore useful to entomologists, ecologists, and forest operators to measure the increasing degree of exposure of natural habitats to the impact of these alien taxa. We have otherwise excluded from our list several other alien xylophagous or xylosaprophagous species known to occur in Italy (Ratti 2006), which have been thus far only occasionally intercepted in harbours (from introduced timber, fruits or vegetables), or are now acclimatized only in strictly anthropogenic environments (e.g., wharehouses, cellars, libraries, buildings containing woody structures, orchards, etc.).

For some saproxylic species (*sensu lato*), which are located at the interface between two or more different trophic categories of Table 3, we reported both categories to emphasize the ecological role of these entities is not easily defined. In the case of many species belonging to some families whose larvae are still poorly studied in terms of morphological and ecological adaptations, it is difficult to give a strict definition of their lifestyle. For example, many mycetophagous species living within larval galleries dug by xylophagous species (for example some Nitidulidae Cryptarchinae, Monotomidae, etc.) are also known as occasional predators of the larval stages of those beetles. Also, many species associated with the fermented sap that flows from the wounds of trees have larvae that live in the mixture of sugary liquids in fermentation, yeasts and bacteria, often associated with larvae of other insects (mainly Diptera), with a non-always clear definition and allocation of actual ecological roles. Furthermore, we have included in the list of Italian saproxylic (s.l.) beetles also a few species whose biology is still completely unknown but, by analogy with related species, we assigned them to a possible saproxylic category. For these and other species, whose ecological requirements are yet unknown, we made use of category UN (unknown or uncertain) (Table 3) .

In some families (for example many Mordellidae, Scraptiidae, Melyridae, some Elateridae and Tenebrionidae Alleculinae) there are genera and species either saproxylic or non-saproxylic, whose larval biology is poorly known; in these cases we have included in our list only the species known as certainly or prevalently saproxylic from the literature.

As a result of the complex decision-making processes that we have tried to explain and motivate, our list is surely not error-free, such as the exclusion of species which nevertheless play a role, albeit marginal, in the saproxylic communities, or to the contrary the inclusion of species that are present with a certain frequency even outside of this functional group. In any case, errors of excess and deficiency would have been inevitable, given the difficulty of evaluation for many species, independently from the criterion used for inclusion / exclusion.

2.5.2 Assessing the Risk Categories

In the calculation of the Area of Occupancy (AOO), for the most part of "generalists", we used a grid square of 10×10 km (therefore considering a squared area of 100 km^2) extended around each site of presence that was not adjacent to another site. By contrast, for more specialized taxa, i.e. those associated with particular microhabitats within forest ecosystems, we adopted a grid square of 2×2 km (therefore considering a squared area of 4 km^2). The choice between these two reference systems has been indicated and justified in the evaluation form (available soon on line) of each taxon.

In the calculation of the Extent of Occurrence (EOO), when the grid square included also large sea surface, the EOO was considered "not applicable", and then we used other criteria of evaluation.

In the assessment of each taxon (species or subspecies) and in its evaluation form available online, we gathered (where possible) the following information:

- Current taxonomy and indications of any Italian name available;
- Risk of extinction in Italy according to the IUCN Categories and Criteria;
- Information on the overall distribution of the taxon and its distribution in Italy;

- Information on the state and recent historical trends of the Italian populations;
- Summary of the habitat preferences and trophic categorization (Table 3);
- Main threats that a taxon is likely to undergo;
- Conservation measures in action and required;
- References essential for risk assessment.

Data collection has been divided for taxonomic groups (from family and/or subfamily to species and/or subspecies level), both in the red list and in the online data sheets. The collection of data was performed by P. A. Audisio and C. Baviera, in collaboration with G. M. Carpaneto and A. B. Biscaccianti, and was based on data and information provided by a network of Italian and foreign specialists (Table 4).

2.6 Revision of the species assessment

All evaluations were reviewed critically, both in the contents and in the application of the Protocol, according to IUCN guidelines, by a network of specialists of different families, under the supervision of P. Audisio and C. Baviera, and in collaboration with the other authors of the present work. The correct application of the IUCN Categories and Criteria was checked by C. Rondinini and Alessia Battistoni.

3 Results

3.1 The Italian Red List of saproxylic beetles

Table 3 – The IUCN red list of Italian saproxylic beetles **(**Fields, symbols and acronyms used).

Family field: refer to Table 4 for Coleoptera suborders and a list of contributing specialists. Families are listed alphabetically, as well as genera, species and subspecies among each family.

Symbols in the species/subspecies field:

•	Subspecies representing the only one population or group of populations known to occur in Italy
	Species or subspecies included in the annexes of the UE Habitats Directive [for these species, only color of the 'IUCN Category (Italy)' column corresponds to their possible Category of Threat]
*	Species or subspecies included in the annex IV of the UE Habitats Directive
	Species or subspecies in category **CR**
	Species or subspecies in category **EN**
	Species or subspecies in category **VU**
	Species or subspecies in category **PE** (Possible Extinct) at Italian regional level (**RE)**
	Certainly allochtonous species, introduced to Italy, acclimatized, often become a pest in forest and anthropogenic habitats **[i]** Species likely allochtonous in Italy **[i ?]** Allochtonous species, introduced to Italy, but thus far not surely acclimatized **[i] ?** **All certainly or probably introduced species were considered in the NA (Not Applicable) IUCN category (Fig. 5)**

IUCN Category (Italy): refers to the IUCN Category of Risk attributed herein (with few corrections and updating) and in Audisio et al. (2014). Refer to Fig. 5 for list of the IUCN categories of risk.

IUCN Category (Europe): refers to the corresponding IUCN Category of Risk attributed at European level by Nieto & Alexander (2010) (only for the 253 species of saproxylic beetles shared by the European and the present Italian Red Lists)

Endemic/Subendemic to Italy:

P	Italian Peninsula and/or continental Italy
Si	Sicily (including Italian circum-Sicilian islands)
Sa	Sardinia (including circum-Sardinian islands)
Sa + [Co]	Corso-Sardinia
P + [Co]	Tuscan-Corsican areas
Si + [Ma]	Sicily (including Italian circum-Sicilian islands) and Maltese Islands
[?]	Presence in Italy based on published but doubtful data
[!]	Presence in Italy based on unpublished data or on data in press elsewhere
[#]	Taxonomy needing revisions or further interpretations

Trophic category (alternative or secondary Trophic Categories in brackets):

AR | arecophagous, i.e., saprophytophagous or spermophagous on Arecaceae (palms)
CO | commensal of SX/XY or of other saproxylic insects
HW | saprophagous in small water pools inside hollow trees
MB | mycetophagous on carpophora of large fungi (mostly Polyporales) growing on veteran trees or on old stumps
MF | bryophytophagous developing on mosses growing on veteran trees or on old stumps
MM | myrmecophilous o melittophagous inside hollow trees or stumps hosting colonies of ants or of other social Hymenoptera
MY | mycophagous (developing on ifae of saproxylic fungi or on micromycetes, yeasts and Myxomiceta)
NI | commensal in bird or small mammal nests, inside hollow trees
PA | larval parasitoid of SX/XY or of other saproxylic insects
PR | predator (as larvae or imagoes) of SX/XY or of other saproxylic insects
SF | feeding on fermented sap and exudates (usually including a mixture of bacteria and yeasts) produced by trees attacked by XY, fungi or wounded by external physical agents
SP | saprophytophagous on rotting vegetal matter associated with dead wood and wood debris
SS | saproxylophagous in fragments of dead wood present in the soils among roots and stumps
SX | saproxylophagous in dead wood during the whole process of its decomposition, including the wood mould inside hollow trees
UN | trophic category unknown
WX | saproxylophagous associated with dead wood completely or partially submerged in water (rivers, lakes, ponds, channels, wetlands, lagoons)
XB | saproxylophagous associated with dead wood (trunks, branches and fragments) deposited by the sea along sandy beaches, shores and sand dunes
XY | xylophagous (also developing on healthy trees)

Genus (Subgenus) **and specific epithet**	**Author(s)**	**IUCN Category** (Italy)	**Criteria**	**IUCN Category** (Europe)	**Endemic/ Subendemic to Italy**	**Trophic Category** (TC II)
ADERIDAE						
Aderus populneus	(Creutzer, 1796)	LC				SX
Anidorus lateralis	(Gredler, 1866)	VU	B2ac(iii)			SX
Anidorus nigrinus	(Germar, 1817)	LC				SX
Anidorus sanguinolentus	(Kiesenwetter, 1861)	LC				SX
Phytobaenus amabilis ssp. *amabilis* •	R.F. Sahlberg, 1834	NT				SX
ALEXIIDAE						
Sphaerosoma apuanum	Reitter, 1909	CR	B1ab(iv)		P	MY
Sphaerosoma aspromontanum	Reitter, 1909	DD			P [#]	MY
Sphaerosoma fiorii	Ganglbauer, 1899	NT			P	MY
Sphaerosoma globosum	(Sturm, 1807)	LC				MY
Sphaerosoma laevicolle	(Reitter, 1883)	DD			[?]	MY
Sphaerosoma latitarse	Apfelbeck, 1915	DD			[?]	MY
Sphaerosoma maritimum	(Reitter, 1904)	VU	B1ab(iv)		P	MY
Sphaerosoma paganettii	Obenberger, 1914	CR	B1ab(iv)		P	MY
Sphaerosoma piliferum	(P.W.J. Müller, 1821)	LC				MY
Sphaerosoma pilosum	(Panzer, 1793)	LC				MY
Sphaerosoma punctatum ssp. *punctatum* •	(Reitter, 1878)	LC				MY
Sphaerosoma reitteri	(Ormay, 1888)	LC			[#]	MY
Sphaerosoma seidlitzi	(Reitter, 1889)	LC				MY
Sphaerosoma solarii	Reitter, 1904	LC			P	MY
Sphaerosoma sparsum	Reitter, 1909	LC			P	MY
Sphaerosoma vallombrosae	(Reitter, 1885)	LC			P	MY
ANTHRIBIDAE						
Allandrus undulatus	(Panzer, 1795)	LC				XY (SX, MY)
Anthribus fasciatus	(Forster, 1771)	LC				XY (SX, MY)
Anthribus nebulosus	(Forster, 1771)	LC				XY (SX, MY)
Anthribus scapularis	(Gebler, 1833)	DD				XY (SX, MY)
Araecerodes grenieri	(C. Brisout de Barneville, 1867)	LC				XY (SX, MY)
Cercomorphus bicolor	Abeille, 1895	DD				XY (SX, MY)
Cercomorphus duvalii	Perris, 1864	DD				XY (SX, MY)
Choragus aureolineatus	(Abeille, 1839)	DD				XY (SX, MY)
Choragus sheppardi	W. Kirby, 1818	LC				XY (SX, MY)
Dissoleucas niveirostris	(Fabricius, 1798)	LC				XY (SX, MY)
Enedreytes hilaris	Fåhraeus, 1839	LC				XY (SX, MY)
Enedreytes sepicola	(Fabricius, 1792)	LC				XY (SX, MY)
Eusphyrus vasconicus	(Hoffmann, 1954)	DD				XY (SX, MY)
Noxius curtirostris	(Mulsant & Rey, 1861)	LC				XY (SX, MY)
Opanthribus tessellatus	(Boheman, 1829)	LC				XY (SX, MY)
Phaenotherion fasciculatum	Reitter, 1891	LC				XY (SX, MY)
Phaeochrotes cinctus	(Paykull, 1800)	DD				XY (SX, MY)
Platyrhinus resinosus	(Scopoli, 1763)	LC				XY (SX, MY)
Platystomos albinus	(Linnaeus, 1758)	LC				XY (SX, MY)
Pseudeuparius centromaculatus	(Gyllenhal, 1833)	LC				XY (SX, MY)
Rhaphitropis marchicus	(Herbst, 1797)	LC				XY (SX, MY)

Genus (Subgenus) **and specific epithet**	**Author(s)**	**IUCN Category** (Italy)	**Criteria**	**IUCN Category** (Europe)	**Endemic/ Subendemic to Italy**	**Trophic Category** (TC II)
Rhaphitropis oxyacanthae	(C. Brisout de Barneville, 1863)	LC				XY (SX, MY)
Trigonorhinus areolatus	(Boheman, 1845)	DD				XY (SX, MY)
Tropideres albirostris	(Herbst, 1783)	LC				XY (SX, MY)
Tropideres dorsalis	(Gyllenhal, 1813)	DD				XY (SX, MY)
Ulorhinus bilineatus	(Germar, 1818)	LC				XY (SX, MY)
BIPHYLLIDAE						
Biphyllus frater	(Aubé, 1850)	LC				SX (MY, PR)
Biphyllus lunatus	(Fabricius, 1787)	LC				SX (MY, PR)
Diplocoelus fagi	Guérin-Méneville, 1844	LC				SX (MY, PR)
BOSTRICHIDAE						
Amphicerus bimaculatus	(A.G. Olivier, 1790)	LC		LC		XY
Apate monachus	Fabricius, 1775	NT		LC		XY
Bostrichus capucinus	(Linnaeus, 1758)	LC		LC		XY
Dinoderus japonicus	Lesne, 1895	NA [i]			[!]	XY
Dinoderus ocellaris ssp. *ocellaris*	Stephens, 1830	NA [i]				XY
Enneadesmus trispinosus	(A.G. Olivier, 1795)	NT		LC		XY
Lichenophanes numida	Lesne, 1899	EN	B2ac(iii)	LC		XY (MY)
Lichenophanes varius	(Illiger, 1801)	EN	B2ac(iii)	NT		XY (MY)
Lyctus brunneus	(Stephens, 1830)	LC				XY
Lyctus linearis	(Goeze, 1777)	LC				XY
Lyctus pubescens	Panzer, 1793	LC				XY
Micrapate xyloperthoides	(Jacquelin du Val, 1859)	LC				XY
Minthea rugicollis	(F. Walker, 1858)	DD				XY
Polycaon stoutii	(Le Conte, 1853)	NA [i]				XY
Psoa dubia	(Rossi, 1792)	LC		LC		XY
Psoa viennensis	Herbst, 1797	VU	B2ac(iii)	LC		XY
Scobicia chevrieri	(A. Villa & G.B. Villa, 1835)	LC		LC		XY
Scobicia pustulata	(Fabricius, 1801)	LC		LC		XY
Sinoxylon perforans	(Schrank, 1789)	LC				XY
Sinoxylon unidentatum	(Fabricius, 1801)	NA [i]				XY
Sinoxylon sexdentatum	(A.G. Olivier, 1790)	LC				XY
Stephanopachys linearis	(Kugelann, 1792)	EN	B2ac(iii)	LC	[?]	XY
Stephanopachys quadricollis	(Fairmaire, 1878)	VU	B2ac(iii)	LC		XY
Stephanopachys substriatus	(Paykull, 1800)	EN	B2ac(iii)	LC		XY
Trogoxylon impressum	(Comolli, 1837)	LC				XY
Xylomedes coronata	(Marseul, 1883)	NA [i] ?			[?]	XY
Xylopertha praeusta	(Germar, 1817)	LC		LC		XY
Xylopertha retusa	(A.G. Olivier, 1790)	VU	B2ac(iii)	LC		XY
Xyloperthella picea	(A.G. Olivier, 1790)	LC		LC		SX
BOTHRIDERIDAE						
Bothrideres bipunctatus	(Gmelin in Linnaeus, 1790)	NT				PR
Ogmoderes angusticollis	(C. Brisout de Barneville, 1861)	NT				PR
Oxylaemus cylindricus	(Panzer, 1796)	NT				PR
Oxylaemus variolosus	(Dufour, 1843)	NT				PR
Teredus cylindricus	(A.G. Olivier, 1790)	LC				PR
Teredus opacus	Habelmann, 1854	VU	B1ab(ii,iv)			PR
BRENTIDAE						
Amorphocephala coronata	(Germar, 1817)	LC				MM
BUPRESTIDAE						
Acmaeodera (Acmaeodera) cylindrica	(Fabricius, 1775)	LC				XY
Acmaeodera (Acmaeodera) pilosellae ssp. *pilosellae* •	(Bonelli, 1812)	LC				XY
Acmaeodera (Acmaeodera) revelierei	Mulsant, 1859	CR	B1ac(iv)+2ac(iv)			XY
Acmaeodera (Acmaeotethya) crinita ssp. *crinita* •	Spinola, 1838	EN	B1ab(iii)+2ab(iii)			XY
Acmaeodera (Acmaeotethya) degener ssp. *degener*	(Scopoli, 1763)	VU	B1ab(iii)+2ab(iii)			XY
Acmaeodera (Acmaeotethya) degener ssp. *quattuordecimpunctata*	(Villers, 1789)	VU	B1ab(iii)+2ab(iii)			XY
Acmaeodera (Acmaeotethya) prunneri	Spinola, 1838	LC				XY
Acmaeodera (Acmaeotethya) quadrifasciata ssp. *quadrifasciata* •	(Rossi, 1790)	LC				XY
Acmaeodera (Acmaeotethya) tassii	Schaefer, 1965	NT			P, Si	XY
Acmaeodera (Palaeotethya) bipunctata ssp. *bipunctata*	(A.G. Olivier, 1790)	LC				XY
Acmaeodera (Palaeotethya) bipunctata ssp. *romanoi*	Sparacio, 1992	VU	B1a+2b(iii)		Si [#]	XY
Acmaeoderella (Carininota) flavofasciata ssp. *flavofasciata* •	(Piller & Mitterpacher , 1783)	LC				XY
Acmaeoderella (Omphalothorax) adspersula ssp. *adspersula* •	(Illiger, 1803)	LC				XY
Agrilus (Agrilus) albomarginatus	Fiori, 1906	LC				XY
Agrilus (Agrilus) antiquus ssp. *antiquus* •	Mulsant & Rey, 1863	LC				XY
Agrilus (Agrilus) auricollis ssp. *auricollis* •	Kiesenwetter, 1857	LC				XY
Agrilus (Agrilus) croaticus	Abeille de Perrin, 1897	LC				XY
Agrilus (Agrilus) cytisi	Baudi di Selve, 1870	VU	B1ab(iii)+2ab(iii)			XY
Agrilus (Agrilus) elegans ssp. *elegans* •	Mulsant & Rey, 1863	LC				XY
Agrilus (Agrilus) litura	Kiesenwetter, 1857	EN	B1ab(iii)+2ab(iii)			XY
Agrilus (Agrilus) meloni	Curletti, 1986	CR	B1ac(iv)+2ac(iv)			XY
Agrilus (Agrilus) suvorovi ssp. *populneus* •	Schaefer, 1946	LC				XY
Agrilus (Anambus) angustulus ssp. *angustulus* •	(Illiger, 1803)	LC				XY
Agrilus (Anambus) betuleti	(Ratzeburg, 1837)	EN	B1ab(iii)+2ab(iii)			XY
Agrilus (Anambus) biguttatus	(Fabricius, 1777)	LC				XY
Agrilus (Anambus) convexicollis	Redtenbacher, 1849	LC				XY

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Agrilus (Anambus) curtulus	Mulsant & Rey, 1863	EN	B1ab(iii)+2ab(iii)			XY
Agrilus (Anambus) cyanescens ssp. cyanescens	(Ratzeburg, 1837)	LC				XY
Agrilus (Anambus) cyanescens ssp. italicus	Obenberger, 1920	LC				XY
Agrilus (Anambus) derasofasciatus	Lacordaire, 1835	LC				XY
Agrilus (Anambus) graecus	Obenberger, 1914	DD				XY
Agrilus (Anambus) graminis ssp. graminis •	Gory & Laporte, 1857	LC				XY
Agrilus (Anambus) grandiceps ssp. hemiphanes •	Marseul, 1866	EN	B1ab(iii)+2ab(iii)			XY
Agrilus (Anambus) hastulifer ssp. hastulifer •	(Ratzeburg, 1837)	LC				XY
Agrilus (Anambus) laticornis	(Illiger, 1803)	LC				XY
Agrilus (Anambus) lineola ssp. lineola •	Kiesenwetter, 1857	LC				XY
Agrilus (Anambus) marozzinii	Gobbi, 1974	LC				XY
Agrilus (Anambus) obscuricollis	Kiesenwetter, 1857	LC				XY
Agrilus (Anambus) olivicolor	Kiesenwetter, 1857	LC				XY
Agrilus (Anambus) relegatus ssp. alexeevi •	Bellamy, 1998	LC				XY
Agrilus (Anambus) roscidus	Kiesenwetter, 1857	LC				XY
Agrilus (Anambus) salicis	J. Frivaldszky, 1877	CR	B1ac(iv)+2ac(iv)			XY
Agrilus (Anambus) sinuatus ssp. sinuatus •	(A.G. Olivier, 1790)	LC				XY
Agrilus (Anambus) subauratus ssp. subauratus •	Gebler, 1833	CR	B1ac(iv)+2ac(iv)			XY
Agrilus (Anambus) sulcicollis	Lacordaire, 1835	LC				XY
Agrilus (Anambus) viridis ssp. viridis •	(Linnaeus, 1758)	LC				XY
Agrilus (Robertius) pratensis ssp. pratensis •	(Ratzeburg, 1837)	LC				XY
Agrilus (Robertius) pseudocyaneus	Kiesenwetter, 1857	EN	B1ab(iii)+2ab(iii)			XY
Agrilus (Uragrilus) ater	(Linnaeus, 1767)	LC				XY
Agrilus (Uragrilus) guerini	Lacordaire, 1835	CR	B1ac(iv)+2ac(iv)			XY
Anthaxia (Anthaxia) candens	(Panzer, 1792)	VU	B1ab(iii)+2ab(iii)			XY
Anthaxia (Anthaxia) chevrieri	Gory & Laporte, 1839	LC				XY
Anthaxia (Anthaxia) dimidiata	(Thunberg, 1789)	LC				XY
Anthaxia (Anthaxia) fulgurans	(Schrank, 1789)	LC				XY
Anthaxia (Anthaxia) hackeri	Frivaldszky, 1884	CR	B1ac(iv)+2ac(iv)			XY
Anthaxia (Anthaxia) lucens ssp. lucens •	Küster, 1852	LC				XY
Anthaxia (Anthaxia) manca	(Linnaeus, 1767)	LC				XY
Anthaxia (Anthaxia) mendizabali	Cobos, 1965	LC				XY
Anthaxia (Anthaxia) midas ssp. midas	Kiesenwetter, 1857	CR	B1ab(iii)+2ab(iii)		[#]	XY
Anthaxia (Anthaxia) midas ssp. oberthuri	Schaefer, 1937	NT				XY
Anthaxia (Anthaxia) nereis	Schaefer, 1938	EN	B1ab(iii)+2ab(iii)			XY
Anthaxia (Anthaxia) nitidula	(Linnaeus, 1758)	LC				XY
Anthaxia (Anthaxia) passerinii	Pecchioli, 1837	NT				XY
Anthaxia (Anthaxia) podolica ssp. podolica •	Mannerheim, 1837	LC				XY
Anthaxia (Anthaxia) salicis ssp. salicis •	(Fabricius, 1777)	LC				XY
Anthaxia (Anthaxia) semicuprea	Küster, 1851	LC				XY
Anthaxia (Anthaxia) senicula ssp. senicula •	(Schrank, 1789)	NT				XY
Anthaxia (Anthaxia) spinolae	Gory & Laporte, 1839	LC				XY
Anthaxia (Anthaxia) suzannae	Théry, 1942	LC				XY
Anthaxia (Anthaxia) thalassophila ssp. thalassophila •	(Abeille de Perrin, 1900)	LC				XY
Anthaxia (Cratomerus) hungarica ssp. hungarica •	(Scopoli, 1772)	LC				XY
Anthaxia (Haplanthaxia) cichorii	(A.G. Olivier, 1790)	LC				XY
Anthaxia (Haplanthaxia) confusa ssp. baudii	Obenberger, 1914	EN	B1ab(iii)+2ab(iii)			XY
Anthaxia (Haplanthaxia) confusa ssp. confusa	Gory, 1841	LC				XY
Anthaxia (Haplanthaxia) flaviae	Lo Cascio & Sparacio, 2010	LC			Si [#]	XY
Anthaxia (Haplanthaxia) millefolii ssp. millefolii	(Fabricius, 1801)	EN	B1ab(iii)+2ab(iii)			XY
Anthaxia (Haplanthaxia) millefolii ssp. polychloros	Abeille de Perrin, 1894	LC				XY
Anthaxia (Haplanthaxia) praeclara ssp. praeclara •	Mannerheim, 1837	VU	B1ab(iii)+2ab(iii)			XY
Anthaxia (Haplanthaxia) scutellaris ssp. scutellaris •	Gené, 1839	LC				XY
Anthaxia (Haplanthaxia) scylla	Levey, 1985	LC			P	XY
Anthaxia (Haplanthaxia) umbellatarum ssp. umbellatarum •	(Fabricius, 1787)	LC				XY
Anthaxia (Melanthaxia) corsica ssp. maremmana •	Tassi, 1966	CR	B1ac(iv)+2ac(iv)		P	XY
Anthaxia (Melanthaxia) giorgioi	Sparacio, 2002	CR	B1ab(iii)+2ab(iii)		Si	XY
Anthaxia (Melanthaxia) godeti	Gory & Laporte, 1839	LC				XY
Anthaxia (Melanthaxia) helvetica ssp. apennina	Obenberger, 1938	NT			P	XY
Anthaxia (Melanthaxia) helvetica ssp. helvetica	Stierlin, 1868	LC				XY
Anthaxia (Melanthaxia) istriana	Rosenhauer, 1847	LC				XY
Anthaxia (Melanthaxia) kochi	Obenberger, 1938	VU	B1ac(iv)+2ac(iv)		P	XY
Anthaxia (Melanthaxia) kubani	Bílý, 1986	DD				XY
Anthaxia (Melanthaxia) liae	Gobbi, 1983	LC				XY
Anthaxia (Melanthaxia) morio	(Fabricius, 1792)	LC				XY
Anthaxia (Melanthaxia) nigritula ssp. nigritula •	Ratzeburg, 1837	LC				XY
Anthaxia (Melanthaxia) nigrojubata ssp. incognita •	Bílý, 1974	EN	B1ab(iii)+2ab(iii)			XY
Anthaxia (Melanthaxia) quadripunctata ssp. quadripunctata •	(Linnaeus, 1758)	LC				XY
Anthaxia (Melanthaxia) rugicollis	Lucas, 1849	VU	B1ab(iii)+2ab(iii)			XY
Anthaxia (Melanthaxia) sepulchralis ssp. sepulchralis •	(Fabricius, 1801)	LC				XY
Buprestis (Ancylocheira) cupressi	Germar, 1836	LC				XY
Buprestis (Ancylocheira) haemorrhoidalis ssp. araratica	(Marseul, 1865)	VU	B1ab(iii)+2ab(iii)			XY
Buprestis (Ancylocheira) haemorrhoidalis ssp. haemorrhoidalis	Herbst, 1780	LC				XY
Buprestis (Ancylocheira) humeralis	Klug, 1829	EN	B1ac(iv)+2ac(iv)			XY
Buprestis (Ancylocheira) novemmaculata ssp. novemmaculata •	Linnaeus, 1767	LC				XY

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Buprestis (Ancylocheira) rustica ssp. rustica •	Linnaeus, 1758	LC				XY
Buprestis (Buprestis) aetnensis	Baviera & Sparacio, 2002	CR	B1ac(iv)+2ac(iv)		Si	XY
Buprestis (Buprestis) magica ssp. doderoi •	Sparacio, 2015	CR	B1ac(iv)+2ac(iv)		Sa	XY
Buprestis (Buprestis) octoguttata ssp. octoguttata •	Linnaeus, 1758	NT				XY
Buprestis (Cypriacis) splendens ssp. splendens* •	Fabricius, 1775	CR	B1ab(iii,iv)+2ab(iii,iv)	EN B2ab(iii,iv)		XY
Buprestis (Pseudyamina) douei	Lucas, 1846	CR	B1ac(iv)+2ac(iv)			XY
Capnodis cariosa ssp. cariosa •	(Pallas, 1776)	LC				XY
Capnodis miliaris ssp. miliaris •	(Klug, 1829)	VU	B1ab(iii)+2ab(iii)			XY
Capnodis tenebrionis	(Linnaeus, 1761)	LC				XY
Chalcophora detrita ssp. detrita •	(Klug, 1829)	EN	B1ab(iii)+2ab(iii)			XY
Chalcophora intermedia ssp. intermedia •	(Rey, 1890)	EN	B1ab(iii)+2ab(iii)			XY
Chalcophora mariana	(Linnaeus, 1758)	LC				XY
Chalcophora massiliensis	(Villers, 1789)	LC				XY
Chalcophorella (Rossiella) fabricii	(Rossi, 1794)	VU	B1ac(iv)+2ac(iv)			XY
Chrysobothris (Chrysobothris) affinis ssp. affinis •	(Fabricius, 1794)	LC				XY
Chrysobothris (Chrysobothris) chrysostigma ssp. chrysostigma •	(Linnaeus, 1758)	LC				XY
Chrysobothris (Chrysobothris) dorsata	(Fabricius, 1787)	VU	B1ab(iii,v)+2ab(iii,v)			XY
Chrysobothris (Chrysobothris) igniventris	Reitter, 1895	EN	B1ab(iii)+2ab(iii)			XY
Chrysobothris (Chrysobothris) solieri	Laporte & Gory, 1837	LC				XY
Coraebus fasciatus	(Villers, 1789)	LC				XY
Coraebus undatus	(Fabricius, 1787)	NT				XY
Dicerca (Argante) moesta	(Fabricius, 1792)	CR	B1ac(iv)+2ac(iv)			XY
Dicerca (Dicerca) aenea ssp. aenea •	(Linnaeus, 1767)	LC				XY
Dicerca (Dicerca) alni	(Fischer von Waldheim, 1824)	NT				XY
Dicerca (Dicerca) berolinensis	(Herbst, 1779)	NT				XY
Eurythyrea austriaca	(Linnaeus, 1767)	VU	B1ac(iv)+2ac(iv)			XY
Eurythyrea micans	(Fabricius, 1792)	LC				XY
Eurythyrea quercus	(Herbst, 1780)	CR	B1ac(iv)+2ac(iv)			XY
Kisanthobia ariasi ssp. ariasi •	(Robert, 1858)	VU	B1ab(iii)+2ab(iii)			XY
Lamprodila (Lamprodila) decipiens ssp. decipiens •	Gebler, 1847	LC				XY
Lamprodila (Lamprodila) mirifica ssp. mirifica •	(Mulsant, 1855)	LC				XY
Lamprodila (Lamprodila) rutilans ssp. rutilans •	(Fabricius, 1777)	LC				XY
Lamprodila (Lamprodila) solieri	(Laporte & Gory, 1837)	CR	B1ac(iv)+2ac(iv)			XY
Lamprodila (Palmar) festiva ssp. festiva •	(Linnaeus, 1767)	LC				XY
Latipalpis (Latipalpis) plana ssp. plana •	(A.G. Olivier, 1790)	LC				XY
Melanophila acuminata	(De Geer, 1774)	CR	B1ac(iv)+2ac(iv)			XY
Melanophila cuspidata	(Klug, 1829)	LC				XY
Meliboeus (Meliboeus) fulgidicollis	(Lucas, 1846)	LC				XY
Perotis lugubris ssp. lugubris	(Fabricius, 1777)	LC				XY
Perotis lugubris ssp. meridionalis	Izzillo & Sparacio, 2011	NT				XY
Perotis unicolor ssp. unicolor •	(Olivier, 1790)	CR	B1ac(iv)+2ac(iv)			XY
Phaenops cyanea	(Fabricius, 1775)	LC				XY
Phaenops formaneki ssp. formaneki •	Jacobson, 1913	VU	B1ab(iii)+2ab(iii)			XY
Phaenops knoteki ssp. knoteki	Reitter, 1898	CR	B1ab(iii)+2ab(iii)			XY
Phaenops knoteki ssp. ochsi	Schaefer, 1947	VU	B1ab(iii)+2ab(iii)			XY
Poecilonota variolosa ssp. variolosa •	(Paykull, 1799)	LC				XY
Ptosima undecimmaculata ssp. undecimmaculata •	(Herbst, 1784)	LC				XY
Trachypteris picta ssp. decostigma •	(Fabricius, 1787)	LC				XY
BYRRHIDAE						
Curimus erinaceus	(Duftschmid, 1825)	DD				MF
Curimus lariensis	(A. Villa & G.B. Villa, 1833)	DD				MF
Curimus petraeus	Gredler, 1863	DD				MF
CERAMBYCIDAE						
Acanthocinus aedilis	(Linnaeus, 1758)	LC				XY
Acanthocinus griseus	(Fabricius, 1792)	LC				XY
Acanthocinus henschi ssp. aetnensis	Rapuzzi & Sama, 2010	CR	B1ab(iii)+2ab(iii)		Si	XY
Acanthocinus henschi ssp. henschi	Reitter, 1900	CR	B2ab(iii)			XY
Acanthocinus reticulatus	(Razoumowsky, 1789)	LC				XY
Acanthocinus xanthoneurus	Mulsant & Rey, 1852	NT			P, Si	XY
Acmaeops marginatus	(Fabricius, 1781)	NT				XY
Acmaeops pratensis	(Laicharting, 1784)	LC				XY
Acmaeops septentrionis	(Thomson, 1866)	NT				XY
Aegomorphus clavipes	(Schrank, 1781)	LC				XY
Aegosoma scabricornis	(Scopoli, 1763)	LC		LC		XY
Alosterna tabacicolor	(De Geer, 1775)	LC				XY
Anaesthetis testacea ssp. testacea •	(Fabricius, 1781)	LC				XY
Anaglyptus gibbosus	(Fabricius, 1787)	LC		LC		XY
Anaglyptus mysticus	(Linnaeus, 1758)	LC		LC		XY
Anaglyptus zappii	Rapuzzi & Sama, 2014	VU	B1ab(iii)			XY
Anastrangalia dubia ssp. dubia •	(Scopoli, 1763)	LC				XY
Anastrangalia reyi	(Heyden, 1889)	LC				XY
Anastrangalia sanguinolenta	(Linnaeus, 1760)	LC				XY
Anisarthron barbipes	(Schrank, 1781)	NT				XY
Anisorus quercus	(Goeze, 1783)	NT				XY
Anoplodera (Anoplodera) rufipes ssp. izzilloi	Sama, 1999	NT			P	XY

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Anoplodera (Anoplodera) rufipes ssp. *rufipes*	(Schaller, 1783)	LC				XY
Anoplodera (Anoplodera) sexguttata	(Fabricius, 1775)	LC				XY
Anoplophora chinensis	(Forster, 1771)	NA [i]				XY
Arhopalus ferus	(Mulsant, 1839)	LC				XY
Arhopalus rusticus	(Linnaeus, 1758)	LC				XY
Arhopalus syriacus	(Reitter, 1895)	LC				XY
Aromia bungi	(Faldermann, 1835)	NA [i]				XY
Aromia moschata ssp. *ambrosiaca*	(Stevens, 1809)	NT				XY
Aromia moschata ssp. *moschata*	(Linnaeus, 1758)	LC		LC		XY
Asemum striatum	(Linnaeus, 1758)	LC				XY
Asemum tenuicorne	Kraatz, 1879	NT				XY
Axinopalpis gracilis	(Krynicki, 1832)	NT		LC		XY
Brachypteroma ottomanum	Heyden, 1863	LC		LC		XY
Callidiellum rufipenne	(Motschulsky, 1862)	NA [i]				XY
Callidium aeneum	(De Geer, 1775)	LC		LC		XY
Callidium coriaceum	Paykull, 1800	NT		LC		XY
Callidium violaceum	(Linnaeus, 1758)	LC		LC		XY
Callimus abdominalis	(A.G. Olivier, 1795)	LC		LC		XY
Callimus angulatus	(Schrank, 1789)	LC		LC		XY
Cerambyx cerdo ssp. *cerdo** •	Linnaeus, 1758	LC		NT		XY
Cerambyx miles	Bonelli, 1812	LC		NT		XY
Cerambyx nodulosus	Germar, 1817	EN	B2ab(iii)	NT		XY
Cerambyx scopolii ssp. *scopolii*	Fuessly, 1775	LC		LC		XY
Cerambyx scopolii ssp. *siculus*	Rapuzzi & Sama, 2010	NT			Si	XY
Cerambyx welensii	(Küster, 1845)	LC		NT		XY
Chlorophorus figuratus	(Scopoli, 1763)	LC		LC		XY
Chlorophorus glabromaculatus	(Goeze, 1777)	LC		LC		XY
Chlorophorus glaucus	(Fabricius, 1781)	EN	B1ab(iii)			XY
Chlorophorus sartor	(O.F. Müller, 1766)	LC		LC		XY
Chlorophorus trifasciatus	(Fabricius, 1781)	LC				XY
Chlorophorus varius ssp. *varius* •	(O.F. Müller, 1766)	LC		LC		XY
Clytus arietis ssp. *arietis* •	(Linnaeus, 1758)	LC		LC		XY
Clytus clavicornis	(Reiche, 1860)	VU	B1ab(iii)	VU B1ab(iii) +2ab(iii)	Si	XY
Clytus lama	Mulsant, 1847	LC		LC		XY
Clytus rhamni	Germar, 1817	LC		LC		XY
Clytus triangulimacula	A. Costa, 1847	VU	B1ab(iii)	VU B2ab(iii)	P	XY
Cornumutila lineata	(Letzner, 1844)	CR	B2ab(iii)			XY
Cortodera aspromontana	G. Müller, 1948	NT				XY
Cortodera femorata	(Fabricius, 1787)	NT				XY
Cortodera humeralis	(Schaller, 1783)	LC				XY
Deilus fugax	(A.G. Olivier, 1790)	LC		LC		XY
Deroplia genei	(Aragona, 1830)	NT				XY
Deroplia troberti	(Mulsant, 1843)	NT				XY
Dinoptera (Dinoptera) collaris	(Linnaeus, 1758)	LC				XY
Drymochares truquii	Mulsant, 1847	VU	B1ab(iii)			XY
Ergates faber	(Linnaeus, 1760)	LC		LC		XY
Etorofus pubescens	(Fabricius, 1787)	NT				XY
Evodinus clathratus	(Fabricius, 1792)	NT				XY
Exocentrus adspersus	Mulsant, 1846	LC				XY
Exocentrus lusitanus	(Linnaeus, 1767)	NT				XY
Exocentrus punctipennis	Mulsant & Guillebeau, 1856	LC				XY
Gaurotes (Carilia) virginea	(Linnaeus, 1758)	LC				XY
Glaphyra kiesenwetteri	(Mulsant & Rey, 1861)	VU	B1ab(iii)	DD		XY
Glaphyra marmottani ssp. *crovatoi*	Sama, 1995	CR	B1ab(iii)+2ab(iii)		P	XY
Glaphyra marmottani ssp. *marmottani*	C. Brisout de Barneville, 1863	VU	B1ab(iii)+2ab(iii)	DD		XY
Glaphyra umbellatarum	(Schreber, 1859)	LC		LC		XY
Gracilia minuta	(Fabricius, 1781)	LC		LC		XY
Grammoptera abdominalis	(Stephens, 1831)	NT				XY
Grammoptera ruficornis ssp. *flavipes*	Pic, 1892	NT			Si	XY
Grammoptera ruficornis ssp. *ruficornis*	(Fabricius, 1781)	LC				XY
Grammoptera ustulata	(Schaller, 1783)	NT				XY
Grammoptera viridipennis	Pic, 1893	EN	B1ab(iii)		Si	XY
Herophila tristis ssp. *martinascoi*	(Contarini & Garagnani, 1983)	NT			P	XY
Herophila tristis ssp. *tristis*	(Linnaeus, 1767)	LC				XY
Hesperophanes sericeus	(Fabricius, 1787)	LC		LC		XY
Hylotrupes bajulus	(Linnaeus, 1758)	LC		LC		XY
Icosium tomentosum ssp. *atticum*	Ganglbauer, 1882	NT				XY
Icosium tomentosum ssp. *tomentosum*	(Lucas, 1854)	NT		LC		XY
Isotomus barbarae	Sama, 1977	NT		VU B2ab(iii)	P	XY
Isotomus speciosus	(Schneider, 1787)	CR	B1ab(iii)	LC		XY
Judolia sexmaculata	(Linnaeus, 1758)	NT				XY
Lamia textor	(Linnaeus, 1758)	NT				XY
Leioderes kollari ssp. *jacopoi*	Rapuzzi & Sama, 2010	CR	B2ab(iii)		Si	XY
Leioderes kollari ssp. *kollari*	Redtenbacher, 1849	NT		LC		XY
Leiopus femoratus	Fairmaire, 1859	NT				XY

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Leiopus nebulosus ssp. *nebulosus* •	(Linnaeus, 1758)	LC				XY
Leiopus settei	Sama, 1985	CR	B2ab(iii)		P	XY
Leptura aethiops	Poda, 1761	CR	B2ab(iii)			XY
Leptura aurulenta	Fabricius, 1792	LC				XY
Lepturobosca virens	(Linnaeus, 1758)	NT				XY
Lioderina linearis	(Hampe, 1870)	CR	B2ab(iii)	DD		XY
Menesia bipunctata	(Zoubkoff, 1829)	VU	B2ab(iii)			XY
Mesosa curculionoides	(Linnaeus, 1760)	LC				XY
Mesosa nebulosa	(Fabricius, 1781)	LC				XY
Molorchus minor ssp. *minor* •	(Linnaeus, 1758)	LC		LC		XY
Monochamus galloprovincialis	(A.G. Olivier, 1795)	LC		LC		XY
Monochamus saltuarius	(Gebler, 1830)	VU	B1ab(iii)	LC		XY
Monochamus sartor	(Fabricius, 1787)	LC		LC		XY
Monochamus sutor ssp. *sutor* •	(Linnaeus, 1758)	LC		LC		XY
Morimus asper	(Sulzer, 1776)	LC			[#]	XY
Morimus funereus	(Mulsant, 1862)	VU	B1ab(iii,iv)		[#]	XY
Nathrius brevipennis	(Mulsant, 1839)	LC		DD		XY
Necydalis major	Linnaeus, 1758	VU	B1ab(iii)			XY
Necydalis ulmi	(Chevrolat, 1838)	NT				XY
Neoclytus acuminatus	(Fabricius, 1775)	NA [i]				XY
Neopiciella sicula	(Ganglbauer, 1886)	CR	B2ab(iii)		Si	XY
Niphona picticornis	Mulsant, 1839	LC				XY
Nothorhina muricata	(Dalman, 1817)	NT				XY
Oberea (Oberea) linearis	(Linnaeus, 1760)	LC				XY
Oberea (Oberea) oculata	(Linnaeus, 1758)	LC				XY
Obrium brunneum	(Fabricius, 1792)	LC		LC		XY
Obrium cantharinum	(Linnaeus, 1767)	NT		LC		XY
Oplosia cinerea	Mulsant, 1839	NT				XY
Oxymirus cursor	(Linnaeus, 1758)	LC				XY
Oxypleurus nodieri	(Mulsant, 1839)	NT				XY
Pachyta lamed	(Linnaeus, 1758)	NT				XY
Pachyta quadrimaculata	(Linnaeus, 1758)	LC				XY
Pachytodes cerambyciformis	(Schrank, 1781)	LC				XY
Pachytodes erraticus ssp. *erraticus* •	(Dalman, 1817)	LC				XY
Paracorymbia fulva	(De Geer, 1775)	LC				XY
Paracorymbia hybrida	(Rey, 1885)	LC				XY
Paracorymbia maculicornis	(De Geer, 1775)	LC				XY
Paracorymbia simplonica	(Fairmaire, 1885)	VU	B1ab(iii)			XY
Parmena algirica	Laporte de Castelnau, 1840	NT				XY
Parmena balteus	(Linnaeus, 1767)	LC				XY
Parmena pubescens ssp. *pubescens* •	(Dalman, 1817)	LC				XY
Parmena subpubescens	Hellrigl, 1971	NT			P, Si, Sa	XY
Parmena unifasciata	(Rossi, 1790)	LC				XY
Pedostrangalia (Pedostrangalia) revestita	(Linnaeus, 1767)	NT				XY
Pedostrangalia (Sphenalia) verticalis	(Germar, 1822)	VU	B2ab(iii)			XY
Penichroa fasciata	(Stephens, 1831)	LC		LC		XY
Phoracantha recurva	Newman, 1840	NA [i]				XY
Phoracantha semipunctata	(Fabricius, 1775)	NA [i]				XY
Phymatodes testaceus	(Linnaeus, 1758)	LC		LC		XY
Pidonia lurida	(Fabricius, 1792)	NT				XY
Plagionotus arcuatus	(Linnaeus, 1758)	LC		LC		XY
Plagionotus detritus	(Linnaeus, 1758)	NT		LC		XY
Poecilium alni ssp. *alni* •	(Linnaeus, 1767)	LC		LC		XY
Poecilium fasciatum	(Villers, 1789)	LC		LC		XY
Poecilium glabratum	(Charpentier, 1825)	NT		LC		XY
Poecilium lividum	(Rossi, 1794)	LC		DD		XY
Poecilium pusillum ssp. *pusillum* •	(Fabricius, 1787)	NT		LC		XY
Poecilium rufipes	(Fabricius, 1777)	NT		LC		XY
Pogonocherus decoratus	Fairmaire, 1855	NT				XY
Pogonocherus eugeniae	Ganglbauer, 1891	NT				XY
Pogonocherus fasciculatus	(De Geer, 1775)	LC				XY
Pogonocherus hispidulus	(Piller & Mitterpacher, 1783)	LC				XY
Pogonocherus hispidus	(Linnaeus, 1758)	LC				XY
Pogonocherus marcoi	Sama, 1993	CR	B1ab(iii)+2ab(iii)		P	XY
Pogonocherus neuhausi	G. Müller, 1916	NT				XY
Pogonocherus ovatoides	Rapuzzi & Sama, 2014	CR	B2ab(iii)		P	XY
Pogonocherus ovatus	(Goeze, 1777)	NT				XY
Pogonocherus perroudi ssp. *perroudi* •	Mulsant, 1839	LC				XY
Prinobius myardi	Mulsant, 1842	NT		LC		XY
Prionus coriarius	(Linnaeus, 1758)	NT		LC		XY
Pronocera angusta	(Kriechbaumer, 1844)	EN	B2ab(iii)	DD		XY
Psacothea hilaris	(Pascoe, 1858)	NA [i]				XY
Pseudosphegesthes cinerea	(Castelnau & Gory, 1836)	NT		DD		XY
Pseudovadonia livida ssp. *livida* •	(Fabricius, 1777)	LC				XY
Purpuricenus (Purpuricenus) apiceniger	Pic, 1914	CR	B2ab(iii)			XY

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Purpuricenus (Purpuricenus) budensis	(Götz, 1783)	VU	B2ab(iii)	LC		XY
Purpuricenus (Purpuricenus) globulicollis	Dejean, 1839	NT		DD		XY
Purpuricenus (Purpuricenus) kaehleri ssp. *kaehleri* •	(Linnaeus, 1758)	LC		LC		XY
Pyrrhidium sanguineum	(Linnaeus, 1758)	LC		LC		XY
Rhagium (Hagrium) bifasciatum	Fabricius, 1775	LC				XY
Rhagium (Megarhagium) mordax	(De Geer, 1775)	LC				XY
Rhagium (Megarhagium) sycophanta	(Schrank, 1781)	NT				XY
Rhagium (Rhagium) inquisitor ssp. *inquisitor* •	(Linnaeus, 1758)	LC				XY
Rhamnusium bicolor	(Schrank, 1781)	NT				XY
Rhamnusium graecum ssp. *italicum* •	G.Müller, 1966	CR	B1ab(iii)+2ab(iii)		P	XY
Ropalopus (Ropalopus) clavipes	(Fabricius, 1775)	LC		LC		XY
Ropalopus (Ropalopus) femoratus	(Linnaeus, 1758)	NT		LC		XY
Ropalopus (Ropalopus) insubricus ssp. *insubricus* •	(Germar, 1824)	VU	B1ab(iii)	NT		XY
Ropalopus (Ropalopus) siculus	(Stierlin, 1864)	EN	B2ab(iii)	DD		XY
Ropalopus (Ropalopus) ungaricus	(Herbst, 1784)	NT		EN B2ab (i,ii,iii,iv)		XY
Ropalopus (Ropalopus) varini	(Bedel, 1870)	NT		LC		XY
*Rosalia alpina**	(Linnaeus, 1758)	NT		LC		XY
Rusticoclytus pantherinus	(Savenius, 1825)	EN	B2ab(iii)			XY
Rusticoclytus rusticus	(Linnaeus, 1758)	LC				XY
Rutpela maculata ssp. *maculata*	(Poda, 1761)	LC				XY
Saperda carcharias	(Linnaeus, 1758)	NT				XY
Saperda octopunctata	(Scopoli, 1772)	NT		LC		XY
Saperda perforata	(Pallas, 1773)	EN	B2ab(iii)	LC		XY
Saperda punctata	(Linnaeus, 1767)	LC		NT		XY
Saperda scalaris ssp. *scalaris* •	(Linnaeus, 1758)	LC		LC		XY
Saperda similis	Laicharting, 1784	NT				XY
Saphanus piceus ssp. *piceus* •	(Laicharting, 1784)	NT				XY
Schurmannia sicula	Sama, 1979	CR	B1ab(iii)+2ab(iii)		Si	XY
Semanotus laurasii ssp. *corsicus* •	(Croissandeau, 1890)	CR	B2ab(iii)	LC	Sa + [Co]	XY
Semanotus russicus	(Fabricius, 1777)	NT		LC		XY
Semanotus undatus	(Linnaeus, 1758)	VU	B2ab(iii)	LC		XY
Spondylis buprestoides	(Linnaeus, 1758)	NT				XY
Stenhomalus (Obriopsis) bicolor	(Kraatz, 1862)	NT		LC		XY
Stenocorus (Stenocorus) meridianus	(Linnaeus, 1758)	NT				XY
Stenopterus ater	(Linnaeus, 1767)	LC		LC		XY
Stenopterus flavicornis	Küster, 1846	NT		LC		XY
Stenopterus rufus ssp. *rufus* •	(Linnaeus, 1767)	LC		LC		XY
Stenostola dubia	(Laicharting, 1784)	NT				XY
Stenostola ferrea	(Schrank, 1776)	NT				XY
Stenurella bifasciata ssp. *bifasciata* •	(O.F. Müller, 1776)	LC				XY
Stenurella melanura	(Linnaeus, 1758)	LC				XY
Stenurella nigra	(Linnaeus, 1758)	LC				XY
Stenurella sennii	Sama, 2002	DD				XY
Stenurella septempunctata ssp. *septempunctata* •	(Fabricius, 1792)	VU	B1ab(iii)			XY
Stictoleptura cordigera ssp. *cordigera*	(Fuessly, 1775)	LC				XY
Stictoleptura cordigera ssp. *illyrica*	(G. Müller, 1948)	NT				XY
Stictoleptura erythroptera	(Hagenbach, 1822)	CR	B1ab(iii)			XY
Stictoleptura oblongomaculata	(Buquet, 1840)	EN	B2ab(iii)			XY
Stictoleptura rubra ssp. *rubra* •	(Linnaeus, 1758)	LC				XY
Stictoleptura rufa ssp. *rufa* •	(Brullé, 1832)	NT				XY
Stictoleptura scutellata ssp. *melas*	(Lucas, 1846)	VU	B1ab(iii)			XY
Stictoleptura scutellata ssp. *scutellata*	(Fabricius, 1781)	NT				XY
Strangalia attenuata	(Linnaeus, 1758)	NT				XY
Stromatium unicolor	(A.G. Olivier, 1795)	LC		LC		XY
Tetropium castaneum	(Linnaeus, 1758)	LC				XY
Tetropium fuscum	(Fabricius, 1787)	NT				XY
Tetropium gabrieli	Weise, 1905	NT				XY (SX)
Tetrops praeustus ssp. *praeustus* •	(Linnaeus, 1758)	LC				XY
Tetrops starkii	Chevrolat, 1859	NT				XY
Tragosoma depsarium	(Linnaeus, 1767)	CR	B2ab(iii)	NT		XY
Trichoferus fasciculatus ssp. *fasciculatus* •	(Faldermann, 1837)	LC		LC		XY
Trichoferus griseus	(Fabricius, 1792)	LC		LC		XY
Trichoferus holosericeus	(Rossi, 1790)	LC		LC		XY
Trichoferus pallidus	(A.G. Olivier, 1790)	EN	B2ab(iii)	LC		XY
Trichoferus spartii	(G. Müller, 1948)	LC				XY
Xylosteus spinolae	Frivaldszky, 1838	EN	B2ab(iii)			XY
Xylotrechus (Xylotrechus) antilope ssp. *antilope* •	(Schönherr, 1817)	LC		LC		XY
Xylotrechus (Xylotrechus) arvicola	(A.G. Olivier, 1795)	LC		LC		XY
Xylotrechus (Xylotrechus) stebbingi	Gahan, 1906	NA [i]			[#]	XY
CEROPHYTIDAE						
Cerophytum elateroides	Latreille, 1809	DD		VU B2ab(iii,iv)		SX
CERYLONIDAE						
Cerylon deplanatum	Gyllenhal, 1827	NT				MY
Cerylon fagi	C. Brisout de Barneville, 1867	LC				MY
Cerylon ferrugineum	Stephens, 1830	LC				MY

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Cerylon histeroides	(Fabricius, 1792)	LC				MY
Cerylon impressum	Erichson, 1845	NT				MY
Murmidius ovalis	(Beck, 1817)	VU	B1ab(iv)			SX (MY)
Philothermus evanescens	(Reitter, 1876)	NT				MY
Philothermus montandoni	Aubé, 1843	NA [i]				MY
Philothermus semistriatus	(Perris, 1865)	LC				MM (MY)
CIIDAE						
Cis alter	Silfverberg, 1991	LC				MB
Cis bidentatus	(A.G.Olivier, 1790)	LC				MB
Cis boleti	(Scopoli, 1763)	LC				MB
Cis castaneus	Mellié, 1848	LC				MB
Cis comptus	Gyllenhal, 1827	LC				MB
Cis dentatus	Mellié, 1848	LC				MB
Cis fagi	Waltl, 1839	LC				MB
Cis fissicollis	Mellié, 1848	LC				MB
Cis fissicornis	Mellié, 1848	LC				MB
Cis glabratus	Mellié, 1848	LC				MB
Cis hispidus	(Paykull, 1798)	LC				MB
Cis jacquemarti	Mellié, 1848	LC				MB
Cis laminatus	Mellié, 1848	LC				MB
Cis lineatocribratus	Mellié, 1848	LC				MB
Cis micans	(Fabricius,1792)	LC				MB
Cis multidentatus	(Pic, 1920)	VU	B1ac(iii)			MB
Cis perrisi	Abeille de Perrin, 1874	VU	B1ac(iii)			MB
Cis punctifer	Mellié, 1848	LC				MB
Cis punctulatus	Gyllenhal, 1827	LC				MB
Cis quadridens	Mellié, 1848	LC				MB
Cis quadridentulus	Perris in Abeille de Perrin, 1874	LC				MB
Cis ragusai	Roubal, 1916	CR	B1ab(iii)+2ab(iii)		Si	MB
Cis rugulosus	Mellié, 1848	LC				MB
Cis setiger	Mellié, 1848	LC				MB
Cis striatulus	Mellié, 1848	LC				MB
Cis tomentosus	Mellié, 1848	LC				MB
Diphyllocis opaculus	(Reitter, 1878)	LC				MB
Ennearthron cornutum	(Gyllenhal, 1827)	LC				MB
Ennearthron filum	Abeille de Perrin, 1874	NT				MB
Ennearthron pruinosulum	(Perris in Abeille de Perrin, 1864)	VU	B1ac(iii)			MB
Hadreule elongatulum	(Gyllenhal, 1827)	VU	B1ac(iii)			MB
Octotemnus glabriculus	(Gyllenhal, 1827)	LC				MB
Octotemnus mandibularis	(Gyllenhal, 1813)	VU	B1ac(iii)			MB
Orthocis alni	(Gyllenhal, 1813)	LC				MB
Orthocis coluber	(Abeille de Perrin, 1874)	LC				MB
Orthocis festivus	(Panzer, 1793)	LC				MB
Orthocis lucasi	(Abeille de Perrin, 1874)	VU	B1ac(iii)			MB
Orthocis pygmaeus	(Marsham, 1802)	LC				MB
Orthocis vestitus	(Mellié, 1848)	LC				MB
Rhopalodontus baudueri	(Abeille de Perrin, 1874)	EN	B2ac(iii)			MB
Rhopalodontus novorossicus	Reitter, 1902	EN	B2ac(iii)			MB
Rhopalodontus perforatus	(Gyllenhal, 1813)	LC				MB
Rhopalodontus populi	C. & H. Brisout de Barneville, 1877	LC				MB
Strigocis bicornis	(Mellié, 1848)	LC				MB
Sulcacis (Entypocis) bidentulus	(Rosenhauer, 1847)	LC				MB
Sulcacis (Entypocis) fronticornis	(Panzer, 1809)	LC				MB
Sulcacis (Sulcacis) affinis	(Gyllenhal, 1827)	LC				MB
Xylographus bostrychoides	(Dufour, 1843)	NA [i]				MB
CLAMBIDAE						
Calyptomerus alpestris	Redtenbacher, 1849	DD				MY
Calyptomerus dubius	(Marsham, 1802)	LC				MY
Clambus armadillo	(De Geer, 1774)	DD				MY
Clambus caucasus	Endrödy-Younga, 1960	DD				MY
Clambus dux	Endrödy-Younga, 1960	LC				MY
Clambus evae	Endrödy-Younga, 1960	DD				MY
Clambus hayekae	Endrödy-Younga, 1960	DD				MY
Clambus minutus ssp. complicans	Wollaston, 1864	LC				MY
Clambus minutus ssp. minutus	(Sturm, 1807)	LC				MY
Clambus nigrellus	Reitter, 1914	DD				MY
Clambus nigriclavis	Stephens, 1853	DD				MY
Clambus pallidulus	Reitter, 1911	LC				MY
Clambus pilosellus	Reitter, 1876	DD				MY
Clambus pubescens	Redtenbacher, 1849	LC				MY
Clambus punctulum	(Beck, 1817)	LC				MY
Loricaster testaceus ssp. pumilus	Reitter, 1884	LC				MY
Loricaster testaceus ssp. testaceus	Mulsant, 1861	LC				MY
CLERIDAE						
Allonyx quadrimaculatus	(Schaller, 1783)	DD				PR

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Clerus mutillarius	Reitter, 1894	**NT**				PR
Denops albofasciatus	(Charpentier, 1825)	**NT**				PR
Dermestoides sanguinicollis	(Fabricius, 1787)	**EN**	B2ab(iii)c(iii)			PR
Enoplium doderoi	Luigioni, 1926	**EN**	B2ab(iii)			PR
Enoplium serraticorne	(A.G. Olivier, 1790)	**NT**				PR
Korynetes caeruleus	(De Geer, 1775)	**NT**				PR
Korynetes pusillus	Klug, 1842	**NT**				PR
Opetiopalpus bicolor	(Castelnau, 1836)	**NT**				PR
Opetiopalpus scutellaris	(Panzer, 1797)	**NT**				PR
Opilo domesticus	(Sturm, 1837)	**LC**				PR
Opilo mollis	(Linnaeus, 1758)	**LC**				PR
Opilo orocastaneus	Zappi & Pantaleoni, 2010	**EN**	B2ab(iii)c(iii)		Sa + [Co]	PR
Opilo pallidus	(A.G. Olivier, 1795)	**NT**				PR
Opilo taeniatus	(Klug, 1842)	**VU**	B2ab(iii)		[#]	PR
Tarsostenus carus	(Newman, 1840)	**NA [i]**				PR
Tarsostenus univittatus	(Rossi, 1792)	**NA [i]**				PR
Teloclerus compressicornis	(Klug, 1842)	**VU**	B2ac(iii)			PR
Thanasimus femoralis	(Zetterstedt, 1828)	**NT**				PR
Thanasimus formicarius	(Linnaeus, 1758)	**LC**				PR
Tilloidea unifasciata	(Fabricius, 1787)	**NT**				PR
Tillus elongatus	(Linnaeus, 1758)	**NT**				PR
Tillus espinosai	Winkler, 1985	**EN**	B1ab(iii)+2ab(iii)		P, Si	PR
Tillus pallidipennis	Bielz, 1850	**DD**				PR
CORYLOPHIDAE						
Arthrolips nana	(Mulsant & Rey, 1861)	**DD**				MY
Arthrolips obscura	(C.R. Sahlberg, 1833)	**DD**				MY
Clypastrea brunnea	(C. Brisout de Barneville, 1863)	**DD**				MY
Clypastrea lata	(Reitter, 1877)	**DD**				MY
Clypastrea pusilla	(Gyllenhal, 1810)	**DD**				MY
Clypastrea reitteri	Bowestead, 1999	**DD**				MY
Corylophus sublaevipennis	Jacquelin du Val, 1859	**DD**				SS (MY)
Orthoperus aequalis	Sharp, 1885	**DD**				MY
Orthoperus atomus	(Gyllenhal, 1808)	**DD**				NI
Orthoperus corticalis	(Redtenbacher, 1849)	**DD**				MY
Orthoperus punctatus	Wankowicz, 1865	**DD**				NI
Orthoperus rogeri	Kraatz,1874	**DD**				MY
CROWSONIELLIDAE						
Crowsoniella relicta	Pace, 1975	**DD**			P	UN
CRYPTOPHAGIDAE						
Atomaria (Agathengis) linearis	Stephens, 1830	**DD**				MY
Atomaria (Agathengis) nigrirostris	Stephens 1830	**LC**				MY
Atomaria (Agathengis) umbrina	(Gyllenhal, 1827)	**LC**				MY
Atomaria (Agathengis) vespertina	Mäklin, 1853	**DD**				MY
Caenoscelis angelinii	Johnson & Bowestead, 2003	**CR**	B1ab(iii)+2ab(iii)		P	MY
Caenoscelis ferruginea	(C.R. Sahlberg, 1820)	**DD**				MY
Caenoscelis subdeplanata	C. Brisout de Barneville, 1882	**DD**				MY
Cryptophagus acutangulus	Gyllenhal, 1827	**LC**				MY
Cryptophagus badius	Sturm, 1845	**LC**				MY (SF)
Cryptophagus brisouti	Reitter, 1875	**DD**				UN
Cryptophagus cellaris	(Scopoli 1763)	**DD**				MY (MM)
Cryptophagus croaticus	Reitter, 1879	**DD**				MY
Cryptophagus cylindrellus	Johnson, 2007	**DD**				MB
Cryptophagus dentatus	(Herbst, 1793)	**LC**				MY
Cryptophagus denticulatus	Heer, 1841	**LC**				MY
Cryptophagus dorsalis	C.R. Sahlberg, 1819	**DD**				MY
Cryptophagus durus	Reitter, 1878	**DD**				UN
Cryptophagus falcozi	Roubal, 1927	**DD**				MY
Cryptophagus fasciatus	Kraatz, 1852	**LC**				XB
Cryptophagus fuscicornis	Sturm, 1845	**DD**				MY
Cryptophagus hexagonalis	Tournier, 1872	**LC**				MY (MM)
Cryptophagus intermedius	Bruce, 1934	**DD**				MM
Cryptophagus jakowlevi	Reitter, 1888	**LC**				MY
Cryptophagus labilis	Erichson, 1846	**VU**	B2ac(iii)			MB
Cryptophagus lapponicus	Gyllenhal, 1827	**DD**				MB (MY)
Cryptophagus laticollis	P.H. Lucas, 1846	**LC**				MB
Cryptophagus micaceus	Rey, 1889	**DD**				MB
Cryptophagus montanus	C. Brisout de Barneville, 1863	**DD**				MB
Cryptophagus nitidulus	Miller, 1858	**DD**				MB
Cryptophagus pallidus	Sturm, 1845	**LC**				MB
Cryptophagus parallelus	C. Brisout de Barneville, 1863	**DD**				MY
Cryptophagus populi	Paykull, 1800	**DD**				MY (MM)
Cryptophagus puncticollis	P.H. Lucas, 1846	**DD**				UN
Cryptophagus punctipennis	C. Brisout de Barneville, 1863	**LC**				SP
Cryptophagus quercinus	Kraatz, 1852	**NT**				MY (MM)
Cryptophagus reflexicollis	Reitter, 1876	**DD**				MY

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Cryptophagus ruficornis	Stephens, 1830	LC				MB
Cryptophagus scanicus	(Linnaeus, 1758)	LC				MY
Cryptophagus schmidtii	Leunis, 1845	DD				MM
Cryptophagus schroetteri	Reitter, 1912	DD				MM
Cryptophagus scutellatus	Newman, 1834	LC				MY
Cryptophagus setulosus	Sturm, 1845	DD				MM
Cryptophagus skalitzkyi	Reitter, 1875	DD				MM
Cryptophagus sporadum	Bruce, 1934	DD				MY
Cryptophagus subdepressus	Gyllenhal, 1827	DD				MY
Cryptophagus subfumatus	Kraatz, 1856	LC				MY
Cryptophagus uncinatus	Stephens, 1830	LC				NI
Curelius exiguus	(Erichson 1846)	LC				MY
Curelius japonicus	(Reitter, 1877)	NA [i]				SP
Henoticus serratus	(Gyllenhal, 1808)	LC				MY
Micrambe abietis	(Paykull, 1798)	DD				MY
Micrambe pilosula	Erichson, 1846	DD				MY
Micrambe umbripennis	Reitter, 1906	DD				MY
Paramecosoma melanocephalum	(Herbst 1793)	LC				SP
Pteryngium crenatum	(Fabricius 1798)	LC				MY
Sternodea baudii	Reitter, 1875	LC				MY
CUCUJIDAE						
*Cucujus cinnaberinus**	(Scopoli, 1763)	VU	B2ac(iv)	NT		PR (MY)
Cucujus haematodes	Erichson, 1845	EN	B1ac(iv)+2ac(iv)	EN B2ab(i,ii,iii,iv)		PR (MY)
Cucujus tulliae	Bonacci, Mazzei, Horak & Brandmayr, 2012	EN	B1ab(iii,iv)+2ab(iii,iv)		P	PR (MY)
Pediacus depressus	(Herbst, 1794)	NT		LC		PR (MY)
Pediacus dermestoides	(Fabricius, 1792)	NT		DD		PR (MY)
Pediacus fuscus	Erichson, 1845	RE		LC		PR (MY)
CURCULIONIDAE						
Acalles aubei	Boheman, 1837	LC				SX
Acalles camelus	(Fabricius, 1792)	LC				SX
Acalles commutatus	Dieckmann, 1982	VU	B2ab(iii)			SX
Acalles dieckmanni	Péricart, 1989	NT				SX
Acalles dubius	Solari & Solari, 1907	VU	B2ab(iii)			SX
Acalles echinatus	(Germar, 1824)	LC				SX
Acalles humerosus	Fairmaire, 1862	VU	B2ab(iii)			SX
Acalles kippenbergi	Dieckmann, 1982	VU	B2ab(iii)			SX
Acalles lemur ssp. *cisalpinus*	Stuben, 2003	LC				SX
Acalles lemur ssp. *lemur*	(Germar, 1824)	NT				SX
Acalles longus	Desbrochers, 1892	NT				SX
Acalles micros	Dieckmann, 1982	LC				SX
Acalles papei	Solari & Solari, 1905	LC			P	SX
Acalles parvulus	Boheman, 1837	LC				SX
Acalles pulchellus	H. Brisout de Barneville, 1864	VU	B2ab(iii)			SX
Acalles sardiniaensis	Stuben, 2001	NT				SX
Acalles setulipennis	Desbrochers, 1871	NT				SX
Acalles temperei	Péricart, 1987	NT				SX
Acalles tibialis	Weise, 1891	NT				SX
Acallocrates denticollis	(Germar, 1824)	LC				SX
Acallocrates minutesquamosus	(Reiche, 1869)	LC				SX
Acallorneuma doderoi	Solari & Solari, 1908	VU	B2ab(iii)		Si	SX
Acallorneuma ingoi	Osella & Zuppa, 2002	NT			Sa	SX
Acallorneuma mainardii	Solari & Solari, 1908	NT			Sa	SX
Acallorneuma montisalbi	Osella & Zuppa, 2002	VU	B2ab(iii)		Sa	SX
Acallorneuma reitteri	Mainardi, 1906	NT			P	SX
Acallorneuma sardeanense	Osella & Zuppa, 2002	VU	B2ab(iii)		Sa	SX
Amaurorhinus (Amaurorhinus) bewickianus	(Wollaston, 1860)	LC				XB
Amaurorhinus (Amaurorhinus) caoduroi	Osella & Pogliano, 1984	LC			P	XB
Amaurorhinus (Amaurorhinus) cesaraccioi	Osella & Gregori, 1989	DD			Sa	XB
Amaurorhinus (Amaurorhinus) lostiae	Fairmaire, 1883	DD				XB
Amaurorhinus (Amaurorhinus) mediterraneus	Folwaczny, 1973	DD				XB
Amaurorhinus (Amaurorhinus) sardous ssp. *gardinii*	Osella, 1981	DD			Sa	XB
Amaurorhinus (Amaurorhinus) sardous ssp. *sardous*	Folwaczny, 1973	DD			Sa	XB
Ambrosiodmus rubricollis	Eichhoff, 1876	NA [i]				MY
Ambrosiophilus atratus	Eichhoff, 1876	NA [i]				MY
Anisandrus dispar	(Fabricius, 1792)	LC				MY
Aphanommata filum	(Mulsant & Rey, 1859)	NT				XB
Brachytemnus porcatus	(Germar, 1824)	LC				SX
Camptorhinus simplex	Seidlitz, 1867	LC				SX
Camptorhinus statua	(Rossi, 1790)	LC				SX
Carphoborus minimus	(Fabricius, 1789)	VU	B2ab(iii)			XY
Carphoborus perrisi	(Chapuis, 1869)	LC				XY
Carphoborus pini	Eichhoff, 1881	LC				XY
Chaetoptelius vestitus	(Mulsant & Rey, 1861)	LC				XY
Choerorhinus squalidus	Fairmaire, 1858	LC				SX
Cisurgus ragusae	Reitter, 1906	LC				XY

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Cossonus (Caenocossonus) cylindricus	C.R. Sahlberg, 1834	LC				SX
Cossonus (Cossonus) linearis	(Fabricius, 1775)	LC				SX
Cossonus (Cossonus) parallelepipedus	(Herbst, 1795)	LC				SX
Cotaster (Cotaster) cuneipennis	(Aubé, 1850)	NT				SX
Cotaster (Cotaster) uncipes	(Boheman, 1838)	LC				SX
Cryphalus asperatus	(Gyllenhal, 1813)	LC				XY
Cryphalus intermedius	Ferrari, 1867	LC				XY
Cryphalus numidicus	Eichhoff, 1878	LC				XY
Cryphalus piceae	(Ratzeburg, 1837)	LC				XY
Cryphalus saltuarius	Weise, 1891	LC				XY
Cryptorhynchus (Cryptorhynchus) lapathi	(Linnaeus, 1758)	LC				SX
Crypturgus cinereus	(Herbst, 1794)	LC				XY
Crypturgus cribrellus	Reitter, 1895	LC				XY
Crypturgus hispidulus	Thomson, 1870	VU	B2ab(iii)			XY
Crypturgus mediterraneus	Eichhoff, 1869	LC				XY
Crypturgus numidicus	Ferrari, 1867	LC				XY
Crypturgus pusillus	(Gyllenhal, 1813)	LC				XY
Cyclorhipidion bodoanum	Reitter, 1913	NA [i]				MY
Dactylotrypes longicollis	Wollaston, 1864	NA [i]				AR
Dendroctonus micans	(Kugelann, 1794)	LC				XY
Dichromacalles rolletii	(Germar, 1817)	NT				SX
Dryocoetes alni	(Georg, 1856)	LC				XY
Dryocoetes autographus	(Ratzeburg, 1837)	LC				XY
Dryocoetes hectographus	Reitter, 1913	LC				XY
Dryocoetes italus	Eggers, 1940	DD				XY
Dryocoetes villosus	(Fabricius, 1792)	LC				XY
Echinodera bellieri	(Reiche, 1860)	NT				SX
Echinodera brisouti ssp. *brisouti* •	(Reitter, 1885)	LC				SX
Echinodera capiomonti	(H. Brisout de Barneville, 1864)	LC				SX
Echinodera hypocrita	(Boheman, 1837)	LC				SX
Echinodera ibleiensis	Stüben, 2003	NT			Si	SX
Echinodera kostenbaderi	Stuben & Wolf, 2002	NT				SX
Echinodera nebrodiensis	Stüben 2003	NT			Si	SX
Echinodera peragalloi	(Chevrolat, 1863)	LC				SX
Echinodera settefratelliensis	Stüben, 2005	NT			Si	SX
Echinodera siciliensis	Stüben, 2003	NT			Si	SX
Echinodera tyrrhenica	(Caldara, 1978)	NT			P	SX
Echinodera variegata	(Boheman, 1837)	NT				SX
Echinomorphus ravouxi	(Jacquet, 1888)	NT				SX
Ernoporicus fagi	(Fabricius, 1798)	LC				XY
Ernoporus tiliae	(Panzer, 1793)	LC				XY
Gasterocercus depressirostris	(Fabricius, 1792)	NT				SX
Gnathotrichus materiarius	Fitch, 1858	NA [i]				MY
Hexarthrum capitulum	(Wollaston, 1858)	DD				SX
Hexarthrum exiguum	(Boheman, 1838)	DD				SX
Hylastes angustatus	(Herbst, 1794)	LC				XY
Hylastes ater	(Paykull, 1800)	LC				XY
Hylastes attenuatus	Erichson, 1836	LC				XY
Hylastes batnensis	H. Brisout de Barneville, 1883	DD				XY
Hylastes brunneus	(Erichson, 1836)	VU	B2ab(iii)			XY
Hylastes cunicularius	Erichson, 1836	LC				XY
Hylastes gergeri	Eggers, 1911	DD				XY
Hylastes linearis	Erichson, 1836	LC				XY
Hylastes opacus	Erichson, 1836	VU	B2ab(iii)			XY
Hylastinus fankhauseri	Reitter, 1895	LC				XY
Hylastinus obscurus	(Marsham, 1802)	LC				XY
Hylesinus crenatus	(Fabricius, 1787)	LC				XY
Hylesinus toranio	(D'Antoine, 1788)	LC				XY
Hylesinus varius	(Fabricius, 1775)	LC				XY
Hylobius (Callirus) abietis	(Linnaeus, 1758)	LC				XY
Hylobius (Callirus) pinastri	(Gyllenhal, 1813)	LC				XY
Hylobius (Callirus) transversovittatus	(Goeze, 1777)	LC				XY
Hylobius (Hylobius) excavatus	(Laicharting, 1781)	LC				XY
Hylurgops glabratus	(Zetterstedt, 1828)	LC				XY
Hylurgops palliatus	(Gyllenhal, 1813)	LC				XY
Hylurgus ligniperda	(Fabricius, 1787)	LC				XY
Hylurgus micklitzi	Wachtl, 1881	LC				XY
Hypoborus ficus	Erichson, 1836	LC				XY
Ips acuminatus	(Gyllenhal, 1827)	LC				XY
Ips amitinus	(Eichhoff, 1872)	LC				XY
Ips cembrae	(Heer, 1836)	LC				XY
Ips sexdentatus	(Boerner, 1766)	LC				XY
Ips typographus	(Linnaeus, 1758)	LC				XY
Kissophagus hederae	(Comolli, 1837)	LC				XY
Kissophagus novaki	Reitter, 1894	LC				XY

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Kyklioacalles (Kyklioacalles) barbarus	Lucas, 1849	NT				SX
Kyklioacalles (Kyklioacalles) characivorus	Stüben, 2005	LC				SX
Kyklioacalles (Kyklioacalles) fausti	Meyer, 1896	LC				SX
Kyklioacalles (Kyklioacalles) provincialis	(Hoffmann, 1960)	VU	B2ab(iii)			SX
Kyklioacalles (Kyklioacalles) punctaticollis ssp. *meteoricus*	(Meyer, 1909)	VU	B2ab(iii)			SX
Kyklioacalles (Kyklioacalles) punctaticollis ssp. *punctaticollis*	(Lucas, 1849)	LC				SX
Kyklioacalles (Kyklioacalles) saccoi	(Colonnelli, 1973)	NT			P	SX
Kyklioacalles (Kyklioacalles) solarii	(Fiori, 1903)	LC				SX
Kyklioacalles (Kyklioacalles) teter	(Boheman, 1844)	NT				SX
Kyklioacalles (Palaeoacalles) navieresi	(Boheman, 1937)	LC				SX
Kyklioacalles (Palaeoacalles) roboris	(Curtis, 1834)	LC				SX
Liparthrum genistae	(Aubé, 1862)	LC				XY
Liparthrum mori	(Aubé, 1862)	LC				XY
Lymantor coryli	(Perris, 1855)	VU	B2ab(iii)			XY
Melicius cylindrus	Boheman, 1838	LC				SX
Melicius gracilis	Rosenhauer, 1856	LC				SX
Mesites (Mesites) aquitanus	Fairmaire, 1859	DD				SX
Mesites (Mesites) cunipes	(Boheman, 1837)	LC				SX
Mesites (Mesites) pallidipennis	(Boheman, 1837)	LC				XB
Neohexarthrum bonnairei	Hoffmann, 1938	LC				SX
Neumatora depressa	Normand, 1920	CR	B2ab(iii)		Si	SX
Onyxacalles croaticus	(H. Brisout de Barneville, 1867)	NT				SX
Onyxacalles henoni	(Bedel, 1888)	NT				SX
Onyxacalles luigionii	(Solari & Solari, 1907)	LC				SX
Onyxacalles pyrenaeus	(Boheman, 1844)	LC				SX
Orthotomicus erosus	(Wollaston, 1857)	LC				XY
Orthotomicus laricis	(Fabricius, 1792)	LC				XY
Orthotomicus longicollis	(Gyllenhal, 1827)	VU	B2ab(iii)			XY
Orthotomicus mannsfeldi	(Wachtl, 1879)	LC				XY
Orthotomicus proximus	(Eichhoff, 1868)	LC				XY
Orthotomicus suturalis	(Gyllenhal, 1827)	LC				XY
Phloeophagus lignarius	(Marsham, 1802)	LC				SX
Phloeosinus aubei	(Perris, 1855)	LC				XY
Phloeosinus thujae	(Perris, 1855)	LC				XY
Phloeotribus cristatus	(Fauvel, 1889)	LC				XY
Phloeotribus liminaris	Harris, 1852	NA [i]				XY
Phloeotribus perfoliatus	Wollaston, 1854	LC				XY
Phloeotribus pubifrons	(Guillebeau, 1893)	LC				XY
Phloeotribus rhododactylus	(Marsham, 1802)	LC				XY
Phloeotribus scarabaeoides	(Bernard, 1788)	LC				XY
Phloeotribus spinulosus	(Rey, 1883)	LC				XY
Pissodes (Pissodes) castaneus	(De Geer, 1775)	LC				XY
Pissodes (Pissodes) harcyniae	(Herbst, 1795)	DD				XY
Pissodes (Pissodes) piceae	(Illiger, 1807)	LC				XY
Pissodes (Pissodes) pini	(Linnaeus, 1758)	LC				XY
Pissodes (Pissodes) piniphilus	(Herbst, 1795)	DD				XY
Pissodes (Pissodes) scabricollis	Miller, 1859	DD				XY
Pissodes (Pissodes) validirostris	(C.R. Sahlberg, 1834)	LC				XY
Pityogenes bidentatus	(Herbst, 1784)	LC				XY
Pityogenes bistridentatus	(Eichhoff, 1878)	LC				XY
Pityogenes calcaratus	(Eichhoff, 1878)	LC				XY
Pityogenes chalcographus	(Linnaeus, 1760)	LC				XY
Pityogenes conjunctus	(Reitter, 1887)	LC				XY
Pityogenes quadridens	(Hartig, 1834)	LC				XY
Pityogenes trepanatus	(Nördlinger, 1848)	LC				XY
Pityokteines curvidens	(Germar, 1824)	LC				XY
Pityokteines spinidens	(Reitter, 1895)	LC				XY
Pityokteines vorontzovi	(Jacobson, 1895)	LC				XY
Pityophthorus buyssoni	Reitter, 1901	LC				XY
Pityophthorus carniolicus	Wichmann, 1910	LC				XY
Pityophthorus exsculptus	(Ratzeburg, 1837)	VU	B2ab(iii)			XY
Pityophthorus glabratus	Eichhoff, 1878	LC				XY
Pityophthorus henscheli	Seitner, 1887	LC				XY
Pityophthorus knoteki	Reitter, 1898	LC				XY
Pityophthorus lichtensteinii	(Ratzeburg, 1837)	LC				XY
Pityophthorus pityographus	(Ratzeburg, 1837)	LC				XY
Pityophthorus pubescens	(Marsham, 1802)	LC				XY
Platypus cylindrus	(Fabricius, 1792)	LC				XY
Polygraphus grandiclava	Thomson, 1886	LC				XY
Polygraphus poligraphus	(Linnaeus, 1758)	LC				XY
Pselactus caoduroi	Osella, 1985	DD			P	XB
Pselactus spadix	(Herbst, 1795)	LC				XB
Pseudothamnurgus mediterraneus	Eggers, 1910	LC				XY
Pteleobius kraatzi	(Eichhoff, 1864)	LC				XY
Pteleobius vittatus	(Fabricius, 1792)	LC				XY

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Rhyncolus (Axenomimetes) reflexus	Boheman, 1838	LC				SX
Rhyncolus (Rhyncolus) ater ssp. ater •	(Linnaeus, 1758)	LC				SX
Rhyncolus (Rhyncolus) elongatus	(Gyllenhal, 1827)	LC				SX
Rhyncolus (Rhyncolus) punctatulus	Boheman, 1838	LC				SX
Rhyncolus (Rhyncolus) sculpturatus	Waltl, 1839	LC				SX
Rhyncolus (Rhyncolus) strangulatus	Perris, 1852	NT				SX
Scolytus amygdali	Guérin-Méneville, 1847	LC				XY
Scolytus carpini	(Ratzeburg, 1837)	VU	B2ab(iii)			XY
Scolytus ensifer	Eichhoff, 1881	VU	B2ab(iii)			XY
Scolytus intricatus	(Ratzeburg, 1837)	LC				XY
Scolytus kirschii	Skalitzky, 1876	LC				XY
Scolytus koenigi	Schevyrew, 1890	LC				XY
Scolytus laevis	Chapuis, 1869	LC				XY
Scolytus mali	(Bechstein, 1805)	LC				XY
Scolytus multistriatus	(Marsham, 1802)	LC				XY
Scolytus pygmaeus	(Fabricius, 1787)	LC				XY
Scolytus ratzeburgii	Janson, 1856	DD				XY
Scolytus rugulosus	(O.F. Müller, 1818)	LC				XY
Scolytus scolytus	(Fabricius, 1775)	VU	B2ab(iii)			XY
Scolytus sulcifrons	Rey, 1892	LC				XY
Scolytus triarmatus	(Eggers, 1912)	EN	B2ab(iii)			XY
Stenoscelis (Stenoscelis) submuricata	(Schönherr, 1832)	LC				SX
Stereocorynes truncorum	(Germar, 1824)	LC				SX
Styphloderes exsculptus	(Boheman, 1843)	VU	B2ab(iii)			XB
Taphrorychus bicolor	(Herbst, 1794)	LC				XY
Taphrorychus minor	Eggers, 1923	LC				XY
Taphrorychus villifrons	(Dufour, 1843)	LC				XY
Thamnurgus characiae	Rosenhauer, in Eichhoff, 1878	DD				XY
Thamnurgus delphinii	(Rosenhauer, 1856)	LC				XY
Thamnurgus euphorbiae	(Küster, 1845)	LC				XY
Thamnurgus kaltenbachii	Bach, 1849	LC				XY
Thamnurgus sardus	Eggers, 1912	DD				XY
Tomicus destruens	(Wollaston, 1865)	LC				XY
Tomicus minor	(Hartig, 1834)	LC				XY
Tomicus piniperda	(Linnaeus, 1758)	LC				XY
Trachodes heydeni	Stierlin, 1881	DD				SX
Trachodes hispidus	(Linnaeus, 1758)	LC				SX
Treptoplatypus oxyurus	Dufour, 1843	LC				XY
Triotemnus ulianai	Gatti & Pennacchio, 2004	DD			P	UN
Trypodendron domesticum	(Linnaeus, 1758)	LC				MY
Trypodendron lineatum	(A.G.Olivier, 1795)	LC				XY
Trypodendron signatum	(Fabricius, 1792)	LC				XY
Trypophloeus alni	(Lindemann, 1875)	DD				XY
Trypophloeus binodulus	(Ratzeburg, 1837)	LC				XY
Xyleborinus saxesenii	(Ratzeburg, 1837)	LC				MY
Xyleborus cryptographus	(Ratzeburg, 1837)	DD				MY
Xyleborus dryographus	(Ratzeburg, 1837)	LC				MY
Xyleborus eurygraphus	(Ratzeburg, 1837)	LC				MY
Xyleborus monographus	(Fabricius, 1792)	LC				MY
Xyleborus pfeili	(Ratzeburg, 1837)	VU	B2ab(iii)			MY
Xylechinus pilosus	(Ratzeburg,1837)	LC				XY
Xylocleptes bispinus	(Duftschmidt, 1825)	LC				XY
Xylocleptes biuncus	Reitter, 1894	LC				XY
Xylosandrus crassiusculus	Motschulsky, 1866	NA [i]				MY
Xylosandrus germanus	Blandford, 1894	NA [i]				MY
DERMESTIDAE						
Ctesias (Ctesias) serra	(Fabricius, 1792)	LC				SX
Globicornis (Globicornis) bifasciata	(Perris, 1866)	NT				SX
Globicornis (Globicornis) fasciata	(Fairmaire & C. Brisout de Barneville, 1859)	LC				SX
Globicornis (Globicornis) luckowi	Herrmann, Háva & Kadej, 2011	NT				SX
Globicornis (Globicornis) nigripes	(Fabricius, 1792)	LC				SX
Globicornis (Globicornis) picta	(Küster, 1851)	LC				SX
Globicornis (Globicornis) tristis	(Reitter, 1881)	LC				SX
Globicornis (Globicornis) variegata	(Küster, 1851)	LC				SX
Globicornis (Hadrotoma) corticalis	Eichhoff, 1863	NT				SX
Globicornis (Hadrotoma) emarginata	(Gyllenhal, 1808)	LC				SX
Globicornis (Hadrotoma) sulcata	(C. Brisout de Barneville, 1866)	NT				SX
Megatoma (Megatoma) ruficornis	Aubé, 1866	NT				SX
Megatoma (Megatoma) undata ssp. undata •	(Linnaeus, 1758)	LC				SX
Orphilus niger	(P. Rossi, 1792)	LC				SX
Trinodes hirtus	(Fabricius, 1781)	LC				SX
DERODONTIDAE						
Derodontus macularis	(Fuss, 1850)	RE				NI
Derodontus raffrayi	Grouvelle, 1917	VU	B1ab(iii)		P	SP (NI)
Laricobius erichsoni	Rosenhauer, 1846	DD				PR

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DRYOPHTORIDAE						
Dryophthorus corticalis	(Paykull, 1792)	NT				XY
Rhynchophorus ferrugineus	Olivier, 1790	NA [i]				AR
ELATERIDAE						
Ampedus auripes	(Reitter,1895)	EN	B1ab(ii,iii,iv)+2ab(ii,iii,iv)	LC		PR
Ampedus balteatus	(Linnaeus, 1758)	NT		LC		PR
Ampedus brunnicornis	Germar, 1844	EN	B2ab(iii)	VU B2ab(iii)		PR
Ampedus callegarii	Platia & Gudenzi, 2000	CR	B1b(ii)+2b(iii)	DD	P	PR
Ampedus cardinalis	(Schiödte, 1865)	LC		NT		PR
Ampedus cinnaberinus	(Eschscholtz, 1829)	LC		LC		PR
Ampedus coenobita	(Costa, 1882)	NT		NT		PR
Ampedus elegantulus	(Schönherr, 1817)	VU	B2ab(iii)	LC		PR
Ampedus erythrogonus	(O.F.Müller, 1821)	NT		LC		PR
Ampedus forticornis	(Schwarz, 1900)	VU	B1ab(ii,iii)+2ab(ii,iii)			PR
Ampedus glycereus	(Herbst, 1784)	LC				PR
Ampedus magistrettii	Platia & Schimmel, 1988	EN	B2ab(i,ii,iii,iv,v)	DD	P	PR
Ampedus melanurus	Mulsant & Guillebeau, 1855	VU	B2ab(i,ii,iii,iv,v)	DD		PR
Ampedus melonii	Platia, 2011	VU	B2b(iii)		Sa	PR
Ampedus nemoralis	Bouwer, 1980	VU	B2ab(i,ii,iii,iv,v)			PR
Ampedus nigerrimus	(Boisduval & Lacordaire, 1835)	LC		NT		PR
Ampedus nigrinus	(Herbst, 1784)	NT		LC		PR
Ampedus nigroflavus	(Goeze, 1777)	EN	B2ab(i,ii,iii,iv,v)	LC		PR
Ampedus pomonae	(Stephens, 1830)	NT		LC		PR
Ampedus pomorum	(Herbst, 1784)	LC		LC		PR
Ampedus praeustus	(Fabricius, 1792	NT		LC		PR
Ampedus quadrisignatus	(Gyllenhal, 1817)	CR	B2ab(ii,iii)	EN B2ab (i,ii,iii,iv)		PR
Ampedus quercicola	(Buysson, 1887)	LC		LC		PR
Ampedus robustus	Bouwer, 1980	EN	B2ab(ii,iii)			PR
Ampedus rufipennis	(Stephens, 1830)	VU	B2ab(i,ii,iii,iv,v)	LC		PR
Ampedus sanguineus	(Linnaeus, 1758)	LC		LC		PR
Ampedus sanguinolentus	(Schrank, 1776)	LC		LC		PR
Ampedus scrofa	(Germar, 1844)	LC				PR
Ampedus sinuatus	(Germar, 1844)	VU	B2ab(i,ii,iii,iv,v)	LC		PR
Ampedus triangulum	(Dorn, 1925)	EN	B2ab(i,ii,iii,iv,v)	LC		PR
Ampedus tristis	(Linnaeus, 1758)	EN	B2ab(i,ii,iii,iv,v)	LC		PR
Anostirus cerrutii	Binaghi, 1940	NT				PR
Anostirus purpureus	(Poda, 1761)	LC				PR
Brachygonus campadellii	Platia & Gudenzi, 2000	CR	B1ab(iii)+2ab(iii)	DD		PR
Brachygonus megerlei	(Boisduval & Lacordaire, 1835	VU	B1ab(iii)+2ab(iii)	NT		PR
Brachygonus ruficeps	(Mulsant & Guillebeau, 1855)	EN	B1ab(iii)+2ab(iii)	NT		PR
Calambus bipustulatus	(Linnaeus, 1767)	VU	B2ab(i,ii,iii,iv,v)	LC		PR
Cardiophorus albofasciatus	Schwarz, 1893	CR	B2ab(ii,iii)		SI	PR
Cardiophorus anticus	Erichson, 1840	NT				PR
Cardiophorus gramineus	(Scopoli, 1763)	NT		NT		PR
Danosoma fasciatum	(Linnaeus, 1758)	NT		LC		PR
Denticollis linearis	(Linnaeus, 1758)	CR	B2ab(ii,iii)	LC		PR
Denticollis rubens	Piller & Mitterpacher, 1783	NT		LC		PR
Diacanthous undulatus	(DeGeer, 1774)	VU	B1ab(iii)+2ab(iii)	LC		PR
Dima elateroides	Charpentier, 1825	EN	B2ab(ii,iii)			UN
Drapetes mordelloides	(Host, 1879)	LC				UN
Ectamenogonus montandoni	(Buysson, 1888)	EN	B2ab(ii,iii)	NT		PR
Elater ferrugineus	Linnaeus, 1758	VU	B2ab(ii,iii)	NT		PR
Haterumelater fulvago	(Marseul, 1868)	EN	B2ab(ii,iii)	DD		PR
Hypoganus inunctus	(Panzer, 1795)	EN	B2ab(ii,iii)	LC		PR
Ischnodes sanguinicollis	(Panzer, 1793)	VU	B2ab(ii,iii)	VU B2ab(iii,iv)		PR
Isidus moreli	Mulsant & Rey, 1874	VU	B1ab(iii)+2ab(iii)	NT		PR
Lacon lepidopterus	(Panzer, 1801)	EN	B1ab(iii)+2ab(iii)	NT		PR
Lacon punctatus	(Herbst, 1779)	LC		LC		PR
Lacon querceus	(Herbst, 1784)	EN	B1ab(iii)+2ab(iii)	NT		PR
Megapenthes lugens	(Redtenbacher, 1842)	VU	B1ab(iii)+2ab(iii)	NT		PR
Megathous ficuzzensis	(Buysson, 1912)	CR	B1ab(iii)+2ab(iii)		Si	PR
Megathous nigerrimus	(Desbrochers des Loges, 1870)	EN	B2ab(ii,iii)			PR
Megathous valtopinensis	Platia & Gudenzi, 2005	EN	B1ab(iii)+2ab(iii)		P	PR
Melanotus castanipes	(Paykull, 1800)	LC		LC		PR
Melanotus villosus	(Geoffroy, 1785)	LC		LC		PR
Podeonius acuticornis	(Germar, 1824)	VU	B2ab(ii,iii)	EN B2ab(iii)		PR
Procraerus tibialis	(Lacordaire, 1835)	EN	B2ab(ii,iii)	LC		PR
Reitterelater bouyoni	(Chassain, 1992)	CR	B1ab(iii)+2ab(iii)	NT		PR
Reitterelater dubius	Platia & Cate, 1990	CR	B1ab(iii)+2ab(iii)	DD		PR
Selatosomus cruciatus	(Linnaeus, 1758)	VU	B1ab(iii)+2ab(iii)			PR
Stenagostus rhombeus	(A.G. Olivier, 1790)	VU	B1ab(iii)+2ab(iii)	LC		PR
Stenagostus rufus	(De Geer, 1774)	VU	B1ab(iii)+2ab(iii)	LC		PR
Stenagostus sardiniensis	(Reitter, 1914)	EN	B1ab(iii)+2ab(iii)	DD	Sa	PR
ELMIDAE						
Macronychus quadrituberculatus	(O.F. Müller, 1806)	EN	B1ab(iii)+2ab(iii)			WX

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Potamophilus acuminatus	(Fabricius, 1792)	EN	B1ab(iii)+2ab(iii)			WX
ENDECATOMIDAE						
Endecatomus reticulatus	(Herbst, 1793)	NT				XY
ENDOMYCHIDAE						
Aclemmysa solarii	Reitter, 1904	NT			P	SS (SX)
Clemmus troglodytes	Hampe, 1850	CR	B1ab(iii,iv)			SS (SX)
Endomychus coccineus	(Linnaeus, 1758)	LC				SX
Hylaia dalmatina	Kaufmann, 1883	DD				MB
Hylaia rubricollis	(Germar, 1845)	DD				MB
Leiestes seminiger	(Gyllenhal, 1808)	VU	B1ab(iii)			MB
Lycoperdina bovistae	(Fabricius, 1792)	LC				MB
Lycoperdina maritima	Reitter, 1884	VU	B1ab(iii)			MB
Lycoperdina succinta	(Linnaeus, 1767)	NT				MB
Lycoperdina validicornis	Gerstaecker, 1858	VU	B1ab(iii)		P, Sa + [Co]	MB
Mycetaea subterranea	(Fabricius, 1801)	LC				MB
Mycetina cruciata	(Schaller, 1783)	LC				MB
Mychothenus minutus	(Frivaldszky, 1877)	NT				MB
Symbiotes armatus	Reitter, 1881	EN	B1ab(iii)+2ab(iii)			MB
Symbiotes gibberosus	(Lucas, 1846)	LC				MB
Symbiotes latus	Redtenbacher, 1849	LC				MB
EROTYLIDAE						
Aulacochilus violaceus	(Germar, 1824)	VU	B1ab(iii,iv)			MB
Combocerus glaber	(Schaller, 1783)	EN	B1ab(iii)+2ab(iii)			MB
Cryptophilus integer	(Heer 1841)	LC				MY
Dacne bipustulata	(Thunberg, 1781)	LC		LC		MB
Dacne notata	(Gmelin, 1788)	LC		LC		MB
Dacne pontica	Bedel, 1867	NT		LC		MB
Dacne rufifrons	(Fabricius, 1775)	NT		DD		MB
Setariola sericea	(Mulsant & Rey, 1863)	LC				MY
Triplax aenea	(Schaller, 1783)	LC		LC		MB
Triplax andreinii	Pic, 1930	DD		DD	P	MB
Triplax collaris	(Schaller, 1783)	DD		LC		MB
Triplax elongata	Lacordaire, 1842	NT		LC		MB
Triplax lacordairii	Crotch, 1870	NT		EN B2ab(ii,iii)		MB
Triplax lepida	Faldermann, 1835	NT		LC		MB
Triplax marseuli	Bedel, 1864	NT		DD		MB
Triplax melanocephala	(Latreille, 1804)	NT		LC		MB
Triplax rufipes	(Fabricius, 1775)	LC		LC		MB
Triplax russica	(Linnaeus, 1758)	LC		LC		MB
Triplax scutellaris	Charpentier, 1825	EN	B1ab(iii)+2ab(iii)	LC		MB
Triplax tergestana	Reitter, 1881	EN	B1ab(iii)+2ab(iii)	DD		MB
Tritoma bipustulata	Fabricius, 1775	LC		LC		MB
Tritoma subbasalis	(Reitter, 1896)	CR	B1ab(iii)+2ab(iii)	LC		MB
Xenoscelis costipennis	(Fairmaire, 1852)	LC				MY
EUCNEMIDAE						
Anelastes barbarus	Lucas, 1846	DD			[?]	SX
Dromaeolus barnabita	(A. Villa & G.B. Villa, 1837)	VU	B1ab(iii)	LC		SX
Epiphanis cornutus	Eschscholtz, 1829	VU	B1ab(iii)	NT		SX
Eucnemis capucina	Ahrens, 1812	NT		LC		SX
Farsus dubius	(Piller, 1783)	LC		NT		SX
Hylis cariniceps	(Reitter, 1902)	NT		LC		SX
Hylis foveicollis	(Thomson, 1874)	NT		LC		SX
Hylis olexai	(Palm, 1955)	NT		LC		SX
Hylis procerulus	(Mannerheim, 1823)	DD		LC	[?]	SX
Hylis simonae	(Olexa, 1970)	NT		NT		SX
Isorhipis melasoides	(Castelnau, 1835)	LC		LC		SX
Melasis buprestoides	(Linnaeus, 1760)	LC		LC		SX
Microrhagus emyi	Rouget, 1855	VU	B1ab(iii)	LC		SX
Microrhagus hummleri	Reitter, 1911	CR	B1ab(iv)	DD	P	SX
Microrhagus lepidus	Rosenhauer, 1847	NT		LC		SX
Microrhagus pygmaeus	(Fabricius, 1792)	NT		LC		SX
Nematodes filum	(Fabricius, 1801)	VU	B1ab(iii)	DD		SX
Phyllocerus elateroides	Ménétriés, 1832	DD			[?]	SX
Phyllocerus flavipennis	Lepeletier & Serville, 1828	VU	B1ab(iii)			SX
Phyllocerus ullmanni	Kirchsberg, 1897	CR	B1ab(iii,iv)			SX
Rhacopus sahlbergi	(Mannerheim, 1823)	DD		LC	[?]	SX
Xylophilus corticalis	(Paykull, 1800)	NT		LC		SX
Xylophilus testaceus	(Herbst, 1806)	EN	B1ab(iii,iv)	NT		SX
HISTERIDAE						
Abraeus globosus	(Hoffmann, 1803)	LC				PR (MM)
Abraeus granulum	Erichson, 1839	LC				PR
Abraeus parvulus	Aubé, 1842	CR	B2ab(i,ii,iii)			PR (MM)
Abraeus perpusillus	(Marsham, 1802)	LC				PR
Acritus (Pycnacritus) homoeopathicus	Wollaston, 1857	NT				PR
Aeletes atomarius	(Aubé, 1843)	LC				PR (MM)

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Atholus debeauxi	(Moro, 1942)	CR	B2ab(i,ii,iii)		Sa + [Co]	PR
Bacanius (Bacanius) consobrinus	(Aubé, 1850)	CR	B2ab(i,ii)			PR
Bacanius (Neobacanius) solarii	G. Müller, 1925	CR	B2ab(i,ii)		P	PR
Cyclobacanius medvidovici	(Reitter, 1912)	CR	B2ab(i,ii)			PR (MM)
Cyclobacanius soliman	(Marseul, 1862)	EN	B2ab(i,ii)			PR
Dendrophilus (Dendrophilus) punctatus ssp. punctatus •	(Herbst, 1792)	LC				PR
Dendrophilus (Dendrophilus) pygmaeus	(Linnaeus, 1758)	EN	B2ab(i,ii,iii)			PR (NI)
Epierus comptus	(Illiger, 1807)	LC				PR
Epierus italicus	(Paykull, 1811)	LC				PR
Eubrachium pusillum	(Rossi, 1792)	LC				PR
Gnathoncus rotundatus	(Kugelann, 1792)	LC				PR (NI)
Halacritus punctum	(Aubé, 1842)	LC				PR
Hololepta (Hololepta) plana	(Sulzer, 1776)	LC				PR
Margarinotus (Grammostethus) ruficornis	(Grimm, 1852)	VU	B2b(ii,iii)			PR (MM)
Margarinotus (Ptomister) merdarius	(Hoffmann, 1803)	LC				PR (NI)
Margarinotus (Ptomister) striola ssp. succicola •	(Thomson, 1862)	NT				PR
Merohister ariasi	(Marseul, 1864)	EN	B2b(ii,iii)			PR
Paromalus (Paromalus) filum	Reitter, 1884	VU	B2b(ii,iii)			PR
Paromalus (Paromalus) flavicornis	(Herbst, 1792)	LC				PR
Paromalus (Paromalus) parallelepipedus	(Herbst, 1792)	LC				PR
Platylister (Popinus) algiricus	(Lucas, 1849)	EN	B2b(ii,iii)			PR
Platylomalus complanatus	(Panzer, 1796)	LC				PR
Platysoma (Cylister) angustatum	(Hoffmann, 1803)	VU	B2b(ii,iii)			PR
Platysoma (Cylister) elongatum ssp. elongatum •	(Thunberg, 1787)	LC				PR
Platysoma (Cylister) filiforme	Erichson, 1834	NT				PR
Platysoma (Cylister) lineare	Erichson, 1834	VU	B2b(ii,iii)			PR
Platysoma (Platysoma) compressum	(Herbst, 1783)	LC				PR
Plegaderus (Plegaderus) caesus	(Herbst, 1792)	CR	B2ab(i,ii)			PR
Plegaderus (Plegaderus) discisus	Erichson, 1839	VU	B2b(ii,iii)			PR
Plegaderus (Plegaderus) dissectus	Erichson, 1839	LC				PR
Plegaderus (Plegaderus) otti	Marseul, 1856	VU	B2b(ii,iii)			PR
Plegaderus (Plegaderus) sanatus ssp. gobanzi •	G. Müller, 1902	CR	B2ab(i,ii,iv)			PR
Plegaderus (Plegaderus) saucius	Erichson, 1834	VU	B2ab(i,ii)			PR
Plegaderus (Plegaderus) vulneratus	(Panzer, 1797)	VU	B2ab(i,ii)			PR
Pseudepierus italicus	(Paykull, 1811)	LC				PR
Sardulus spelaeus	Patrizi, 1955	CR	B2ab(i,ii,iii)		Sa	PR
Teretrius (Neotepetrius) parasita	Marseul, 1862	VU	B1ab(i,ii,iii)+2ab(i,ii,iii)			PR
Teretrius (Teretrius) fabricii	Mazur, 1972	VU	B2ab(ii,iii)			PR
Teretrius (Teretrius) picipes	(Fabricius, 1792)	LC				PR
LAEMOPHLOEIDAE						
Cryptolestes (Cryptolestes) abietis	(Wankowicz, 1865)	NT				MY (PR)
Cryptolestes (Cryptolestes) capensis	(Waltl, 1832)	NA [i]				MY
Cryptolestes (Cryptolestes) corticinus	(Erichson, 1845)	VU	B1ab(iii,iv)			MY (PR)
Cryptolestes (Cryptolestes) duplicatus	(Waltl, 1839)	NT				MY
Cryptolestes (Cryptolestes) ferrugineus	(Stephens, 1831)	LC				SX
Cryptolestes (Cryptolestes) fractipennis	(Motschulsky, 1845)	LC				MY (PR)
Cryptolestes (Cryptolestes) pusillus	(Schönherr, 1817)	NA [i]				MY
Cryptolestes (Cryptolestes) spartii	(Curtis, 1834)	LC				PR (SX)
Cryptolestes (Cryptolestes) turcicus	(Grouvelle, 1876)	NA [i]				MY
Cryptolestes (Cryptolestes) weisei	(Reitter, 1879)	CR	B1ab(iv)			SX
Cryptolestes (Leptophloeus) alternans	(Erichson, 1845)	NT				PR (MY)
Cryptolestes (Leptophloeus) clematidis	(Erichson, 1845)	LC				PR
Cryptolestes (Leptophloeus) hypobori	(Perris, 1855)	LC				CO
Cryptolestes (Leptophloeus) juniperi	(Grouvelle, 1874)	LC				CO
Cryptolestes (Leptophloeus) perrisi	(Grouvelle, 1876)	NT				PR (MY)
Laemophloeus kraussi	Ganglbauer, 1897	NT				MY
Laemophloeus monilis	(Fabricius, 1787)	LC				MY
Laemophloeus nigricollis	Lucas, 1849	NT				SX
Lathropus sepicola	(P.W.J. Müller, 1821)	NT				PR (SX)
Notolaemus castaneus	(Erichson, 1846)	NT				MY
Notolaemus unifasciatus	(Latreille, 1804)	NT				MY
Placonotus testaceus	(Fabricius, 1787)	LC				SX
LATRIDIIDAE						
Adistemia watsoni	(Wollaston, 1871)	LC				MY
Cartodere constricta	(Gyllenhal, 1827)	LC				MY
Cartodere nodifer	(Westwood, 1839)	LC				MY
Corticaria bella	Redtenbacher, 1849	DD				MY
Corticaria beloni	Reitter, 1889	DD				MY
Corticaria corsica	H. Brisout de Barneville, 1878	DD				MY
Corticaria crenicollis	Mannerheim, 1844	LC				MY
Corticaria cribricollis	Fairmaire, 1863	LC				MY
Corticaria crenulata	(Gyllenhal, 1827)	LC				MY
Corticaria cucujiformis	Reitter, 1880	DD		DD		MY
Corticaria elongata	Vincent, 1990	LC				MY
Corticaria ferruginea	Marsham, 1802	LC				MY

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Corticaria foveola	(Beck, 1817)	LC				MY
Corticaria fulva	(Comolli, 1837)	LC				MY
Corticaria illaesa	Mannerheim, 1844	LC				MY
Corticaria impressa	(A.G. Olivier, 1790)	LC				MY (WX)
Corticaria lapponica	Vincent, 1990	DD				MY
Corticaria lateritia	Mannerheim, 1844	DD				MY
Corticaria linearis	(Paykull, 1798)	DD				MY
Corticaria longicornis	(Herbst, 1793)	LC				MY
Corticaria pineti	Lohse, 1960	LC				MY
Corticaria pubescens	(Gyllenhal, 1827)	LC				MY
Corticaria rubripes	Mannerheim, 1844	LC				MY
Corticaria saginata	Mannerheim, 1844	LC				MY
Corticaria serrata	(Paykull, 1798)	LC				MY
Corticaria umbilicata	(Beck, 1817)	DD				MY
Corticarina fulvipes	(Comolli, 1837)	LC				MY
Corticarina lambiana	(Sharp, 1910)	DD				MY
Corticarina similata	(Gyllenhal, 1827)	LC				MY
Corticarina truncatella	(Mannerheim, 1844)	LC				MY
Cortinicara gibbosa	(Herbst, 1793)	LC				MY
Dienerella angelinii	Rücker, 1998	LC			P	MY
Dienerella anatolica	(Mannerheim, 1844)	LC				MY
Dienerella argus	(Reitter, 1884)	LC				MY
Dienerella beloni	(Reitter, 1882)	DD				MY
Dienerella clathrata	(Mannerheim, 1844)	LC				MY
Dienerella corsica	Vincent, 1990	DD				MY
Dienerella costulata	(Reitter, 1877)	LC				MY
Dienerella elegans	(Aubé, 1850)	LC				MY
Dienerella elongata	(Curtis, 1830)	LC				MY
Dienerella filiformis	(Gyllenhal, 1827)	LC				MY
Dienerella filum	(Aubé, 1850)	DD				MY
Dienerella parilis	(Rey, 1889)	LC				MY
Dienerella pilifera	(Reitter, 1875)	LC				MY
Dienerella polyhymnia	Rücker & Poggi, 2013	LC			P, Si, Sa	MY
Dienerella ruficollis	(Marsham, 1802)	LC				MY
Dienerella separanda	(Reitter, 1887)	LC				MY
Dienerella siciliana	Vincent, 1990	DD			P, Si	MY
Enicmus atriceps	Hansen, 1962	DD				MY
Enicmus brevicornis	(Mannerheim, 1844)	LC				MY
Enicmus fungicola	C.G. Thomson, 1868	LC				MY
Enicmus histrio	Joy & Tomlin, 1910	LC				MY
Enicmus rugosus	(Herbst, 1793)	LC				MY
Enicmus testaceus	(Stephens, 1830)	LC				MY
Enicmus transversus	(A.G. Olivier, 1790)	LC				MY
Latridius amplus	Johnson, 1977	DD				MY
Latridius assimilis	(Mannerheim, 1844)	DD				MY
Latridius brevicollis	(C.G. Thomson, 1868)	DD				MY
Latridius consimilis	Mannerheim, 1844	LC				MY
Latridius hirtus	Gyllenhal, 1827	LC				MY
Latridius minutus	(Linnaeus, 1767)	LC				MY (MM)
Latridius porcatus	(Herbst, 1793)	LC				MY
Melanophthalma distinguenda	(Comolli, 1837)	LC				MY
Melanophthalma fuscipennis	(Mannerheim, 1844)	LC				MY
Melanophthalma maura	Motschulsky, 1866	LC				MY
Melanophthalma rispini	Rucker & Johnson, 2007	LC				MY
Melanophthalma sericea	(Mannerheim, 1844)	LC				MY
Melanophthalma suturalis	(Mannerheim, 1844)	LC				MY
Melanophthalma taurica	(Mannerheim, 1844)	LC				MY
Melanophthalma transversalis	(Gyllenhal, 1827)	LC				MY
Metophthalmus niveicollis	(Jacquelin du Val, 1857-59)	LC				MY
Metophthalmus ragusae	Reitter, 1875	LC				MY
Metophthalmus solarii	Binaghi, 1946	DD			P	MY
Migneauxia crassiuscula	(Aubé, 1850)	LC				MY
Migneauxia phili	Johnson, 2007	LC			[#]	MY
Revelieria genei	(Aubé, 1850)	LC				MY
Stephostethus alternans	(Mannerheim, 1844)	LC				MY
Stephostethus angusticollis	(Gyllenhal, 1827)	LC				MY
Stephostethus caucasicus	(Mannerheim, 1844)	DD			[#]	MY
Stephostethus lardarius	(DeGeer, 1775)	DD				MY
Stephostethus pandellei	(C.Brisout de Barneville, 1863)	LC				MY
Stephostethus productus	(Rosenhauer, 1856)	DD				MY
Stephostethus rugicollis	(A.G. Olivier, 1790)	DD				MY
Thes bergrothi	(Reitter, 1881)	DD				MY
LEIODIDAE						
Agathidium (Agathidium) atrum	(Paykull, 1798)	LC				MY
Agathidium (Agathidium) badium	Erichson, 1845	LC				MY

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Agathidium (Agathidium) bartolii	Poggi, 1981	NT			P	MY
Agathidium (Agathidium) bohemicum ssp. *bohemicum*	Reitter, 1884	NT				MY
Agathidium (Agathidium) bohemicum ssp. *heyrovskyi*	Hlisnikovsky, 1964	DD			P	MY
Agathidium (Agathidium) dentatum	Mulsant & Rey, 1861	LC				MY
Agathidium (Agathidium) italicum	Hlisnikovsky, 1964	LC				MY
Agathidium (Agathidium) laevigatulum	Reitter, 1904	LC			P	MY
Agathidium (Agathidium) laevigatum	Erichson, 1845	LC				MY
Agathidium (Agathidium) minimum	Dodero, 1916	NT			P	MY
Agathidium (Agathidium) obenbergeri	Hlisnikovsky, 1964	LC			P	MY
Agathidium (Agathidium) paganettianum	Hlisnikovsky, 1964	LC			P	MY
Agathidium (Agathidium) pisanum	C. Brisout de Barneville, 1872	LC				MY
Agathidium (Agathidium) seminulum	(Linnaeus, 1758)	LC				MY
Agathidium (Cyphoceble) arcticum	Thomson, 1862	NT				MY
Agathidium (Cyphoceble) discoideum	Erichson, 1845	NT				MY
Agathidium (Cyphoceble) nigrinum	Sturm, 1807	LC				MY
Agathidium (Neoceble) aglyptoides	Reitter, 1884	DD				MY
Agathidium (Neoceble) banaticum	Reitter, 1884	DD				MY
Agathidium (Neoceble) brisouti	Reitter, 1884	DD				MY
Agathidium (Neoceble) confusum	C. Brisout de Barneville, 1863	LC				MY
Agathidium (Neoceble) convexum	Sharp, 1866	DD				MY
Agathidium (Neoceble) haemorrhoum	Erichson, 1845	LC				MY
Agathidium (Neoceble) mandibulare	Sturm, 1807	LC				MY
Agathidium (Neoceble) marginatum	Sturm, 1807	LC				MY
Agathidium (Neoceble) montemurroi	Angelini & De Marzo, 1985	VU	B2ab(i,ii,iii)			MY
Agathidium (Neoceble) nigriceps	C. Brisout de Barneville, 1872	NT				MY
Agathidium (Neoceble) nigripenne	(Fabricius, 1792)	LC				MY
Agathidium (Neoceble) nudum	Hampe, 1870	DD				MY
Agathidium (Neoceble) plagiatum	(Gyllenhal, 1810)	LC				MY
Agathidium (Neoceble) pseudopallidum	Hlisnikovsky, 1964	NT				MY
Agathidium (Neoceble) rotundatum ssp. *paganettii*	Reitter, 1908	LC			P	MY
Agathidium (Neoceble) rotundatum ssp. *rotundatum*	(Gyllenhal, 1827)	LC				MY
Agathidium (Neoceble) varians	Beck, 1817	LC				MY
Amphicyllis globiformis	(C.R. Sahlberg, 1834)	LC				MB
Amphicyllis globus	(Fabricius, 1792)	LC				MB
Anisotoma axillaris	Gyllenhal, 1810	VU	B2ab(i,ii,iii)			MB
Anisotoma castanea	(Herbst, 1792)	LC				MB
Anisotoma glabra	(Fabricius, 1792)	VU	B2ab(i,ii,iii)			MB
Anisotoma humeralis	(Fabricius, 1792)	LC				MB
Anisotoma orbicularis	(Herbst, 1792)	LC				MB
Liodopria serricornis	(Gyllenhal, 1813)	VU	B2ab(i,ii,iii)			MB
LUCANIDAE						
Aesalus scarabaeoides ssp. *meridionalis*	Bartolozzi, 1989	CR	B1ab(ii,iii,iv)+2ab(ii,iii,iv)		P	SX
Aesalus scarabaeoides ssp. *scarabaeoides*	(Panzer, 1794)	EN	B2ab(ii,iii,iv)	NT		SX
Aesalus scarabaeoides ssp. *siculus*	Baviera, 2008	CR	B1ab(ii,iii,iv)+2ab(ii,iii,iv)		Si	SX
Ceruchus chrysomelinus	(Hochenwart, 1785)	EN	B2ab(iii,iv)	NT		SX
Dorcus musimon	Gené, 1836	VU	B1ab(iii)+2ab(iii)	LC		SX
Dorcus parallelipipedus	(Linnaeus, 1758)	LC		LC		SX
Lucanus cervus	(Linnaeus, 1758)	LC		NT		SX
Lucanus tetraodon ssp. *sicilianus*	Planet, 1899	NT			Si [#]	SX
Lucanus tetraodon ssp. *tetraodon*	Thunberg, 1806	LC		LC		SX
Platycerus caprea	(De Geer, 1774)	LC		LC		SX
Platycerus caraboides	(Linnaeus, 1758)	LC		LC		SX
Sinodendron cylindricum	(Linnaeus, 1758)	LC		LC		SX
LYCIDAE						
Dictyoptera aurora	(Herbst, 1784)	LC				MY (PR)
Lopherus rubens	(Gyllenhal, 1817)	NT				MY (PR)
Lygistopterus anorachilus	Ragusa, 1883	NT			P, Si	MY (PR)
Lygistopterus sanguineus	(Linnaeus, 1758)	LC				MY (PR)
Platycis minutus	(Fabricius, 1787)	LC				MY (PR)
Pyropterus nigroruber	(De Geer, 1774)	LC				MY (PR)
LYMEXYLIDAE						
Elateroides dermestoides	(Linnaeus, 1760)	NT				XY (MY)
Lymexylon navale	(Linnaeus, 1758)	NT				XY (MY)
MELANDRYIDAE						
Abdera (Abdera) bifasciata	(Marsham, 1802)	LC				MY
Abdera (Abdera) biflexuosa	(Curtis, 1829)	NT				MY
Abdera (Abdera) quadrifasciata	(Curtis, 1829)	NT				MY
Abdera (Caridua) affinis	(Paykull, 1799)	NT				MY
Abdera (Caridua) flexuosa	(Paykull, 1799)	NT				MY
Anisoxya fuscula	(Illiger, 1798)	NT				MY
Conopalpus brevicollis	Kraatz, 1855	NT				MY
Conopalpus testaceus	(A.G. Olivier, 1790)	NT				MY
Dircaea australis	Fairmaire, 1856	DD				MY
Dircaea quadriguttata	(Paykull, 1798)	NT				MY
Dolotarsus lividus	Sahlberg, 1833	NT				MY

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Hypulus bifasciatus	(Fabricius, 1792)	NT				MY
Hypulus quercinus	(Quensel, 1790)	NT				MY
Marolia variegata	(Bosc d'Antic, 1791)	NT				MY
Melandrya barbata	(Fabricius, 1792)	NT				MY
Melandrya caraboides	(Linnaeus, 1760)	NT				MY
Melandrya dubia	(Schaller, 1783)	NT				MY
Orchesia (Clinocara) blandula	Brancsik, 1874	VU	B1ab(iii)			MY
Orchesia (Clinocara) fasciata	(Illiger, 1798)	VU	B1ab(iii)			MY
Orchesia (Clinocara) grandicollis	Rosenhauer, 1847	VU	B1ab(iii)			MY
Orchesia (Clinocara) maculata	Mulsant & Godart, 1856	VU	B1ab(iii)			MY
Orchesia (Clinocara) minor	Walker, 1837	NT				MY
Orchesia (Clinocara) undulata	Kraatz, 1853	LC				MY
Orchesia (Orchesia) micans	(Panzer, 1794)	LC				MY
Osphya aeneipennis	Kriechbaumer, 1848	NT				MY
Osphya bipunctata	(Fabricius, 1775)	LC				MY
Phloiotrya (Phloiotrya) granicollis	Seidlitz, 1898	CR	B1ab(iii,iv)		Si	MY
Phloiotrya (Phloiotrya) rufipes	(Gyllenhal, 1810)	NT				MY
Phloiotrya (Phloiotrya) tenuis	(Hampe, 1850)	NT				MY
Rushia parreyssi	(Mulsant, 1856)	NT				MY
Serropalpus (Serropalpus) barbatus	(Schaller, 1783)	NT				MY
Wanachia triguttata	(Gyllenhal, 1810)	DD				MY
Xylita laevigata	(Hellenius, 1786)	NT				MY
Zilora obscura	(Fabricius, 1794)	VU	B1ab(iii)			MY
MELYRIDAE						
Aplocnemus (Aplocnemus) acutangulus	Kiesenwetter, 1861	LC				PR
Aplocnemus (Aplocnemus) alpestris	Kiesenwetter, 1861	LC				PR
Aplocnemus (Aplocnemus) angelinii	Liberti, 1995	LC			P	PR
Aplocnemus (Aplocnemus) corcyricus	Miller, 1866	LC				PR
Aplocnemus (Aplocnemus) cribricollis	Mulsant & Rey, 1868	LC				PR
Aplocnemus (Aplocnemus) difficilis	(Holdhaus, 1923)	LC				PR
Aplocnemus (Aplocnemus) etruscus	Liberti & Zinetti, 2009	NT			P	PR
Aplocnemus (Aplocnemus) impressus	(Marsham, 1802)	LC				PR
Aplocnemus (Aplocnemus) integer	Baudi, 1873	LC				PR
Aplocnemus (Aplocnemus) jejunus	(Kiesenwetter, 1863)	LC				PR
Aplocnemus (Aplocnemus) koziorowiczi	Desbrochers, 1871	LC			P + [Co]	PR
Aplocnemus (Aplocnemus) marginatus	(Rottenberg, 1870)	LC				PR
Aplocnemus (Aplocnemus) nigricornis ssp. *garganicus*	Liberti, 1995	NT			P	PR
Aplocnemus (Aplocnemus) nigricornis ssp. *nigricornis*	(Fabricius, 1792)	LC				PR
Aplocnemus (Aplocnemus) panalpinus	Liberti, 1995	LC				PR
Aplocnemus (Aplocnemus) pectinatus	(Küster, 1850)	LC				PR
Aplocnemus (Aplocnemus) quercicola	Mulsant & Rey, 1868	VU	B2ab(iii)			PR
Aplocnemus (Aplocnemus) rufomarginatus	Perris, 1869	LC				PR
Aplocnemus (Aplocnemus) tarsalis	(C.R. Sahlberg, 1822)	LC				PR
Aplocnemus (Aplocnemus) trinacriensis	(Ragusa, 1872)	LC				PR
Aplocnemus (Aplocnemus) virens	(Suffrian, 1843)	LC				PR
Aplocnemus (Diplambe) crenicollis	(Kiesenwetter, 1863)	LC				PR
Aplocnemus (Diplambe) duplicatus	Kiesenwetter, 1871	LC			Sa	PR
Aplocnemus (Diplambe) januaventi	Liberti, 2007	LC			Sa	PR
Attalus (Abrinus) analis	(Panzer, 1798)	LC				PR
Cyrtosus abeillei	Dodero, 1922	LC				PR
Dasytes (Dasytes) doderoi	Pic, 1924	CR	B1ab(ii)		Sa	PR
Dasytes (Dasytes) pauperculus	Castelnau, 1840	LC				PR
Dasytes (Dasytes) thoracicus ssp. *lucanus*	Wittmer, 1935	VU	B1ab(ii); D		P	PR
Dasytes (Dasytes) thoracicus ssp. *thoracicus*	Mulsant & Rey, 1868	LC				PR
Dasytes (Hypodasytes) subalpinus	Baudi, 1873	LC				PR
Dasytes (Mesodasytes) aeneiventris	Küster, 1850	LC				PR
Dasytes (Mesodasytes) aeratus	Stephens, 1830	LC				PR
Dasytes (Mesodasytes) croceipes	Kiesenwetter, 1865	LC				PR
Dasytes (Mesodasytes) iteratus	Peyerimhoff, 1925	LC				PR
Dasytes (Mesodasytes) nigroaeneus	Küster, 1850	LC				PR
Dasytes (Mesodasytes) nigrocyaneus	Mulsant & Rey, 1868	LC				PR
Dasytes (Mesodasytes) plumbeus	O.F. Müller, 1776	LC				PR
Dasytes (Mesodasytes) virens	Marsham, 1802	LC				PR
Dasytes (Metadasytes) caeruleus	De Geer, 1774	LC				PR
Ebaeus (Ebaeus) appendiculatus	Erichson, 1840	LC				PR
Ebaeus (Ebaeus) battonii	Pardo, 1962	LC			P	PR
Ebaeus (Ebaeus) coerulescens	Erichson, 1840	LC				PR
Ebaeus (Ebaeus) collaris ssp. *collaris* •	Erichson, 1840	LC				PR
Ebaeus (Ebaeus) flavicornis	Erichson, 1840	LC				PR
Ebaeus (Ebaeus) gibbus	(Drapiez, 1819)	LC				PR
Ebaeus (Ebaeus) humilis	Erichson, 1840	LC				PR
Ebaeus (Ebaeus) ruffoi	Pardo, 1962	LC			P	PR
Ebaeus (Ebaeus) thoracicus	(Geoffroy, 1785)	LC				PR
Hypebaeus (Hypebaeus) flavicollis	(Erichson, 1840)	LC				PR
Hypebaeus (Hypebaeus) flavipes	(Fabricius, 1787	LC				PR

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Malachius calabrus	Baudi, 1873	LC			P, Si	PR
Malachius italicus	Pardo, 1967	LC			P, Si	PR
Sphinginus coarctatus	Erichson, 1840	LC				PR
Sphinginus constrictus	Erichson, 1840	LC				PR
Sphinginus lobatus ssp. *apicalis*	(Perris, 1864)	LC				PR
Sphinginus lobatus ssp. *lobatus*	(A.G. Olivier, 1790)	LC				PR
Trichoceble floralis	(A.G. Olivier, 1790)	VU	B2ab(iii)			PR
Trichoceble memnonia	Kiesenwetter, 1861	LC				PR
Troglops albicans	(Linnaeus, 1767)	LC				PR
Troglops cephalotes ssp. *cephalotes* •	(A.G. Olivier, 1790)	CR	B2ab(iii,iv)			PR
Troglops italicus	Wittmer, 1984	LC			P, Si	PR
Troglops silo	Erichson, 1840	LC				PR
MONOTOMIDAE						
Monotoma (Gyrocecis) angusticollis	Gyllenhal, 1827	LC				MY
Monotoma (Gyrocecis) conicicollis	Aubé, 1837	DD				MY
Monotoma (Monotoma) bicolor	A. Villa & G.B. Villa, 1835	LC				MY
Monotoma (Monotoma) brevicollis	Aubé, 1837	LC				MY
Monotoma (Monotoma) diecki	Reitter, 1877	LC				MY
Monotoma (Monotoma) gotzi	Holzschuh & Lohse, 1981	DD				MY
Monotoma (Monotoma) longicollis	(Gyllenhal, 1827)	LC				MY
Monotoma (Monotoma) picipes	Herbst, 1793	LC				MY
Monotoma (Monotoma) punctaticollis	Aubé, 1843	LC				MY
Monotoma (Monotoma) quadricollis	Aubé, 1837	DD				MY
Monotoma (Monotoma) quadrifoveolata	Aubé, 1837	LC				MY
Monotoma (Monotoma) spinicollis	Aubé, 1837	LC				MY
Monotoma (Monotoma) testacea	Motschulsky, 1845	DD				MY
Rhizophagus (Cyanostolus) aeneus	(Richter, 1820)	DD				WX (MY)
Rhizophagus (Eurhizophagus) depressus	(Fabricius, 1792)	DD				MY (PR)
Rhizophagus (Eurhizophagus) grandis	Gyllenhal, 1827	DD				MY (PR)
Rhizophagus (Rhizophagus) bipustulatus	(Fabricius, 1792)	LC				MY (PR)
Rhizophagus (Rhizophagus) brancsiki	Reitter, 1905	DD				MY (PR)
Rhizophagus (Rhizophagus) cribratus	Gyllenhal, 1827	DD				MY (PR)
Rhizophagus (Rhizophagus) dispar	(Paykull, 1800)	LC				MY (PR)
Rhizophagus (Rhizophagus) fenestralis	(Linnaeus, 1758)	DD				MY (PR)
Rhizophagus (Rhizophagus) ferrugineus	(Paykull, 1800)	LC				MY (PR)
Rhizophagus (Rhizophagus) nitidulus	(Fabricius, 1798)	NT				MY (PR)
Rhizophagus (Rhizophagus) oblongicollis	Blatch & Horner, 1892	DD				MY (PR)
Rhizophagus (Rhizophagus) parallelocollis	Gyllenhal, 1827	DD				MY (PR)
Rhizophagus (Rhizophagus) perforatus	Erichson, 1845	DD				MY (PR)
Rhizophagus (Rhizophagus) picipes	(A.G. Olivier, 1790)	LC				MY (PR)
Rhizophagus (Rhizophagus) puncticollis	C.R. Sahlberg, 1837	DD				MY (PR)
Rhizophagus (Rhizophagus) unicolor	Lucas, 1846	LC				MY (PR)
MORDELLIDAE						
Mordellistena humeralis	(Linnaeus 1758)	EN	B2ab(iii,iv)			SX
Mordellistena variegata	(Fabricius, 1798)	VU	B2ab(iii,iv)			SX
Mordellochroa abdominalis	(Fabricius, 1775)	LC				SX
Mordellochroa milleri	(Emery, 1876)	CR	B2ab(iii,iv)			SX
Tomoxia bucephala	A. Costa, 1854	LC				SX
MYCETOPHAGIDAE						
Esarcus (Entoxylon) abeillei	(Ancey, 1870)	NT				SS (MY)
Esarcus (Entoxylon) baudii	Seidlitz, 1889	VU	B1ab(iii)			SS (MY)
Esarcus (Esarcus) fiorii	Reitter, 1887	VU	B1ab(iii)		P, Si	SS (MY)
Litargus (Alitargus) balteatus	Le Conte, 1856	NA [i]				MY
Litargus (Alitargus) coloratus	Rosenhauer, 1856	NT				MY
Litargus (Litargus) connexus	(Geoffroy, 1785)	LC		LC		MY
Mycetophagus (Ilendus) multipunctatus	Fabricius, 1792	NT		LC		MY
Mycetophagus (Mycetophagus) quadripustulatus	(Linnaeus, 1760)	LC		LC		MY
Mycetophagus (Mycetoxides) fulvicollis ssp. *fulvicollis* •	Fabricius, 1792	NT		LC		MY
Mycetophagus (Parilendus) quadriguttatus	P.W.J. Müller, 1821	LC		LC		MY
Mycetophagus (Ulolendus) decempunctatus	Fabricius, 1801	NT		LC		MY
Mycetophagus (Philomyces) populi	Fabricius, 1798	NT		LC		MY
Mycetophagus (Ulolendus) atomarius	(Fabricius, 1787)	LC		LC		MY
Mycetophagus (Ulolendus) piceus	(Fabricius, 1777)	NT		LC		MY
Mycetophagus (Ulolendus) salicis	C. Brisout de Barneville, 1862	NT			[!]	MY
Pseudotriphyllus suturalis	(Fabricius, 1801)	NT		NT		MY
Triphyllus bicolor	(Fabricius, 1777)	LC		LC		MY
Typhaea angusta	Rosenhauer, 1856	DD				MY
Typhaea stercorea	(Linnaeus, 1758)	LC				MY
Typhaeola maculata	(Perris, 1865)	LC				MY
NITIDULIDAE						
Amphotis marginata	(Fabricius, 1781)	LC				MM
Amphotis orientalis	Reiche, 1861	NA [i ?]				MM
Carpophilus bipustulatus	(Heer, 1841)	LC				SF
Carpophilus bifenestratus	Murray, 1864	NA [i]				SP (SF)
Carpophilus dimidiatus	(Fabricius, 1792)	NA [i]				SP (SF)

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Carpophilus hemipterus	(Linnaeus, 1758)	NA [i]				SP (SF)
Carpophilus lugubris	Murray, 1864	NA [i]				SP (SF)
Carpophilus marginellus	Motschulsky, 1845	NA [i]				SP (SF)
Carpophilus mutilatus	Erichson, 1843	NA [i]				SP (SF)
Carpophilus nepos	Murray, 1864	NA [i]				SP (SF)
Carpophilus obsoletus	Erichson, 1843	NA [i]				SP (SF)
Carpophilus quadrisignatus	Erichson, 1843	NA [i ?]				SP (SF)
Carpophilus sexpustulatus	(Fabricius, 1791)	NT				MY
Carpophilus truncatus	Murray, 1864	NA [i]				SP (SF)
Carpophilus zeaphilus	Dobson, 1969	NA [i]				SP (SF)
Colopterus abdominalis	(Erichson, 1843)	NA [i]				SP (SF)
Cryptarcha strigata	(Fabricius, 1787)	LC				SF
Cryptarcha undata	(A.G. Olivier, 1790)	NT				SF
Cychramus luteus	(Fabricius, 1787)	LC				MY
Cychramus variegatus	(Herbst, 1792)	NT				MY
Cyllodes ater	(Herbst, 1792)	CR	B2ab(i)			MB
Epuraea (Dadopora) fuscicollis	(Stephens, 1835)	LC				SF
Epuraea (Dadopora) guttata	(A.G. Olivier, 1811)	LC				SF
Epuraea (Epuraea) angustula	Sturm, 1844	VU	B2ab(iii)			MY
Epuraea (Epuraea) argus	Reitter, 1894	DD				MY
Epuraea (Epuraea) biguttata	(Thunberg, 1784)	LC				MY
Epuraea (Epuraea) binotata	Reitter, 1872	VU	B2ab(iii)			MY
Epuraea (Epuraea) boreella	(Zetterstedt, 1828)	LC				MY
Epuraea (Epuraea) deubeli	Reitter, 1898	EN	B1ab(iii)+2ab(iii)			MY
Epuraea (Epuraea) distincta	(Grimmer, 1841)	NT				MY
Epuraea (Epuraea) fageticola	Audisio, 1991	VU	B1ab(iii)+2ab(iii)			MB
Epuraea (Epuraea) laeviuscula	(Gyllenhal, 1827)	EN	B1ab(iii)+2ab(iii)			MY
Epuraea (Epuraea) longiclavis	Sjöberg, 1939	NT				MY
Epuraea (Epuraea) longula	Erichson, 1845	LC				MY
Epuraea (Epuraea) marseuli	Reitter, 1872	LC				MY
Epuraea (Epuraea) muehli	Reitter, 1908	NT				MY
Epuraea (Epuraea) neglecta	(Heer, 1841)	VU	B2ab(iii)			MY
Epuraea (Epuraea) oblonga	(Herbst, 1793)	VU	B2ab(iii)			MY
Epuraea (Epuraea) pallescens	(Stephens, 1835)	LC				MY
Epuraea (Epuraea) placida	Mäklin, 1853	VU	B1ab(iii)+2ab(iii)			MY
Epuraea (Epuraea) pygmaea	(Gyllenhal, 1808)	LC				MY
Epuraea (Epuraea) rufomarginata	(Stephens, 1832)	VU	B2ab(iii)			MY
Epuraea (Epuraea) silacea	(Herbst, 1784)	VU	B2ab(iii)			MY
Epuraea (Epuraea) terminalis	Mannerheim, 1843	LC				MY
Epuraea (Epuraea) thoracica	Tournier, 1872	VU	B2ab(iii)			MY
Epuraea (Epuraea) unicolor	(A.G. Olivier, 1790)	LC				SF
Epuraea (Epuraea) variegata	(Herbst, 1793)	LC				MY
Epuraea (Epuraeanella) limbata	(Fabricius, 1787)	VU	B1ab(iii)+2ab(iii)			MY
Epuraea (Haptoncus) imperialis	(Reitter, 1877)	NA [i]				SF (SP)
Epuraea (Haptoncus) luteola	Erichson, 1845	NA [i]				SF (SP)
Epuraea (Haptoncus) ocularis	Fairmaire, 1849	NA [i]				SF (SP)
Epuraea (Micruria) melanocephala	(Marsham, 1802)	LC				MY
Glischrochilus fasciatus	(A.G. Olivier, 1790)	NA [i]				SP (SF)
Glischrochilus hortensis	(Geoffroy in Fourcroy, 1785)	LC				SF
Glischrochilus quadriguttatus	(Fabricius, 1776)	VU	B2ab(iii)			SF
Glischrochilus quadripunctatus	(Linnaeus, 1758)	NT				MY
Glischrochilus quadrisignatus	(Say, 1835)	NA [i]				SF (SP)
Ipidia binotata	Reitter, 1875	VU	B2ab(iii)			MY
Ipidia sexguttata	(R.F. Sahlberg, 1834)	DD			[?]	MY
Phenolia picta	(MacLeay, 1825)	NA [i]			[!]	SF (SP)
Pityophagus ferrugineus	(Linnaeus, 1761)	LC				PR (MY)
Pityophagus laevior	Abeille, 1872	VU	B2ab(iii)			PR (MY)
Pityophagus quercus	Reitter, 1877	EN	B2ab(iii)c(iii)			PR (MY)
Soronia grisea	(Linnaeus, 1758)	LC				SF
Soronia oblonga	C. Brisout de Barneville, 1863	LC				SF
Soronia punctatissima	(Illiger, 1794)	EN	B2ab(iii)			SF
Stelidota geminata	(Say,1825)	NA [i]				SF (SP)
Urophorus humeralis	(Fabricius, 1798)	NA [i]				SF (SP)
Urophorus rubripennis	(Heer, 1841)	LC				SP (SF)
NOSODENDRIDAE						
Nosodendron fasciculare	(A.G. Olivier, 1790)	LC				SF
OEDEMERIDAE						
Anogcodes ferrugineus	(Schrank, 1776)	DD				SX
Anogcodes fulvicollis	(Scopoli, 1763)	LC				SX
Anogcodes ruficollis	(Fabricius, 1781)	LC				SX
Anogcodes rufiventris	(Schrank, 1776)	LC				SX
Anogcodes seladonius	(Fabricus, 1792)	LC				SX
Anogcodes ustulatus	(Scopoli, 1763)	DD				SX
Calopus serraticornis	(Linnaeus, 1758)	DD				SX
Chrysanthia geniculata	(W. Schmidt, 1846)	LC				SX

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Chrysanthia viridissima	(Linnaeus, 1758)	**LC**				SX
Ischnomera caerulea	(Linnaeus, 1759)	**LC**				SX
Ischnomera cinerascens	(Pandellé in Grenier, 1867)	**LC**				SX
Ischnomera cyanea	Fabricius, 1792)	**LC**				SX
Ischnomera sanguinicollis	(Fabricius, 1787)	**LC**				SX
Ischnomera xanthoderes	(Mulsant, 1858)	**DD**				SX
Nacerdes (Nacerdes) melanura	(Linnaeus, 1758)	**LC**				XB (SX)
Nacerdes (Xanthochroa) carniolica	(Gistl, 1834)	**LC**				SX
Nacerdes (Xanthochroa) gracilis	(W. Schmidt, 1846)	**LC**				SX
Oedemera (Oncomera) femoralis	A.G.Olivier, 1803	**LC**				SX
Sparedrus orsinii	A. Costa, 1852	**LC**			P, Si	SX
Sparedrus testaceus	(Andersch in Hope, 1797)	**LC**				SX
Stenostoma cossyrense	Bologna, 1995	**NT**			Si	UN
Stenostoma rostratum	(Fabricius, 1767)	**NT**				XB
PHLOEOSTICHIDAE						
Phloeostichus denticollis	Redtenbacher, 1842	**LC**				MY
PHLOIOPHILIDAE						
Phloiophilus edvardsii	Stephens, 1830	**DD**				MY
PROSTOMIDAE						
Prostomis mandibularis	(Fabricius, 1801)	**LC**		NT		PR
PTILIIDAE						
Acrotrichis (Acrotrichis) arnoldi	Rosskothen, 1935	**NT**				SP
Acrotrichis (Acrotrichis) atomaria	(De Geer, 1774)	**LC**				SP
Acrotrichis (Acrotrichis) dispar	(Matthews, 1865)	**NT**				SP
Acrotrichis (Acrotrichis) rosskotheni	Sundt, 1971	**LC**				SP
Acrotrichis (Ctenopteryx) montandoni	(Allibert, 1844	**LC**				SP
Actidium aterrimum	(Motschulsky, 1845)	**DD**				SP
Actidium boudieri	(Allibert, 1844)	**DD**				SP
Actidium coarctatum	(Haliday, 1855)	**DD**				SP
Actidium reitteri	Flach, 1887	**DD**				SP
Euryptilium gillmeisteri	Flach, 1889	**LC**				SP
Euryptilium saxonicum	(Gillmeister, 1845)	**NT**				SP
Micridium angulicolle	(Fairmaire, 1857)	**DD**				SP
Nossidium flachi	Ganglbauer, 1899	**DD**				SP
Nossidium pilosellum	(Marsham, 1802)	**LC**				SP
Ptenidium (Gillmeisterium) insulare	Flach, 1889	**DD**				UN (SP)
Ptenidium (Gillmeisterium) nitidum	(Heer, 1841)	**DD**				SP
Ptenidium (Gillmeisterium) reitteri	Flach, 1887	**DD**				SP
Ptenidium (Matthewsium) laevigatum	Erichson, 1845	**DD**				SP
Ptenidium (Matthewsium) ponteleccianum	Strassen, 1955	**NT**			Sa + [Co]	SP
Ptenidium (Matthewsium) turgidum	Thomson, 1855	**DD**				SP
Ptenidium (Ptenidium) formicetorum	(Kraatz, 1851)	**DD**				SP (MM)
Ptenidium (Ptenidium) fuscicorne	Erichson, 1845	**LC**				SP
Ptenidium (Ptenidium) longicorne	Fuss, 1878	**DD**				SP
Ptenidium (Ptenidium) punctatum	(Gyllenhal, 1827)	**DD**				SP
Ptenidium (Ptenidium) pusillum	(Gyllenhal, 1808)	**DD**				SP
Ptenidium (Wankowiczium) brenskei	Flach, 1887	**DD**				SP
Ptenidium (Wankowiczium) intermedium	Wankowicz, 1869	**LC**				SP
Pteryx ganglbaueri	Erichson, 1909	**NT**			P [#]	SP
Pteryx suturalis	(Heer, 1841)	**LC**				SP
Ptiliolum (Euptilium) caledonicum	(Sharp, 1871)	**DD**				SP
Ptiliolum (Euptilium) schwarzi	(Flach, 1887)	**LC**				SP
Ptiliolum (Ptiliolum) africanum	Peyerimhoff, 1917	**DD**				SP
Ptiliolum (Ptiliolum) fuscum	(Erichson, 1845)	**LC**				SP
Ptiliolum (Ptiliolum) hopffgarteni	(Flach, 1888)	**DD**				SP
Ptiliolum (Ptiliolum) marginatum	(Aubé, 1850)	**LC**				SP
Ptiliolum (Ptiliolum) sahlbergi	(Flach, 1888)	**DD**				SP
Ptiliolum (Ptiliolum) spencei	(Allibert, 1844)	**DD**				SP
Ptiliolum (Typhloptilium) oedipus	(Flach, 1886)	**NT**				SP
Ptilium affine	Erichson, 1845	**DD**				SP
Ptilium caesum	Erichson, 1845	**DD**				SP
Ptilium exaratum	(Allibert, 1844)	**DD**				SP
Ptilium latum	(Gillmeister, 1845)	**DD**				SP
Ptilium modestum	Wankowicz, 1869	**DD**				SP
Ptilium tenue	Kraatz, 1858	**DD**				SP
Ptilium vexans	Flach, 1889	**NT**				SP
Ptinella aptera	(Guérin-Méneville, 1839)	**LC**				SX
Ptinella denticollis	(Fairmaire, 1857)	**LC**				SP
Ptinella limbata	(Heer, 1841)	**DD**				SP
PTINIDAE						
Anobium hederae	Ihssen, 1949	**LC**				XY
Anobium inexpectatum	Lohse, 1954	**NT**				XY
Anobium punctatum	(De Geer, 1774)	**LC**				XY
Cacotemnus rufipes	(Fabricius, 1792)	**NT**				XY
Cacotemnus thomsoni	(Kraatz, 1881)	**EN**	B1ac(iii)+2ac(iii)			XY

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Caenocara affine	(Sturm, 1837)	LC				MB
Caenocora bovistae	(J.J. Hoffmann, 1803)	VU	B2ac(iii)			MB
Caenocara subglobosum	(Mulsant & Rey, 1864)	LC				MB
Dorcatoma chrysomelina	Sturm, 1837	LC				MB
Dorcatoma dresdensis	Herbst, 1792	LC				MB
Dorcatoma flavicornis	(Fabricius, 1792)	LC				MB
Dorcatoma punctulata	Mulsant & Rey, 1864	VU	B2ac(iii)			MB
Dorcatoma robusta	Strand, 1938	VU	B2ac(iii)			MB
Dorcatoma setosella ssp. *setosella* •	Mulsant & Rey, 1864	LC				MB
Dorcatoma substriata	Hummel, 1829	LC				MB
Dryophilus anobioides	Chevrolat, 1832	LC				XY
Dryophilus densipilis	Abeille de Perrin, 1872	LC				XY
Dryophilus forticornis	Abeille de Perrin, 1875	VU	B2ac(iii)			XY
Dryophilus longicollis	(Mulsant & Rey, 1853)	LC				XY
Dryophilus luigionii	Pic, 1921	VU	B2ac(iii)			XY
Dryophilus pusillus	(Gyllenhal, 1808)	LC				XY
Dryophilus siculus	Ragusa, 1896	NT				XY
Episernus angulicollis	C.G. Thomson, 1863	VU	B2ac(iii)			XY
Episernus gentilis	(Rosenhauer, 1847)	LC				XY
Episernus granulatus	J. Weise, 1887	VU	B2ac(iii)			XY
Episernus striatellus	(C. Brisout de Barneville, 1863)	VU	B2ac(iii)			XY
Ernobius angelinii	Lohse, 1991	EN	B1ac(iii)+2ac(iii)		P	XY
Ernobius angusticollis	(Ratzenburg, 1837)	VU	B2ac(iii)			XY
Ernobius explanatus	(Mannerheim, 1829)	VU	B2ac(iii)			XY
Ernobius freudei	Lohse, 1970	EN	B1ac(iii)+2ac(iii)			XY
Ernobius fulvus	C. Johnson, 1975	EN	B1ac(iii)+2ac(iii)			XY
Ernobius gigas	(Mulsant & Rey, 1863)	EN	B1ac(iii)+2ac(iii)			XY
Ernobius juniperi	Chobaut, 1899	VU	B2ac(iii)			XY
Ernobius kiesenwetteri	Schilsky, 1898	LC				XY
Ernobius laticollis	Pic, 1927	NT				XY
Ernobius longicornis	(Sturm, 1837)	LC				XY
Ernobius mollis ssp. *mollis* •	(Linnaeus, 1758)	LC				XY
Ernobius mulsanti ssp. *mulsanti* •	Kiesenwetter, 1887	VU	B2ac(iii)			XY
Ernobius nigrinus	(Sturm, 1837)	LC				XY
Ernobius oertzeni	Schilsky, 1900	NT				XY
Ernobius parens	(Mulsant & Rey, 1863)	LC				XY
Ernobius pini ssp. *pini* •	(Sturm, 1837)	LC				XY
Ernobius pruinosus	(Mulsant & Rey, 1863)	EN	B1ac(iii)+2ac(iii)			XY
Ernobius rufus	(Illiger, 1807)	EN	B1ac(iii)+2ac(iii)			XY
Falsogastrallus unistriatus	(Zoufal, 1897)	EN	B1ac(iii)+2ac(iii)			XY
Gastrallus corsicus	Schilsky, 1898	LC				XY
Gastrallus immarginatus	(P.W.J. Müller, 1821)	LC				XY
Gastrallus kocheri	Espanol, 1963	VU	B2ac(iii)			XY
Gastrallus laevigatus	(A.G. Olivier, 1790)	LC				XY
Gastrallus mauritanicus	Español, 1963	VU	B2ac(iii)			XY
Grynobius planus	(Fabricius, 1787)	LC				XY
Hadrobregmus denticollis	(Creutzer, 1796)	LC				XY
Hadrobregmus pertinax	(Linnaeus, 1758)	LC				XY
Hedobia pubescens	(A.G. Olivier, 1790)	LC				XY
Hemicoelus canaliculatus	(C.G. Thomson, 1863)	LC				XY
Hemicoelus costatus	(Aragona, 1830)	LC				XY
Hemicoelus fulvicornis	(Sturm, 1837)	LC				XY
Hemicoelus rufipennis	(Duftschmid, 1825)	LC				XY
Homophthalmus rugicollis	(Mulsant & Rey, 1853)	LC				XY
Hyperisus declive	(Dufour, 1843)	EN	B1ac(iii)+2ac(iii)			XY
Hyperisus plumbeum	(Illiger, 1801)	LC				XY
Mesocoelopus collaris	Mulsant & Rey, 1864	LC				XY
Mesocoelopus niger	P.W.J. Müller, 1821	LC				XY
Mesothes ferrugineus	(Mulsant & Rey, 1861)	LC				XY
Metholcus phoenicius	(Fairmaire, 1859)	LC				XY
Microbregma emarginatum	(Duftschmid, 1825)	LC				XY
Mizodorcatoma dommeri	(Rosenhauer, 1856)	LC				MB
Nicobium castaneum	(A.G. Olivier, 1790)	LC				XY
Ochina (Dulgieris) latreillii	(Bonelli, 1812)	NT				XY (SX)
Ochina (Ochina) ferruginea	Schilsky, 1899	EN	B1ac(iii)+2ac(iii)			XY
Ochina (Ochina) hirsuta	Seidlitz, 1889	LC				XY
Ochina (Ochina) ptinoides	(Marsham, 1802)	LC				XY
Oligomerus brunneus	(A.G. Olivier, 1790)	LC				XY
Oligomerus disruptus	(Baudi di Selve, 1874)	EN	B1ac(iii)+2ac(iii)			XY
Oligomerus ptilinoides	(Wollaston, 1854)	LC				XY
Priartobium leonhardi	Roubal, 1917	EN	B1ac(iii)+2ac(iii)			XY
Priartobium serrifunis	Reitter, 1901	EN	B1ac(iii)+2ac(iii)			XY
Priobium carpini	(Herbst, 1793)	NT				XY
Pseudodryophilus paradoxus	(Rosenhauer, 1856)	EN	B1ac(iii)+2ac(iii)			XY
Pseudoptilinus fissicollis	(Reitter, 1876)	VU	B2ac(iii)			XY

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Ptilinus fuscus	Geoffroy, 1785	LC				XY
Ptilinus pectinicornis	(Linnaeus, 1758)	LC				XY
Ptinomorphus angustatus	(C. Brisout de Barneville, 1862)	VU	B2ac(iii)			XY
Ptinomorphus imperialis	(Linnaeus, 1767)	LC				XY
Ptinomorphus regalis	(Duftschmid, 1825)	LC				XY
Ptinus (Pseudoptinus) lichenum	Marsham 1802	LC				XY (SX)
Stagetus andalusiacus ssp. *cribricollis* •	(Aubé, 1861)	LC				SX (MY ?)
Stagetus byrrhoides	(Mulsant & Rey, 1861)	LC				SX (MY ?)
Stagetus calabriensis	Toskina, 2012	VU			P	SX (MY ?)
Stagetus elongatus	(Mulsant & Rey, 1861)	LC				SX (MY ?)
Stagetus italicus ssp. *italicus*	(Reitter, 1885)	LC				SX (MY ?)
Stagetus italicus ssp. *paganettii*	Toskina, 2012	DD			P	SX (MY ?)
Stagetus pilula	(Aubé, 1861)	LC				SX (MY ?)
Stagetus sardous	(Reitter, 1915)	EN	B1ac(iii)+2ac(iii)		Sa	XY
Xestobium rufovillosum	(De Geer, 1774)	LC				XY
Xestobium subincanum	(Reitter, 1878)	EN	B1ac(iii)+2ac(iii)			XY
Xyletinus (Pseudocalypterus) pectiniferus	Fairmaire, 1879	NT				XY
Xyletinus (Xyletinus) ater	(Creutzer, 1796)	LC				XY
Xyletinus (Xyletinus) balcanicus	Gottwald, 1977	VU	B2ac(iii)			XY
Xyletinus (Xyletinus) fibyensis	O. Lundblad, 1949	VU	B2ac(iii)			XY
Xyletinus (Xyletinus) laticollis	(Duftschmid, 1825)	LC				XY
Xyletinus (Xyletinus) longitarsis ssp. *longitarsis* •	Jansson, 1942	VU	B2ac(iii)			XY
Xyletinus (Xyletinus) pectinatus ssp. *pectinatus* •	(Fabricius, 1792)	LC				XY
Xyletinus (Xyletinus) ruficollis	Gebler, 1833	VU	B2ac(iii)			XY
Xyletinus (Xyletinus) vaederoeensis	Lundblad, 1969	VU	B2ac(iii)			XY
PYROCHROIDAE						
Agnathus decoratus	(Germar, 1818)	EN	B2ab(iii)			WX
Pyrochroa coccinea	(Linnaeus, 1761)	LC				SX
Pyrochroa serraticornis ssp. *kiesenwetteri*	Fairmaire, 1849	NT				SX
Pyrochroa serraticornis ssp. *serraticornis*	(Scopoli, 1763)	LC				SX
Schizotus pectinicornis	(Linnaeus, 1758)	LC				SX
PYTHIDAE						
Pytho depressus	(Linnaeus, 1767)	DD		LC		MY
RIPIPHORIDAE						
Pelecotoma fennica	(Paykull, 1799)	DD			[?]	PA
RHYSODIDAE						
Clinidium canaliculatum	O.G. Costa, 1839	VU	B2ab(iii)	DD		MY
Omoglymmius germari	(Ganglbauer, 1892)	VU	B2ab(iii)	DD		MY
Rhysodes sulcatus	(Fabricius, 1787)	EN	B2ab(iii)	DD		MY
SALPINGIDAE						
Aglenus brunneus	(Gyllenhal, 1813)	LC				SX
Colposis mutilatus	(Beck, 1817)	NT				SX
Lissodema cursor	(Gyllenhal, 1813)	NT				SX
Lissodema denticolle	(Gyllenhal, 1813)	LC				SX
Lissodema lituratum	A. Costa, 1847	LC				SX
Rabdocerus foveolatus	(Ljungh, 1823)	LC				SX
Rabdocerus gabrieli	(Gerhardt, 1901)	NT				SX
Salpingus aeneus	(A.G. Olivier, 1807)	LC				SX
Salpingus planirostris	(Fabricius, 1787)	LC				SX
Salpingus ruficollis	(Linnaeus, 1760)	NT				SX
Salpingus tapirus	(Abeille de Perrin, 1874)	NT				SX
Sphaeriestes (Sphaeriestes) aeratus	(Mulsant, 1859)	NT				SX
Sphaeriestes (Sphaeriestes) bimaculatus	Gyllenhal, 1810	VU	B2ab(iii,iv)			SX
Sphaeriestes (Sphaeriestes) castaneus	(Panzer, 1796)	NT				SX
Sphaeriestes (Sphaeriestes) reyi	(Abeille de Perrin, 1874)	NT				SX
Sphaeriestes (Sphaeriestes) stockmanni	Biström, 1977	NT				SX
Vincenzellus ruficollis	(Panzer, 1794)	LC				MY
SCARABAEIDAE						
Aethiessa squamosa	Gory & Percheron, 1833	NT			P, Si	SX (SP)
Anomala devota	(Rossi, 1790)	NT				XB
Calicnemis latreillii	(Castelnau, 1832)	VU	B1ab(iii)+2ab(iii)			XB
Calicnemis obesa sardiniensis •	Leo, 1985	EN	B1ab(iii)+2ab(iii)			XB
Cetonia aurata ssp. *aurata*	(Linnaeus 1761)	LC				SX (SP)
Cetonia aurata ssp. *sicula*	Aliquò, 1983	NT			Si	SX (SP)
Cetonia carthami ssp. *carthami* •	Gory & Percheron, 1833	VU	B1ab(i,ii,iii)+2ab(i,ii,iii)		Sa + [Co]	SX (SP)
Gnorimus decempunctatus	Helfer, 1833	EN	B1ab(i,ii,iii)+2ab(i,ii,iii)	VU B1ab(iii) +2ab(iii)	Si	SX
Gnorimus nobilis	(Linnaeus, 1758)	NT		LC		SX
Gnorimus variabilis	(Linnaeus, 1758)	VU	B1ab(iii)	NT		SX
Oryctes nasicornis	(Linnaeus, 1758)	LC				SX
*Osmoderma cristinae**	Sparacio, 1994	EN	B1ab(i,ii,iii)+2ab(i,ii,iii)	EN B1ab(iii) +2ab(iii)	Si	SX
*Osmoderma eremita**	(Scopoli, 1763)	VU	B2ab(i,ii,iii,iv,v)			SX
*Osmoderma italicum**	Sparacio, 2001	EN	B2ab(i,ii,iii)	EN B2ab(iii)	P	SX
Protaetia affinis	(Andersch, 1797)	LC		DD		SX
Protaetia angustata	(Germar, 1817)	DD		LC		SX
Protaetia cuprea ssp. *cuprea*	(Fabricius 1775)	LC				SX

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Protaetia cuprea ssp. *hypocrita*	Ragusa, 1905	LC			Si + [Ma]	SX
Protaetia fieberi	(Kraatz, 1880)	VU	B1ab(iii)+2ab(iii)	NT		SX
Protaetia lugubris	(Herbst, 1786)	VU	B2ab(i,ii,iii); D	LC		SX
Protaetia mirifica	(Mulsant, 1842)	CR	B2ab(i,ii,iii);	VU B2ab(ii,iii,iv)		SX
Protaetia oblonga	(Gory & Percheron, 1833)	NT				SX (SP)
Protaetia opaca	(Fabricius, 1787)	LC		LC		SX (MM)
Protaetia sardea	(Gory & Percheron, 1833)	VU	B1ab(iii)+2ab(iii)	DD	Sa + [Co]	SX
Protaetia speciosissima	(Scopoli, 1786)	LC		NT		SX
Protaetia squamosa	(Lefebvre, 1827)	VU	B1ab(iii)+2ab(iii)		P, Si	SX
Trichius fasciatus	(Linnaeus, 1758)	LC		LC		SX
Trichius gallicus ssp. *gallicus*	Dejean, 1821	LC				SX
Trichius gallicus ssp. *zonatus*	Germar, 1831	CR	B1ab(iii)+2ab(iii)	LC		SX
Trichius sexualis	Bedel, 1906	VU	B1ab(iii)+2ab(iii)	LC		SX
Valgus hemipterus	(Linnaeus, 1758)	LC		LC		SX
SCIRTIDAE						
Prionocyphon serricornis	(P.W.J. Muller, 1821)	NT				HW
SCRAPTIIDAE						
Anaspis costai	Emery, 1876	VU	B2ab(iii)			SX
Anaspis flava	(Linnaeus, 1758)	LC				SX
Anaspis frontalis	(Linnaeus, 1758)	LC				SX
Anaspis lurida	Stephens, 1832	LC				SX
Anaspis pulicaria	A. Costa, 1854	LC				SX
Anaspis ruficollis	(Fabricius, 1792)	EN	B2ab(iii)			SX
Anaspis rufilabris	Gyllenhal, 1827	EN	B2ab(iii)			SX
Scraptia ophthalmica	Mulsant, 1856	VU	B2ab(iii)			SX
SILVANIDAE						
Ahasverus advena	(Waltl, 1832)	NA [i]				MY (SF)
Airaphilus nasutus	Chevrolat, 1860	NT			[#]	SX
Airaphilus talpa	(Kraatz, 1862)	LC			[#]	SX
Dendrophagus crenatus	(Paykull, 1799)	VU	B1ab(iii)			MY
Oryzaephilus mercator	(Fauvel, 1889)	NA [i]				SP
Oryzaephilus surinamensis	(Linnaeus, 1758)	NA [i]				SP
Silvanoprus fagi	(Guérin-Méneville, 1844)	NT				SX (SF)
Silvanus bidentatus	(Fabricius, 1792)	LC				MY (SF)
Silvanus recticollis	Reitter, 1876	NA [i]				SP
Silvanus unidentatus	(Fabricius, 1792)	LC				MY (SF)
Telephanus velox	(Haldeman, 1851)	NA [i]				SP
Uleiota planatus	(Linnaeus, 1760)	LC				MY
SPHINDIDAE						
Aspidiphorus lareyiniei	Jacquelin Du Val, 1859	NT				MY
Aspidiphorus orbiculatus	(Gyllenhal, 1808)	LC				MY
Odontosphindus grandis	(Hampe, 1861)	VU	B1ab(iii)			MY
Sphindus dubius	Megerle in Dejean, 1821	NT				MY
STAPHYLINIDAE						
Acrulia inflata	(Gyllenhal, 1813)	NT				PR
Amauronyx maerkelii	(Aubé, 1844)	NT				PR
Anomognathus cuspidatus	(Erichson, 1839)	LC				UN
Anomognathus tricuspis	(Eppelsheim, 1884)	DD				UN
Atheta liturata	(Stephens, 1832)	LC				UN
Atheta pallidicornis	(Thomson, 1856)	LC				UN
Atheta picipes	(Thomson, 1856)	LC				UN
Atrecus affinis	(Paykull, 1789)	LC				PR
Atrecus ardeanus	Ciceroni, 1990	EN	B1ab(iii)+2ab(iii)		P	PR
Atrecus longiceps	(Fauvel, 1873)	LC				PR
Atrecus pilicornis	(Paykull, 1790)	VU	B2ab(iii)			PR
Baeocera nobilis	Reitter, 1884	VU	B2ab(iii)			MY
Baeocera schirmeri	Reitter, 1880	VU	B2ab(iii)			MY
Batrisodes adnexus	(Hampe, 1863)	LC				PR, MM
Batrisodes buqueti	(Aubé, 1833)	NT				PR, MM
Batrisodes delaporti	(Aubé, 1833)	NT				PR, MM
Batrisodes hubenthali	Reitter, 1913	VU	B2ab(iii)			PR, MM
Batrisodes oculatus	(Aubé, 1833)	LC				PR, MM
Batrisodes venustus	(Reichenbach, 1816)	LC				PR, MM
Batrisus formicarius	Aubé, 1833	VU	B2ab(iii)			PR, MM
Bibloporus bicolor ssp. *bicolor*	(Denny, 1825)	VU	B2ab(iii)			PR
Bibloporus bicolor ssp. *devillei*	Jeannel, 1950	NT				PR
Bibloporus mayeti	Guillebeau, 1888	NT				PR
Bibloporus minutus	Raffray, 1914	NT				PR
Bibloporus ultimus	Guillebeau, 1892	NT				PR
Bolitochara humeralis	Lucas, 1846	NT				UN
Bolitochara lucida	(Gravenhorst, 1802)	CR	B2ab(iii)			UN
Bolitochara mulsanti	Sharp, 1875	LC				UN
Bolitochara obliqua	Erichson, 1837	LC				UN
Bolitochara tecta	Assing, 2014	LC				UN
Bolitochara varia	Erichson, 1839	NT				UN

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Bryaxis curtisii ssp. *curtisii*	(Leach, 1817)	LC				PR
Bryaxis curtisii ssp. *orientalis*	(Karaman, 1952)	VU	B2ab(iii)			PR
Bryaxis puncticollis	(Denny, 1825)	LC				PR
Bythinus burrelli	Denny, 1825	LC				PR
Caryoscapha limbata	Erichson, 1845	VU	B2ab(iii)			MY
Cyphaea curtula	(Erichson, 1837)	EN	B2ab(iii)			UN
Dadobia immersa	(Erichson, 1837)	LC				UN
Dasycerus sulcatus	Brongniart, 1800	LC				MY
Dexiogyia corticina	(Erichson, 1837)	LC				UN
Dialycera distincticornis	(Baudi di Selve, 1870)	LC				PR
Dinaraea aequata	(Erichson, 1837)	LC				UN
Dinaraea angustula	(Gyllenhal, 1810)	LC				UN
Dinaraea arcana	(Erichson, 1839)	LC				UN
Dinaraea linearis	(Gravenhorst, 1802)	NT				UN
Dropephylla ammanni	(Bernhauer, 1940)	NT				PR
Dropephylla brevicornis	(Erichson, 1840)	NT				PR
Dropephylla devillei	(Bernhauer, 1902)	NT				PR
Dropephylla gracilicornis	(Fairmaire & Laboulbène, 1856)	VU	B2ab(iii)			PR
Dropephylla ioptera	(Stephens, 1834)	LC				PR
Dropephylla koltzei	Jászay & Hlaváč, 2006	DD				PR
Dropephylla linearis	(Zetterstedt, 1828)	VU	B2ab(iii)			PR
Dropephylla perforata	(Fiori, 1900)	VU	B2ab(iii)			PR
Dropephylla vilis	(Erichson, 1840)	NT				PR
Euplectus bonvouloiri ssp. *felschei*	Reitter, 1887	NT			Sa	PR
Euplectus bonvouloiri ssp. *narentinus*	Reitter, 1881	LC				PR
Euplectus bonvouloiri ssp. *rosae*	Raffray, 1910	LC				PR
Euplectus bonvouloiri ssp. *siculus*	Raffray, 1910	NT			Si	PR
Euplectus brunneus	Grimmer, 1841	NT				PR
Euplectus corsicus	Guillebeau, 1888	LC				PR
Euplectus decipiens	Raffray, 1910	VU	B2ab(iii)			PR
Euplectus doderoi	Reitter, 1884	VU	B2ab(iii)			PR
Euplectus duponti	Aubé, 1833	CR	B2ab(iii)			PR
Euplectus frater	Besuchet, 1964	EN	B2ab(iii)			PR
Euplectus infirmus	Raffray, 1910	EN	B2ab(iii)			PR
Euplectus karstenii	(Reichenbach, 1816)	LC				PR
Euplectus kirbii ssp. *hummleri*	Reitter, 1906	LC				PR
Euplectus kirbii ssp. *kirbii*	Denny, 1825	VU	B2ab(iii)			PR
Euplectus linderi	Reitter, 1884	NT				PR
Euplectus mutator	Fauvel, 1895	NT				PR
Euplectus nanus	(Reichenbach, 1816)	VU	B2ab(iii)			PR
Euplectus piceus ssp. *lucanus*	Meggiolaro, 1966	CR	B1ab(iii)+2ab(iii)		P	PR
Euplectus piceus ssp. *piceus*	Motschulsky, 1835	NT				PR
Euplectus punctatus	Mulsant & Rey, 1861	NT				PR
Euplectus sparsus	Besuchet, 1964	NT				PR
Euplectus theryi	Guillebeau, 1893	NT				PR
Euplectus tholini	Guillebeau, 1888	VU	B2ab(iii)			PR
Euplectus validus	Besuchet, 1958	VU	B2ab(iii)			PR
Euplectus verticalis	Reitter, 1884	NT				PR
Euryusa castanoptera	Kraatz, 1856	NT				UN
Euryusa optabilis	Heer, 1839	LC				UN
Euryusa pipitzi	(Eppelsheim, 1887)	CR	B2ab(iii)			UN
Euryusa sinuata	Erichson, 1837	NT				UN
Gabrius splendidulus	(Gravenhorst, 1802)	LC				PR
Hapalaraea pygmaea	(Paykull, 1800)	VU	B2ab(iii)			PR
Hesperus rufipennis	(Gravenhorst, 1802)	NT				PR
Homalota plana	(Gyllenhal, 1810)	LC				UN
Hypnogyra angularis	(Ganglbauer, 1895)	LC				PR
Ischnoglossa elegantula	(Mannerheim, 1830)	NT				UN
Ischnoglossa prolixa	(Gravenhorst, 1802)	NT				UN
Leptoplectus spinolae	(Aubé, 1844)	VU	B2ab(iii)			PR
Leptusa fuliginosa	(Aubé, 1850)	VU	B2ab(iii)			UN
Leptusa fumida	(Erichson, 1839)	LC				UN
Leptusa major ssp. *major* •	Bernhauer, 1900	VU	B2ab(iii)			UN
Leptusa pulchella	Mannerheim, 1830	LC				UN
Leptusa ruficollis	(Erichson, 1839)	LC				UN
Medon rufiventris	(Nordmann, 1837)	NT				PR
Meliceria sulciventris	(Guillebeau, 1888)	VU	B2ab(iii)			PR
Nacaeus impressicollis	Motschulsky, 1837	NA [i] ?				PR
Nudobius collaris	(Erichson, 1839)	NT				PR
Nudobius lentus	(Gravenhorst, 1806)	LC				PR
Paranopleta inhabilis	(Kraatz, 1856)	DD				UN
Phloeocharis subtilissima	Mannerheim, 1830	LC				UN
Phloeonomus minimus	(Erichson, 1839)	VU	B2ab(iii)			SX
Phloeonomus punctipennis	Thomson, 1867	LC				SX
Phloeonomus pusillus	(Gravenhorst, 1806)	LC				SX

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Phloeopora concolor	(Kraatz, 1856)	DD				UN
Phloeopora corticalis	(Gravenhorst, 1802)	LC				UN
Phloeopora scribae	(Eppelsheim, 1884)	LC				UN
Phloeopora teres	(Gravenhorst, 1802)	LC				UN
Phloeopora testacea	(Mannerheim, 1830)	LC				UN
Phloeostiba lapponica	(Zetterstedt, 1838)	NT				SX
Phloeostiba plana	(Paykull, 1792)	LC				SX
Phyllodrepa melanocephala ssp. *melanocephala*	(Fabricius, 1787)	VU	B2ab(iii)			PR
Phyllodrepa melanocephala ssp. *pollinensis*	Scheerpeltz, 1956	VU	B1ab(iii)+2ab(iii)		P	PR
Phyllodrepa nigra	(Gravenhorst, 1806)	VU	B2ab(iii)			PR
Phyllodrepa salicis	(Gyllenhal, 1810)	VU	B2ab(iii)			PR
Phyllodrepoidea crenata	(Ganglbauer, 1895)	NT				PR
Placusa adscita	Erichson, 1839	NT				PR
Placusa atrata	(Mannerheim, 1830)	LC				PR
Placusa complanata	Erichson, 1839	LC				PR
Placusa depressa	Mäklin, 1845	LC				PR
Placusa pumilio	Gravenhorst, 1802	LC				PR
Placusa tachyporoides	(Waltl, 1838)	LC				PR
Plectophloeus binaghii	Besuchet, 1964	NT				PR
Plectophloeus erichsoni ssp. *occidentalis* •	Besuchet, 1969	VU	B2ab(iii)			PR
Plectophloeus fischeri	(Aubé, 1833)	LC				PR
Plectophloeus nitidus	Fairmaire, 1857	LC				PR
Plectophloeus nubigena ssp. *bosnicus*	Besuchet, 1964	VU	B2ab(iii)			PR
Plectophloeus nubigena ssp. *nubigena*	Reitter, 1876	VU	B2ab(iii)			PR
Quedius abietum	Kiesenwetter, 1858	VU	B2ab(iii)			PR
Quedius aetolicus	Kraatz, 1858	VU	B2ab(iii)			PR
Quedius andreinii	Gridelli, 1924	VU	B1ab(iii)+2ab(iii)		P, Si	PR
Quedius brevicornis	(Thomson, 1860)	EN	B2ab(iii)			PR
Quedius cruentus	(A.G. Olivier, 1795)	LC				PR
Quedius maurus	(C. R. Sahlberg, 1830)	LC				PR
Quedius microps	Gravenhorst, 1847	VU	B2ab(iii)			PR
Quedius plagiatus	Mannerheim, 1843	LC				PR
Quedius scitus	(Gravenhorst, 1806)	NT				PR
Quedius truncicola	Fairmaire & Laboulbène, 1856	VU	B2ab(iii)			PR
Quedius xanthopus	Erichson, 1839	LC				PR
Rugilus mixtus	(Lohse, 1956)	CR	B2ab(iii)			PR
Scaphidium quadrimaculatum	A.G. Olivier, 1790	NT				MY
Scaphisoma agaricinum	(Linnaeus, 1758)	LC				MY
Scaphisoma assimile	Erichson, 1845	LC				MY
Scaphisoma balcanicum	Tamanini, 1954	LC				MY
Scaphisoma boreale	Lundblad, 1952	NT				MY
Scaphisoma flavonotatum	Pic, 1905	VU				MY
Scaphisoma inopinatum	Löbl, 1967	NT				MY
Scaphisoma italicum	Tamanini, 1955	LC				MY
Scaphisoma loebli	Tamanini, 1969	NT				MY
Scaphisoma obenbergeri	Löbl, 1963	NT				MY
Scaphisoma palumboi	(Ragusa, 1892)	NT				MY
Scaphisoma subalpinum	Reitter, 1881	LC				MY
Scaphium immaculatum	(A.G. Olivier 1790)	NT				MY
Scotoplectus capellae	Reitter, 1879	EN	B2ab(iii)			PR
Scydmaenus (Cholerus) hellwigi	(Herbst, 1792)	LC				PR
Scydmaenus (Cholerus) perrisi	Reitter, 1881	VU	B2ab(iii)			PR
Scydmaenus (Cholerus) rufus	P.W.J. Müller & Kunze, 1822	VU	B2ab(iii)			PR
Sepedophilus aestivus	(Rey, 1882)	NT				MY
Sepedophilus binotatus	(Gravenhorst, 1802)	NT				MY
Sepedophilus bipunctatus	(Gravenhorst, 1802)	NT				MY
Sepedophilus bipustulatus	(Gravenhorst, 1802)	NT				MY
Sepedophilus constans	(Fowler, 1888)	NT				MY
Sepedophilus immaculatus	(Stephens, 1832)	LC				MY
Sepedophilus lusitanicus	Hammond, 1973	NT				MY
Sepedophilus marshami	(Stephens, 1832)	LC				MY
Sepedophilus testaceus	(Fabricius, 1793)	LC				MY
Siagonium humerale	Germar, 1836	NT				UN
Siagonium quadricorne	Kirby & Spence, 1815	NT				UN
Silusa rubiginosa	Erichson, 1837	VU	B2ab(iii)			UN
Silusa rubra	Erichson, 1839	VU	B2ab(iii)			UN
Thamiaraea cinnamomea	(Gravenhorst, 1802)	LC				UN
Thamiaraea hospita	(Märkel, 1845)	LC				UN
Thoracophorus corticinus	Motschulsky, 1837	EN	B2ab(iii)			UN
Trichonyx sulcicollis	(Reichenbach, 1816)	NT				PR
Trigonurus mellyi	Mulsant, 1847	EN	B2ab(iii)			UN
Trimium aemonae	Reitter, 1881	LC				PR
Trimium amplipenne	Reitter, 1908	NT			Sa	PR
Trimium besucheti	Sabella, 1989	VU	B2ab(iii)		P, Si	PR
Trimium brevicorne	(Reichenbach, 1816)	LC				PR

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Trimium diecki	Reitter, 1881	CR	B2ab(iii)		P? + [Co]	PR
Trimium minimum	Dodero, 1900	NT				PR
Trimium paganettii	Reitter, 1906	VU	B2ab(iii)		P, Si	PR
Trimium zoufali	Krauss, 1900	LC			P, Si	PR
Tyrus mucronatus ssp. mucronatus •	(Panzer, 1805)	NT				PR
Xylostiba bosnica	(Bernhauer, 1902)	VU	B2ab(iii)			SX
Xylostiba monilicornis	(Gyllenhal, 1810)	NT				SX
Zeteotomus brevicornis	(Erichson, 1839)	EN	B2ab(iii)			PR
TENEBRIONIDAE						
Accanthopus velikensis	(Piller & Mitterpacher, 1783)	LC				SX
Allardius oculatus	Baudi, 1876	VU	B2ab(i,ii,iii,iv)		Si	SX
Allardius sardiniensis	Allard, 1877	NT			Sa	SX
Allecula aterrima	Rosenhauer, 1847	VU	B1ab(iii)			SX
Allecula morio	(Fabricius, 1787)	LC				SX
Allecula rhenana	Bach, 1856	VU	B1ab(iii)			SX
Allecula suberina	Novak, 2012	EN	B2ab(iii)		P	SX
Bolitophagus interruptus	Illiger, 1800	EN	B2ab(ii,iii)c(iv)			MB
Bolitophagus reticulatus	(Linnaeus, 1767)	VU	B2ab(i,ii,iii,iv)			MB
Corticeus bicolor	(A.G. Olivier, 1790)	LC				CO (MY, PR)
Corticeus bicoloroides	Roubal, 1933	CR	B1ab(iii)			SX
Corticeus fasciatus	(Fabricius, 1790)	LC				CO (MY, PR)
Corticeus linearis	(Fabricius, 1790	LC				CO (MY, PR)
Corticeus pini	(Panzer, 1799)	LC				CO (MY, PR)
Corticeus suberis	Lucas, 1846	DD				CO (MY, PR)
Corticeus unicolor	(Piller & Mitterpacher,1783)	LC				CO (MY, PR)
Corticeus versipellis	Baudi, 1876	DD				SX
Cteniopus neapolitanus	Baudi, 1877	NT			P	SP (SX)
Cteniopus sulphureus	(Linnaeus, 1758)	LC				SP (SX)
Cteniopus sulphuripes	(Germar, 1824)	NT				SP (SX)
Diaclina fagi	(Panzer, 1799)	DD				MY
Diaclina testudinea	(Piller & Mitterpacher, 1783)	EN	B2ab(ii,iii)c(iii)			UN
Diaperis boleti	(Linnaeus, 1758)	LC				MB
Eledona agricola	(Herbst, 1783)	NT				MB
Eledonoprius armatus	(Panzer, 1799)	CR	B2ab(iii)			SX
Eledonoprius serrifrons	Reitter, 1890	CR	B2ab(iii)			SX
Gerandryus aetnensis	(Rottenberg, 1871)	EN	B1ab(iii,iv)+2ab(iii,iv)			SX
Helops coeruleus	(Linnaeus, 1758)	LC				SX
Helops rossii	Germar, 1817	LC				SX
Hymenalia rufipes	(Fabricius, 1792)	LC				SX
Hymenophorus doublieri	Mulsant, 1851	NT				SX
Iphthiminus italicus	Truqui, 1857	VU	B2ab(i,ii,iii,iv)			SX
Italohelops subchalybaeus	Reitter, 1907	NT			P, Si	SX
Lyphia tetraphylla	Fairmaire,1856	VU	B2ab(ii)c(iv)			CO (MY)
Menephilus cylindricus	(Herbst, 1784)	NT				SX
Mycetochara (Ernocharis) flavipennis	Reitter, 1908	EN	B2ab(iii,iv)		P	SX
Mycetochara (Ernocharis) humeralis	(Fabricius, 1787)	NT				SX
Mycetochara (Ernocharis) linearis	(Illiger, 1794)	LC				SX
Mycetochara (Ernocharis) pygmaea	(Redtenbacher, 1874)	NT				SX
Mycetochara (Ernocharis) quadrimaculata	(Latreille, 1804)	LC				SX
Mycetochara (Ernocharis) straussii	Seidlitz ,1896	CR	B1ab(iii,iv)		[!]	SX
Mycetochara (Ernocharis) thoracica	(Gredler, 1854)	NT				SX
Mycetochara (Mycethochara) axillaris ssp. axillaris •	(Paykull, 1799)	NT				SX
Mycetochara (Mycethochara) flavipes	(Fabricius, 1792)	NT				SX
Nalassus alpigradus	Fairmaire, 1882	DD				SX
Nalassus dermestoides	(Illiger, 1798)	LC				SX
Nalassus dryadophilus	Mulsant, 1854	LC				SX
Nalassus genei	Gené, 1839	LC				SX
Nalassus pastai	Aliquò, Leo & Lo Cascio, 2006	CR	B1ac(iv)+2ac(iv)			SX
Nalassus picinus	Küster, 1850	NT				SX
Nalassus planipennis	Küster, 1850	LC			P	SX
Nalassus plebejus	Küster, 1850	CR	B1ab(i,ii,ii)+2ab(i,ii,iii)			SX
Neatus noctivagus	Mulsant & Rey, 1853	VU	B2ab(ii,iii,iv)		P, Si	SX
Neatus picipes	(Herbst, 1797)	VU	B2ab(ii,iii)			SX
Neomida haemorrhoidalis	(Fabricius, 1787)	EN	B2ab(ii,iii,iv)			MB
Odocnemis clypeatus	Küster, 1851	NT				SX
Odocnemis exaratus	(Germar, 1817)	LC				SX
Odocnemis ruffoi	(Canzoneri, 1970)	CR	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)		P, Si	SX
Palorus depressus	(Fabricius, 1790)	LC				SX
Pentaphyllus chrysomeloides	(Rossi, 1792)	EN	B2ab(ii,iii)c(iv)			MB
Pentaphyllus testaceus	(Hellwig, 1792)	EN	B2ab(ii,iii)c(iv)			MB
Platydema europaea	Laporte de Castelnau & Brullé, 1831	CR	B2ab(iii,iv)c(iii,iv)			SX
Platydema violacea	(Fabricius, 1791)	NT				SX (MY)
Prionychus ater	(Fabricius, 1775)	NT				SX
Prionychus fairmairii	(Reiche, 1860)	NT				SX
Prionychus lugens	(Küster, 1850)	VU	B1ab(iii,iv)			SX

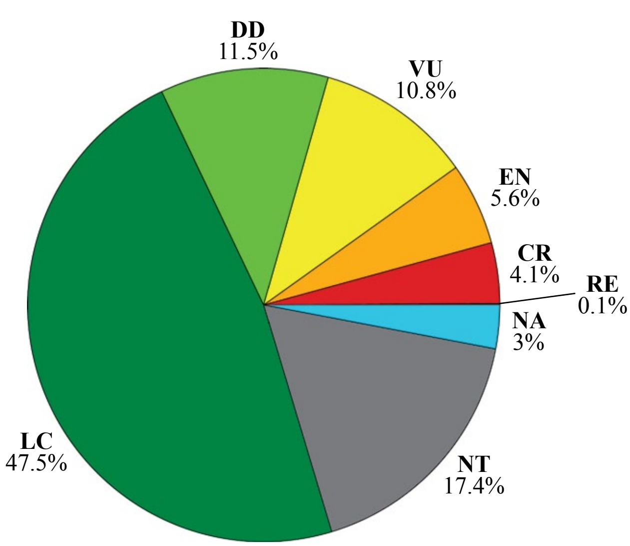
Genus (Subgenus) **and specific epithet**	**Author(s)**	**IUCN Category** (Italy)	**Criteria**	**IUCN Category** (Europe)	**Endemic/ Subendemic to Italy**	**Trophic Category** (TC II)
Prionychus melanarius	(Germar, 1813)	NT				SX
Probaticus anthrax	(Seidlitz, 1898)	DD			P, Si	SX
Probaticus ebeninus	(A. Villa & G.B. Villa, 1838)	LC				SX
Probaticus gibbithorax	(Gemminger, 1870)	DD			Sa	SX
Probaticus sphaericollis	(Küster, 1850)	DD			P, Si	SX
Probaticus tomentosus	Reitter, 1906	NT			Si	SX
Pseudocistela ceramboides ssp. *ceramboides* •	(Linnaeus, 1760)	NT				SX
Raiboscelis azureus	(Brullé, 1832)	DD				SX
Scaphidema metallica	(Fabricius, 1792)	LC				MY
Stenohelops carlofortinus	Leo, 1980	DD			Sa	SX
Stenomax aeneus	(Scopoli, 1763)	LC				SX
Stenomax foudrasi	Mulsant, 1854	DD				SX
Stenomax piceus	(Sturm, 1826)	NT				SX
Tenebrio obscurus	Fabricius, 1792	LC				SX
Tenebrio opacus	Duftschmid, 1812	CR	B2ab(iii)			SX
Tenebrio punctipennis	Seidlitz, 1896	DD				SX
Uloma culinaris	(Linnaeus, 1758)	LC				SX
Uloma rufa	(Piller & Mitterpacher 1783)	EN	B2ab(i,ii,iv)			SX
TETRATOMIDAE						
Eustrophus dermestoides	(Fabricius, 1792)	NT				MY
Hallomenus (Hallomenus) axillaris	(Illiger, 1807)	NT				MB
Hallomenus (Hallomenus) binotatus	(Quensel, 1790)	NT				MB
Mycetoma suturale	(Panzer, 1797)	DD			[?]	MB
Tetratoma ancora	Fabricius, 1790	NT				MB
Tetratoma desmarestii	Latreille, 1807	EN	B2ab(iii,iv)			MB
Tetratoma fungorum	Fabricius, 1790	LC				MB
Tetratoma tedaldi	Reitter, 1887	VU	B1ab(iii)		P, Si	MB
THROSCIDAE						
Aulonothroscus brevicollis	(Bonvouloir, 1859)	LC				SX
Trixagus algiricus	(Bonvouloir, 1861)	DD				SX
Trixagus angelinii	Leseigneur, 2005	LC				SX
Trixagus asiaticus	(Bonvouloir, 1859)	DD				SX
Trixagus atticus	Reitter, 1921	DD				SX
Trixagus carinifrons	(Bonvouloir, 1859)	DD				SX
Trixagus dermestoides	(Linnaeus, 1766)	LC				SX
Trixagus duvalii	(Bonvouloir, 1859)	DD				SX
Trixagus elateroides ssp. *elateroides* •	(Heer, 1841)	LC				SX
Trixagus gracilis	Wollaston, 1854	LC				SX
Trixagus leseigneuri	Muona, 2002	DD				SX
Trixagus minutus	Rey, 1891	DD				SX
Trixagus myebohmi	Leseigneur, 2005	NT				SX
Trixagus obtusus	(Curtis, 1827)	LC				SX
Trixagus rougeti	(Fauvel, 1885)	DD				SF
TROGIDAE						
Trox perrisi	Fairmaire, 1868	DD				NI
TROGOSSITIDAE						
Calitys scabra	(Thunberg, 1784)	VU	B1ab(iii,iv)	LC		PR
Grynocharis oblonga	(Linnaeus, 1758)	NT		LC		PR
Nemozoma elongatum	(Linnaeus, 1760)	LC		LC		PR
Ostoma ferrugineum	(Linnaeus, 1758)	NT		LC		PR
Peltis grossa	(Linnaeus, 1758)	VU	B1ab(iii,iv)	LC		PR
Temnoscheila caerulea	(A.G. Olivier, 1790)	LC		LC		PR
Tenebroides fuscus	(Goeze, 1777)	DD		DD	[?]	PR (CO)
Tenebroides maroccanus	Reitter, 1884	NA [i ?]			[?]	PR (CO)
Tenebroides mauritanicus	(Linnaeus, 1758)	NA [i ?]				PR (CO)
Thymalus limbatus	(Fabricius, 1787)	LC		LC		PR
ZOPHERIDAE						
Aulonium ruficorne	(A.G. Olivier, 1790)	LC				SX
Aulonium trisulcum	Fourcoy, 1785	NT				SX
Bitoma crenata	(Fabricius, 1775)	LC				SX
Colobicus hirtus	(Rossi, 1790)	NT				SX
Colydium elongatum	Fabricius, 1787	LC				PR
Colydium filiforme	Fabricius, 1792	NT				PR
Corticus celtis	(Germar, 1824)	LC				SX
Coxelus pictus	(Sturm, 1807)	LC				SX
Diodesma denticincta	Abeille de Perrin, 1899	NT				SX
Diodesma subterranea	Latreille, 1829	LC				SX
Endophloeus marcovichianus	(Piller & Mitterpacher, 1783)	NT				SX
Langelandia anophtalma	Aubé, 1843	LC				SS
Langelandia antennaria	Binaghi, 1937	CR	B1ab(iv)		Sa	SS
Langelandia ausonica	Obenberger, 1914	CR	B1ab(iv)		P	SS
Langelandia exigua	Perris, 1869	CR	B1ab(iv)			SS
Langelandia hummleri	Obenberger, 1918	CR	B1ab(iv)		P	SS
Langelandia leonhardi	Reitter, 1912	EN	B1ab(iv)		Si, Sa	SS
Langelandia montalbica	Fancello & Magrini, 2013	CR	B1ab(iv)		Sa	SS

Genus (Subgenus) **and specific epithet**	**Author(s)**	**IUCN Category** (Italy)	**Criteria**	**IUCN Category** (Europe)	**Endemic/ Subendemic to Italy**	**Trophic Category** (TC II)
Langelandia nitidicollis	Reitter, 1910	CR	B1ab(iv)		Sa	SS
Langelandia reitteri	Belon, 1882	NT				SS
Langelandia vienensis	Reitter, 1912	DD				SS
Nosodomodes tuberculatus	Germar, 1831	DD			[?]	SX
Orthocerus clavicornis	(Linnaeus, 1758)	LC				SX
Orthocerus crassicornis	(Erichson, 1845)	NT				SX
Pycnomerus inexpectus	(Jacquelin du Val, 1859)	NA [i]				SX
Pycnomerus italicus	(Ganglbauer 1899)	EN	B1ab(iii,iv)		P	SX
Pycnomerus terebrans	(A.G. Olivier, 1790)	NT				SX
Rhopalocerus rondanii	(A. Villa & G.B. Villa, 1833)	NT				SX (MM)
Synchita fallax	Schuh, 1998	NT				SX
Synchita humeralis	(Fabricius, 1792)	LC				SX
Synchita mediolanensis	A. Villa & G.B. Villa, 1836	LC				SX
Synchita separanda	Reitter, 1882	NT				SX
Synchita undata	Guérin-Méneville, 1844	NT				SX
Synchita variegata	Hellwig, 1792	LC				SX
Tarphius gibbulus	Erichson, 1845	NT			P, Si	SX
Xylolaemus fasciculosus	(Gyllenhal, 1827)	CR	B2ab(iii)			SX

3.2 Extinction Risk

Of the 2049 species of saproxylic beetles listed (97% of them evaluated, i.e. excluding all Not Applicable taxa) in this work (the count excludes the subspecies of taxa being represented in Italy by more than a single subspecies; including all subspecies the known taxa are 2097) (Table 3), only a few have not been found in recent years in Italy, and it is possible that in the future they will be effectively extinct in the country. A borderline situation was also observed for few species that, for the moment, we prudentially classified as CR, because of the lack of extensive surveys in the single or very few sites where they have been found in Italy. The regional or total extinction of an insect species is always very difficult to support by documentary evidence (Trizzino et al. 2013). The fact that some saproxylic beetles, although very striking and recognizable, are not found in nature for many decades (as exemplified by the emblematic case of the conspicuous *Cucujus cinnaberinus* in Italy), is not an evidence of extinction. In this case, experience showed that changes in climate or vegetation may bring the populations of a believed 'extinct' species to recover from the crash and to reach a density level similar to or higher than before it alleged disappearance (Horak et al. 2008; Mazzei et al. 2011).

On the whole, the endangered species of saproxylic beetles are 421 (Fig. 6), i.e. 21% of the species assessed. Whereas for ca. 12% of the species the available data are not sufficient to assess the risk of extinction, and assuming that 30% of these is still threatened, an estimated total of about 25% of saproxylic beetles is threatened in Italy. Nevertheless, some 48% of Italian saproxylic beetles are unlikely to undergo an imminent risk of extinction. Species in common between the European Red List (Nieto & Alexander 2010) and the Italian Red List are 253; as discussed below, just over 6% of these are threatened at Euro-



RE	2
CR	85
EN	115
VU	221
DD	236
LC	973
NT	356
NA - [i], [i ?], [i]?	61
Total	**2049**

Fig. 6 – Percentages of the IUCN categories of risk among the 2049 listed Italian saproxylic beetle species.

pean level (Nieto & Alexander 2010) (Fig. 7), while over 34% are threatened at Italian level (Fig. 8).

3.3 Habitat

The Italian saproxylic beetles, excluding some generalist species, show a clear environmental sensitivity, and their presence is strongly influenced by the available large patches of old growth forests. However, many studies revealed that also small forest fragments, tree rows or even single old trees (sometimes also in urban or suburban habitats) can support relict populations of rare saproxylic beetles (Oleksa et al. 2007; Carpaneto et al. 2010; Audisio et al. 2008, 2011; Redolfi et al. 2014a). The habitat types preferred by saproxylic beetles are hardwood forests, followed by coniferous forests, and several threatened species are often associated with large hollow deciduous trees or to the fruiting bodies of large arboreal fungi. The lowland forest areas are the habitats where there is a high concentration of threatened species (many of them are endangered). Few but important species are associated with wooden fragments deposited by the sea along beaches and sand dunes, with 0.8% of XB species (Fig. 9), often characterized by relict and fragmented geographic ranges. Even the few species closely associated with tree trunks immersed in the waters of lentic rivers, ponds and lagoons, with 0.2% of WX species (Fig. 9), are particularly at risk because of the combined effect of reduced wood supply in these natural habitats and the frequent pollution or drying up of water bodies.

3.4 Demographic trends

Although the saproxylic beetle communities are overall declining, due to the general degradation and destruction of suitable habitats, we lack quantitative data even for the best known and most studied species (Trizzino et al. 2013). Only in the last decade we started to use capture-mark methods to gather data on population abundance of some protected species in some Italian localities, and these data will represent a starting point for future research on demographic changes. For instance, the population density of *Osmoderma eremita* was estimated in southern Latium, in central Italy (Chiari et al. 2013a), while abundance and survival probability of *Lucanus cervus* was calculated in a chestnut woodland of northern Italy (Chiari et al. 2014a). Nevertheless, demographic data cannot be generalized at geographical or ecological level, because the quantitative parameters of beetle populations can vary enormously from a locality to another. A study conducted in Italy on *O. eremita* and its predator *Elater ferrugineus* revealed a demographic disproportion in the abundance of the two species which have always been considered an exclusive predator–prey system. In fact, in northern and western Europe, both species are abundant and coexist in many forest stands, being reported to inhabit the same tree hollows, with the former usually more abundant than the last one. By contrast, in Mediterranean areas *E. ferrugineus* seems to be more abundant than *O. eremita* and may occur also when the latter is scarce or absent. This suggests that *E. ferrugineus* may have a greater number of potential prey

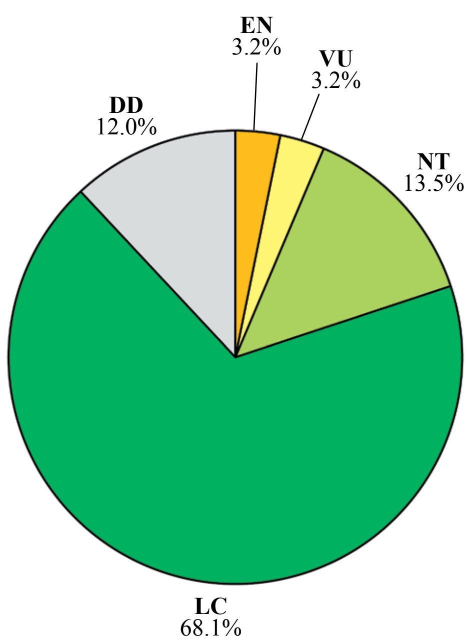


Fig. 7 – Percentages of the species assigned to each IUCN Category of Risk in the Nieto & Alexander's (2010) European Red List of Saproxylic Beetles, calculated among the 253 species shared with the present Italian Red List of Saproxylic beetles.

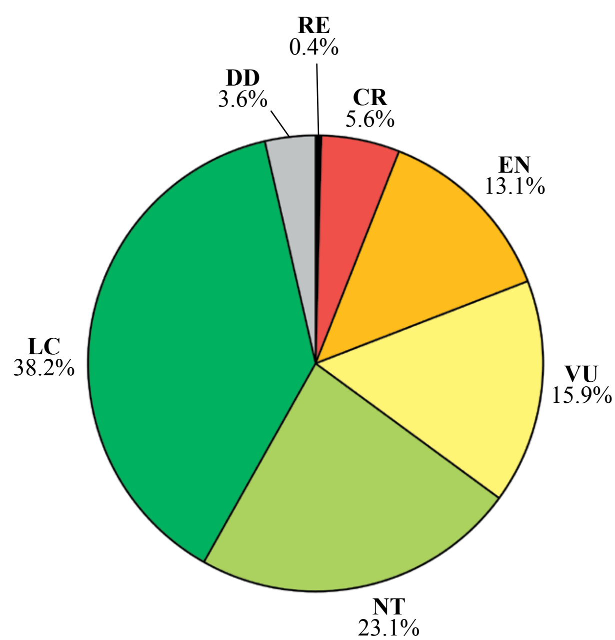
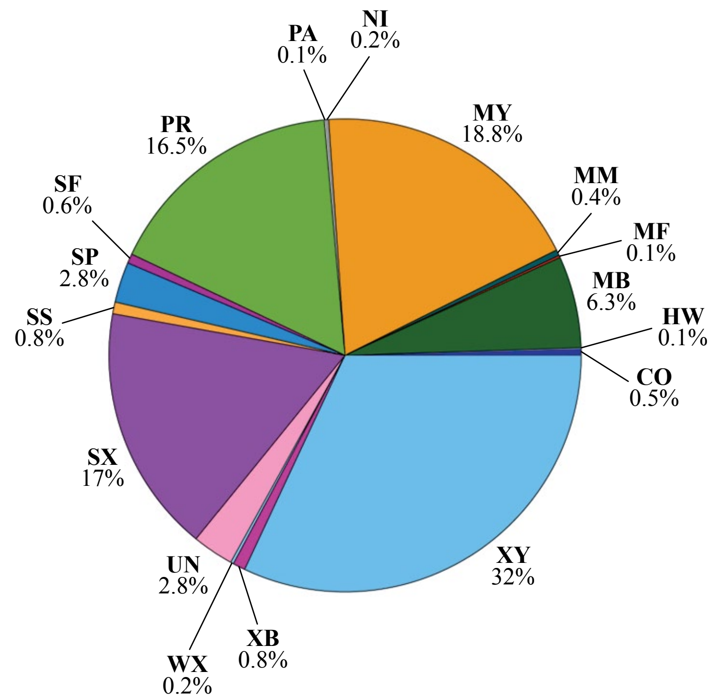


Fig. 8 – Percentages of the species assigned to each IUCN Category of Risk in the present Italian Red List of Saproxylic beetles, calculated among the 253 species shared with the Nieto & Alexander's (2010) European Red List of Saproxylic Beetles.



Trophic Category	N species
CO	9
HW	1
MB	125
MF	3
MM	8
MY	373
NI	5
PA	1
PR	329
SF	13
SP	55
SS	16
SX	337
UN	56
WX	4
XB	17
XY	636
Total	**1988**

Fig. 9 – Percentages of the 1988 Italian assessed saproxylic beetles (excluding NA, i.e. all the 61 introduced species) included in each of the 18 Trophic Categories listed in Table 3 (the AR Trophic Category, only including two alien species occasionally present in natural habitats, is not listed here).

species throughout its distributional range, and feeding on large size larvae of beetles that live inside tree hollows such as many species of saproxylic scarab and darkling beetles (Zauli et al. 2014).

3.5 Threats

The main threats to Italian saproxylic beetles are represented by the loss, fragmentation or structural simplification of the suitable habitats. The largest species (e.g. Lucaninae, Cerambycinae, Lamiinae, Cetoniinae) (Figs 2, 10-12) are also threatened by the increasing predation rate by invasive birds, such as crows (Corvidae) and starlings (Sturnidae), whose demographic trend is rising, chiefly in anthropogenic environments (Luniak 2004). Light pollution has also a negative effect on many species of saproxylic beetles. Only very few species could be affected by direct withdrawal from beetle collectors and mainly from insect dealers. As a matter of facts, these activities cannot be represent a real threat, but can at least produce a local impoverishment of some populations of certain species which have a restricted Extent of Occurrence, and are either rare or easy to collect. Considering (Table 3, Fig. 6) all the Least Concern species (LC: 47.7%) plus the 70% of the Data Deficient species (DD: 11.5%, assuming, as before motivated, that only 30% of these may be somehow threatened), almost 60% of the Italian saproxylic beetles does not seem undergo this threat (Fig. 6). Among the threats to consider, there is also the potential competition exerted by many species introduced from other countries, which could have a direct or indirect negative impact on the populations of native saproxylic beetles (Mooney & Cleland 2000; Skarpaas & Okland 2009; Roques 2010; Jucker & Lupi 2011).

Some saproxylic beetles are persecuted by humans because they are considered harmful to forest health. Among them, paradoxically, there is also *Cerambyx cerdo*, a priority species listed in Annex II and IV of the Habitats Directive, that is considered a plague for oak forests in several areas of the Italian peninsula. In truth, in areas where there is a scarcity of both predators and parasites of *C. cerdo*, this species may become very abundant and cause a slow and gradual reduction of the tree canopy, followed by poor fruiting. In addition, the species is considered harmful because of its xylophagous larva (Fig. 13), which lasts throughout the year and digs tunnels into the wood. The current restoration techniques include the use of insecticides in the galleries of the attacked tree trunks, which are then sealed with mastic (see web sites of companies specialized in biological pest control). Heavily attacked trees (Fig. 14) are cut and burnt, in order to avoid reinfestation. Such use of pesticides and the felling of trees have a negative impact on many other animals, from insects to birds and fungi, including even endangered species. For example, the cutting of trees whose branches are infested by *C. cerdo* may lead to the extinction of a local population of *Osmoderma eremita* that finds shelter in the cavities of their trunks, and may deprive many birds and mammals of

Table 4 – List of specialists who compiled or contributed to compile the Italian Redlist of saproxylic Beetles, for each included family; they all share the authorship of each family. Among specialists were first included taxonomic specialists, as well as other entomologists which strongly contributed with data on conservation, monitoring, molecular taxonomy and eco-ethology of several important species, chiefly those included in the EU Habitats Directive.

Suborder	Family	Species	Endemic [subendemic]	Introduced	Specialist(s)
Archostemata	CROWSONIELLIDAE	1	1	0	P. Audisio, C. Baviera
Adephaga	RHYSODIDAE	3	0	0	A. Vigna Taglianti, P. Brandmayr, A. Mazzei, T. Bonacci
Polyphaga	ADERIDAE	5	0	0	G. Nardi
	ALEXIIDAE	16	8	0	A.B. Biscaccianti, P. Audisio, F. Angelini
	ANTHRIBIDAE	26	0	0	E. Colonnelli
	BIPHYLLIDAE	3	0	0	A.B. Biscaccianti, P. Audisio, C. Baviera
	BOSTRICHIDAE	29	0	5	G. Nardi, C. Baviera, P. Audisio
	BOTHRIDERIDAE	6	0	0	P. Audisio, A.B. Biscaccianti, C. Baviera
	BRENTIDAE	1	0	0	L. Bartolozzi, C. Baviera
	BUPRESTIDAE	139	5	0	G. Curletti, M. Gigli, A. Liberto, C. Baviera, I. Sparacio
	BYRRHIDAE	3	0	0	R. Fabbri, A.B. Biscaccianti
	CERAMBYCIDAE	230	11	8	P. Rapuzzi, A.B. Biscaccianti, C. Baviera, P. Roversi, S. Hardersen, G. Antonini, E. Solano, E. Mancini, G.Nigro, F. Mosconi, G. Sabbatini Peverieri
	CEROPHYTIDAE	1	0	0	P. Audisio, C. Baviera
	CERYLONIDAE	9	0	1	P. Audisio, A.B. Biscaccianti
	CIIDAE	48	0	1	P. Audisio, A.B. Biscaccianti, C. Baviera
	CLAMBIDAE	15	0	0	P. Audisio, C. Baviera
	CLERIDAE	24	1 [1]	2	P. Audisio, I. Zappi, A. Liberto
	CORYLOPHIDAE	12	0	0	A.B. Biscaccianti, P. Audisio
	CRYPTOPHAGIDAE	56	1	1	J.C. Otero, F. Angelini, P. Audisio, C. Baviera
	CUCUJIDAE	6	1	0	P. Audisio, C. Baviera, A. Mazzei, P. Brandmayr, T. Bonacci, A.B. Biscaccianti
	CURCULIONIDAE	249	19	8	E. Colonnelli, E. Gatti
	DERMESTIDAE	15	0	0	P. Audisio, C. Baviera
	DERODONTIDAE	3	1	0	P. Audisio, C. Baviera, A.B. Biscaccianti
	DRYOPHTORIDAE	2	0	1	E. Colonnelli, C. Baviera
	ELATERIDAE	69	6	0	G. Platia, A. Liberto, A. Mazzei
	ELMIDAE	2	0	0	P. Audisio, M. Trizzino, S. Sabatelli
	ENDECATOMIDAE	1	0	0	P. Audisio, C. Baviera
	ENDOMYCHIDAE	16	[1]	0	P. Audisio, A.B. Biscaccianti, C. Baviera, A. De Biase
	EROTYLIDAE	23	1	0	A.B. Biscaccianti, P. Audisio, C. Baviera
	EUCNEMIDAE	23	1	0	A. Liberto, A.B. Biscaccianti, P. Audisio, C. Baviera
	HISTERIDAE	45	2 [1]	0	P. Vienna, C. Baviera
	LAEMOPHLOEIDAE	22	0	3	A.B. Biscaccianti, P. Audisio, C. Baviera
	LATRIDIIDAE	84	3	0	J.C. Otero, P. Audisio, F. Angelini
	LEIODIDAE	40	5	0	F. Angelini
	LUCANIDAE	9	0	0	G.M. Carpaneto, L. Bartolozzi, C. Baviera, P. Audisio, E. Piattella, A. Campanaro, M. Bardiani, M. Tini, F. Romiti, G. Antonini, E. Solano, S. Cortellessa
	LYCIDAE	6	1	0	P. Audisio, C. Baviera, A.B. Biscaccianti
	LYMEXYLIDAE	2	0	0	A.B. Biscaccianti, P. Audisio, C. Baviera
	MELANDRYIDAE	34	1	0	A. Liberto, A.B. Biscaccianti, P. Audisio
	MELYRIDAE	60	10 [1]	0	G. Liberti
	MONOTOMIDAE	29	0	0	P. Audisio, C. Baviera
	MORDELLIDAE	5	0	0	E. Ruzzier

continued

Suborder	Family	Species	Endemic [subendemic]	Introduced	Specialist(s)
	MYCETOPHAGIDAE	20	1	1	A.B. Biscaccianti, P. Audisio, C. Baviera
	NITIDULIDAE	69	0	21	P. Audisio
	NOSODENDRIDAE	1	0	0	A.B. Biscaccianti, P. Audisio, C. Baviera
	OEDEMERIDAE	22	2	0	M.A. Bologna
	PHLOEOSTICHIDAE	1	0	0	P. Audisio, C. Baviera
	PHLOIOPHILIDAE	1	0	0	P. Audisio, C. Baviera
	PROSTOMIDAE	1	0	0	P. Audisio, C. Baviera
	PTILIIDAE	48	1 [1]	0	A.B. Biscaccianti, P. Audisio
	PTINIDAE	104	3	0	G. Nardi
	PYROCHROIDAE	4	0	0	M.A. Bologna, G. Nardi, P. Audisio, C. Baviera
	PYTHIDAE	1	0	0	P. Audisio, C. Baviera
	RIPIPHORIDAE	1	0	0	F. Turco, M.A. Bologna, P. Audisio
	SALPINGIDAE	17	0	0	A.B. Biscaccianti, P. Audisio, C. Baviera
	SCARABAEIDAE	28	5 [1]	0	G.M. Carpaneto, P. Audisio, C. Baviera, I. Sparacio, S. Chiari, E. Maurizi, A. Zauli, A. Campanaro, S. Sabatelli, F. Mosconi
	SCIRTIDAE	1	0	0	A.B. Biscaccianti, P. Audisio, C. Baviera
	SCRAPTIIDAE	8	0	0	E. Ruzzier
	SILVANIDAE	12	0	5	P. Audisio, C. Baviera, A.B. Biscaccianti
	SPHINDIDAE	4	0	0	P. Audisio, A.B. Biscaccianti
	STAPHYLINIDAE	180	4	1	A. Zanetti, G. Sabella, R. Poggi, P. Audisio, A.B. Biscaccianti
	TENEBRIONIDAE	84	15	0	S. Fattorini, P. Leo, A. Liberto, A.B. Biscaccianti, P. Audisio, G.M. Carpaneto
	TETRATOMIDAE	8	1	0	P. Audisio, C. Baviera, A.B. Biscaccianti
	THROSCIDAE	15	0	0	A.B. Biscaccianti, P. Audisio, C. Baviera
	TROGIDAE	1	0	0	G.M. Carpaneto
	TROGOSSITIDAE	10	0	2	P. Audisio, A.B. Biscaccianti
	ZOPHERIDAE	36	7	1	P. Audisio, C. Baviera, A.B. Biscaccianti
		2049	**117** [6]	**61**	

their shelters and food resources. Three relict beech forests of central Italy were surveyed for both saproxylic beetles and hole-nesting birds, using two different types of interception traps, in order to find an ecological correlation between these two groups of animals. The results showed a significant relationship between saproxylic beetles and hole-nesting bird communities (Redolfi et al. 2014b) and suggest specific recommendations useful for forest management and planning.

3.6 Relationships among species traits, taxonomy, specialist approaches, and IUCN categories

An analysis conducted on ca. 1800 native species, for which the conservation status was established, revealed that conservation categories were represented with significantly different proportions ($\chi^2 = 1485$, df = 4, $p < 0.0001$ for deviation from a uniform distribution). In particular, the LC category was the most numerous.

If species are dichotomized into only two categories (imperilled vs. not imperilled = LC), the number of non imperilled species (983) is still much higher than that of imperilled species (815) ($\chi^2 = 1485$, df = 4, $p < 0.0001$), which means that most of the Italian saproxylic beetles have still a relatively good state of conservation.

To investigate if the proportion of the IUCN categories varied among the beetle families, we applied a chi-square test to a contingency table reporting the number of species included in the various IUCN categories for 59 families for which data were available. We found that IUCN categories were represented with different proportions among the different families ($\chi^2 = 782.875$, df = 232, $p < 0.0001$). When this contingency table was partitioned to assess how the various IUCN categories were represented within single families, we found – among the 9 most numerous families (i.e. those including more than 50 species) – that the LC category was significantly less represented than expected in Cerambycidae, Staphylinidae, Elateridae and Tenebrionidae. This result may suggest either that these insects are really more menaced than others, or that the specialists who made the assessment were more pessimistic in their evaluation. It is also interesting to note that Buprestidae,

Fig. 10 – *Protaetia mirifica* (Mulsant, 1842) (Scarabaeidae), a large and rare saproxylic species not protected by the EU Habitats Directive. In Italy it occurs only in few localities of central Tyrrhenian regions, strictly associated with xerophylous old-growth oak forests (CR – Critically Endangered). Photo by Estefanía Micó Balaguer.

Fig. 11 – *Lucanus cervus* (Linnaeus, 1758) (Lucanidae), a large saproxylic species protected by the EU Habitats Directive, in Italy occurring in northern and central regions, usually associated with old-growth forests (LC – Least Concern). Photo by Sonke Hardersen.

Fig. 12 – *Osmoderma eremita* (Scopoli, 1763) (Scarabaeidae), a large saproxylic species protected by the EU Habitats Directive, usually associated with old-growth forests or to isolated veteran trees, is present in Italy in northern and central regions (VU – Vulnerable). Photo by Alessandro Campanaro.

Fig. 13 – Mature larva of *Cerambyx cerdo* Linnaeus, 1758 (Cerambycidae), a widespread xylophagous species protected by the EU Habitats Directive, usually associated with old-growth oaks (LC – Least Concern). Photo by Antonio Mazzei.

Fig. 14 – A senescent oak heavily attacked by *Cerambyx* spp. (Cerambycidae). Photo by Paolo Audisio.

Tenebrionidae and Elateridae had a number of CR species significantly higher than expected. Ptinidae had a significantly high number of EN species, but their overall conservation status appeared less alarming. Staphylindae showed a significantly higher number of NT and VU species than expected, revealing that they have an intermediate position (or that the specialist who made the assessment adopted a more cautionary approach, typically avoiding the use of extreme categories). Among these families, only Curculionidae had a significantly higher number of LC species, but a lower number of CR, EN, and NT, than expected. Thus, Curculionidae seem to be the less imperilled group. However, this may due to the fact that Curculionidae are less known than other families and the specialist might have be driven to interpret a paucity of records as a result of scarce knowledge, instead of a proof of small extent of occurrence, reduced area of occupancy, reduced population size, etc.

As previously noted in chapter 4.2, it is also important to stress that changes in the taxonomic status at species level, due to splitting or lumping events, may make it difficult to compare the conservation status of beetle groups subject to different taxonomic treatments in the assessment of the specific/infraspecific IUCN Categories of risk. Differences in the "traditional" approaches to infraspecific taxonomy, followed by specialists of different beetle families, can markedly bias the total species assessment, both in term of number of endemic species evaluated and of Category of Risk attributed. For example, while in Buprestidae and Cerambycidae (Table 3) a number of believed subspecies are formally recognized by most specialists, in other large and well-known saproxylic groups, such as Elateridae and Tenebrionidae, no or very few subspecies are listed. We therefore believe that only a more balanced and homogeneous approach to the beetle infraspecific/specific taxonomy (subspecies, "biological races", ESUs, etc.) among specialists of all families could finally provide a reasonably comparable species assessment of the IUCN Categories of Risk.

We also tested if there was an association between trophic categories and families, i.e. if the proportion of trophic categories varied among the families. To reduce the number of trophic categories, we omitted those that were represented by a very small number of species and combined categories with similar meaning into broader groups. Namely, we omitted the HW, MM, NI and WX categories, and obtained the following broader groups where similar trophic habits were lumped: MY (all MY categories), PR (all PR categories), SP (all SP categories), SSX (all SS and SX categories), XBT (all XB categories) and XY (all XY categories). On the whole, for this analysis, we considered 1745 species belonging to 56 families and 9 trophic categories. We found that there was an overall significant association between families and trophic categories ($\chi^2 = 6655.421$, df = 440, $p < 0.0001$). In particular, when the contingency table was partitioned, we found – among the most numerous families – that:

(1) Tenebrionidae were the only family with a significantly higher proportion of CO species. This can be explained by the fact that many tenebrionids associated with dead wood (in particular those belonging to the genus *Corticeus*) are in fact commensals or occasional predators of other saproxylic beetles.

(2) The trophic categories MB and MY (i.e. the mycetophagous and mycophagous beetles) tend to be significantly less frequent than expected in all major families, with the exception of the family Latridiidae, which have more MY species than expected.

(3) Predators (PR species) are significantly less frequent than expected in all major families, except for Staphylinidae, Elateridae and Melyridae. This is not surprising because Staphylinidae and Melyridae are typically predaceous beetles and it is also known that many Elateridae living in dead wood have predaceous larvae (Stokland et al. 2012; Traugott et al. 2015). Yet this result stresses the incidence of considering predaceous beetles in studies dealing with saproxylic insects.

(4) SS and SX (i.e. saproxylophagous s.l.) species are significantly less frequent than expected in all major families except than in Curculionidae and Tenebrionidae, where they were more frequent than expected. This indicates the key role that these two families may play in the decomposition of dead wood. On the other hand, the low frequencies of SS species in other families may be due to undersampling and to the lack of adequate knowledge about the ecology of many species.

(5) SP (saprophytophagous) species are significantly more frequent than expected only in the Tenebrionidae.

(6) The only family with a significantly high proportion of XB species (i.e. saproxylophagous species associated with dead wood deposited by the sea) is Curculionidae. This trophic category is very rare, making Curculionidae an important group for dead wood recycling in the beach-dunes ecosystems.

(7) The XY (xylophagous) category is either significantly more or significantly less represented not only in the major families, but in 31 out of the 56 analysed families. In other words, most of families can be virtually dichotomized into two groups: those with a significantly higher number of XY species, and those with a significantly lower number of XY species. Among the major families, Cerambycidae, Curculionidae, Buprestidae and Ptinidae have a significantly higher number of XY species than expected, while Staphylinidae, Tenebrionidae, Elateridae, Melyridae and Latridiidae have fewer XY species than expected.

We also used a chi-square test to assess if there was an association between trophic categories and IUCN Categories of Risk. This test revealed an overall significant association ($\chi^2 = 132.407$, df = 32, $p < 0.0001$), which means that the various trophic categories occur with different frequencies among the IUCN categories.

When the contingency table was partitioned to assess how trophic categories were represented within single IUCN Categories of Risk, we found that:

(1) The CO, SF, SP and XB categories are represented with similar frequencies among the different IUCN categories. Thus, it seems that there is no association between extinction risk and these trophic categories.

(2) The MY (mycophagous) species were particularly frequent in the LC and NT IUCN categories, which indicates that a mycophagous feeding habit makes species less subject to extinction risk compared with species that have different feeding habits.

(3) By contrast, there was a significant prevalence of PR (predator) species in the EN and VU IUCN categories. This indicates that a predatory habit increases the extinction risk, which is also consistent with the fact that, in general, predators are more imperilled than prey.

(4) In SS and SX categories there was a significant prevalence of CR and NT species (and a significantly lower number of LC species). Thus, saproxylophagous species seem more prone to extinction. However, since these species might be subject to undersampling, it is possible that they are not so imperilled as they seem. Because of sampling difficulties, it is possible that even endemic SS species might be more widely distributed and have larger population than currently assumed.

(5) The XY (xylophagous) species, with few exceptions, appear to be the less imperilled ones, being more frequent than expected within the LC species.

In summary, it seems that (1) the SS-SX is the feeding habit typical of the most imperilled species; (2) the PR feeding habit makes species less prone to extinction than the SS-SX, but it is still associated with moderate-high levels of extinction risk; (3) the XY and MY species are those less subject to extinction risk.

As regards the influence of the distribution type (endemic vs. non endemic status) on the extinction risk, the use of a chi-square test on a set of more than 1600 species for which the endemic/non endemic status was established with certainty, revealed an overall significant association ($\chi^2 = 189.972$, df = 4, $p < 0.0001$), which means that the various IUCN categories occur with different frequencies between endemic and non endemic species. When the contingency table was partitioned to assess how the proportion of endemic species varied among the IUCN categories, we found that endemics prevailed significantly among CR, EN and NT species, whereas non-endemic prevailed among the LC species. This indicates, as expected, that endemic species are more imperilled than non-endemic ones. In other words, a smaller range (which is also typically associated with a fragmented area of occupancy and a high trophic specialization) increases the extinction risk.

Finally, we used a chi-square test to assess if there were an association between distribution type (endemic vs non-endemic) and trophic categories. We found a significant association ($\chi^2 = 54.062$, df = 8, $p < 0.0001$) and, when the contingency table was partitioned, we found that endemic species prevailed among those with SP, SS, SS and PR trophic habits (i.e. among predaceous and saproxylic species), whereas non-endemic species tend to include prevalently MB and XY species.

4 Discussion

4.1 Status of knowledge and application of criteria

On the whole, the saproxylic beetles are one of the most studied taxonomic and functional groups of insects on a European scale. In Italy, the knowledge of many saproxylic beetles [Buprestidae (Figs , 15-17), Cerambycidae (Figs 2, 13, 18-19), Lucanidae (Fig. 11, 20), Scarabaeidae (Figs 10, 12, 21-22), etc.] is rather good if compared with most other groups of insects (excluding butterflies, dragonflies and ground beetles). In spite of this, no saproxylic beetle species has been the object of a long term research population dynamics. Only recently, standardized and replicable methods of sampling and monitoring populations became available for a few species listed in the Annexes of the Habitats Directive (Bellman et al. 2011; Campanaro et al. 2011; Trizzino et al. 2013; Chiari et al. 2013a, b; 2014a, b). Producing these estimates, however, requires the collection and processing of a remarkable amount of data, particularly for still abundant and widespread species, thus some ratings were based on a mix of direct and indirect information. For instance, the decline of saproxylic beetles that are closely related to old-growth forests may by proportional to the loss of this habitat typology. Although to a lesser extent, the availability of reliable quantitative information is still very limited also for the other criteria, and sometimes required the use of inferences. This practice is also used for the global Red Lists, because the achievement of data for assessing the extinction risk is very expensive. Specific projects for monitoring the most relevant species of each taxonomic group should be launched even in Italy, in order to estimate the parameters used by the IUCN criteria, considering that the IUCN categories have become the global standard models to synthesize the current knowledge on biodiversity state and trends.

The IUCN criteria follow a specific philosophy, to highlight only the problems of conservation of the highly endangered species, whose risk of extinction in the short or medium term is concrete and substantial. The direct consequence of this is that many species whose condition is deteriorating and that need for conservation actions, fall into the category of Least Concern, unless their decline is fast enough and their distribution sufficiently narrow to fall within a category of threat, but these conditions may be difficult to ascertain.

As reported above, the proportion of threatened saproxylic beetles in Italy appears globally much higher than that of the whole European continent, at least for the relatively few species (253) whose evaluation was made on both scales (cf: Nieto & Alexander 2010): just over 6% in the European list of threatened species, more than 34% in the Italian one (Figs 7-8). The reason for this phenomenon is clearly linked to the fact that the Italian evaluation considers only a small part of the global population of non endemic species. Since the risk of extinction is correlated with the size of the population, it is quite obvious that a subpopulation is exposed to a higher risk then the global population, especially for taxa with predominantly European or Sibirico-European distribution patterns, which have only a small portion of their geographic range in Italy, often determined by macroclimatic and macroecological factors.

An examination of our data (Table 3) shows that the percentage of Italian endemics among the saproxylic beetles is much lower (about 6%) than the average of all the

Fig. 15 – *Chalcophora intermedia intermedia* Rey, 1890 (Buprestidae), a rare and threatened xylophagous species, mostly occurring in southern Italy and the W Balkans, is associated with old-growth pine forests (EN – Endangered). Photo by Antonio Mazzei.

Fig. 16 – *Buprestis splendens splendens* (Fabricius, 1775) (Buprestidae), a rare and elusive saproxylic species protected by the EU Habitats Directive, in Italy present with certainty only along the mountain areas of the Pollino Massif and neighbouring ridges (Basilicata and Calabria), associated with relict old-growth trees of the Bosnian pine, *Pinus heldreichii* H.Christ, 1863 (CR – Critically Endangered). Photo by Maurizio Gigli.

beetles, which hovers around to 18%. This evidence seems to indicate how the saproxylic habitat, with the exception of some species with low dispersal ability (who live at interface between forest litter and wood mould accumulated within the stumps (e.g. Alexiidae, several Zopheridae), is not much favorable to speciation events, being this habitat widespread on a global scale and ecologically quite stable. Probably, the episodes of contraction and expansion of different forest types in Europe, during the alternation of glacial and interglacial periods of the Pleistocene did not prevent a certain connectivity between populations of saproxylic beetles thanks to their low level of specialization to tree species. The particular conformation of Italy, entirely surrounded by the sea and closed to the north by the Alps, made the populations of many species relatively precluded from genetic exchange out of the Alps. Therefore, in all cases, the IUCN global criteria were applied without any change.

Overall, the state of knowledge on saproxylic beetles turned out to be directly proportional to the number of specialists in activities at national level and an informal parameter that can be defined as the "size + aesthetics " of single species. It follows that for the most studied taxa (i.e. with a high number of specialists and amateurs in activity) and for the more showy, large and easily recognizable taxa, there are plenty of data and information (e.g. for Lucanidae, Scarabaeidae Cetoniinae and Dynastinae, Cerambycidae, Buprestidae). *Osmoderma eremita* (Fig. 12) and *Lucanus cervus* (Fig. 11) have been the subject of two multi-author papers (Ranius et al. 2005; Harvey et al. 2015), each consisting of a review of ecological and distributional issues for the target species. Such a great interest in these and other few species is due to their previous inclusion in the annexes of the Habitats Directive 92/43 / EEC and the consequent obligations of national monitoring lead to gather a lot of information, then implemented by records obtained from Citizen Science initiatives co-financed by the European Union (e.g. the project MIPP - Monitoring of Insects with Public Participation, as part of the EU LIFE + program; LIFE11 NAT / IT / 000252: see also: http://www.lifemipp.eu and as discussed below in chapter 4.2) (Mason et al. 2015).

Unfortunately, the vast majority of saproxylic beetles belongs to families or genera represented by species lit-

Fig. 17 – *Eurythyrea micans* (Fabricius, 1792) (Buprestidae), a widespread saproxylic species, typically associated with poplar trees (LC – Least Concern). Photo by Maurizio Gigli.

tle showy, small and elusive that require specialized skills for sampling and study. On the other hand, the IUCN Red Lists are a key instrument to check the progress in the objectives of monitoring and conserving biodiversity, including through the Red List Index, a measure of biodiversity trend which requires repeated assessments of risk extinction over the years. Thus, our red lists of saproxylic beetles (Audisio et al. 2014 and the current one), along with the recently published red list of dragonflies (Riservato et al. 2014), are a useful starting point for further studies and analyses on the state of conservation of Italian invertebrates. It would be appropriate to expand the Red List in several other taxonomic groups that are particularly representative of the Italian biodiversity, including other invertebrates (such as mollusks, spiders, butterflies, etc.), plants and fungi, or other key functional groups (for example, insects of rivers, streams, ponds, and littoral habitats).

Fig. 18 – *Acanthocinus xanthoneurus* Mulsant & Rey, 1852 (Cerambycidae), an uncommon xylophagous species associated with old-growth beech forests (NT – Near Threatened). Photo by Antonio Mazzei.

4.2 The conservation of saproxylic beetles at species and guild level: problems and perspectives

4.2.1 Strategies of forest management, habitat complexity and fragmentation, connectivity and artificial implementations

As mentioned previously, inadequate forest management is, on a local scale, one of the most obvious problems that need to be addressed in the conservation of the European saproxylic fauna. Historically, in many European countries (Italy included) the presence of dead wood has long been explicitly or implicitly considered a symptom of neglect and poor forest management, in favor of the concept of "clean wood". Despite the importance of deadwood for the conservation of biodiversity, now recognized also by organs of the National Forest Service (cf. Mason et al. 2003), many Italian forests are still systematically "cleaned" and deprived of fallen logs and standing dead trees, with the risk of possible local extinctions of many saproxylic species of insects and other invertebrates, some of which are protected at EU and national levels.

According to the canons of traditional forestry, still followed in many areas, the presence of dead plants in woods was a negative parameter of forest management. In this perspective, dead trees had to be eliminated because they were considered responsible for at least three consequences: (1) increasing risk of fire, (2) to favour spread of disease to healthy trees, and (3) to create difficulties in transiting and accessing to forested areas for the exploitation of natural resources (e.g. gathering mushrooms, berries, chestnuts, woods, etc.). In addition, the old trees are still eliminated to ensure the safety to persons in the event of any fall of logs and larger branches, for preventing risk for tourists and land users (La Fauci et al. 2006).

One of the old practices of forest management most used at international level was the "salvage logging", which still ranks among the activities of restoration of ar-

Fig. 19 – *Rosalia alpina* (Linnaeus, 1758) (Cerambycidae), another uncommon xylophagous species, associated with old-growth beech forests. This species is listed on Appendix II of the Bern Convention and Annex II and IV of the EU Habitats Directive (NT – Near Threatened). Photo by Paolo Audisio.

Fig. 20 – *Sinodendron cylindricum* (Linnaeus, 1758) (Lucanidae), a relatively common saproxylic species, widespread in beech forests (LC – Least Concern). Photo by Antonio Mazzei.

Fig. 21 – *Gnorimus decempunctatus* Helfer, 1833 (Scarabaeidae), a rare and threatened saproxylic species strictly endemic to northern Sicily, mostly associated with old-growth forests (EN – Endangered). Photo by Calogero Muscarella.

Fig. 22 – *Calicnemis latreillii* (Castelnau, 1832) (Scarabaeidae), a rare and elusive beetle flying at dark on Italian beaches and dunes in early spring, associated as larva with trunks and large wood fragments stranded by the sea (VU – Vulnerable). Photo by Maurizio Gigli.

Fig. 23 – *Clinidium canaliculatum* O.G. Costa, 1839 (Rhysodidae), a rare saproxylic mycophagous species, typically associated in southern peninsular Italy with bark of veteran trees (VU – Vulnerable). Photo by Antonio Mazzei.

Fig. 24 – *Cucujus haematodes* Erichson, 1845 (Cucujidae), a rare and threatened species, predator of small invertebrates, in Italy occurs only in Calabria, beneath bark of old-growth forests dominated by Calabrian black pine (*Pinus nigra calabrica* (Loud.) Cesca & Peruzzi) (EN – Endangered). Photo by Antonio Mazzei.

Fig. 25 – *Pyrochroa serraticornis* (Scopoli, 1763) (Pyrochroidae), a widespread saproxylic predator species, whose large and flattened larvae are typically associated with bark of veteran trees (LC – Least Concern). Photo by Maurizio Gigli.

eas affected by fires, and provides for the removal of the entire wood mass damaged. The aim of this practice is to protect woods by the increased risk of fires and to avoid the spread of pathogens to plants. The first risk factor is actually unimportant because the state of rotting wood is generally humid and so poorly attacked by fire respect than wood of healthy trees. The second risk factor is also questionable because the "pathogenic" organisms, especially fungi, live mostly on decaying wood and do not attack healthy trees.

Instead, according to the criteria of Sustainable Forest Management (SFM), five basic components of forest ecosystems (aboveground biomass, belowground biomass, deadwood, litter and soil) can be primarily accounted for in the national budget on the storage of carbon dioxide, from the signatory countries of the Kyoto Protocol (Morelli et al. 2007). Therefore it is important to emphasize that forest management is now increasingly regulated at the international level, and that even in Italy has been repeatedly highlighted the importance of deadwood in forest ecosystems (Mason et al. 2003). In particular, Legislative Decree 18 May 2001, n. 227 "Orientation and modernization of the forest sector" had the purpose of promoting forestry, through the drafting and revision of forest plans at regional level. This decree highlighted the importance of dead wood: "the regions, in accordance with the principles of conservation of biodiversity, with particular reference to woody necromass, promote the release of trees in the forest to be allocated to aging indefinitely".
In the appropriate proportions, adjusted also with the purpose of forest cultivation, the presence of dead wood is therefore deemed essential for the maintenance of biodiversity, representing a number of suitable microhabitats for the survival of thousands of species (Marchetti & Lombardi 2006). Maintaining deadwood, in terms of quantity and quality, it should also be carefully considered, in order to reconcile economic needs with the conservation objectives and increase biodiversity.

Recently, two management strategies have been proposed according to the forest type (artificial or natural) and to the purposes to be achieved (La Fauci et al. 2006). In the first strategy, concerning the artificial reforestation after natural or induced disasters, such as fires, the amount of deadwood is high and in these cases the strategy provides that it be readily removed for both prevention of fires (because of dry branches largely spread over the soil) and phytosanitary reasons. For this strategy, the health of the vegetation is important for suitable wood production, but in many cases reforestation can be guided towards a long term process of natural aging up to the optimal steps for saproxylic insects. However, in our opinion, deadwood should not be removed completely because forests, especially the Mediterranean ones, are able to support periodic fires and therefore a certain amount of deadwood derives from the natural occurrence of such events. It is worth noting that some species of saproxylic beetles (e.g. some Buprestidae) are specialized in developing from burnt wood after fires, and are able to detect fires through special sensory unities. In the second strategy, concerning natural forests, deadwood should remain on the forest soil to allow the survival of saproxylic organisms, with the primary objective of maintaining biodiversity. Despite these considerations, at least in the Mediterranean region, the accumulation of dead wood along the paved roads or clearings should be avoided, because it may increase the risk of fire. In fact, the decaying wood exposed to sun and to human disturbance becomes dry and represents a potential fuel, combined to burning cigarettes and light reflecting materials, as glass (La Fauci et al. 2006).

In one of the most complete and recent studies on the threshold values of dead wood in the management of European forests (Müller & Bütler 2010), the authors conclude that it is more important to maintain some forest areas with a higher quantity of dead wood (> 20-50 m^3/ha), scattered in the forest landscape, rather than planning a lower average quantity throughout all the territory. These dead wood-rich areas are called "islands of senescence" (where trees can reach steps of natural aging), and represent small reserves of "wilderness", within a matrix of cultivated forest landscape. This procedure is already routinely applied in many productive forest in Switzerland and France. However, also in this context of forests managed for productive purposes, the strategy planned the release of a certain number of large old trees, alive and dead per hectar (Büse et al. 2007; New 2010). On the same themes, see also the recent contribution by Lachat et al. (2013).

At the landscape scale, the major threats for saproxylic insects are the fragmentation and degradation of forest ecosystems. The first threat (fragmentation) is mainly due to deforestation in areas where man makes room for activities of greater economic return in the short term, such as agriculture and housing aimed at both residential and industrial houses. The second threat (degradation) is mainly due to the fact that many forests are used for the production of wood and paper, and managed with unsustainable practices. However, the threats on saproxylic insects do not concern only large deforestation, but also the loss of single veteran trees, which have appropriate features for the reproduction of many species. Throughout Europe we have actually seen a decline in the extent of the original deciduous forests and the decrease in the degree of naturalness (Ranius et al. 2005).

The fragmentation of natural environments is currently considered one of the main anthropogenic threats to biological diversity. The reduction, destruction, transformation and isolation of habitats are all components of this process. The effects of fragmentation are species-specific and the ability to survive in a fragmented environment depends mainly on the eco-ethological characteristics of different species, e.g. by their degree of mobility and dispersal ability, as well as the degree of fragmentation and the spatial distribution of suitable habitats (Battisti 2004). For

Fig. 26 – Mature larva of *Pyrochroa coccinea* (Linnaeus, 1761) (Pyrochroidae), a widespread species, predator of small invertebrates, occurring beneath bark of old-growth trees (LC – Least Concern). Photo by Paolo Audisio.

Fig. 27 – *Iphthiminus italicus* (Truqui, 1857) (Tenebrionidae), a rare saproxylic species active at dark, mostly associated with old-growth forests (VU – Vulnerable). Photo by Maurizio Gigli.

Fig. 28 – *Stenagostus rhombeus* (Olivier, 1790) (Elateridae), a rare saproxylic species, typically associated with veteran trees (VU – Vulnerable). Photo by Maurizio Gigli.

instance, *Osmoderma eremita* is particularly sensitive to environmental fragmentation (Van der Sluis et al. 2004; Ranius 2002 c). According to Ranius (2002c), each cavity in the trunk of an old tree can be seen as an habitat fragment, suitable to support a local population of *O. eremita*; each population is more or less connected with the other, through dispersal, forming a system of meta-populations (Ranius 2002a, c). The same tree can support a population for several decades and tens of generations, thanks to a single source of nourishment (a tree) that is considered a key resource for many saproxylic species (Ranius & Hedin 2001). From these ecological evidences, the following two considerations emerge:

1) To understand the local distribution of a saproxylic species, it is important to take into account the history of the area, hence the past distribution of the trees that represent food and shelter for beetles in the study area. In this way, the suitability of a habitat is continuously changing, as the spatial and temporal distribution of its resources.
2) The value of a single habitat consisting of a hollow tree is extremely high, whether or not it hosts one target species, because the species hosted by a tree during its life cycle varies over time according to the dynamics of a forest community. The damage accomplished by cutting a large old tree is mainly related to the fact that this can support a large number of generations of many different species. Felling of veteran trees is then destined to affect the dynamic equilibrium of a forest ecosystem. As discussed more fully below, in Italian habitats heavily influenced by man (as many agricultural ecosystems), there is a progressive and inexorable reduction in the number of new trees destined to replace the old trees that are cut down and removed.

The problems that arise in addressing the issue of conservation of saproxylic beetles are so many also because of ecological complexity of the functional group in question and of the resources they use. Dead wood is formed in quite long periods of time and in various ecological conditions which are not always suitable for the survival of a target species. In fact, the size and shape of the trunks and of the cavities, as well as the conditions of physical and chemical factors that are established in these microenvironments, may not be appropriate to a particular species, either temporarily or permanently. The formation of dead wood and cavities in tree trunks still alive is a gradual process, partially stochastic, which includes all age classes between the main tree species. Ideally, the formation of dead wood should be quantitatively and qualitatively continuous and able to ensure a succession of ecological communities at various stages of their dynamics. In the space of 1 km^2 of forest, there should be a number of newborn, young, mature and undamaged trees, as well as small to large cavities, standing or fallen tree trunks and stumps, at different stages of degradation of wood. Such a ideal habitat diversity could ensure the maximum species richness and population viability, through an assortment of ecological conditions favorable for every kind of saproxylic guilds of beetles.

Maintaining heterogeneity in age classes of trees in a forest (i.e. the condition in which all age groups are largely divided equally among the tree species, at the same time) is an essential factor in the preservation of biodiversity of saproxylic beetles. Many entomologists experienced in the field the apparent paradox of coppice forests consisting mainly of young trees but with old tree stumps left in place, which show a species richness in saproxylic beetles much higher than the surrounding forests where cutting has been abandoned since many decades. The latter, in fact, despite having seemingly majestic trees (but often peers), are often made up of individuals yet completely healthy, slightly attacked by fungi and other arboreal saproxylic organisms and usually associated with a small amount of dead wood on the ground and of dead branches. In these cases, the saproxylic beetle diversity will grow only after a very long period of resilience of the ecosystem (at least 40-50 years or even more), associated with the presence of contiguous forest stands that can act as a source. Such a long-term process of renaturalization could eventually allow the accumulation curve of saproxylic species to reach high values of diversity, comparable to those of the true old growth forests. In this same scenario, the importance of forest edge ecotones to preserve species-rich saproxylic communities was recently demonstrated by Wermelinger et al. (2007).

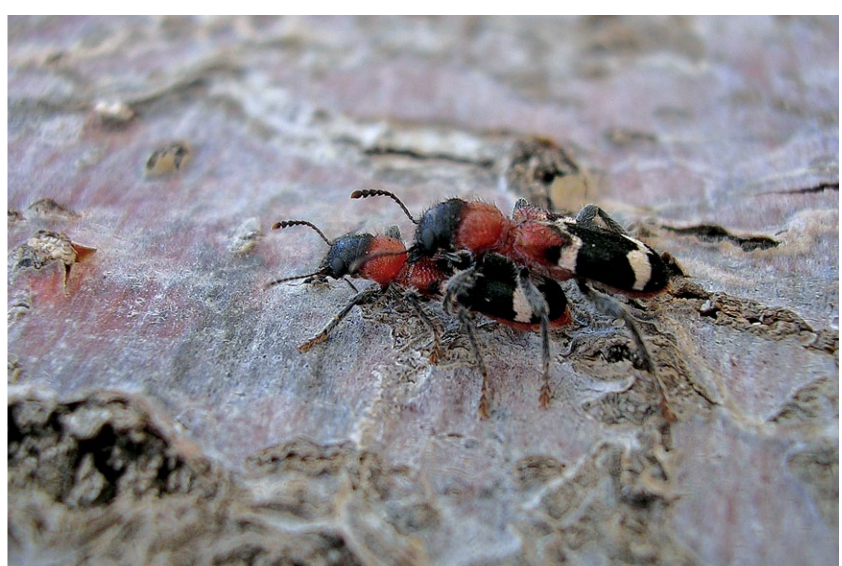
In most cases, there are no special programs for forest renaturalization and conservation of the saproxylic fauna. For example, Telnov (2003) in Latvia showed a very disappointing outlook for the local conservation of saproxylic beetles, precisely because of the absence of young and middle-aged trees in forested areas. Therefore, the ecological continuity cannot be maintained by the time. Within a span of 50-70 years, these trees will be dead and the local populations of saproxylic insects become extinct. The same situation occurs in many forest areas of Italy, even in parks and reserves, suffering from lack of heterogeneity in age classes of trees. Because dead wood is a variable resource in time and space, the saproxylic populations have to face changes in abundance of this resource in different stages of forest dynamics (Jonsson et al. 2005). According to Ranius (2002c), in areas in which hollow trees are dense, the saproxylic fauna is able to follow the resources moving through the environmental mosaic. But if the suitable trees are scarce and too isolated, some species cannot survive, being incapable of an active long-range dispersion. Since the settlement occurs at random and the rate of re-colonization may be limited (as in *Osmoderma eremita*), populations are likely to experience local extinction even in areas where the presence of suitable trees is guaranteed over a wide range (Ranius 2002 c).

When populations are small or faced with "bottleneck"

Fig. 29 – *Lacon punctatus* (Herbst, 1779) (Elateridae), a common and widespread saproxylic species, typically associated with veteran trees (LC – Least Concern). Photo by Maurizio Gigli.

Fig. 30 – *Temnoscheila caerulea* (A.G. Olivier, 1790*)* (Trogossitidae), a widespread saproxylic predator species, typically associated with bark of veteran trees (LC – Least Concern). Photo by Antonio Mazzei.

Fig. 31 – *Thanasimus formicarius* (Linnaeus, 1758) (Cleridae), a common saproxylic species widespread in Italy, is a frequent predator of bark beetles in forest habitats (LC – Least Concern). Photo by Cosimo Baviera.



events, a local extinction in the medium-long term is very likely. Despite the loss of habitat, some species may be able to survive for some time going to form relict populations but these are doomed to extinction, if suitable conditions for long-term survival are lacking; these populations are affected by the so-called 'extinction debt'. When natural areas become fragmented, some species are able to survive only with small populations more or less isolated (Van der Sluis et al. 2004). For example, populations of *Lucanus cervus* that are isolated by more than 3 km have a high probability of suffering local extinctions (Rink & Sinsch 2007), because this distance is greater than the radius of dispersion observed on average for this species. Regarding *Osmoderma eremita*, some models showed that the populations inhabiting wooded land with less than ten oak (or other old trees) face a considerable risk of extinction (Ranius 2002c). Instead, a good landscape connectivity can afford the long-term survival of the same two species. The landscape connectivity depends from both the dispersal ability of the species and the habitat typology. For instance, the ecological networks bring into connection the fragments of woodlands by creating corridors and facilitate dispersal ability of the species. The development of ecological networks and corridors, as a strategy for linking up fragments of woodland, is a positive policy to promote nature conservation on local and global scale.

In general, there are three different types of corridors based on their function (Vam der Sluis et al. 2004): (1) Commuting corridors, used for regular movements from breeding sites and resting to foraging areas; (2) Migration corridors, used for the annual movements of migration from one area to another with a particular resource; and (3) Dispersal corridors, used for one-way movements, usually by young individuals (imagoes, among insects) moving between birth places to new territories. Only the third type affects regularly saproxylic insects, the other two being the most typically used by mammals and birds. In some cases, however, even the first type (commuting corridor) may involve some species with saproxylic larvae and flower-visiting adults, such as many Scarabaeidae, Cerambycidae and Buprestidae. These species require vast suitable habitats that allow individuals to easily reach the feeding areas of the adult (for example, flowering meadows) and then return in hollow trees in which they were born to breed and lay eggs.

The usefulness of corridors for dispersion of *Lucanus cervus* was discussed by Van der Sluis et al. (2004). In this species, dispersion is especially important for females, who need suitable sites for breeding. The most important condition for the survival of *L. cervus* seems to be the presence of a network dense enough of woodlands with appropriate portions of dead wood on the ground or rotting stumps among whose roots grow the larvae, as well as living trees for adult feeding (based on lymph). Where necessary, dead branches can be introduced artificially stacking the wood into blocks or quadrangular pyramids on the basis of which the larvae develop. This strategy could be useful also for other species, such as *Rosalia alpina*, in the beech belt of mountain environments.

Methods of environmental regeneration and simultaneous monitoring are already being tested in Italy under the Life project MIPP (see www.lifemipp.eu/). These techniques could be used to increase the populations of saproxylic beetles that have flower visiting adults, by placing piles of logs along the edge of grasslands or in forest clearings, where abundant blooms of thistles, brambles, carrots, and elders are produced. For other scarab beetles, e.g. *Oryctes nasicornis*, which are not attracted by flowers, heaps of sawdust and other by-products of wood processing may be sufficient.

Corridors can also be divided in four models according to their shape: (1) linear; (2) linear with nodes; (3) stepping stones; and (4) residual fragments. The corridors connecting the breeding areas to facilitate dispersion (dispersal corridors) should be of the linear with node type, with knots every two km. Rink and Sinch (2007), however, suggested that the presence of breeding sites placed like stepping stones, less than 1 km apart from each other, can better ensure dispersion and colonization of new areas by *Lucanus cervus*. The corridors should be built away from the streets, as many large saproxylic beetles have a slow flight (*Lucanus, Oryctes, Cerambyx*) and are very sensitive to traffic (Van der Sluis et al. 2004). In terms of landscape, connectivity can be maintained with the simple preservation of old trees (including those of the rows that delimit fields, pastures or not-busy agricultural roads), and with the conservation of forest fragments (Van der Sluis et al. 2004).

As regards reforestation, this is not always a winning strategy for the conservation of saproxylic species. In Sweden, for the conservation of *Osmoderma eremita*, it was considered more desirable to maintain a low vegetation cover since the old trees must receive abundant sunlight (Ranius & Jansson 2000). This ecological requirement for the hermit beetle in Sweden is due to the fact that this is one of the coldest areas within the distribution range of the species; by contrast, in Mediterranean environments of Italy, where the insolation is strong, a good protection of the cavities by the canopy could be important for larval biology (Chiari et al. 2012, 2013 a, b, 2014 b). Recent observations on the biology of *Osmoderma cristinae* in northern Sicily, however, led us to believe that this species is actually well adapted to live on isolated plants also very exposed to the sun (C. Baviera, unpublished data). The doubts raised by these considerations help us understand the importance of local studies that take into account the environmental conditions in which different populations of the same species or closely related species may live, to avoid incorrect generalizations of scientific data and inadequate intervention for management. *Osmoderma eremita* seems to be declining in all European countries. In every part of Europe, most of the areas with recent findings of this species are small and isolated. For this reason, we should expect many local extinctions in the future, even though the trees with cavities that remained were all protected. Computer simulations show that the population dynamics of *O. eremita* is slow, meaning that local populations can survive for centuries, from the beginning of habitat fragmentation before dying, obviously passing through stages where the population decreases progressively. In smaller stands that still host relict populations of this species, there is a high risk of local extinction within 100 years (Ranius et al. 2005). If the number of oaks and other old hollow trees decreases progressively in a forest fragment, the rate of extinction is growing rapidly. In conservation actions the highest priority should be given to maintaining the quality and extent of the places with larger surface, to avoid bottlenecks within the populations. Probably, in many regions, the saproxylic species that have a relict distribution will undergo extinction even if the density of old trees will be maintained or increased, if not ensured an efficient network between the fragments (Ranius 2002c).

As a result of past forest management policies, also in Italy, many habitats are lacking hollow trees and suitable amounts of dead wood. To overcome this shortcoming, in some cases, it is possible to induce the formation of deadwood in large trees, but still healthy, and then follow the evolution of the phenomenon over the years, through the monitoring of saproxylic organisms.

Various types of treatment can be performed, from selective cuts to inoculation of fungi (Ranius & Jansson 2000). In Italy, the first attempts of forest restoration by increasing dead wood and planning its regular distribution were made in the forest "Bosco della Fontana" (Mantova) (Cavalli & Mason 2003). Non-native trees occurring in this forest were selected for a plan of eradication of alien species. It dealt with red oaks (*Quercus rubra*) and plane trees (*Platanus* spp.), which were chosen to start an experimental project aimed to describe the increase of biodiversity by the artificial production of necromass. The latter was performed with the aid of natural engineering techniques aimed at producing hollows, wood mould, pyramides of branches, etc. Since in many forest habitats there are more or less abundant populations of alien trees, such interventions could be made without affecting the native plant species, thanks to the absence of species/specific selection by many saproxylic insects. In this way, the research/management team of Bosco della Fontana started a slow and gradual removal of non-native trees, turning them into dead wood (CWD) and then in "microhabitats" for the saproxylic fauna. The goal was pursued by uprooting and breaking individuals of red oak and realizing habitat trees with the plane trees. The creation of open areas (artificial clearings) within the forests, according to the management plan of the reserves, was followed by the reforestation of some of them, while the remaining ones were left free to regrow. All actions were subject to corresponding monitoring activities. The actions brought to the following dead wood typology as product: broken stems standing and on the ground; artificially uprooted trees; standing dead trees; habitat trees. The broken stems standing and on the ground were obtained by breaking the stems at a height of 4.3 m; the upper part is left to the ground while the remainder goes to constitute the stump. These types of intervention were realized also with the use of explosive charges. The uprooting was initially judged more effective from an ecological point of view, because the roots rising outside produced a mixing of the soil. However, Linde and Lindelöw (2004) demonstrated the importance of the stumps as breeding sites of various saproxylic species including stag beetles. This simple indication allows a greater awareness of the actions, so if a tree has to be felled for safety reasons, it is better to cut it, leaving the stump rather than eradicate it completely. In fact, the root systems of the trees, especially during the long period of their decay, constitutes an important underground habitat for many insects, e.g. ensuring the development of the stag beetle larvae or hosting many small species under the decaying bark.

The form of action "dead tree leaning" is carried out only partially uprooting the tree and making it supported by surrounding trees. A double girdling, obtained by removing the bark along a transversal ring belt near to the tree base causes the death of the tree remained standing. Finally, as regards the actions of type "tree habitats", one or two operations can be made, based on the diameter of the tree. If the diameter is considered sufficient, both the cavities on the trunk and a basal basin can be made; for smaller diameters only a basal basin is produced. The choice of execution of one or both of the interventions is related to the degree of resistance of the "tree habitat" (Cavalli & Mason, 2003).

The importance of building artificial habitats for saproxylic insects, especially when it is aimed at increasing the populations of endangered species, is emphasized by other authors. Jonsson et al. (2005) gave relief to the fact that the planning of effective operations in forest management should be based on the possibility of making predictions through mathematical models. An important index for the conservation of saproxylic beetles through a negative exponential model is: $y_t = y_0e^{-kt}$. Where y_t is the amount of mass in time t, y_0 is the initial mass and kt is the rate of decay in time. This index allows the prediction of changes in quantity of dead wood over time and has already been used for boreal forests (Jonsson et al. 2005).

4.2.2 The role of single species in conserving ecosystems

An efficient strategy for the conservation of biodiversity is the recognition of important areas for the presence of priority species, bearing in mind not only the species listed in the Habitats Directive (whose appointments are, as we have seen, far from sufficient) but of all species that are considered of conservation concern by the field experience of entomologists. The selection of important sites in terms of conservation should also consider the different ecological role and social importance of the species that live there, assigning them to the following categories (Bulgarini et al. 2006):

- Key (or keystone) species , which occupy a crucial position in the ecosystem or community to which they belong; if these die out, there may be a cascade effect, such as a decline of the entire community;
- Umbrella species, which are characterized by relatively large home ranges and a wide variety of ecological requirements, so the protection of their environment should automatically lead to the protection of many other co-occurring species;
- Flagship species, which are very popular and charismatic species and which can be therefore used as objects of psychological attraction to the public to promote conservation action and awareness; these species fall within a communication mechanism, similar to that of marketing, which can otherwise make a useful service for the conservation of nature.

However, to carry out detailed taxonomic and faunistic inventories in large groups like insects in general, or to study the ecological role of large functional groups such as saproxylic beetles in particular, a considerable effort in terms of time, budget and number of specialists involved is required (Ranius 2002b).

The recognition of indicator species allowed us to detect threats and select actions for the protection of vast areas. Saproxylic beetles recognized as bioindicators, e.g. *Osmoderma eremita*, are used to protect many other species. However, it is not obvious that this role, suggested for northern European regions, is valid also for the Mediterranean region, because the latter is much more complex and inhabited by a number of species markedly higher. Moreover, *O. eremita* seems to have ecological requirements too narrow and therefore not suitable to be used as an umbrella species. On the other hand, this species was also considered a keystone by Jonsson et al. (2004). Even this picture is very questionable when extended to other regions, because of the rarity of this species in the current forest ecosystems and its absence from many regions where forests are lush and rich in biodiversity. In truth, the interactions between this species and other members of its community have not yet been adequately studied, especially in the complex Mediterranean forests (Ranius 2002b), although more recent contributions are beginning to shed light on the subject (Chiari et al. 2012, 2013 a, b, 2014 b; Zauli et al. 2014). Also for *Lucanus cervus*, the situation is unclear: Rink & Sinsch (2007) argue that, to use it as an indicator of forest quality, a more detailed knowledge on its ecology is required. It is thus necessary to establish a framework in which there is a lack of information and formulate positions; and it is therefore desirable to increase data and an in-depth knowledge on the ecology of this and other species. The exploration of these topics and their support by scientific data is the challenge of the coming years of research on saproxylic beetles.

As for the flagship species, the European stag beetle is undoubtedly the best placed to play this role, thanks to its armored and armed male, which seems a small engines of war. This menacing appearance easily recalls the human attention, particularly children who, given also the educational experiences carried out in Japan and other countries, develop a passionate interest in these animals. This makes it possible to imagine widespread educational campaigns on the protection of forests and their inhabitants, based particularly on the role of old growth trees, with flagship species as stag beetles and rhinoceros beetles (*Oryctes nasicornis*). An excellent example of the use of flagship species among beetles is made in this direction by aforementioned LIFE project MIPP (www.lifemipp.eu/), which provides data collections on several species of large saproxylic beetles (*Lucanus cervus, Osmoderma eremita, Cerambyx cerdo, Rosalia alpina, Morimus asper / funereus*) by a Citizen Science approach. Another goal of this project, highly attractive for the public, is the training of a "molecular dog", named "Osmodog" (Fig. 32), who is learning to search *Osmoderma eremita* from its strong smell of ripe peach or freshly tanned leather, produced by the males releasing a sex pheromone (a γ-decalactone, see Svensson & Larsson 2008) (Mason et al. 2015).

4.2.3 Scientific knowledge: interactions between professionals and amateurs

Researchers from many European countries often complain about the small amount of information about the distribution of saproxylic species in most of countries, and highlight the importance of checklists and red lists as a starting point in planning insect conservation (Méndez 2003; Alexander 2003). Méndez (2003) puts such emphasis on the lack of knowledge on the occurrence and distribution of Spanish saproxylic species, and therefore proposed an agenda for the future, including several points. For example, he proposed the creation of detailed thematic maps, where one can find the current and historical distribution of the species in different habitat types of all administrative regions. He also stressed the need of continuing the analysis of the factors threatening the species at local and regional level, in all protected areas and in additional areas of conservation concern. This need to increase the level of knowledge denotes the fact that the current information on most of saproxylic species is rather scarce and often based on outdated and unreliable data. In addition, the latest findings are often related to a handful of species, those protected by the current legislation, which are not the rarest, the most threatened or interesting species of the European continent or of each individual country. For instance, among the saproxylic lamellicorn beetles,

Fig. 32 – The golden retriever Teseo (Osmo-dog) and its trainer. This "molecular dog" was trained for the aims of the EU Life MIPP project (Mason et al. 2015) for detecting specimens of Osmoderma eremita (Scopoli, 1763), whose males are known to produce a sexual pheromone characterized by a peculiar smell of ripening peaches. Photo by Sonke Hardersen.

the current EU legislation protects only *Lucanus cervus* and *Osmoderma eremita*, whereas several other species of conservation concern occur in the continent. The Iberian Peninsula, for example, has an important responsibility for *Platycerus spinifer* Schaufuss, 1862, an endemic Iberian species, and *Lucanus barbarossa* Fabricius, 1801, an endemic Ibero-Maghrebinian species, etc. (Méndez 2003). The same applies to Italy, which hosts several saproxylic lamellicorn beetles of conservation interest, such as *Lucanus tetraodon, Aesalus scarabaeoides meridionalis, A. s. siculus, Gnorimus decempunctatus* (Fig. 21)*, Protaetia cuprea hypocrita* (= *P. incerta*)*, P. sardea, P. squamosa, Calicnemis obesa sardiniensis,* all endemic or subendemic to Italy, more or less threatened and currently unprotected (Audisio et al. 2003, 2014; Carpaneto et al. 1998, 2001).

The hobby activities of insect collectors have sometimes been seen as a possibly strong threat to the survival of some species of beetles. However, apart from cases involving a small number of persons with deplorable behavior (mostly including unscrupulous traders of insects) and some species particularly rare and localized, the "normal" collecting activities of amateur entomologists can hardly be considered a significant factor of decline of beetle populations. In fact, the number of entomologists who collect beetles in the same area is generally very small, while the majority of beetles occur in wide geographic ranges with populations consisting of thousands of individuals (never comparable with vertebrate populations). Moreover, the natural rate of mortality of adult beetles is very high (in many cases near or equal to 100% at the annual level, the end of their breeding season). A single jay or another predatory bird, during a summer week, is able to prey upon a number of stag beetles higher than an entomologist who visits every day the same locality over the whole season. Today, conservation biologists agree in recognizing that the impact of entomological collectors is marginal and largely offset by the benefits resulting from collaboration between amateur entomologists and researchers in terms of insect monitoring and growth of knowledge on the distribution and biology of the species (Ballerio 2004; Samways et al. 2009; Buse et al. 2009). In fact, researchers get a lot of data on the spatial and temporal distribution of the species, just through access to private collections of many amateur entomologists, especially the local ones, who held long-term observations always in the same place, making a sort of voluntary monitoring over several decades, led only by passion for nature. Obviously very different, as mentioned above, are the cases that involve insect traders or maniacal minds, who have the potential to really put at risk local populations of some species of particular value to collectors, often very rare, especially if localized in a few known breeding sites (think, for example, the populations of species of *Osmoderma cristinae* and *Gnorimus decempunctatus*, both endemic to north Sicilian mountain areas).

4.2.4 The role of urban green areas

The urban parks of Europe (Fig. 33) can harbor small but viable populations of saproxylic insects of high conservation concern, in spite of high disturbance due to continuous human presence and to intensive local management of green areas (Ranius et al. 2005; Oleksa et al. 2006; Buse et al. 2007; Carpaneto et al. 2010). Their presence can be detected mainly in trees lining the roads or in urban parks, historical villas and other green areas. In Italy these circumstances have been verified for *Cerambyx cerdo, Os-*

Fig. 33 – A senescent holm in an urban park of Rome; even more or less isolated large trees like this can host, among several other saproxylic beetles, *Osmoderma eremita* (Scopoli, 1763), *Protaetia speciosissima* (Scopoli, 1786) (Scarabaeidae), *Cerambyx welensii* (Küster, 1845), *C. cerdo cerdo* Linnaeus, 1758 (Cerambycidae), and *Latipalpis plana plana* (A. G. Olivier, 1790) (Buprestidae). Photo by Paolo Audisio.

moderma eremita, Lucanus cervus, Lucanus tetraodon and other rare and localized species, even though not protected by the EU Habitats Directive. In fact, these areas often host old trees which have become very uncommon in rural areas where they are threatened by commercial forestry management procedures based on frequent tree cutting. By contrast, old trees are often left alive in some urban parks because they (1) have an aesthetical and symbolic value in recreational areas; (2) provide people with shadow and coolness; (3) are not prioritized for timber exploitation (Carpaneto et al. 2010). For this reason, urban parks can harbor populations of saproxylic insects and have the role of small biodiversity reservoirs for this insect community. Nevertheless, old trees of urban parks may become a public danger, because diseased branches can fall and represent a hazard for public safety (Carpaneto et al. 2010). Therefore, cutting and removal procedures are carried out in the management of urban green areas to reduce human risk. The occurrence of beetles protected by the EU Habitat Directive requires management authorities of the urban green areas to carry out a study of Environmental Impact Assessment, before any intervention.

Therefore, it is important to find a synergy between entomologists and municipalities in managing the felling of trees or parts of trees attacked by protected species, which ensures the best possible compromise between the protection of saproxylic species and the safety of the users of public parks. A case study is the park of Villa Borghese in Rome, where a small population of *Osmoderma eremita* still lives (presence confirmed during the project ARP-Lazio and project Life MIPP at least until July 2015; Carpaneto et al. unpublished data). In the summer of 2009, one of the most important trees for the conservation of this species in Villa Borghese was cut down by the Garden Service of the City of Rome, as it was considered dangerous to the safety of citizens. It was the only tree recognized as breeding site of *O. eremita* because many larvae where found in the cavities from 2005 to 2009. Therefore, the survival of this species in Villa Borghese (SCI protected by international conventions for the conservation of *O. eremita* and *C. cerdo*) has become worrying, even though new possibly breeding trees have been detected in the last years.

In urban environments, the saproxylic beetles still find favorable conditions for their survival, for at least two reasons: (1) the aging of the trees in these areas, where they are not subject to cutting for timber and had only provide shade and decoration; (2) the scarcity of predators in areas intensively frequented by people, where the presence of wild mammals, birds and reptiles is reduced. In recent decades, however, the security policies for the safety of citizens, in some cases perhaps excessive and disproportionate to the risk, frequently eliminated the best breeding grounds for saproxylic beetles. In addition, there has been a sharp increase in large and medium-sized birds (crows, starlings and yellow-legged gulls in particular) who have settled more and more numerous in the cities, attracted by the presence of waste and other man-made food resources, and that usually prey large beetles. As evidence of this, remains of large longhorn and rhinoceros beetles with the elytra and pronotum drilled by bird bills can be seen on the ground in parks and streets of the cities more and more often in the summer months.

4.2.5 Problems of conservation in special habitats: littoral and fresh-water saproxylic beetles

Some special environments (other than purely forest or bush) may be home of a significant amount of dead wood, often underestimated even by those who deal with saproxylic insect fauna. One of these environments is represented by sandy coastal habitats, where sometimes, not too far from important river mouths, a remarkable amount of tree trunks, large branches and wooden fragments of various sizes is brought by waves, after the storms, and deposited on sand beaches and dunes (Audisio et al. 2003) (Fig.

34) This woody biomass, often composed of trunks and branches remained at sea for weeks or months, can be the unique food source for many species of saproxylic beetles depending on this special environment for their development (indicated by the acronym XB in Table 3). The Scarabaeidae Dynastinae of the genus *Calicnemis*, and the Rutelinae *Anomala devota*, together with some Curculionidae and Oedemeridae, are the most peculiar inhabitants of these coastal saproxylic communities. The males of *Calicnemis* (represented by two rare species in Italy) fly at dark on Mediterranean beaches and dunes in early spring, while the males of *Anomala devota* fly at sunset in early summer: the presence of both the species is usually an indicator of environmental quality of natural beaches.

The preservation of these residual habitats is rather problematic in Italy. Well preserved coastal habitats, suitable for insect life, are now found almost only in a few coastal strips under protection of some sort (protected natural areas, WWF Oases, shooting ranges of national army, etc.), but dune systems and beaches (not to mention the private beaches) are overwhelmingly subjected to seasonal pressures or land use types incompatible with the maintenance of a significant woody biomass beached. In particular, the removal of logs, branches and wood fragments is a pre-summer routine in almost all coastal municipalities of Italy, adopted for a better use of beaches by bathers. The extensive use of mechanical means of moving sand to make these removals further contributes to ravage these dynamic but fragile ecosystems, with their assemblage of saprophagous, microphagous or zoophagous species, all associated with the stranded marine debris (Audisio et al. 2003). The conservation of these habitats in the future will only be possible if common actions will be taken to protect them, for example by bans against the removal of wood debris from the beaches (but allowing the manual removal of man-made debris like plastic waste by groups of volunteers). Another action should be to restrict the use of stretches of beaches and residual dunes with higher environmental quality to educational activities aimed at spreading information on the preservation and value of these habitats. Only the creation of an extensive system of ecological corridors along the coastal beaches of Italy will really guarantee the survival of saproxylic beetles and many other arthropods associated with these environments.

Another peculiar and generally overlooked habitat for saproxylic beetles is represented by ponds, lakes, freshwater lagoons, end sections of slow course rivers, where a significant percentage of logs and large branches of trees are partially submerged in the water and remain there for months or years. In these situations, a small number of peculiar and rare species of saproxylophagous beetles is exclusively dependent upon the wood during its the process of decomposition in stagnant freshwater basins. Among the Italian representatives of these communities, there are at least a couple of species of Elmidae (*Macronychus quadrituberculatus* and *Potamophilus acuminatus*), which colonize the submerged parts of the trunks in lentic river basins, while other two species, a Monotomidae (*Rhizophagus aeneus*) and a Pyrochroidae (*Agnatus decoratus*), colonize the emerged part of the trunk, especially along the banks of ponds and lagoons. For these species and a few others among different families it is essential a rather complex combination of favorable conditions: the maintenance of suitable aquatic habitats (the dramatic reduction of lowland wetlands in recent decades has gone exactly in the opposite direction), the presence of water basins of good quality, without a significant presence of pollutants,

Fig. 34 – A trunk stranded on a beach of the Tyrrhenian Sea; large woody fragments like this can host, among several other saproxylic psammophylous beetles, *Calicnemis latreillii* (Castelnau, 1832) (VU – Vulnerable) (Fig. 22) or, in S Sardinia, *C. obesa sardiniensis* Leo, 1985 (EN – Endangered) (Scarabaeidae). Photo by Paolo Audisio.

and the maintenance in place of wooden material fell into the water. It is easy to understand that such conditions are hardly available in most of Italy.

4.2.6 Light pollution

Light pollution is the nocturnal presence of strong lights or lighthouses near man-made settlements (houses, business centers, industrial buildings, streets, avenues, railway stations, fuel distributors, etc.) (Rich & Longcore 2006). Such condition is an acknowledged and well-known threat for a large amount of nocturnal flying insects which are attracted by the artificial lights, with particular reference to Lepidoptera and Coleoptera (Eisenbeis & Hänel 2009). Many flying insects show a marked positive phototropism at night, and are thus attracted to light, sometimes massively, and ended up crushed by vehicular traffic, preyed upon by bats, geckos or nocturnal birds of prey, or simply spread in habitats totally unsuitable for their survival. The impact of light pollution on saproxylic beetles is luckily limited and affects significantly only a fairly small number of species, such as certain medium and large size longhorn beetles that fly at dusk and night, some lamellicorn beetles in twilight flight, some representatives of Cucuioidea, and some other families such as Cleridae, Bostrichidae and Oedemeridae, especially when the light sources are in close proximity to forest habitats of good environmental quality. The impact of light pollution to saproxylic beetles is reduced by the scarce flying ability of many small and very small species, by the apterism and subapterism of many Tenebrionidae and Curculionidae, by the prevailing daytime activity of many families, and poor phototropism of many others. The reduction or adjustment of the light sources in the vicinity of forest areas (mainly those protected or important for conservation) is the most important action to prevent the phenomenon, together with the use of less attractive light sources, such as sodium vapor lamps.

4.2.7 Potentials for reintroduction

Reintroduction and restocking in insects is hampered by the lack of knowledge on the local factors that led to the extinction of species. Reintroduction can be successful only in cases in which we know the reasons of the extinction of a population in an area. Otherwise, we risk to make bad investments, with loss of energy, finance and precious individuals of endangered species. In the current state of knowledge on the Italian populations, and more generally on the European ones, we believe that a reintroduction project of one or more species of saproxylic beetles may constitute a hazard. Even the relocation of individuals from an area where the species is highly endangered to another where the species appears to be represented by a viable population, is not recommended if we do not know the carrying capacity K of the latter, a very difficult parameter to assess in the light of current knowledge on saproxylic beetle ecology. In fact, it might cause overcrowding in the area where we transfer the individuals, leading to their death by predation while roaming in search of food resources and adequate breeding sites. An intervention of transfer could, however, be justified, in the case where all the trees were felled in a suitable area. In this case, operators could find themselves in the situation of having to decide what to do with young larvae found in remnants of the logs, which would not be able to complete their life cycle. Perhaps, in these cases, the best solution would be to maintain the larvae in captivity and to reproduce the adults obtained, constituting a stock of individuals from captive breeding, ready to be released in appropriate places and times. For species protected under the EU Habitats Directive, this action, however, requires the authorization of the Ministry for the Environment, Land and Sea, with the approval of a project. In any case, breeding of many species, mainly saproxylophagous, is not difficult. There are protocols fairly easy to follow, in which the main problem to be solved is the attack of mould that can easily kill the larvae. For this reason, it is used to freeze wood mould before using it as substrate and food for the larvae.

4.3 Synthesis of the strategies and conservation actions

It is impossible to identify suitable habitats for the conservation of all or most Italian species of saproxylic beetles, where their populations can be maintained or enhanced by a unique model of management actions. On the contrary, an effective planning of saproxylic insect conservation should stress the importance of conserving many selected forest habitats in order to maintain a high degree of heterogeneity. In these selected forests, the management authorities should respect and improve, in the same time, the occurrence of a variety of decaying wood, including both standing and fallen trunks, stumps and snags, fine and coarse debris inside hollows and on the soil surface. As regards the life cycle, it is not possible to identify a critical period of the year for larval development, because the life-cycle of each species is usually longer than one year. For this reason, such variable is generally unable to influence management programs. Instead, being the phenology of adults of most species limited to a restricted period (generally, between mid spring and mid summer), the management authorities must take into account what happens in the area during this time interval of extreme importance, because it corresponds to the reproductive period. Other ecological parameters that seem to be significant for the conservation of almost all saproxylic beetles are: (1) the diameter of the trunk of still alive but decaying trees, (2) the diameter of fallen logs, (3) the occurrence of hollows and dead branches in still alive trees, and (4) the exposure of dead wood to sun. The role of the last factor was highlighted in northern Europe as a parameter that favors the larval development of some large saproxylic beetles (e.g. *Cerambyx cerdo, Osmoderma eremita* and *Rosalia alpina*) (e.g., Ranius & Nilsson 1997); however, its validity under the climatic conditions of Mediterranean countries needs a confirmation. Following to Lindenmayer et al. (2006) and Müller & Bütler (2010), we reiterate here at least five general rules of management, applicable to all forest ecosystems: (1) maintaining connectivity; (2) maintaining the integrity of the associated water systems and supporting the hydrological and geomorphological processes; (3) maintaining adequate structural complexity; (4) maintaining landscape heterogeneity and designing "islands of senescence" in forestry; (5) promoting the use of natural disturbance events, both real and simulated, to guide forest management.

Finally, merging the directions given by several authors (Bracco et al. 2001; Audisio et al. 2003; Ranius et al. 2005; Carpaneto et al. 2010; Fabbri & Pizzetti 2011) with those that arose during the preparation of this review, we give some guidelines for selecting the actions of more general importance in the conservation of Italian saproxylic beetles, probably applicable also to other Mediterranean countries:

1. conserving remaining areas of natural forests, favoring heterogeneity and uneven-aged composition, promoting forest edges and ecotones characterized by good environmental quality, never removing the fallen trees, ensuring the maintenance of abundant wood material on the ground (where possible, also leave some trunks fallen into freshwater basins such as rivers, lakes and ponds), and not removing the stranded trunks and large branches along beaches and sand dunes;
2. operating actions to improve the quality of forest ecosystems in general, guaranteeing a significant portion of old-growth forest, and (if necessary) using artificial techniques for accelerating the formation of suitable breeding sites for the saproxylic beetles;
3. preserving and restoring relict forests (i.e. forest fragments) in connection with archaeological and historical landscape, thus creating a positive synergy of conservation of natural and cultural assets;
4. identifying and supporting synergies for preservation or implantation of trees also in agricultural landscape (e.g. old oaks for producing acorns to feed pigs in organic farming; mulberry rows to feed silkworm; old willows for production of faggots; old chestnut trees, cork oaks, etc.);
5. preserving forest fragments of urban green spaces (synergy with the aesthetic value of historic villas, architecture design and recreational areas), with a careful and scientifically based management of dangerous trees.

5 Conclusions

Red Lists are a crucial tool for biodiversity conservation, because they provide an inventory of the species whose extinction risk is imminent, on a global or local scale. As a matter of fact, global extinction is an irreversible phenomenon, which leads to the disappearance of an entire gene pool, and therefore the loss of a product of a long evolutionary process, adapted to occupy a particular ecological niche. Even local extinction is difficult to reverse, because in many case it can require costly reintroduction actions with uncertain outcome. Action to conserve species before they are too close to extinction reduces costs and increases the chances of success of conservation projects.

The actions necessary for saving endangered species vary according to the type of threat. In Italy, particularly on the mainland, the vast majority of insects are threatened by habitat loss and pollution rather than other factors such as direct killing and/or exploitation by man; only crop and sanitary pests are directly killed by the use of chemicals that affect many other species other than the target ones. Some of the endangered species, however, require specific conservation actions for the legal protection of their populations.

Red Lists are not, in themselves, lists of conservation priorities. For example, key elements in setting priorities for conservation that are not considered in red listing include the cost of conservation and the probability of success. The resources available for conservation are limited, so the goal of a conservation strategy must be to maximize the result obtainable with these resources. With equal risk of extinction, cheaper conservation actions for species with greater resilience should be preferred (Di Marco et al. 2012). At national level, another key element in setting priorities is the responsibility of single countries in the conservation of a species. For instance, endemic species of Italy (i.e. the species whose geographic range is entirely included in Italy) and subendemic ones (i.e. the species whose geographic range is almost entirely restricted to Italy) should receive the highest priority for the unique or leading role of our country in shaping their destiny (Visconti et al. 2011).

Red Lists can also be used to define priorities and objectives of scientific research. Populations and species classified DD (Data Deficient, for which it is not possible to determine the category of threat) should be studied to assess the status of their populations and to detect possible threats, while threatened species should be investigated by focusing on the trend of the causes of threat and the possible conservation actions.

At the tenth Meeting of the Conference of Parties of the Convention on Biological Diversity, held in Nagoya, October 2010, the participating countries signed 20 goals for biodiversity to be achieved by 2020, known as the Aichi targets. The IUCN Red List is a key element to monitor progresses towards these objectives, even through the Red List Index, an index of biodiversity trend which requires repeated assessments of the extinction risk over the years. The evaluation of Italian saproxylic beetles presented in our review represents still a starting point. Moreover, the evaluations of a Red List are considered obsolete and no longer reliable after 10 years. For these reasons it is desirable to develop a national network of specialists for monitoring the state of the Italian fauna through a periodic assessment of the extinction risk of a significant number of species and higher taxa.

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Example of suggested citation for specialistic (family-level) contributions (Tables 3-4):
Colonnelli E., Gatti E. 2015. Family Curculionidae. Pp. 77-80, in: Carpaneto G.M., Baviera C., Biscaccianti A.B., Brandmayr P., Mazzei A., Mason F., Battistoni A., Teofili C., Rondinini C., Fattorini S., Audisio P. (eds): A Red List of Italian Saproxylic Beetles: taxonomic overview, ecological features and conservation issues (Coleoptera). Fragmenta entomologica, 47 (2): 53-126.

References

Alexander K.N.A. 2010. Tree biology and saproxylic Coleoptera: issues of definitions and conservation language. Revue d'Écologie (Terre Vie), 63 (2008): 1–5.

Alinvi O., Ball J.P., Danell K., Hjältén J., Pettersson R.B. 2007. Sampling saproxylic beetle assemblages in dead wood logs: comparing window and eclector traps to traditional bark sieving and a refinement. Journal of Insect Conservation, 11: 99–112.

Audisio P. (ed.), Fauna Europaea: Coleoptera 2. Fauna Europaea version 2.4, available at http://www.faunaeur.org [accessed 1 August 2011 as version 2.4 of 27 January 2011].

Audisio P. 2013. Quante sono e dove sono le specie in Italia. Lettura 2.2. pp. 38–39. In: Primack, R. & Boitani, L., Biologia della Conservazione. Zanichelli ed., Bologna.

Audisio P., Muscio G., Pignatti S., Solari M. 2003. Sand dunes and beaches. Italian Habitats, 4. Ministero dell'Ambiente e della Tutela del Territorio, Roma-Udine, 160 pp.

Audisio P., Vigna Taglianti A. 2005. Coleotteri. pp. 249–255. In: Blasi, C., Boitani, L., La Posta, S., Manes, F. & Marchetti, M. (eds), 2005. Stato della biodiversità in Italia - Contributo alla strategia nazionale per la biodiversità. Palombi Editori, Roma.

Audisio P., Biscaccianti A.B., Carpaneto G.M., Chiari S., De Biase A., Maurizi E., Pace G. 2008. *Odontosphindus grandis*, genere e specie nuovi per la fauna italiana (Coleoptera, Sphindidae). Bollettino dell'Associazione Romana di Entomologia, 63 (1-4): 43–46.

Audisio P., Brustel H., Carpaneto G. M., Coletti G., Mancini E., Trizzino M., Antonini G., De Biase A. 2009. Data on molecular taxonomy and genetic diversification of the European Hermit beetles, a species-complex of endangered insects (Coleoptera: Scarabaeidae, Cetoniinae, Osmoderma). Journal of Zoological Systematics and Evolutionary Research, 47 (1): 88–95.

Audisio P., Chiari S., Zauli A., Jansson N., Carpaneto G. M. 2011. *Pityophagus quercus* Reitter, 1877, a new saproxylic beetles for the Italian fauna (Coleoptera Nitidulidae). Fragmenta entomologica, 43 (2): 147–152.

Audisio P., Trizzino M., Stoch F. 2014a. Coleotteri. pp. 111–118. In: Genovesi, P., Angelini, P., Bianchi, E., Dupré, E., Ercole, S., Giacanelli, V., Ronchi, F. & Stoch, F. (eds). 2014. Specie ed habitat di interesse comunitario in Italia: distribuzione, stato di conservazione e trend. ISPRA, Serie Rapporti, 194/2014, 331 pp.

Audisio P., Baviera C., Carpaneto G.M., Biscaccianti A.B., Battistoni A., Teofili C., Rondinini C. 2014b. Lista Rossa IUCN dei Coleotteri saproxilici Italiani. Comitato Italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma, 132 pp.

Audisio P., Alonso Zarazaga M., Slipinski A., Nilsson A., Jelínek J., Vigna Taglianti A., Turco F., Otero C., Canepari C., Kral D., Liberti G., Sama G., Nardi G., Löbl I, Horak J., Kolibac J., Háva J., Sapiejewski M.†, Jäch M., Bologna M., Biondi M., Nikitsky N., Mazzoldi P., Zahradnik P., Wegrzynowicz P., Constantin R., Gerstmeier R., Zhantiev R., Fattorini S., Tomaszewska W., Rücker W., Vazquez-Albalate X., Cassola F., Angelini F., Johnson C., Schawaller W., Regalin R., Baviera C., Rocchi S., Cianferoni F., Beenen R., Schmitt M., Sassi D., Kippenberg H., Zampetti M., Trizzino M., Chiari S., Carpaneto G., Sabatelli S., de Jong Y. 2015. Fauna Europaea: Coleoptera 2 (excl. series Elateriformia, Scarabaeiformia, Staphyliniformia and superfamily Curculionoidea). Biodiversity Data Journal, 3: e4750. doi: 10.3897/BDJ.3.e4750

Ballerio A. 2004. EntomoLex, la conservazione degli insetti e la legge. http://www.socentomit.it/italiano/Ballerio.html.

Bartolozzi L. 1989. Descrizione di una nuova sottospecie di *Aesalus scarabaeoides* (Panzer, 1794) di Basilicata. Bollettino della Società Entomologica Italiana, 121(2): 104–107.

Bartolozzi L., Maggini L. 2005. Coleoptera Lucanidae. In: Ruffo S., Stoch F. (eds). Checklist e distribuzione della fauna italiana. Memorie del Museo Civico di Storia Naturale di Verona (s.2), Sez. Scienze della Vita, 15: 191–192.

Battisti C. 2004. Frammentazione ambientale, connettività, reti ecologiche. Un contributo teorico e metodologico con particolare riferimento alla fauna selvatica. Provincia di Roma, Assessorato alle politiche ambientali, Agricoltura e Protezione civile.

Baviera C. 2008. Prima segnalazione del genere *Aesalus* Fabricius, 1801 in Sicilia con descrizione di *Aesalus scarabae-*

oides siculus n. ssp. (Coleoptera Lucanidae: Aesalinae). Revue Suisse de Zoologie, 115: 585–592.

Blasi C., Boitani B., La Posta S., Manes F., Marchetti M. 2005. Stato della biodiversità in Italia. Contributo alla strategia nazionale per la biodiversità. Ministero dell'Ambiente e della Tutela del Territorio. Direzione per la protezione della natura. Palombi Editori, Roma.

Blasi C., Marchetti M., Chiavetta U., Aleffi M., Audisio P., Azzella M.M., Brunialti G., Capotorti G., Del Vico E. , Lattanzi E., Persiani A.M., Ravera S., Tilia A., Burrascano S. 2010. Multi-taxon and forest structure sampling for identification of indicators and monitoring of old-growth forest. Plant Biosystems, 144 (1): 160–170.

Boitani L., Corsi F., Falcucci A., Maiorano L., Marzetti I., Masi M., Montemaggiori A., Ottaviani D., Reggiani G., Rondinini C. 2002. Rete ecologica nazionale. Un approccio alla conservazione dei vertebrati italiani. Ministero dell'Ambiente e della Tutela del Territorio. Direzione per la protezione della natura, Roma.

Bolla M. 2009. Il grande entomologo che ha dedicato un insetto a Monteforte. Weekly newspaper "Verona Fedele", Verona, September 6th, 2009, LXIII - New Series (37): 20.

Bouchard P., Bousquet Y., Davies A.E., Alonso-Zarazaga M. A., Lawrence J.F., Lyal C.H.C., Newton, A.F., Reid C.A.M., Schmitt M., Slipinski S.A., Smith A.B.T. 2011. Family-group names in Coleoptera (Insecta). ZooKeys, 88: 1–972.

Bracco F., Marchiori S., Mason F., Zanetti A. 2001. Le foreste della Pianura Padana. Un labirinto dissolto. Quaderni Habitat, 3. Ministero dell'Ambiente e della Tutela del Territorio, Roma-Udine, 160 pp.

Bulgarini F., Petrella S., Teofili C. (eds). 2006. Biodiversity Vision - La Conservazione della Biodiversità nell'Ecoregione Mediterraneo Centrale. WWF Italia-MIUR, Roma.

Buse J., Schröderb B., Assmann T. 2007. Modelling habitat and spatial distribution of an endangered longhorn beetle - A case study for saproxylic insect conservation. Biological Conservation, 137 (3): 372–381.

Buse J., Ranius T., Assmann T. 2008. An Endangered Longhorn Beetle Associated with Old Oaks and Its Possible Role as an Ecosystem Engineer. Conservation Biology, 22 (2): 329–337.

Buse J., Alexander K.N.A., Ranius T., Assmann T. 2009. Saproxylic Beetles - Their Role and Diversity in European Woodland and Tree Habitats. Proceedings of the 5th Symposium and Workshop on the Conservation of Saproxylic Beetles. Pensoft Publishers, 236 pp.

Butchart S.H.M., Akçakaya H.R., Chanson J., Baillie J.E.M., Collen B., Quader S., Turner W.R., Amin R., Stuart S.N., Hilton-Taylor C. 2007. Improvements to the Red List Index. PLoS One, 2: e140.

Butchart S.H.M., Walpole M., Collen B., van Strien A, Scharlemann J.P., Almond R.E., Baillie J.E., Bomhard B., Brown C., Bruno J., Carpenter K.E., Carr G.M., Chanson J., Chenery A.M., Csirke J., Davidson N.C., Dentener F., Foster M., Galli A., Galloway J.N., Genovesi P., Gregory R.D., Hockings M., Kapos V., Lamarque J.F., Leverington F., Loh J., McGeoch M.A., McRae L., Minasyan A., Hernández Morcillo M., Oldfield T.E., Pauly D., Quader S., Revenga C., Sauer J.R., Skolnik B., Spear D., Stanwell-Smith D., Stuart S.N., Symes A., Tierney M., Tyrrell T.D., Vié J.C., Watson R. 2010. Global Biodiversity: Indicators of Recent Declines. Science, 328: 1164–1168.

Bütler R., Lachat T., Schlaepfer R. 2006. Saproxilische Arten in der Schweiz: ökologische Potenzial und Hotspots. Schweizerische Zeitschrift für Forstwesen, 157 (6): 208–216.

Campanaro A., Bardiani M., Spada L., Carnevali L., Montalto F., Antonini G., Mason F. & Audisio P. (eds), 2011. Linee guida per il monitoraggio e la conservazione dell'entomofauna saproxilica. Quaderni Conservazione Habitat, 6. Cierre Grafica, Verona, 8 pp. + CD-ROM.

Cardoso P., Borges P.A.V., Triantis K.A., Ferrández M.A., Martín J.L. 2011. Adapting the IUCN Red List criteria for invertebrates. Biological Conservation, 144: 2432–2440.

Carpaneto G.M., Piattella E., 1997. Coleoptera Lucanoidea, Scarabaeoidea. In: M. Zapparoli (ed.), Gli Insetti di Roma. Fratelli Palombi Editori, Roma.

Carpaneto G.M., Maltzeff P., Piattella E., Pontuale G., 1998. I Coleotteri Lamellicorni della Tenuta Presidenziale di Castelporziano e delle aree limitrofe (Coleoptera, Lamellicornia). Bollettino dell'Associazione Romana di Entomologia, 52(1997): 9–54.

Carpaneto G.M., Maltzeff P., Piattella E., Facchinelli L., 2001. Nuovi reperti di Coleotteri Lamellicorni della Tenuta Presidenziale di Castelporziano e delle aree limitrofe (Coleoptera, Lamellicornia). Bollettino dell'Associazione Romana di Entomologia, 56(1-4): 311–329.

Carpaneto G.M., Mazziotta A., Coletti G., Luiselli L., Audisio, P., 2010. Conflict between insect conservation and public safety: the case study of a saproxylic beetle (*Osmoderma eremita*) in urban parks. Journal of Insect Conservation, 14(5): 555–565.

Carpaneto G.M., Chiari S., Audisio P., Leo P., Liberto A., Jansson N., Zauli A., 2013. Biological and distributional review of the genus *Eledonoprius* (Coleoptera: Tenebrionidae): rare fungus-feeding beetles of European old-growth forests. European Journal of Entomology, 110 (1): 173–176.

Cavalli R., Mason F. (eds), 2003. Tecniche di ripristino del legno morto per la conservazione delle faune saproxiliche. Il progetto LIFE Natura NAT/IT/99/6245 di «Bosco della Fontana» (Mantova, Italia). Rapporti Scientifici, 2. Centro Nazionale per lo Studio e la Conservazione della Biodiversità Forestale di Verona - Bosco della Fontana. Gianluigi Arcari Editore, Mantova, 112 pp.

Chiari S., Carpaneto G.M., Zauli A., Marini L., Audisio P., Ranius T. 2012. Habitat of an endangered saproxylic beetle, *Osmoderma eremita*, in Mediterranean woodlands. Ecoscience, 19 (4): 299–307.

Chiari S., Zauli A., Mazziotta A., Luiselli L., Audisio P., Carpaneto G.M. 2013a. Surveying an endangered saproxylic beetle, *Osmoderma eremita*, in Mediterranean woodlands: a comparison between different capture methods. Journal of Insect Conservation, 17 (1): 171–181.

Chiari S., Carpaneto G.M., Zauli A., Zirpoli G.M., Audisio P., Ranius, T. 2013b. Dispersal patterns of an endangered saproxylic beetle, *Osmoderma eremita*, in Mediterranean woodlands. Insect Conservation and Diversity, 6: 309–318.

Chiari S., Zauli A., Audisio P. A., Campanaro A., Donzelli P. F., Romiti F., Svensson G. P., Tini M., Carpaneto G.M. 2014a. Monitoring presence, abundance and survival probability of the stag beetle, *Lucanus cervus*, using visual and odour-based capture methods: implications for conservation. Journal of Insect Conservation, 18: 99–109.

Chiari S., Carpaneto G.M., Audisio P., Zauli, A. 2014b. Interactions between larvae of the threatened saproxylic beetle *Osmoderma eremita* and other flower chafers in Mediterranean woodlands: implications for conservation. Insect Conservation and Diversity, 7 (5): 462–469.

Cocciufa C., Gerth W., Luiselli L., Redolfi de Zan L., Cerretti P., Carpaneto G. M. 2014. Survey of saproxylic beetle assemblages at different forest plots in central Italy. Bulletin of Insectology, 67(2): 295–306.

Crowson R.A. 1975. The systematic position and implications of *Crowsoniella*. Bollettino del Museo Civico di Storia Naturale di Verona, 2: 459–463.

Cuttelod A., García N., Abdul Malak D., Temple H., Katariya V. 2008. The Mediterranean: a biodiversity hotspot under threat. In: Vié, J.-C., Hilton-Taylor, C. & Stuart, S.N. (eds). The 2008 Review of The IUCN Red List of Threatened Species. IUCN Gland, Switzerland.

Densmore N., Parminter J., Stevens, V. 2004. Corse woody debris: inventory, decay modelling, and management implications in three biogeoclimatic zones. Journal of Ecosystems and Management, 5 (2): 14–29.

Drag L., Cizek L. 2015. Successful reintroduction of an endangered veteran tree specialist: conservation and genetics of the Great Capricorn beetle (*Cerambyx cerdo*). Conservation Genetics, 16: 267–276.

Dudley N., Vallauri D. 2004. Deadwood - living forests. WWF Report - October 2004. Gland, Switzerland, 15 pp. + III.

Eisenbeis G., Hänel A. 2009. Chapter 15. Light pollution and the impact of artificial night lighting on insects. Pp. 243-263, in: McDonnell M. J., Hah, A.H., Breust J.H.: Ecology of Cities and Towns, Cambridge University Press, Cambridge 2009.

Fabbri R., Pizzetti L. 2011. Misure di Conservazione delle specie. Invertebrati, 58-81. In: Palazzini, M. & Biondi, M.V. (coord.), Fauna minore - Tutela e conservazione in Emilia-Romagna. Regione Emilia-Romagna, Handy Dandy, 190 pp.

Falcucci A., Maiorano L., Boitani L. 2007. Changes in land-use/land-cover patterns in Italy and their implications for biodiversity conservation. Landscape Ecology, 22: 617–631.

Ge S.-Q., Hörnschemeyer T., Friederich F., Beutel R.G.. 2010. Is *Crowsoniella relicta* really a cucujiform beetle? Systematic Entomology, 36(1): 175–179.

Genovesi P. (ed.) 2007. Linee guida per l'immissione di specie faunistiche. Quaderni Conservazione natura, 27. Ministero dell'Ambiente e della Tutela del Territorio e del Mare - Istituto Nazionale per la Fauna Selvatica.

Global Forest Resources Assessment. 2005. Progress towards sustainable forest management. FAO forestry paper 147. Food and Agriculture Organization of the United Nation, Rome, 2006.

Gordon G. 2011. A Dictionary of Entomology (2nd edition). CAB International, Oxford (UK) and Cambridge (USA).

Grove S.J. 2002. Saproxylic Insect Ecology and the Sustainable Management of Forest. Annual Review of Ecology and Systematics, 33: 1–23.

Harvey D. J., Gange A. C., Hawes C. J., Rink M., Abdehalden M., Al Fulaij N., Asp T., Ballerio A., Bartolozzi L., Brustel H., Cammaerts R., Carpaneto G. M., Cederberg B., Chobot K., Cianferoni F., Drumont A., Ellwanger G., Ferreira S., Grosso-Silva G. M., Gueorguiev B., Harvey W., Hendriks P., Istrate P., Jansson N., Jelaska L. S., Jendek E., Jovic M., Kervyn T., Krenn H. V., Kretschmer O., Palma R. M., Neculiseanu Z., Rabitsch W., Rodriguez S. M., Smit J. T., Smith M., Sprecher-Uebersax E., Telnov D., Thomaes A., Thomsen P. F., Tykarski P., Vrezec A., Werner S., Zach P. 2011. Bionomics and distribution of the stag beetle, *Lucanus cervus* (L.) across Europe. Insect Conservation and Diversity, 4(1): 23–38. DOI: 10.1111/j.1752-4598.2010.00107.x

Hoffmann M., Hilton-Taylor C., Angulo A., Böhm M., Brooks T. M., Butchart S.H.M. et al. 2010. The impact of conservation on the status of the world's vertebrates. Science, 330 (6010), 1503–1509.

Horák J., Chobot K., Kohutka A., Gebauer R. 2008. Possible factors influencing the distribution of a threatened saproxylic beetle *Cucujus cinnaberinus* (Scopoli 1763) (Coleoptera: Cucujidae). The Coleopterists Bulletin, 62: 437–440.

IISE 2011. State of Observed Species. International Institute for Species Exploration, Tempe, Arizone. http://timgostony.com/iisetemp/SOS2011_FINALr.pdf

IUCN 2003. Guidelines for Application of IUCN Red List Criteria at Regional Levels: Version 3.0. IUCN. Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

IUCN 2012a. IUCN Red List Categories and Criteria: Version 3.1. Second edition. IUCN, Gland, Switzerland and Cambridge, UK. iv + 32pp.

IUCN 2012b. Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Version 4.0. IUCN, Gland, Switzerland and Cambridge, UK.

IUCN 2013. Guidelines for Using the IUCN Red List Categories and Criteria: Version 10. Prepared by the Standards and Petitions Subcommittee. IUCN, Gland, Switzerland and Cambridge, UK.

Johannesson J., Ek T. 2005. Multi-purpose management of oak habitats. Examples of best practice from the County of Östergötland, Sweden. Administration Board of Östergötland, Norrköpings, Report, 16: 102 pp.

Jonsson N., Méndez M., Ranius T. 2004. Nutrient richness of wood mould in tree hollows with the scarabeid beetle *Osmoderma eremita*. Animal Biodiversity and Conservation, 27 (2): 79–82.

Jonsson B.G., Kruys N., Ranius T. 2005. Ecology of species living on dead wood - lessons for dead wood management. Silva Fennica, 39 (2): 289-309.

Jucker C., Lupi D. 2011. Exotic Insects in Italy: An Overview on Their Environmental Impact, pp. 51–74. In: López-Pujol J. (ed.), The Importance of Biological Interactions in the Study of Biodiversity. InTech. DOI: 10.5772/24263

Komonen A., Jonsell M., Ranius T. 2008. Red-listing saproxylic beetles in Fennoscandia: current status and future perspectives. Endangered Species Research, 6: 149–154.

Lachat T., Bütler R. 2007. Gestion des vieux arbres et du bois mort. Îlots de sénescence, arbres habitat et métapopulations saproxyliques. Gestion des vieux arbres et du bois mort. Laboratoire des systèmes écologiques. Ecole polytechnique fédérale Lausanne (EPFL). Institut fédéral de recherches sur la forêt, la neige et le paysage. WSL, site de Lausanne.

Lachat T., Bouget C., Bütler R., Müller J. 2013. Deadwood: quantitative and qualitative requirements for the conservation of saproxylic biodiversity. Chapter 2.2, pp. 92-102, in: Kraus D. & Krumm F. (eds), Integrative approaches as an opportunity for the conservation of forest biodiversity. In Focus – Managing Forest in Europe, European Forest Institute, Freiburg, 284 pp.

La Fauci A., Bagnato S., Gugliotta O.I., Mercurio R. 2006. First observations on dead wood in Calabrian pine (*Pinus laricio* Poiret) stands in the Aspromonte National Park (Italy). Forest@, 3: 54–62.

Löbl I., Smetana A. (eds). 2003-2013. Catalogue of Palaearctic Coleoptera. Vol. 1-8, Apollo Books, Stenstrup.

Luniak M. 2004. Synurbization - adaptation of animal wildlife to urban development. Pp. 50–55, in: Shaw et al. (eds) Proceedings 4th International Urban Wildlife Conservation Symposium, Tucson, 2004.

Lindenmayer D.B., Franklin J.F., Fischer J. 2006. General management principles and a checklist of strategies to guide forest biodiversity conservation. Biological Conservation, 131: 433–445.

Maiorano L, Falcucci A., Boitani L. 2006. Gap analysis of terrestrial vertebrates in Italy: priorities for conservation planning in a human dominated landscape. Biological Conservation, 133: 455–473.

Maiorano L., Falcucci A., Boitani L. 2007. Contribution of the Natura 2000 network to biodiversity conservation in Italy. Conservation Biology, 21: 1433–1444.

Marchetti M., Lombardi F. 2006. Analisi quali-quantitativa del legno morto in soprassuoli non gestiti: il caso di "Bosco Pennataro", alto Molise. L'Italia Forestale e Montana, 61 (4): 275–302.

Mason F., Nardi G., Tisato M. (eds) 2003. Legno morto: una chiave per la biodiversità. - Dead wood: a key to biodiversity. Atti del Simposio Internazionale, 29-31 maggio 2003, Mantova (Italia) - Proceedings of the International Symposium 29th - 31st May 2003, Mantova (Italy). Sherwood - Foreste ed Alberi Oggi, suppl. to n. 95: 99 pp.

Mason F., Roversi P. F., Audisio P., Bologna M.A., Carpaneto G.M., Antonini G., Mancini E., Sabbatini Peverieri G., Mosconi F., Solano E., Maurizi E., Maura M., Chiari S., Sabatelli S., Bardiani M., Toni I., Redolfi De Zan L., Rossi De Gasperis S., Tini M., Cini A., Zauli A., Nigro G., Bottacci A., Hardersen S., Campanaro A. 2015. Monitoring of insects with public participation (MIPP; EU LIFE project 11 NAT/IT/000252): overview on a citizen science initiative and a monitoring programme (Insecta: Coleoptera; Lepidoptera; Orthoptera). Fragmenta entomologica, 47 (1): 51–52.

Mazzei A., Bonacci T., Contarini E., Zetto T., Brandmayr P. 2011. Rediscovering the "umbrella species" candidate *Cucujus cinnaberinus* (Scopoli, 1763) in Southern Italy (Coleoptera Cucujidae), and notes on bionomy. Italian Journal of Zoology, 78(2): 264–270.

Méndez M. 2003. Conservation of *Lucanus cervus* in Spain: an amateur's perspective. Proceedings of the second pan-European conference on Saproxylic Beetles. http://entomologia.rediris.es/gtli/espa/dos/lucanus_spain.pdf.

Minelli A. 1996. La checklist delle specie della fauna italiana. Un bilancio del progetto. Bollettino del Museo Civico di Storia Naturale di Verona, 20: 249–261.

Minelli A., Ruffo S., La Posta S. (eds). 1993-1995. Checklist delle specie della fauna italiana. Fascicoli 1-110, Edizioni Calderini, Bologna.

Mooney H.A., Cleland E.E. 2000. The evolutionary impact of invasive species. Proceedings of the National Academy of Sciences of the United States of America, 98: 5446–5451.

Morelli S., Paletto A., Tosi V., 2004. Il legno morto dei boschi: indagine sulla densità basale del legno di alcune specie del Trentino. Forest@, 4 (4): 395–406.

Müller J., Bütler R. 2010. A review of habitat thresholds for dead wood: a baseline for management recommendations in European forests. European Journal of Forest Research, 129: 981–992.

Myers N., Mittermeier R. A., Mittermeier C.G., da Fonseca G.A., Kent J. 2000. Biodiversity hot spots for conservation priorities. Nature, 403: 853–858.

New T.R. 2010. Beetles in Conservation. Wiley-Blackwell, X + 238 pp.

Nieto A., Alexander K.N.A. 2010. European Red List of Saproxylic Beetles. Luxembourg: Publications Office of the European Union.

Novak V., Jansson N., Chiari S., Zauli A., Audisio P., Carpaneto G.M. 2012. A new species of *Allecula* (Coleoptera: Tenebrionidae: Alleculinae) from cork oak stands of Italy. Zootaxa, 3483: 29–38.

Oleksa A., Ulrich W., Gawronski R. 2007. Host tree preferences of hermit beetles (*Osmoderma eremita* Scop., Coleoptera: Scarabaeidae) in a network of rural avenues in Poland. Polish Journal of Ecology, 55: 315–323.

Pace R. 1975. An exceptional endogeous beetle: *Crowsoniella relicta* n. gen. n. sp. of Archostemata Tetraphaleridae from central Italy. Bollettino del Museo Civico di Storia Naturale di Verona, 2: 445–458.

Pesarini F. 2003. Gli insetti come "massa critica" della biodiversità: l'esempio degli alberi morti e deperenti, pp. 21-25. In: De Curtis O. (ed.), Atti del convegno "Dagli alberi morti… la vita della foresta. La conservazione della biodiversità forestale legata al legno morto". Parco Nazionale delle Foreste Casentinesi, Monte Falterona e Campigna. Corniolo, 10 maggio 2002. D.B. Grafica, Pratovecchio.

Purvis A. Hector A. 2000. Getting the measure of biodiversity. Nature, 405: 212–219.

Ranius T. 2001. Constancy and asynchrony of *Osmoderma eremita* populations in tree hollows. Oecologia, 126: 208–215.

Ranius T. 2002a. Influence of stand size and quality of tree hollows on saproxylic beetles in Sweden. Biological Conservation, 103: 85–91.

Ranius T. 2002b. *Osmoderma eremita* as an indicator of species richness of beetles in tree hollows. Biodiversity and Conservation, 11: 931–941.

Ranius T. 2002c. Population ecology and conservation of beetles and psudoscorpions living in hollow oaks in Sweden. Animal Biodiversity and Conservation, 25 (1): 53–68.

Ranius T. 2006. Measuring the dispersal of saproxylic insects: a key characteristic for their conservation. Population Ecology, 48: 177–188.

Ranius T, Aguado L A, Antonsson K, Audisio P, Ballerio A, Carpaneto G M, Chobot K, Gjurašin B, Hanssen O, Huijbregts H, Lakatos F, Martin O, Neculiseanu Z, Nikitsky N B, Paill W, Pirnat A, Rizun V, Ruicãnescu A, Stegner J, Süda I, Szwalko P, Tamutis V, Telnov D, Tsinkevich V, Versteirt V, Vignon V, Vögeli M & Zach P. 2005. *Osmoderma eremita* (Coleoptera: Scarabaeidae: Cetoniinae) in Europe. Animal Biodiversity and Conservation, 28(1): 1–44.

Ranius T., Hedin J. 2001. The dispersal rate of a beetle, *Osmoderma eremita*, living in tree hollows. Oecologia, 126: 363–370.

Ranius T., Jansson N. 2000. The influence of forest regrowth, original canopy cover and tree size on saproxylic beetles associated with old oaks. Biological Conservation, 95: 85–94.

Ranius T., Nilsson S.G. 1997. Habitat of *Osmoderma eremita* Scop. (Coleoptera: Scarabaeidae), a beetle living in hollow trees. Journal of Insect Conservation, 1 , 193–204.

Ranius T., Wilander P. 2000. Occurrence of *Larca lata* H.J. Hansen (Pseudoscorpionida: Garypidae) and *Allochernes wideri* C.L. Koch (Pseudoscorpionida: Chernetidae) in tree hollows in relation to habitat quality and density. Journal of Insect Conservation, 4 (1): 23–31.

Ratti E. 2006. Specie aliene di Coleotteri in Italia (1957-2006). Museo Di Venezia. http://msn.visitmuve.it/it/ricerca/banchedati-2/db-coleotteri-italia/specie-aliene-coleotteri-in-italia-1957-2006/.

Redolfi De Zan L., Bellotti F., D'Amato D., Carpaneto G.M. 2014a. Saproxylic beetles in three relict beech forests of central Italy: analysis of environmental parameters and implications for forest management. Forest Ecology and Management, 328: 229–244.

Redolfi De Zan L., Battisti C., Carpaneto G.M. 2014b. Bird and beetle assemblages in relict beech forests of central Italy: a multi-taxa approach to assess the importance of dead wood in biodiversity conservation. Community Ecology, 15(2): 235–245.

Rich C., Longcore T. 2006. Ecological Consequences of Artificial Night Lighting. Island Press, Washington, 480 pp.

Rink M., Sinsch U. 2007. Radio-telemetric monitoring of dispersing stag beetles: implications for conservation. Journal of Zoology, 272: 235–243.

Riservato E., Fabbri R., Festi A., Grieco C., Hardersen S., Landi F., Utzeri C., Rondinini C., Battistoni A., Teofili C. (eds) 2014. Lista Rossa IUCN delle libellule Italiane. Comitato Italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma, 41 pp.

Roques A. 2010. Alien forest insects in a warmer world and a globalized economy: impacts of changes in trade, tourism and climate on forest biosecurity. New Zealand Journal of Forestry, 40(suppl): 77–94.

Samways M.J., McGeoch M.A., New T.R. 2009. Insect Conservation: A Handbook of Approaches and Methods. Oxford University Press, 441 pp.

Skarpaas O., Okland B. 2009. Timber import and the risk of forest pest introductions. Journal of Applied Ecology, 46: 55–63.

Solano E., Mancini E., Ciucci P., Mason F., Audisio P., Antonini G. 2013. The EU protected taxon *Morimus funereus* Mulsant, 1862 (Coleoptera: Cerambycidae) and its western Palaearctic allies: Systematics and conservation outcomes. Conservation Genetics (2013) 14: 683–694.

Speight M.C.D. 1989. Saproxylic invertebrates and their conservation. Council of Europe, Strasbourg, 78 pp.

Stoch F. 2000. How many endemic species? Species richness assessment and conservation priorities in Italy. Belgian Journal of Zoology, 2: 125–133.

Svensson G., Larsson M. 2008. Enantiomeric Specificity in a Pheromone-Kairomone System of Two Threatened Saproxylic Beetles, *Osmoderma eremita* and *Elater ferrugineus*. Journal of Chemical Ecology, 34 (2): 189–97.

Telnov D. 2003. Saproxylic Latvia - The situation, species diversity and possibilities. Proceedings of the Second Pan-European Conference on Saproxylic Beetles. http://entomologia.rediris.es/gtli/espa/dos/lucanus_spain.pdf.

Traugott M., Benefer C.M., Blackshaw R.P., van Herk W.G., Vernon R.S. 2015. Biology, Ecology, and Control of Elaterid Beetles in Agricultural Lands. Annual Review of Entomology, 60: 313–334.

Trizzino M., Audisio P., Bisi F., Bottacci A., Campanaro A., Carpaneto G. M., Hardersen S., Mason F., Nardi G., Preatoni D., Vigna Taglianti A., Zilli A., Cerretti P. 2013. Gli artropodi italiani in Direttiva Habitat: biologia, ecologia, riconoscimento e monitoraggio. MiPAAF - Corpo Forestale dello Stato, Centro Nazionale per lo Studio e la Conservazione della Biodiversità Forestale “Bosco Fontana” di Verona. Conservazione Habitat Invertebrati, 7, Cierre Edizioni, Verona, 255 pp.

Trizzino M., Bisi F., Maiorano L., Martinoli A., Petitta M., Preatoni D.G. & Audisio P. 2015. Mapping biodiversity hotspots and conservation priorities for the Euro-Mediterranean headwater ecosystems, as inferred from diversity and distribution of a water beetle lineage. Biodiversity and Conservation, 24: 149–170.

Vallauri D., André J., Dodelin B., Eynard-Machet R., Rambaud D. 2005. Bois mort et à cavités - Une clé pour des forêts vivantes. Ed. Tec & Doc, Lavoisier, Paris, pp. 405.

Van der Sluis T., Bloemmen M., Bouwma I.M. 2004. European corridors: Strategies for corridor development for target species. ECNC, Tilburg, the Netherlands & Alterra, 32 pp.

Visconti P., Pressey R.L., Giorgini D., Maiorano L., Bakkenes M., Boitani L., Alkemade R., Falcucci A., Chiozza A., Rondinini C. 2011. Future hot spots of terrestrial mammal loss. Philosophical Transactions of the Royal Society (Series B): Biological Science 366: 2693–2702.

Wermelinger B., Flückiger P.F., Obrist M.K., Duelli P. 2007. Horizontal and vertical distribution of saproxylic beetles (Col., Buprestidae, Cerambycidae, Scolytinae) across sections of forest edges. Journal of Applied Entomology, 131(2): 104–114.

Zapparoli M. 2010. Il problema delle specie animali alloctone in Italia: gli invertebrati terrestri. In: Parrinello, N., Arizza, V. & Cammarata, M. (eds), Atti LXXI Congresso Nazionale dell’Unione Zoologica Italiana, Palermo 20-23 Settembre 2010: 26.

Zapparoli M., Carnevali L. 2014. The National database of invasive alien species in Italy: Terrestrial Invertebrates. Proceedings of the 75th National Conference of the Unione Zoologica Italiana, 94.

Zauli A., Chiari S., Hedenstrom E., Svensson G. P., Carpaneto G. M. 2014. Using odour traps for population monitoring and dispersal analysis of the threatened saproxylic beetles *Osmoderma eremita* and *Elater ferrugineus* in central Italy. Journal of Insect Conservation, 18(5): 801–813.

Zhang Z.-Q. 2013. Phylum Arthropoda. In: Zhang, Z.-Q. (Ed.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness (Addenda 2013). Zootaxa, 3703: 17–26. http://dx.doi.org/10.11646/zootaxa.3703.1.6