British Wildlife Field Guides

Field Guide to the Amphibians & Reptiles of Britain and Europe

Jeroen Speybroeck
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Bobby Bok
Jan Van Der Voort
Illustrated by **Ilian Velikov**

BLOOMSBURY

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Preface

At an early age, particularly with the support of my mother, I became passionate about nature and wildlife. While several of my friends caught some degree of the more popular birdwatching fever, as a ten year old I fell in love with more readily approachable vertebrates. My first field guide was a small book written in the 1970s. It was in fact a mammal guide, but it had a small section on the herpetofauna of the Benelux countries, featuring intriguing, although somewhat monstrous, illustrations. And so my life-long obsession with amphibians and reptiles was born. My early years were marked by ignorance, having no clue where to begin to search for the limited number of species occurring in my home country. Gradually, this passion evolved into a more comprehensive perspective on the herpetofauna of Europe. Fuelling that passion were a great number of trips with dedicated enthusiasts from different countries. A twitching target was born – the ambition to see all of the species of amphibians and reptiles found in Europe. A wonderful journey lead to the achievement of this goal, during which I gained much knowledge, experience and insight, as well as several of my best friends.

On seeing Ilian's illustrations on an online forum (fieldherping.eu) in 2010, I came up with the idea of a new European field guide. It felt right to put together all that I have learned over the years. The goal was not to challenge Nick Arnold's book, a little bible that I have devoured over and over again. The latter has been my most cherished possession since my earliest days, both in its 1978 edition (the year I was born) and in the more recent revised editions (2002, 2004). Yet, we believed we had some fresh, perhaps more contemporary, ideas to share. However, at the indisputable core of this book stands Ilian's artwork. I was immediately convinced that its outstanding quality alone would make this book an attractive must-have. I was not wrong.

Writing a new field guide with the aim of making it up-to-date, original and fresh, is not easy. I have had the good fortune to have three dear friends who agreed to take part in the adventure. We all did our fair share of what turned out to be a (very) sizeable endeavour. Being inexperienced in the field of publishing books, we were thrilled when we found out there was actually a publisher who was prepared to back our project.

Not unlike my European herping (an ugly term for the search for amphibians and reptiles) adventures, the genesis of this book has been a long and dedicated crusade. Now that it is finally ready, I am not going to lie about the pride I feel when holding a copy. I am extremely grateful to all of those involved. Hopefully, this book will earn the reputation of being the attractive, user-friendly tool that we set out to create. May it live long and provide insight and joy to many readers. There is nothing quite like the enchantment offered by a sizeable frog chorus in a Bulgarian swamp comprising a mixture of tree frogs, fire-bellied toads, green toads, spadefoot toads and water frogs. Reptilian thrills are plentiful, such as finding your first chameleon, bumping into mating tortoises, or experiencing the thrill of chasing down a feisty whip snake. I hope this book will foster this fascination in many more people, albeit always with respect for the animals and the conservation of them and their natural environment.

Jeroen Speybroeck, August 2015, Belgium

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We also want to thank all the people who have herped with us over the years or helped with local information. Naming all of them would be impossible, but as well as several of those mentioned above they include Tim Adriaens (Belgium), Pim Arntzen (the Netherlands), Oscar J. Arribas (Spain), Thomas Bader (Austria), Lasse Bergendorf (Sweden), Jan Beukema (the Netherlands), Tekla Boersma (the Netherlands), Jasper Boldingh (the Netherlands), Emanuele Biggi (Italy), Javier Blasco-Zumeta (Spain), Sergé Bogaerts (the Netherlands), Marco Bologna (Italy), Guido Bonnett (Malta), Roger Bour (France), Peter Brakels (the Netherlands), Henrik Bringsøe (Denmark), Salvador Carranza (Spain), Dan Cogălniceanu (Romania), Carl Corbidge (UK), Gijs Damen (Belgium), Philip de Pous (the Netherlands), Johan De Smedt (Germany), Wouter de Vries (Spain), Stefanie Delarue (Belgium), Frank Deschandol (France), Maria Dimaki (Greece), David Donaire (Spain), Patrick Dons (Belgium), Gerd Dossche (Belgium), Peter Engelen & Anniek Aerden (Belgium), Daniel Escoriza (Spain), Luis García-Cardanete (Spain), Jürgen Gebhart (Germany), Iulian Gherghel (Romania), Ioan Ghira (Romania), Maarten Gilbert (the Netherlands), Juan Pablo González de la Vega (Spain), Pierre Grillet (France), Rok Grželj (Slovenia), Arlo Hinckley (Spain), Yannis Ioannidis (Greece), Tomaž Jagar & Erika Ostanek (Slovenia), Robert Jooris (Belgium), Tomáš Klacek (Czech Republic), Ronald Laan (the Netherlands), Mark Lehouck (Belgium), Fabrizio Li Vigni (Italy), Pietro Lo Cascio (Italy), Petros Lymberakis (Greece), Gertjan Martens (the Netherlands), Gabriel Martínez (Spain), Werner Mayer (Austria), Joan Mayol (Spain), Paolo Mazzei (Italy), Konrad Mebert (Switzerland), Bart Misana (the Netherlands), Thomas Mutz (Germany), Joachim Nerz (Germany), Dario Ottonello (Italy), Frank Pasmans (Belgium), Boyan Petrov (Bulgaria), Onésime Prud'homme (France), Gilles Pottier (France), Teja Požar (Slovenia), Edoardo Razzetti (Italy), Thomas Reich (Switzerland), Alexandre Roux (France), Sebastiano Salvidio (Italy), Pilar Sánchez (Spain), Sander Schagen (the Netherlands), Benedikt Schmidt (Switzerland), Anders Selmer (Sweden), Aleksandar Simović (Serbia), Roberto Sindaco (Italy), Dieuwertje Smolenaars (the Netherlands), Giuseppe Sotgiu (Italy), Henk Strijbosch (the Netherlands), Alexandru Strugariu (Romania), Rémon ter Harmsel (the Netherlands), Francesco Tomasinelli (Italy), Benny Trapp (Germany), Sandro Tripepi (Italy), Nikolay Tzankov (Bulgaria), Mirjam Vandevliet (the Netherlands), Gert Jan Verspui (the Netherlands), Sebastian Voitel (Germany), David Vuylsteke (Belgium), Alexander Westerström (Sweden), Trevor Willis (UK), Leonard Zammit (Malta), Ronald Zimmerman (the Netherlands).

Praise goes to Nigel Redman (Bloomsbury Publishing) who has been a solid beacon of light throughout the publication process.

About this book

The main goal of this field guide is to identify amphibians and reptiles to species level. While many will probably want to attempt this simply by browsing the illustrations, this book also presents a comprehensive set of identification keys and tables. Where the reader lacks experience, or when dealing with difficult species, this may be the swifter option. For those who dislike this method, the species accounts have sufficient, if not all, of the diagnostic information needed for identification including distribution maps, thus ruling out the nuisance of having to page back and forth more than necessary. For the same reason, species have been ordered so that related species are close together, or so that coexisting species (e.g. small lacertas) are placed close to each other.

The book contains a number of chapters.

The diversity of European amphibians and reptiles and their origin offers a description of the origin of the contemporary species composition, through evolutionary and more recent history.

How to watch amphibians and reptiles lists basic practical aspects of field herpetology and how to search for herpetofauna in the field.

Where to watch amphibians and reptiles presents an overview of the herpetofauna of a number of regions in Europe, selected on the basis of their species richness and/or presence of endemic species.

Amphibian eggs and larvae provides information on the identification of the earlier stages in amphibian life-cycles.

Species accounts make up the core of the book. Each group of species is preceded by an introductory text about the group in general, and may contain keys and tables for identification purposes. On some occasions species are grouped together when a combined account seems more appropriate.

The species accounts generally follow a standard structure:

Description offers a concise description of the external features of the species, mainly focusing on diagnostic features. It generally includes maximum size, and aspects of structure and coloration.

Distribution offers a comprehensive summary of the range of the species, and amplifies the information in the range map (see below).

Variation describes subspecies and/or colour morphs within the species, including details on their range and morphology.

Habitat briefly describes the main features of the species' environment.

Biology highlights some typical aspects of the natural history of the species (behaviour, life-cycle, etc.).

Venom information is provided for venomous snakes only, describing the level of toxicity of the species' venom.

Call is a description of the mating calls of species of frogs and toads.

Note offers additional notes, such as recent views on evolutionary history which have resulted in the revision of relationships between species and (quite often) changes in their names. The level of threat as given in the 2009 IUCN Red List is also specified where relevant.

The Map shows a generalised overview of the species' contemporary distribution, which is further described in the 'Distribution' section.

Photographs have been included where appropriate, mainly to show additional morphs of certain species, besides the more common morph(s) shown in the illustrations.

Glossary lists more specialised terms and explains them.

Selected references is a concise, selective list of resources.

GEOGRAPHICAL COVERAGE

The area covered by this book is defined as the geographical boundaries of Europe west of an arbitrary line drawn through eastern Ukraine and the Sea of Azov. However, a number of islands are excluded, even though they belong politically to European countries. These include the Canary Islands, Madeira, Linosa, Lampedusa, Lampione, Pantelleria, etc. In addition, Cyprus and the Spanish sovereign territories in North Africa are not considered to be part of our geographical definition of Europe. As an exception to this rule, the Greek islands in the eastern Aegean Sea, situated off the Anatolian coast, are included, because they are close to our defined area and are a popular holiday destination. These include, among others, Lesbos, Chios, Samos, Kos, Kalymnos and Rhodes.

SPECIES COVERED

In general, the species included are those with populations that breed in the wild within the specified area. Regarding alien species (introduced by mankind, knowingly or otherwise), we only provide a separate species account for those which have established and/or more or less stable or self-sustaining populations. In addition, some extra species are discussed in the 'Alien species' section in the next chapter.

NEW SPECIES, NEW NAMES

Compared with previous books dealing with the same region, this field guide presents a much higher number of amphibian and reptile species and some are listed under new genus names. Two related reasons form the basis of these changes: an increase in herpetological research in southern Europe, and more dedicated molecular research during the last decade. In some cases, species which were simply not well studied in the past have proved to represent not one but several distinct species – the Iberian wall lizards *Podarcis hispanicus* complex are a good example. Moreover, by examining genetic relationships within groups such as lacertas and bufonids, it became clear that the species previously grouped together in the genera *Lacerta* and *Bufo* were often not each other's closest relatives, and belonged in different, distinct groups. Therefore, these have been placed in new genera. We are well aware that many naturalists, be they amateurs or professionals, often feel uncomfortable with such changes. It is therefore important to note that many taxonomic changes are needed if we want the names of these living creatures to reflect their evolutionary relationships. Luckily, the majority of European amphibian or reptile species has nowadays been studied from a genetic viewpoint, making future name changes increasingly less likely, but never entirely out of the question.

Diversity of European amphibians and reptiles and their origin

Natural species composition in Europe

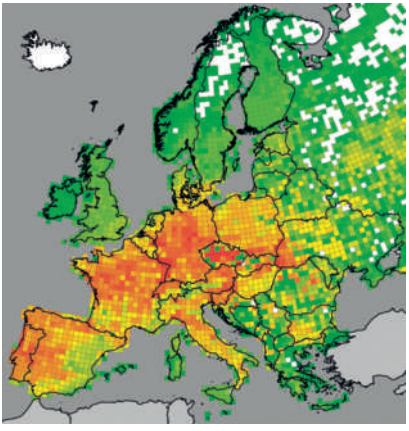
Looking at a map of Europe, the continent's irregular shape becomes apparent immediately. Peninsulas and islands are a common sight, while high mountain ranges dominate central and southern Europe. Owing to this large geographical variability, a large number of diverse amphibian and reptile species inhabit this continent. These species are, however, not evenly spread throughout Europe. Large numbers of amphibian species are found in central Europe, the Iberian Peninsula and Italy. Southern Europe, and particularly the Balkans, host a great many reptile species. The study of species and ecosystems through geographical space and Earth history is called biogeography.

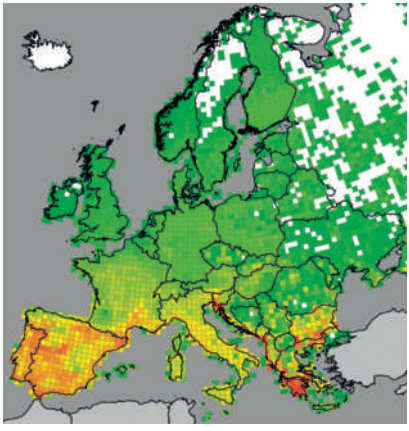
Here, a short introduction is given in relation to Europe's amphibians and reptiles. It should be noted that the vast majority of these species already existed during the Miocene, more than five million years ago. Attention is therefore focused on the factors that shaped species distributions in recent geological times, and not on the drivers of speciation.

ENVIRONMENTAL VARIATION

The most obvious reason for the large number of amphibian and reptile species is perhaps the high level of environmental variation that characterises Europe. From north to south, a cold polar climate changes into warm

Species richness maps of amphibians (left) and reptiles (right) in Europe, based on combined species distribution data at 50 km × 50 km resolution. Warmer colours show higher species richness. Data-deficient areas are shown in white. Courtesy of Neftali Sillero.





Mediterranean conditions. A similar gradient in climate is also found from mountain summits down to lowland areas. In both cases this allows large numbers of species to segregate into their preferred habitats. Major mountain chains, such as the Alps and Pyrenees, are interspersed with lowlands, further separating populations. Yet these mountain ranges do not act solely as a barrier; they themselves are home to exclusively montane species, including members of the rock lizard genera *Iberolacerta* and *Dinarolacerta*. The islands that abound in the Mediterranean Sea are home to combinations of endemic and continental species, and in particular support many Wall Lizard *Podarcis* species. Sometimes they function as refuges for ancient lineages found nowhere else, such as the Mallorcan Midwife Toad *Alytes muletensis* or the Brook Newt species of the genus *Euproctus* found on Corsica and Sardinia. When mountain ranges occur on islands or largely isolated peninsulas, especially in southern Europe, large numbers of species can coexist – the Peloponnese Peninsula in the south of Greece is a textbook example of this phenomenon. In addition to the ancient and complex geographical evolution of Europe which includes the uplifting of mountain chains and island drift, there is a relatively recent phenomenon which greatly influenced the distribution of amphibians and reptiles today – the Ice Ages.

THE ICE AGES

Throughout recent geological history Europe has been subject to ice ages, also known as glacial periods. During these periods, surface temperatures were lower than today and the ice sheets of the North Pole and those located on major mountain ranges expanded. In consequence, the distributions of animal and plant species were reduced in the north, and in many cases expanded southwards. When temperatures started to rise again, parts of northern Europe and the higher elevations of mountains were recolonised. As amphibians and reptiles do not possess a means of maintaining their body temperature at a more or less constant level, they rely completely on environmental warmth to maintain their preferred temperature. Consequently, these species were greatly influenced by the glacial periods.

The Iberian Peninsula, Italy and the southern Balkans were the main European refugia; areas in which species took refuge when northern climates were too cold for them to persist. Today these climatically more stable areas still host relatively large numbers of species, and especially high genetic variability. Some species display fragmented distribution ranges because some of their populations migrated southwards during glacial periods but did not later recolonise northern areas. Examples are the Alpine Newt subspecies *Ichthyosaura alpestris cyreni* in northern Spain, or the Four-lined Snake *Elaphe quatuorlineata* and the Italian Yellow-bellied Toad *Bombina variegata pachypus* in Italy. Many species of amphibians, but also several species of reptiles, did however manage to migrate northwards along temperate or humid corridors. Classic examples of this are the Western Spadefoot Toad *Pelobates cultripes*, the Iberian Tree Frog *Hyla molleri* and the Iberian Three-toed Skink *Chalcides striatus*, which all dispersed along the French Atlantic coast from an Iberian refugium. Several wide-ranging species which now reach central or even northern Europe such as the Parsley Frog *Pelodytes punctatus*, Natterjack Toad *Epidalea calamita*, Marbled Newt *Triturus marmoratus* and Spiny Toad *Bufo spinosus* also originate from Spain and Portugal. Similarly, the Western Green Lizard *Lacerta bilineata* and the Western Whip Snake *Hierophis viridiflavus* dispersed from Italy. Occasionally, populations of a single species which had been isolated in different refugia came into secondary contact after such recolonisation events. The contact zone of two Fire Salamander *Salamandra salamandra* lineages in central Germany is a well-researched example; one of these lineages (represented by the striped subspecies *terrestris*) originates from Spain, while the other dispersed (as the spotted nominate subspecies *salamandra*) from the Balkans. Other amphibian and reptile species with an eastern European origin include the Smooth Newt *Lissotriton vulgaris*, Marsh Frog

Pelophylax ridibundus and Eastern Green Lizard *Lacerta viridis*.

The combination of recolonisation events from several refugia and a relatively humid, temperate climate is the main factor supporting the high species richness of amphibians in central Europe. For instance, there are ponds in western France that support up to five newt species including those originating from Iberian (Palmate Newt *Lissotriton helveticus*, Marbled Newt *Triturus marmoratus*) and Balkan refugia (Smooth Newt *Lissotriton vulgaris*, Great Crested Newt *Triturus cristatus*, Alpine Newt *Ichthyosaura alpestris*).

In more northern areas, the Ice Ages may very well have led to reduced diversity. In combination with the isolated nature of islands, certain species are naturally absent from the British Isles, although suitable habitats appear to be available (e.g. Fire Salamander *Salamandra salamandra*, Alpine Newt *Ichthyosaura alpestris*, Common Tree Frog *Hyla arborea*). As an even more extreme case, Ireland is home to only three native species – Natterjack Toad *Epidalea calamita*, Common Frog *Rana temporaria* and Viviparous Lizard *Zootoca vivipara*. Combining unfavourable climatic conditions and long-lasting isolation, no herpetofauna species occur on Iceland.

DISPERSAL FROM OTHER CONTINENTS

Several species which may seem to be characteristic representatives of the European herpetofauna actually originated on other continents. One of the main geographical features which enabled the arrival of these species were land bridges, which occurred during different parts of Europe's history. Most recently, such land bridges were a direct consequence of the glacial periods. When the ice sheets expanded, the ocean level dropped and areas which were formerly covered by seawater subsequently became dry land. Older causes for the formation of land bridges include the processes of continental drift, during which the collision of continental plates (such as those of Europe and Africa, but also those of Europe and Arabia) caused the uplift of lowlands or areas initially submerged under the sea. One of the most important historical connections was located in what is now the Strait of Gibraltar, which separates Spain from Morocco. Several amphibian and reptile species dispersed either north- or southwards during the time that a land bridge here linked Europe and Africa with each other. Typical Spanish reptile species such as the Spiny-footed Lizard *Acanthodactylus erythrurus*, the Iberian Worm Lizard species *Blanus cinereus* and *Blanus mariae* and the Iberian False Smooth Snake *Macroprotodon brevis* are of African origin. Fewer species and subspecies have dispersed across land bridges between Tunisia and the southern Italian island of Sicily; these include the African Green Toad *Bufotes boulengeri* and Italian Three-toed Skink *Chalcides chalcides*. The occurrence of 'African' species in several areas of south-western Europe is, however, not only the result of natural causes; for instance the Painted Frog *Discoglossus pictus* (western parts of Mediterranean France and adjacent Spain), Spur-thighed Tortoise *Testudo graeca* (south-eastern Spain) and Mediterranean Chameleon *Chamaeleo chamaeleon* (coastal parts of south Portugal and Spain) were introduced in more recent times, after which they expanded their ranges. Evidence of dispersal through land bridges is, however, not limited to western Europe. The Bosphorus, which connects the Mediterranean Sea with the Black Sea, has also functioned as a bridge during several periods. Species that have used this connection include the Snake-eyed Lacertid *Ophisops elegans*, Reddish Whip Snake *Platyceps collaris*, Ottoman Viper *Montivipera xanthina* and Bedriaga's Water Frog *Pelophylax* cf. *bedriagae*.

However, amphibian and reptile species which originate from other continents did not reach Europe by land bridges alone. Because eastern Europe connects to Asia through the major landmass that is Russia and the other former Soviet States, some species simply penetrated Europe by moving through corridors of continuous habitat. Examples on the geographical edges of the continent

include the Steppe Viper *Vipera renardi*, Steppe Runner *Eremias arguta* and Steppe Snake *Elaphe dione*. Other common, wide-ranging European species such as the Sand Lizard *Lacerta agilis*, Green Toad *Bufotes viridis* and Dice Snake *Natrix tessellata* evolved in central Asia, from where they dispersed into Europe.

The main causes of the high species richness of reptiles in southern Europe are the relatively warm, stable climate, characteristic of the Mediterranean Basin, in combination with historical species dispersal from Africa and Anatolia (Turkey).

THE ODD ONES

There are still other species which arrived in Europe by different means, often exogenous, but sometimes natural. The first category contains, for instance, the invasive North American slider turtles of the genus *Trachemys* and the African Clawed Frog *Xenopus laevis*, which are expanding their ranges throughout several areas in Europe. However, there are also species whose distribution was barely influenced by the factors described above, but which do occur in Europe. A number of tailed amphibian species stand out. For example, the Olm *Proteus anguinus* – a blind, fully aquatic cave salamander that inhabits underground waterbodies in the western Balkans. The closest relatives of the Olm are the mudpuppies (*Necturus* spp.) of North America. These species originate from a common ancestor which inhabited the mega-continent Laurasia, which connected Europe and North America several hundred million years ago. As such, the Olm is an ancient species of which no similar example can be found in Europe. Interestingly, the nearest relatives of the cave salamanders *Speleomantes* spp. are also to be found in North America. The ancestors of these species, however, migrated across the Bering Strait into the whole of Asia and on into Europe. They then disappeared throughout this vast area, only persisting in small areas in Italy and France. Subsequently, they colonised Sardinia in two separate events; Gené's Cave Salamander *Speleomantes genei* (or its direct ancestor) arrived on the island first, whereas the ancestor of the four eastern-distributed species arrived in a second wave from Italy across a land bridge. A final example concerns the Greek island of Karpathos and two neighbouring smaller islands which host an endemic species of terrestrial salamander, Karpathos Salamander *Lyciasalamandra helverseni*. How exactly this species reached the island from Anatolia is not entirely clear.

A POLITICAL BORDER DOES NOT LIMIT A SPECIES DISTRIBUTION

Adjacent continents, biogeographical regions or even ecosystems are never fully separated – moreover, species do not follow the political boundaries which humans draw on maps. The decision to include in this book amphibian and reptile species native to Greek islands situated close to the Turkish mainland adds a number of typical Anatolian species. Examples include the Levant Skink *Trachylepis aurata*, Coin-marked Snake *Hemorrhois nummifer* and two rock lizard species of the genus *Anatololacerta*.

Alien species

Many, if not all, species that found their way into Europe in more recent times were aided by man. These introductions can be roughly divided into two groups: relatively wide-ranging introductions originating from the pet trade, food industry or laboratory research, and more restricted species that arrived either in cargo or were purposely introduced.

The first group is less diverse, but contains the vast majority of alien individuals or populations found in our area. For example, several terrapin species originating from the

south-eastern USA were imported to Europe as pets for many years, most notably the Red-eared Slider *Trachemys scripta elegans*. These animals were often set free into the wild if they outgrew their enclosures. While these terrapins fail to reproduce in north European countries due to the relatively low average summer temperatures, many breeding populations have been formed in southern Europe where they compete with our native species for space, food and other resources. An EU ban on the import of these species in 1997 obviously came too late. It also failed to address the problem as importers simply shifted to other species and subspecies. Several other alien terrapin species have also been found in Europe (e.g. *Chrysemys picta*, *Pseudemys* spp., *Chelydra serpentina*, etc.). American Bullfrogs *Lithobates catesbeianus* and an array of non-native water frogs *Pelophylax* spp. were sold as additions to the garden pond, and have thus managed to form large populations throughout several European countries in which they pose a serious threat to the native fauna. In contrast to the terrapin species mentioned above, they are also able to reproduce successfully in more northern areas (e.g. American Bullfrog in Belgium).

The African Clawed Frog *Xenopus laevis* has established itself in several European countries. Like the previous species, these animals are also fast breeders and were used in laboratories in relation to pregnancy research. The species also poses a serious threat to our native amphibians as, like the American Bullfrog, it is thought to be a vector for diseases such as the highly contagious and occasionally lethal chytrid fungi.

A much smaller number of introduced species have found their way into our region accidentally inside cargo containers. The Algerian Whip Snake *Hemorrhois algirus* was introduced to the Maltese capital Valletta during World War I, hidden in shipments of timber from North Africa. Similarly, the Madeiran Wall Lizard *Teira dugesii* managed to form a small stable population in Lisbon after it arrived there in banana shipments from its native Madeira. The Flowerpot Snake *Indotyphlops braminus* is a well-known species that has become distributed around the world because of human globalisation. Due to its fossorial habits and diminutive size, it is easily overlooked and accidentally transported in soil. Asexual reproduction allows it to multiply easily without having to find a mate. European records of this species are scarce, although its presence has been confirmed in Almería, Spain.

Perhaps most obviously, species native to some part of our region may appear at other locations outside of their natural range. As such, these are locally alien species, even though they are native to some part of Europe. The Italian Wall Lizard *Podarcis siculus* is one characteristic example; this species turns up as far north as Belgium in shipments of Mediterranean plants.

Finally, there are several populations – of a wide variety of species – which often appear to be introduced knowingly. The Russian Rat Snake *Elaphe schrenckii* was introduced into a private garden in the Netherlands. This population has spread only moderately since its original introduction in the mid 1990s and apparently seems able to coexist with the native Grass Snake *Natrix natrix*. Several African species are found within our region as well. The African Chameleon *Chamaeleo africanus* has been present for many centuries in a small, confined area on the Peloponnese, allegedly since Roman times. Nowadays, however, its population struggles to survive under growing pressure from tourism and violation of the protected status of its habitat as a Natura 2000 site. Within our region, the Mediterranean Chameleon *Chamaeleo chamaeleon* probably only occurs as a native species on the Greek island of Samos, with all other European populations resulting from introductions. Even the Mediterranean Tree Frog *Hyla meridionalis*, a common sight (and sound) across Mediterranean Spain and France, is thought to be only present in our area because of (at least) two introduction events.

The Balearic Islands serve as an interesting case, as these have been found to host a considerable number of non-native species which originate either from the Iberian

Peninsula or from North Africa. These comprise the Green Toad *Bufotes viridis* (Mallorca, Menorca), Mediterranean Tree Frog *Hyla meridionalis* (Menorca), Iberian Water Frog *Pelophylax perezi* (Mallorca), Spur-thighed Tortoise *Testudo graeca* (Mallorca, Formentera), Hermann's Tortoise *Testudo hermanni* (Mallorca, Menorca), European Pond Terrapin *Emys orbicularis* (Mallorca, Menorca), Moorish Gecko *Tarentola mauritanica* and Turkish Gecko *Hemidactylus turcicus* (both on all of the larger islands), Ibiza Wall Lizard *Podarcis pityusensis* (native to the western islands, but introduced to Mallorca), Italian Wall Lizard (Menorca but more recently also Formentera), Moroccan Rock Lizard *Teira perspicillata* (present on Menorca, occurs naturally in Morocco), Algerian False Smooth Snake *Macroprotodon cucullatus* (Mallorca, Menorca), Viperine Snake *Natrix maura* (Mallorca, Menorca), Western Montpellier Snake *Malpolon monspessulanus* (Ibiza), Horseshoe Whip Snake *Hemorrhois hippocrepis* (Mallorca, Ibiza), and the Ladder Snake *Rhinechis scalaris* (Menorca, Ibiza). The successful introduction of the Algerian False Smooth Snake has been associated with the absence of Lilford's Wall Lizard on Mallorca and Menorca. The same has been hypothesised in regard to the restricted contemporary range of the Mallorcan Midwife Toad *Alytes muletensis*, which may be the result of predation by Viperine Snake and predation by, and competition with, Iberian Water Frog.

The Armenian Rock Lizard *Darevskia armeniaca*, naturally occurs in the Caucasus region and has been introduced to the Zhytomyr area (Ukraine), supposedly in 1963. More recently, Dahl's Rock Lizard *Darevskia dahli*, known only from eight isolated populations in northern Armenia and southern Georgia, was discovered within this introduced population. Both are parthenogenetic species – only females exist and reproduction is clonal.

Finally, many other (European) species are present within our area in allochthonous populations. Taxa such as *Testudo* and *Podarcis* are found throughout Europe in non-natural populations. Examples are far too numerous to be described in detail here although the Italian Wall Lizard deserves special mention, as it seems to have partially or completely displaced endogenous species. The most striking example is that of the Aeolian Wall Lizard *Podarcis raffoneae*, which used to thrive on all of the larger Aeolian Islands but is now restricted to only four tiny islets.

Threats and conservation

For threats associated with alien invasive species, see previous paragraph.

Amphibians and reptiles, like much of the world's fauna, are subject to anthropogenic pressures. Habitat loss represents the single threat of greatest concern to the European herpetofauna. This can occur both through the actual physical destruction of habitat, and through gradual or acute habitat degradation.

Amphibians are considered to be particularly susceptible to habitat loss, as most species occupy both an aquatic and a terrestrial habitat during different parts of the year and/or of their life-cycle. Water quality often suffers as a result of nutrient enrichment, lowered oxygen levels, loss of aquatic invertebrate abundance and diversity (resulting in lost food resources), loss of submerged vegetation and the introduction of (non-native) fish species. Especially in short-lived species, just a few years without reproductive success may cause notable drops in abundance. In practice, the picture is of course more complex, with different species having different requirements, e.g. for breeding – the larger pond-breeding newts tend to prefer sunny, well-vegetated water, fire-bellied toads *Bombina* spp. prefer sunny, poorly-vegetated water, larvae-

depositing populations of the Fire Salamander *Salamandra salamandra* prefer shaded, well-oxygenated, poorly-vegetated water, and so on.

While it is hard to generalise, many reptile species thrive in habitats with high structural diversity, including patchily distributed vegetation of varying height (lower vegetation, shrubs, small trees, etc.) and sufficient basking opportunity in the shape of bare ground, stones, exposed tree trunks, etc. In industrialised countries and particularly in areas with large-scale agricultural activities, these types of 'untidy' environment are often 'cleaned up', depriving the reptile fauna of shelter, basking and feeding opportunities. In other situations reptile populations may benefit from human disturbance, as they often thrive in transitional habitats and disappear when climax forest vegetation deprives them of basking opportunities.

Besides losses in the amount and quality of available habitat, fragmentation into smaller habitat patches also presents particular problems, with reduced connectivity between subpopulations hampering exchanges of individuals and genes and therefore the sustainable persistence of species. Roads commonly act as significant barriers and may also give rise to significant levels of mortality, while traffic noise and light may disrupt the reproductive activity of frogs and toads as well as nesting sea turtles.

Pathogens comprise a separate category of threat. Infection with the fungus *Batrachochytrium dendrobatidis* has caused the collapse of amphibian populations in many different parts of the world, especially Central America. While this fungus now seems widespread in many European amphibian populations, it is only known to have caused mortality in central Spain and Sardinia. As recently as 2013, a related fungus was discovered, *Batrachochytrium salamandrivorans*, which drastically reduced the Dutch Fire Salamander population. This fungus subsequently led to severe mortality in neighbouring populations in Belgium as well. Experimental research showed that a wide array of North American and European newt and salamander species are highly susceptible to it, and thus potentially in serious danger. The origin of the fungus was traced back to eastern Asia, where the local salamander fauna seems to coexist with it. Restrictions on the salamander pet trade have been suggested as a possible control measure. Besides fungal infections, a viral infection, ranavirosis, has also caused the collapse of local amphibian populations at least in various areas in western Europe and the Iberian Peninsula.

While often difficult to follow or enforce, measures can be taken by both professional and amateur herpetologists to limit the spread of these diseases in amphibian habitats. Take care to dry your footware and any equipment used in the field for several days after visiting amphibian populations, and try to limit the number of visits to multiple locations within a short time frame. Several disinfectants such as Virkon are readily available and highly recommended for those who visit many separate amphibian populations within a restricted amount of time. Usually, such disinfectants can be diluted with water and sprayed onto field materials and shoes or boots using a simple hand sprayer.

The number of conservation efforts to save amphibian and reptile species from local extinction has increased significantly during the last decades in many European countries. Improved information on the actual distribution of species and knowledge of their evolutionary relationships have further facilitated the identification of conservation priorities. For instance, it is now known that the Sardinian Brook Newt *Euproctus platycephalus* and the Italian Agile Frog *Rana latastei* are not as rare as previously thought, owing to the discovery of many hitherto unknown populations. This creates the need to reassess their conservation status. Luckily, a number of active conservation groups exist throughout Europe which use their local knowledge to save populations, or even species, from extinction. Examples include the protection of sea turtle nesting sites in Greece, saving lowland populations of the Meadow Viper *Vipera ursinii* complex in Romania and Hungary from extinction, and habitat

improvements implemented throughout Europe to support many fragmented and specialised species such as the Great Crested Newt *Triturus cristatus*, Yellow-bellied Toad *Bombina variegata* or Midwife Toads *Alytes* spp. The European Union, notably through the LIFE programme, has (co)funded dozens of these projects.

Conservation efforts are, however, not limited to official organisations. Instead of going out to look for amphibian and reptiles in the field, one can also encourage them to colonise gardens or other semi-natural places by making improvements that will attract them. If newts inhabit your area, you might find them in your garden within a year of constructing an amphibian-friendly, and fish-free, pond. Creating basking spots composed of rocks, stone roof tiles and pieces of wood in a sunny spot surrounded by low vegetation may attract various reptile species native to your area. Creating a small ecosystem in your own garden is an easy way to support local herpetofauna populations and to observe and admire them at close range.

How to watch amphibians and reptiles

PREPARATION

Reading as much as you can about the species you want to see is essential. If you don't know where, when and how a species lives, you can't really expect to find it. The species accounts in this book provide many clues. Additional information from regional guide books, articles, and so on, may be useful as the ecology and behaviour of many species varies over their distributional range. Experience also helps. If you found some Cat Snakes *Telescopus fallax* before, you will probably be more likely to search in the right place and at the right moment next time.

The internet allows us to get in touch with professional and amateur herpetologists all over the continent. Often, nothing beats local help when travelling. Enjoy learning more about these animals by looking for them together with local herpetofauna enthusiasts. On the other hand, it may not be very useful to trust all local knowledge, especially when it comes to snakes. People sometimes tend to generalise on the habits or scarcity of a species, based on anecdotes and personal (limited) catch success only.

Asking local people while travelling can also be helpful. However, this often leads to stories tinged with a certain amount of exaggeration and folklore. We have heard local people talk about snakes drinking milk (Italy), snake poison located in the tail-tip (Greece), leprosy transmitted by geckos (Spain, Malta), Ocellated Skink *Chalcides ocellatus* being extremely dangerous due to toxic substances exuded from both head and tail (Karpathos), vipers only living in the mountains (Greece), and so on. Also, people's knowledge of the abundance of a species living on their doorstep can be strange. On Karpathos, we were at first not that happy to learn that the locals (or at least many of them) did not know about the endemic salamander *Lyciasalamandra helverseni*. In this case, we were lucky to find that this proved to be in contrast to its actual abundance.

Of course, you will not always have local

guidance, so that's where personal experience and knowledge come into play.

Once you get the hang of a species' habitat requirements, online aerial photography provides an ample playground for pinpointing places to visit.

SEARCHING AND FINDING

How to search and find, depends on the species. Usually, finding amphibians comes down to finding the right habitat, in the right area, mostly associated with waterbodies. Calling frogs and toads can lead you to these places, so digging up some sound recordings of the call of a species helps. Salamanders can be hard to find in one season, but are often all over the place in good (humid) conditions at the right time of the year. Newts are usually readily found in their aquatic habitat during the breeding season, although – as with most amphibians – a nocturnal hunt is often the most rewarding. Net dipping is the way to go if you are looking for newt photography. In less favourable conditions, flipping all kinds of objects, both natural (logs, rocks, etc.) and man-made, in the more humid, or less dry, corners of the habitat tends to provide at least some results, also for lizards and snakes. To respect the habitat of these animals, it is crucial to always replace shelter objects back in their original position.

When handling venomous snakes, the use of thick (welding) gloves is a necessity. Also note the cooking pan lid; this can be used to cover the snake temporarily, in order not to stress the animal too much.

Turning over stones and carefully walking alongside dry-stone walls are especially useful techniques to find almost any European reptile species.

Diving and snorkelling in small ponds or streams can be good to observe aquatic species, like newts (such as here, Sardinian Brook Newt) or, for example, Dice Snake.

Tortoises are rather easy to find as well, as they are slow and often make plenty of noise while making their way through the vegetation. Lizards often bask conspicuously and, again, when you are in the right place, it is usually rather a matter of tens of minutes than of hours to find them. Skinks can be less conspicuous, but are often (very) abundant in the right habitat in spring. A number of more secretive and/or subterranean species are best found by flipping objects.

In general, snakes may be the hardest group to find. Besides animals found dead on the road, finding snakes may require dedicated and specific searches. Whereas many tourists come across the occasional lizard, snakes are usually a much rarer sight if you do not really search for them intensively. A few snake species are easy to find. In many areas, the aquatic species of the genus *Natrix* can be readily seen. When turning stones in spring, the Worm Snake *Xerotyphlops vermicularis* is also not that hard to find in the more southern parts of its range. Vipers can be restricted to small areas, but where they exist, they can be abundant and rather slow-moving. Whip Snakes (*Hierophis, Hemorrhois, Platyceps, Dolichophis*) and Montpellier Snakes *Malpolon* spp. are also often abundant but are usually very fast moving. Rat snakes (*Elaphe, Rhinechis, Zamenis*) and Smooth Snakes *Coronella* spp. are often either more secretive or less abundant and it can be puzzling to decide which is more true – perhaps both in some cases? Finding them comes down to proper timing and persistence. Sand Boa *Eryx jaculus* may require a lot of time flipping stones in suitable habitat, although the hottest part of the day is generally best avoided when flipping for any species which may move freely to deeper ground.

Different species have different habits and habitats. Reading as much as you can really helps. Many snake species like areas with a diverse mixture of open spots, some rocks, herbs, shrubs and bushes. Most, and certainly the more difficult, snake species rarely lie around fully exposed. Looking carefully for small parts of their body visible in between the vegetation or underneath a rock is necessary. Most species are thermophiles – so one's chances are often better on a south-facing slope, including those exposed to the morning sun. Some species, like Montpellier snakes, are opportunistic and can be found in places which are less natural but which offer ample food (e.g. rats) such as dumpsites. A snake has got to eat, so food availability may be more important for snake abundance than the pristine 'naturalness' of the habitat. Many snakes can be found underneath something, so turning over rocks, logs, garbage, etc. can be rewarding too. The key is not to give up too soon. Large, flat stones are most promising. Again, remember to put them back as carefully as possible without squashing any animals or altering the habitat in general. Many species occur in fragile and endangered habitats which only recover from disturbance slowly.

Timing is also important. From a seasonal perspective, spring is the best time for finding most herpetofauna species, while they are reproductively active. In terms of time of day, do not expect to find many snakes when temperatures are above 30°C. Harsh summer conditions may even cause animals to withdraw into hiding and aestivate. On warm days, many reptile species (snakes, lizards and also tortoises) only come out during the first

Boardwalks provide shade and hiding places for reptiles in an otherwise hot dune habitat. Note the use of fishing rods to catch small lizard species that occur on or near the boardwalk.

and last hours of sunshine. Excellent weather for finding snakes is cloudy but warm enough, and after rain when they also come out to bask. If it is too hot for an observer to walk around, there are usually not many snakes out and about. It can be useful to feel the substrate temperature with your hands. If the soil is really hot, no snake will lie on it, so searching in more shaded places might be more productive. The same goes for turning stones: if the lower surface of a rock is boiling, there is no reason to expect reptiles there. While searching, walk slowly and scan every part of the habitat (e.g. a dry-stone wall with shrubs). If you hear a short, stumbling noise, it is most likely a lizard – they are only fast over short distances. Snakes make a longer lasting noise. If you hear such a noise, quickly but carefully make your way to the sound. Patience and persistence are the qualities of a good snake hunter.

Finally, your chances of finding anything increase with the number of people searching. In contrast to birding, where too many people may scare the animals away, herpetofauna hunting success is, in our opinion, proportional to the number of searchers. Of course, while gifted snake hunters are not that common, they are a highly valuable asset to a searching team.

CATCHING AND HANDLING

Any person interested in amphibians and reptiles should realise that many species are protected by European and/or national law and catching them is illegal. In many cases, observing them and photographing them can be perfectly well achieved without touching them.

A good way to observe amphibians and reptiles up-close is to join the local monitoring or rescue activities led by a myriad of organisations. These include moving amphibians across roads during the breeding season or regularly checking up on the same population and noting down the numbers of individuals observed. Alternatively, many national herpetological societies throughout Europe provide opportunities to help with collecting distribution data or with other activities in the field. Start by looking on the website of the European herpetological society, Societas Europaea Herpetologica (SEH) – www.seh-herpetology.org/links/european_herpetological_societies.

To catch newts, leaving a funnel trap in ponds overnight has proved useful in areas with (presumably) average or low abundance of the larger newt species. This also works well in densely-vegetated ponds, where net dipping is difficult. Funnel traps are often

When handling any snake species (like this Caspian Whip Snake from Samos, Greece), but especially larger individuals, it is important to support their entire body instead of just picking them up by the tail.

cheap, and easy to assemble and take apart again afterwards for transportation. Torches are indispensable to explore waterbodies and their surroundings at night, when, for example, larger newt species become more active and visible. Another nocturnal excursion is exploring stone walls with holes in them, looking for geckos but also the snakes that hunt them (e.g. Cat Snake *Telescopus fallax*). If the weather is not too cold, not too windy, and (for amphibians) not too dry, cruising roads by bike or car at twilight or after dark can also be productive for many species of amphibians and every now and then some snake species (e.g. Ladder Snake *Rhinechis scalaris*, Cat Snake, Milos Viper *Macrovipera lebetina schweizeri*, Four-lined Snake *Elaphe quatuorlineata*, etc.).

Dipnetting is a good way to catch many amphibian species, both during the day and at night.

To obtain a satisfying photograph, to admire an animal at close range, and sometimes even to identify it, it may be necessary to catch lizards or snakes. Lizards can be easily caught using a variety of lizard nooses, which usually consist of a stick with a fishing line or dental floss noose positioned at the far end. When moving the stick towards the lizard's head, the subject usually remains still, or might even try to bite the noose. Note, however, that the weight of smaller lizards such as the small Psammodromus species complex or smaller Algyroides might be too low to close the noose, while large Green and Ocellated Lizards (*Lacerta* and *Timon* species) might be too heavy to lift up just by their neck. Despite the availability of a variety of snake-catching tools, welding gloves are common equipment for catching most European venomous snakes. The gloves should be kept on all the time while exploring suitable habitat, as you never know when you will encounter a snake. They are also useful when turning stones or finding your way

through thorny vegetation. But this method is never foolproof, and accidents may happen, especially with worn-out gloves. Larger individuals of Ottoman Viper *Montivipera xanthina* and Milos Viper *Macrovipera lebetina schweizeri* are able to bite through them. Taking good care is always essential and experience with smaller species is useful before trying to catch larger ones. Photographing venomous snakes is best done with at least one glove on if you want to get closer. In that way, you have one hand to prevent the snake from going the wrong way and another to handle your camera in a more or less comfortable manner. For better safety, use of snake tongs and hooks is recommended.

It is important to detain any animal as briefly as possible to avoid stress and the chance of fatality. As most species occupy small home ranges, it is best to release any herp in the same spot as they were caught. This is essential with species that have a small home range. Handling them should always be done firmly but with due care so as not to harm them in any way.

Many amphibian and reptile species may hide under rubbish.

PHOTOGRAPHY

To photograph newts and some of the more aquatic frogs and toads, such as fire-bellied toads (*Bombina* species), you can use a small aquarium that is slim from front to back, so the animal is obliged to be close to the front glass – where the photographer is. Newt photography often requires a lot of patience, as nearly all of them refuse to stay clear of the margins of the aquarium, which spoils the picture. This can be solved by placing suitable substrate (stones, pebbles, vegetation, dead leaves, etc.) onto the bottom of the aquarium.

The majority of lizard species are best photographed without handling them. While this may require patience and a slow approach, in most cases persistence pays off

Macedonian Crested Newt photoshoot in Montenegro. Small, narrow aquaria can be used to photograph amphibian larvae and their adult, aquatic counterparts. Note the use of a wooden box to store the aquarium while travelling.

remarkably well. From an aesthetic point of view this also makes for the best pictures, as handled lizards show stressed postures in pictures, with oddly curved bodies, dull eyes and curled-up toes. Consequently, lizard photography might even be among the more enjoyable types of nature photography, as the photographer stealthily creeps up to his subject and (in an anthropocentric way) experiences some sort of interaction with the curious but wary animal.

For snake photography, covering the animal with the lid of a cooking pan provides some sense of security and when the lid is lifted, a few seconds of snake tranquillity can be enough for a picture of any of the more mobile snake species. Make sure that the lid does not catch too much sunlight, otherwise the snake underneath it will do anything but calm down. With animals that are too large or too small for the 'lid method', covering them with clothing or similar objects may work as well. The nervous Worm Snake *Xerotyphlops vermicularis* is too small to feel safe underneath the smallest lid; they hate sunlight and become very active when exposed to it. A smaller object (e.g. glove) can be useful to provide them with the same sense of security. Some snake species will, however, always be hard to photograph. A warmed-up whip snake (*Hierophis, Hemorrhois, Platyceps, Dolichophis*) is never really calm. Rat snake species (*Elaphe, Rhinechis, Zamenis*) can refuse to stay still as well, especially if laid out in the sun, as they are not too fond of direct sunlight. The most agreeable snake species to photograph may well be vipers. After a few attacks, they often calm down. However, in contrast to the phlegmatic nature often attributed to them, in our experience, Meadow Vipers (the *Vipera ursinii* complex) are not calm and docile at all. All those that we have photographed, i.e. a total of over 20 individuals of at least three *ursinii* subspecies, as well as Greek Meadow Viper *Vipera graeca*, were almost constantly focusing on the photographer, hissing and threatening to bite all the time. In such cases, an assistant acting as decoy to attract the snake's attention can be most useful for a nice profile shot.

We will not dwell on the qualities of the different photographic equipment available, nor on post-processing of photos, as that would make for a different book. Technique and skill always play a role and are not easy to describe. Personal taste is of course also involved. Besides focusing on the animal's eye, keeping your position in relation to the sun in mind and looking for a setting with moderate or low contrast are good basic rules for a novice photographer.

REPORTING

Taking notes and recording the coordinates of any observation may make a valuable contribution to ongoing mapping projects and other research activities. Information on these can be obtained through the organisations mentioned earlier.

Snake and lizard species can be found while carefully scrutinising partially overgrown roadbanks.

Where to watch amphibians and reptiles

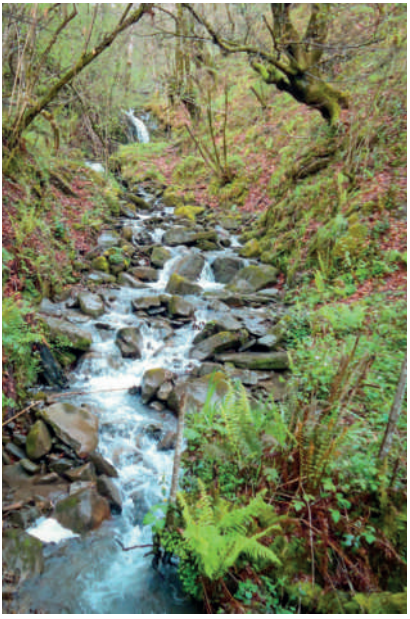
This chapter provides a non-exhaustive, regional tour through the highlights of Europe's herpetofauna by selected regions.

IBERIAN PENINSULA – SPAIN AND PORTUGAL

The Iberian Peninsula hosts a particularly high herpetological diversity due to its mixture of Atlantic, Mediterranean and continental climates, and the existence of several mountain ranges. In addition, several reptile species of African origin have been able to colonise this area in the distant past via the Gibraltar land bridge. While diverse combinations of amphibian and reptile species can be found across this peninsula, three areas especially stand out.

The north of the peninsula has a temperate, Atlantic climate resulting in the development of lush and humid deciduous forests. They are generally located along steep, dramatically shaped mountain ranges, such as the Picos de Europa, which are home to various reptile and amphibian (sub)species found nowhere else. Widespread species that are typical of most of central and northern Europe reach their south-western limits here, including the Common Midwife Toad *Alytes obstetricans* (represented by the subspecies *boscai* in the northwest), Slow Worm *Anguis fragilis*, Common Wall Lizard *Podarcis muralis* and Western Green Lizard *Lacerta bilineata*. Other species are represented by endemic subspecies, such as the Fire Salamander *Salamandra salamandra bernardezi* and *gallaica*, Alpine Newt *Ichthyosaura alpestris cyreni*, Common Frog *Rana temporaria parvipalmata*, Viviparous Lizard *Zootoca vivipara louislantzi* and Smooth

Oak forests shift to shrub vegetation and eventually into rocky slopes along the Sierra de Peña de Francia in central Spain. A myriad of species occur along this habitat gradient, including Carbonell's Wall Lizard, Lataste's Viper and Peña de Francia Rock Lizard.



Small, fast-flowing streams provide typical amphibian habitats in the mountains of northern Spain. Fire Salamander (ssp. *bernardezi*), Golden-striped Salamander (ssp. *longipes*), Common Frog (ssp. *parvipalmata*), Iberian Stream Frog and Spiny Toad occur in or around this particular torrent near Oviedo.

Snake *Coronella austriaca acutirostris*. All of these can be found together in the vicinity of streams and ponds which are usually scattered along the characteristic humid meadows and rocky plateaus. The most striking, typical Iberian species occurring in this area is perhaps the Golden-striped Salamander *Chioglossa lusitanica*, whose only relative lives far away in the Caucasus Mountains. A swift, slender salamander, this species has adapted to life in these humid environments by reducing its lungs and relying on breathing through the skin and the mucous lining of the mouth. Other Iberian taxa commonly found across the north of the Iberian Peninsula include the Iberian Stream Frog *Rana iberica*, Schreiber's Green Lizard *Lacerta schreiberi* and both subspecies of Seoane's Viper *Vipera seoanei*. High in the mountains, Iberian Rock Lizard *Iberolacerta monticola* is a fairly common sight.

Further south, across the dry, flat Spanish meseta, lie the hillsides and mountains of the Sistema Central. This ancient mountain range is home to a mixture of Atlantic and Mediterranean herpetofauna. Many different species can be found at a single locality. Travelling upwards along the mountains of Madrid or Salamanca, we first pass through Mediterranean dehesas: open deciduous forests usually consisting of oaks, interspersed with cattle ponds, large boulders and fields of low, herbaceous vegetation. These areas are home to amphibians such as the Iberian Painted Frog *Discoglossus galganoi*, Iberian Midwife Toad *Alytes cisternasii*, parsley frogs *Pelodytes* spp., Western Spadefoot Toad *Pelobates cultripes*, Bosca's Newt *Lissotriton boscai*, marbled newts *Triturus marmoratus* and *T. pygmaeus* and Sharp-ribbed Newt *Pleurodeles waltl*, but also more widespread species such as the Natterjack Toad *Epidalea calamita*, Spiny Toad *Bufo spinosus*, tree frogs *Hyla* spp. and Iberian Water Frog *Pelophylax perezi*. Lizards such as the Large Psammodromus *Psammodromus algirus*, Spanish Psammodromus *Psammodromus hispanicus* complex, Ocellated Lizard *Timon lepidus* – and also the Iberian Three-toed Skink *Chalcides striatus* and Bedriaga's Skink *Chalcides bedriagai* – can be observed speeding from cover to cover. Turning stones might reveal worm lizard species *Blanus* spp. Apart from three snake taxa which only occur in the

Large dune formations along the southern Spanish coast can host more than twenty amphibian and reptile species. Doñana National Park, Spain.

Pyrenees and northern Spain, all of the snakes of the Iberian Peninsula can be found here. As we move higher up the mountains, forests are replaced by eroded mountain tops. Here, Cyren's Rock Lizard *Iberolacerta cyreni* and Peña de Francia Rock Lizard *Iberolacerta martinezricai* occur locally.

Partially-vegetated erosion slopes in the Sierra de Guadarrama, Spain, are home to Common Wall Lizard, Cyren's Rock Lizard, Smooth Snake and Lataste's Viper.

Going all the way south, we reach the Atlantic and Mediterranean coasts. Most of the aforementioned species also occur here, but in spacious dune areas such as the Coto Doñana, marshes and low, coastal mountain ranges. The amphibians breed in winter, while reptile species are generally active during early spring and autumn. Lataste's Viper *Vipera latastei* and the Iberian False Smooth Snake *Macroprotodon brevis* are just a few of the reptile species hiding in the dense dune vegetation. Carbonell's Wall Lizard *Podarcis carbonelli* can be seen running from bush to bush, if you are lucky enough to encounter one of the fragmented populations of this species. Higher up in the bushes, one can see Mediterranean Chameleons *Chamaeleo chamaeleon*. Semi-desert areas are especially common in the southeast of the peninsula where Spur-thighed Tortoise *Testudo graeca* has made its home, while the Western Montpellier Snake *Malpolon monspessulanus* and Horseshoe Whip Snake *Hemorrhois hippocrepis* may reach sizes of close to two metres long. Tiny Spanish Wall Lizards *Podarcis hispanicus* and massive Sierra Nevada Ocellated Lizards *Timon nevadensis* further add to the diversity of this dry, but certainly not species-poor region.

In addition to the regions briefly described here, there are many other interesting areas to explore. One deserves special mention – the Betic (or Baetic) Mountains, which host the endemic species Betic Midwife Toad *Alytes dickhilleni* and Spanish Algyroides *Algyroides marchi*.

PYRENEES

With a dry, Mediterranean climate on its southern slopes and lush Atlantic forests on the northern sides, the presence of several endemic species makes the Pyrenean Mountains a true herpetological hotspot. The endemic amphibians are found along clear, fast-flowing mountain streams in forests, or above the tree line. These include the Pyrenean Brook Newt *Calotriton asper*, Pyrenean Stream Frog *Rana pyrenaica* and the attractive subspecies *fastuosa* of the Fire Salamander *Salamandra salamandra*, usually

Open, high-altitude Pyrenean valleys provide suitable habitat for amphibians such as Fire Salamander and Pyrenean Brook Newt. Rocky areas of the upper Aran Valley in Spain, shown here, are also home to Common Wall Lizard, Aran Rock Lizard and Asp Viper (ssp. *zinnikeri*).

Humid meadows and small ponds, often characterised by an abundant orchid flora in spring, are typical habitats for Viviparous Lizard (ssp. *louislantzi*) and Palmate Newt. Huesca, Pyrenees, Spain.

characterised by a dorsal pattern of two rather wide, continuous stripes. Probably the most common reptile here is the omnipresent Common Wall Lizard *Podarcis muralis*. The lower, westernmost Pyrenees are home to the dark and heavily blotched subspecies *sebastiani* of the Catalonian Wall Lizard *Podarcis liolepis*, while its nominate subspecies can be found along most of the southern Pyrenees. Three other rock-climbing lizard species also occur here. They are restricted to isolated areas of particularly high elevation, where they usually replace other lizard species. They are adapted to a short active season and the inhospitable weather conditions that may rule out activity even on summer days. From west to east, the Pyrenean Rock Lizard *Iberolacerta bonnali*, Aran Rock Lizard *Iberolacerta aranica* and Aurelio's Rock Lizard *Iberolacerta aurelioi* all have restricted ranges, but all occur in both France and Spain, while the latter can also be found in Andorra. The Viviparous Lizard *Zootoca vivipara* is represented here by the egg-laying subspecies *louislantzi*.

The Pyrenean subspecies of the Asp Viper *Vipera aspis zinnikeri* is highly variable and also occurs at lower altitudes in adjacent parts of France. A second viper species, Seoane's Viper *Vipera seoanei*, reaches the extreme west of the Pyrenees only.

BALEARIC ISLANDS

The Balearics are home to three endemic species. Lilford's Wall Lizard *Podarcis lilfordi* is nowadays found only on several uninhabited islands and islets off the coast of Mallorca and Menorca. Populations on the main islands have possibly become extinct after humans introduced cats, rodents, snakes (Algerian False Smooth Snake *Macroprotodon cucullatus,* Ladder Snake *Rhinechis scalaris*) and other predators. The Moorish Gecko *Tarentola mauritanica* is very common and very active during the day, perhaps due to the lack of competition from other diurnal lizards. The endemic lacertid of the larger western islands of Ibiza and Formentera, the Ibiza Wall Lizard *Podarcis pityusensis*, also inhabits many tiny islets, but is still very abundant on both larger islands as well. It has also been introduced to a few places on Mallorca, mainly near human settlements. A small number of ravines and canyons in the Serra de Tramuntana mountain

The Esculls de Codrell islets, off the coast of Menorca, represent a typical habitat for Lilford's Wall Lizard.

range along Mallorca's north-western shore are home to the elusive Mallorcan Midwife Toad *Alytes muletensis*, a distinctive species which was only described as late as the end of the 1970s. Its historical range has been greatly reduced by predation and competition (from the introduced Viperine Snake *Natrix maura* and Iberian Water Frog *Pelophylax perezi*, among others). Luckily, conservation measures, including the introduction of captive-bred individuals, show promising results. All other species present on the Balearic Islands are thought to have been introduced by humans. In particular, the Moroccan Rock Lizard *Teira perspicillata* found on Menorca (especially in the west), and the Algerian False Smooth Snake found on both Menorca and Mallorca, have their only European presence here.

TYRRHENIAN ISLANDS – CORSICA & SARDINIA

A prolonged isolation from the mainland has made the Tyrrhenian Archipelago home to a large number of endemic species, some of which are only found on Corsica or Sardinia, others on both. While Corsica is covered by high, forested mountains composed largely of granitic rocks, Sardinia is predominantly hilly but hosts some impressive karstic limestone ranges.

Corsica's landscape diversity is therefore more extreme. Its interior features high mountain ranges with snow-covered tops, interspersed with numerous brooks and torrents. In particular, the more shaded, cooler streams and adjacent puddles are home to several endemic amphibian species which are often encountered alongside each other. These species are, however, not restricted to mountain areas but may also occur at much lower altitudes, even in maquis vegetation with cool microhabitats. The first of these, the Corsican Painted Frog *Discoglossus montalentii*, often breeds in stagnant puddles alongside running water. It is a secretive, cryptic species, which was only described as distinct from its locally sympatric relative the Tyrrhenian Painted Frog *Discoglossus sardus* in 1984. The Corsican Brook Newt *Euproctus montanus* favours similar habitats but is also found in running water. This species is especially conspicuous during summer, although it may be necessary to turn over submerged objects in the shallows of brooks to find it. Finally, the colourful and variable Corsican Fire Salamander *Salamandra corsica*

Karstic limestone massifs are typical habitats for cave salamanders (in this case Monte Albo Cave Salamander), while stone water troughs provide suitable habitat for the much more generalist Tyrrhenian Tree Frog. Monte Albo, Sardinia.

A typical habitat of endemic Tyrrhenian amphibian species such as Corsican Painted Frog, Tyrrhenian Painted Frog, Corsican Brook Newt and Corsican Fire Salamander. Foret d'Aïtone, Corsica, France.

occupies a wide altitudinal range, and can be found from low-altitude maquis vegetation up to mountainous, deciduous broad-leaved woods, including the typical Corsican chestnut forests.

The Sardinian situation is quite different. Alpine slopes are less abundant, whereas its karstic limestone mountain ranges set it apart from Corsica. These mountains provide ample shelter from the inhospitable summer heat for a range of cave salamanders endemic to this island – the Monte Albo Cave Salamander *Speleomantes flavus*, Sette Fratelli Cave Salamander *Speleomantes sarrabusensis*, Sopramonte Cave Salamander *Speleomantes supramontis*, Odorous Cave Salamander *Speleomantes imperialis* and Gené's Cave Salamander *Speleomantes genei*. The name 'cave salamanders' is somewhat misleading – in the wet and colder parts of the year, these animals can be found all over the forest floor of these mountains and adjacent lowlands. The name indicates that outside of winter they are usually seen in caves, where they remain approachable throughout most of the year. The final strictly Sardinian endemic species is the Sardinian Brook Newt *Euproctus platycephalus*. Like its Corsican counterpart, it was once found in most parts of the island in streams, brooks and a few mountain lakes, but pollution (e.g. from the use of DDT), habitat destruction and predation by introduced fish and snake species such as Viperine Snake *Natrix maura* have been identified as possible causes of its significant decline. Nowadays it can only be found in relatively remote, pristine localities. Similarly, the Tyrrhenian subspecies *cetti* of the Grass snake *Natrix natrix* is rare on Sardinia, while it is quite numerous on Corsica (and was previously named *N. natrix corsa*).

Several other endemic species are found both on Corsica and Sardinia, as well as some of the surrounding islets. Both the Tyrrhenian Painted Frog *Discoglossus sardus* and Tyrrhenian Tree Frog *Hyla sarda* are likely to occur anywhere where water is present. On Corsica, the former can even coexist with its more restricted Corsican relative. Bedriaga's Rock Lizard *Archaeolacerta bedriagae* is largely restricted to rocky outcrops in the mountains, but also inhabits some coastal rock formations. It is much more widespread on Corsica than on Sardinia and large numbers can often

Large, coastal rock formations on Corsica provide habitat for Bedriaga's Rock Lizard, Tyrrhenian Wall Lizard, Western Whip Snake, European Leaf-toed Gecko and Moorish Gecko.

Smaller caves, which may be challenging to find, are particularly suitable for cave salamanders, especially outside the winter months.

be observed along brooks. For the semi-shade loving Pygmy Algyroides *Algyroides fitzingeri* the opposite is true – while only rarely encountered in clearings in woods and similar habitats on Corsica, it is surprisingly widespread on Sardinia, also occupying treeless, coastal maquis. More abundant than either of these, the Tyrrhenian Wall Lizard *Podarcis tiliguerta* is widespread and locally extremely numerous across the archipelago. In more man-made and low elevation localities, it can, however, be replaced by the equally abundant, introduced Italian Wall Lizard *Podarcis siculus*. A final lizard specialty of the region is the European Leaf-toed Gecko *Euleptes europaea*, a small species found amongst granite rocks which offer numerous crevices, usually at frost-free coastal elevations.

LIGURIA

The northern Italian region of Liguria largely comprises the area where the Apennine Mountains come close to the Tyrrhenian Sea. In contrast to many other areas of peninsular Italy, this region is particularly humid and therefore hosts a considerable number of endemic and other amphibian species. This, in combination with some species that only just penetrate into Italy from adjacent France, such as the Parsley Frog *Pelodytes punctatus*, Ocellated Lizard *Timon lepidus*, Western Montpellier Snake *Malpolon monspessulanus* and Iberian Three-toed Skink *Chalcides striatus*, make Liguria an attractive destination at any time of the year.

The lush woods of eastern Liguria coincide more or less with the northern limit of a number of Apennine endemics, including the Italian Stream Frog *Rana italica*, the Italian subspecies of the Yellow-bellied Toad *Bombina variegata pachypus* and Fire Salamander *Salamandra salamandra gigliolii*, and the Northern Spectacled Salamander *Salamandrina perspicillata*. The small yet attractive spectacled salamanders represent an old and distinct salamander lineage, found only in Italy. Stretching from Liguria south across the Apennine axis to about halfway across the country, two species of cave salamander occur in wet woods with sufficient subterraneous hiding opportunities. From northwest to southeast these are Strinati's Cave Salamander *Speleomantes strinatii*, stretching west into south-eastern France, and Ambrosi's Cave Salamander *Speleomantes ambrosii* which occupies a tiny range near the border of

The constant water availability provided by small water troughs may attract many amphibian species. Fire Salamander (ssp. *gigliolii*), Spectacled Salamander, Ambrosi's Cave Salamander, Alpine Newt (ssp. *apuana*) and Common Toad were found in and around this example. La Spezia, Italy.

Caves hidden in the steep, forested Ligurian slopes provide refuge for cave salamanders of the genus *Speleomantes*. Busalla, Genoa, Italy.

Liguria and Tuscany. The Italian Cave Salamander *Speleomantes italicus* is found further south, in Tuscany. Any pond or other stagnant waterbody in the area may provide sightings of other typical Italian species and subspecies such as the Smooth Newt *Lissotriton vulgaris meridionalis*, Alpine Newt *Ichthyosaura alpestris apuana*, Italian Crested Newt *Triturus carnifex* and Italian Tree Frog *Hyla intermedia*, as well as more widespread species such as the Common Toad *Bufo bufo*, Green Toad *Bufotes viridis*, Agile Frog *Rana dalmatina* and two water frog taxa (Pool Frog *Pelophylax lessonae* and Edible Frog *Pelophylax* kl. *esculentus*).

Open meadows, rocky cliffs and stone walls are home to reptiles such as the abundant Common Wall Lizard *Podarcis muralis*, which is here represented by the largely black-and-green subspecies *nigriventris*. The Aesculapian Snake *Zamenis longissimus*, Asp Viper *Vipera aspis francisciredi* and Western Whip Snake *Hierophis viridiflavus* are a fairly common sight, while dusk and dawn are the best times to observe Southern Smooth Snake *Coronella girondica* in the warmer habitats. Finally, all three European water snakes occur here – Grass Snake *Natrix natrix*, Dice Snake *Natrix tessellata* and Viperine Snake *Natrix maura*.

SOUTHERN ITALY AND SICILY

Despite the fact that southern Italy is not a noted hotspot of herpetological diversity, it hosts a unique assemblage of species including some from Africa and the Balkans. Starting in the 'heel' of Italy, the region of Apulia is largely flat, with open landscapes interspersed with dry-stone walls and small pine forests. The landscape, reminiscent of that on the other side of the Adriatic Sea, also hosts a few typically Balkan species such as Kotschy's Gecko *Mediodactylus kotschyi* and Leopard Snake *Zamenis situla*. Italian Aesculapian Snake *Zamenis lineatus* and Asp Viper *Vipera aspis hugyi* occur here and in the remainder of southern Italy. Small cattle ponds and water tanks are often home to the Italian Newt *Lissotriton italicus*.

Travelling further south, steep, high mountains rise from the hilly lowlands and the shores of the Mediterranean Sea. The Calabrian beaches are largely devoid of mass tourism, and so the majority of Italian Loggerhead Turtle *Caretta caretta* breeding sites are located here. Calabria, as well as

Vast mountainous areas on the mainland of southern Italy are covered by old-growth forests. Amphibians such as Fire Salamander (ssp. *gigliolii*), Southern Spectacled Salamander and Italian Stream Frog can be found in the small streams flowing down from them.

Dry-stone walls provide a habitat for the endemic Sicilian Wall Lizard, against the dramatic background of Mount Etna.

southern Campania and Basilicata are home to most of Italy's peninsular herpetofauna, in addition to hosting many populations of the Southern Spectacled Salamander *Salamandrina terdigitata*, the nearly completely yellow Fire Salamanders *Salamandra salamandra gigliolii*, and the remarkable southern subspecies *breviceps* of the Common Wall Lizard *Podarcis muralis*, which occurs in relatively humid environments. This subspecies is largely ground-dwelling. Its shorter head and limbs make it somewhat similar to Viviparous Lizard *Zootoca vivipara*. In contrast to the Common Wall Lizard, the larger and equally abundant Italian Wall Lizard *Podarcis siculus* seems to become increasingly abundant further south, where its dorsal pattern becomes more often reticulated rather than striped.

Crossing the Strait of Messina from the mainland, we reach Sicily. Many lowland areas of this island look quite similar to North Africa and several species of African origin can be found here. The Ocellated Skink *Chalcides ocellatus* occurs throughout the island. Being more closely related to its African relatives than those of the Italian mainland, the green toads on Sicily are represented by the endemic subspecies *Bufotes boulengeri siculus*. However, this is replaced by the Green Toad *Bufotes viridis* in the extreme northeast of the island. Another amphibian of African origin is the Painted Frog *Discoglossus pictus*, which is rather widespread and often breeds in shallow puddles alongside larger streams. These puddles and ponds can also be home to the Italian Tree Frog *Hyla intermedia*, two water frog species (the Pool Frog *Pelophylax lessonae*, of which an undescribed subspecies occurs on Sicily, and Edible Frog *Pelophylax* kl. *esculentus*), as well as Common Toad *Bufo bufo*, which can reach enormous sizes. Unfortunately, a rather large area in the west of the island also hosts an alien amphibian species – the African Clawed Frog *Xenopus laevis*. Both the Sicilian Pond Terrapin *Emys orbicularis trinacris* and Hermann's Tortoise *Testudo hermanni* have healthy, but patchily distributed populations. The ubiquitous Italian Wall Lizard is the most abundant lacertid, generally occurring in somewhat more lush habitats than the emerald-green, endemic Sicilian Wall Lizard *Podarcis waglerianus*. Most of the snakes of southern Italy are also present on Sicily. Searching for Italian Aesculapian Snake, Leopard Snake, Smooth Snake *Coronella austriaca* and Asp Viper on the partially overgrown lava fields of Mount Etna is a unique experience. Finally, a few of the Aeolian Islands, located just north of Sicily, still host the endemic and highly threatened Aeolian Wall Lizard *Podarcis raffoneae*.

ADRIATIC COAST AND THE DINARIC MOUNTAINS

The karstic limestone mountains and coastal lowlands that line the eastern coast of the Adriatic Sea (from extreme north-eastern Italy across Slovenia, Croatia, parts of Bosnia and Herzegovina, and Montenegro to northern Albania) represent a herpetologically diverse region hosting a number of endemic species. The warm, coastal region especially functioned as a highway for northwards dispersal of several species typical of the Balkan Peninsula. These may reach as far north as Italy or Slovenia. Furthermore, most islands are inhabited by varied combinations of species,

The surroundings of Bukumirsko Jezero in Montenegro are home to endemic taxa such as Prokletije Rock Lizard and the subspecies *montenegrina* of the Alpine Newt, but also host an array of other amphibians and reptiles.

with the larger Croatian islands of Krk and Cres holding the highest diversity.

The most remarkable species occurring in this area is without doubt the Olm *Proteus anguinus*. This pale, eel-like, cave dweller lives in the subterranean waterbodies common in the porous karstic limestone substrate. Besides the Olm, this region does not host any other endemic amphibian species, which might be due to the rarity of surface waterbodies in this porous landscape. However, in the northernmost areas, the Italian Agile Frog *Rana latastei* occurs in a limited part of western Slovenia and Croatian Istria. The Fire-bellied Toad *Bombina bombina*, Common Spadefoot Toad *Pelobates fuscus* and Moor Frog *Rana arvalis* occur in most lowland areas beyond the karstic region. Newts are sparsely distributed, with the Italian Crested Newt *Triturus carnifex* and Macedonian Crested Newt *Triturus macedonicus* being separated by a large gap where the landscape is not suitable. Part of the range of the latter species however lies in the lowlands and wider surroundings of the beautiful and species-rich Skadar Lake, which is also home to the Albanian Pool Frog *Pelophylax shqipericus*.

On many Croatian Islands, large areas exist which are flat and largely devoid of trees, although numerous dry-stone walls and wetlands may be present, supporting a fairly diverse herpetofauna. Pag island, Croatia.

Lizard species that are particularly typical of the karstic formations include the Dalmatian Wall Lizard *Podarcis melisellensis* and

Large, partially overgrown dry-stone walls such as this one in Montenegro may host small lizard species, but also larger ones such as Balkan Green Lizard.

Sharp-snouted Rock Lizard *Dalmatolacerta oxycephala*. Horvath's Rock Lizard *Iberolacerta horvathi* and the *Dinarolacerta* species usually occupy fairly shaded and humid habitats at medium elevation. Reptile species found across coastal areas and islands include Hermann's Tortoise *Testudo hermanni*, Balkan Terrapin *Mauremys rivulata* (only as far north as southern Croatia), Dalmatian Algyroides *Algyroides nigropunctatus,* Balkan Green Lizard *Lacerta trilineata*, Glass Lizard *Pseudopus apodus*, Dahl's Whip Snake *Platyceps najadum*, Balkan Whip Snake *Hierophis gemonensis*, Four-lined Snake *Elaphe quatuorlineata*, Leopard Snake *Zamenis situla*, Cat Snake *Telescopus fallax* and Eastern Montpellier Snake *Malpolon insignitus*.

Up in the Dinaric Alps, a few typical central European species are represented by distinct subspecies. The Alpine Salamander *Salamandra atra prenjensis* thrives in several mountain ranges, although much remains to be learned about the distribution of this subspecies. Some other montane specialities include the Meadow Viper *Vipera ursinii macrops* and Adder *Vipera berus bosniensis*. While these may even coexist locally, the latter is also found at lower elevation in north-eastern Croatia. Another viper species, the Nose-horned Viper *Vipera ammodytes*, is widespread throughout the area. The Yellow-bellied Toad *Bombina variegata scabra* and Greek Stream Frog *Rana graeca* (in southern areas only) may be particularly common at mid-elevations.

On the Balkan Peninsula, alpine grasslands interspersed with low shrubs may be home to both Adder (ssp. *bosniensis*) and Meadow Viper (ssp. *macrops*).

NORTH-EASTERN GREEK MAINLAND

The Greek regions of Macedonia and Thrace, which are bordered by Bulgaria in the north and Turkey in the east, host a herpetological community found nowhere else in Europe – mainly due to the fact that several Central Asian and Anatolian species have penetrated this area. The especially rich snake fauna includes, among others, the Blotched Snake *Elaphe sauromates*, Ottoman Viper *Montivipera xanthina*, Leopard Snake *Zamenis situla*, Cat Snake *Telescopus fallax,* Eastern Montpellier Snake *Malpolon insignitus*, Caspian Whip Snake *Dolichophis caspius*, Nose-horned Viper *Vipera ammodytes* and Worm Snake *Xerotyphlops vermicularis*. Noteworthy lizard species include the Snake-eyed Lacertid *Ophisops elegans*, found in dry habitats, and the Meadow Lizard *Darevskia praticola*, which is restricted to a small area of humid oak forest in Thrace in eastern Greece. Dadia Forest and the adjacent Evros Delta are hotspots where most of these species can be found. Furthermore, the marshes of the Evros delta are home to the Fire-bellied Toad *Bombina bombina*, Levant Water Frog *Pelophylax* cf. *bedriagae*, Eastern Spadefoot Toad *Pelobates syriacus* and Buresch's Crested Newt *Triturus ivanbureschi*, among many others. Due to this speciose mix, fifteen species or more can be found at a single site.

PELOPONNESE

The Peloponnese is an extraordinary and varied peninsula, both in terms of landscape and herpetological diversity. Several amphibian species of eastern/central European origin occur here, which are often represented by distinct subspecies (e.g. Fire Salamander *Salamandra salamandra werneri*, Alpine Newt *Ichthyosaura alpestris veluchiensis* and Smooth Newt *Lissotriton vulgaris graecus*). The main attraction of the Peloponnese, however, lies in its diverse and partially endemic reptile fauna, which includes species such as the Greek Algyroides *Algyroides moreoticus*, Peloponnese Wall Lizard *Podarcis peloponnesiacus*, Greek Rock Lizard *Hellenolacerta graeca*, Legless Skink *Ophiomorus punctatissimus* and Peloponnese Slow Worm *Anguis cephallonica*. The African Chameleon *Chamaeleo africanus* stems from an ancient introduction and only occurs here, restricted to a small sandy beach area in the southwest of the peninsula. Particularly speciose areas are the Mani Peninsula below the Taygetos Mountains and the wetland

TOP: The wetlands near Alexandroupoli, Greece, are home to Eastern Spadefoot Toad, Eastern Tree Frog, Green Toad and Marsh Frog.

BOTTOM: Crested newts and many other species of amphibians and reptiles can be found in and around fish-free ponds.

areas in the northwest. The latter is a regional stronghold for species such as the Eastern Spadefoot Toad *Pelobates syriacus*, Epirus Water Frog *Pelophylax epeiroticus* and Aesculapian Snake *Zamenis longissimus*. Additionally, abandoned olive orchards in the southern Peloponnese are among the best places in Europe to look for Hermann's Tortoise *Testudo hermanni*, Marginated Tortoise *Testudo marginata*, Worm Snake *Xerotyphlops vermicularis*, Sand Boa *Eryx jaculus*, Glass Lizard *Pseudopus apodus*, Balkan Whip Snake *Hierophis gemonensis*, Leopard Snake *Zamenis situla*, Eastern Montpellier Snake *Malpolon insignitus*, Nose-horned Viper *Vipera ammodytes* and many other species including most of the endemics. The combination of Mediterranean shrub-lands, orchards, temperate montane regions and spacious dune ecosystems, including marshes, make the Peloponnese one of the best areas in Europe to observe many amphibian and reptile species within a restricted area.

TOP: Due to the combination of waterbodies, forests and rocky areas, nearly all of the amphibian and reptile species native to the Peloponnese can be found near the Stymfalia wetlands and the nearby Feneos Basin.

BOTTOM: Coastal wetlands along the western coast of the Peloponnese are inhabited by species not found in the mountains, such as Epirus Water Frog, Eastern Spadefoot Toad and Sand Boa.

GREEK ISLANDS

For many centuries, Greece has been renowned for its countless islands. The number of amphibian and reptile species on any of them largely corresponds to an island's proximity to the mainland and its size. The former is usually related to the age of the island's separation from the mainland, whereas the latter – in addition to simple surface area – also correlates with its potential and actual habitat diversity. Long isolation allowed for the development of a number of endemic species. While their Mediterranean climate and low topography may offer a wealth of habitats for reptiles, amphibians, however, are much more restricted due to the limited availability of waterbodies.

Ionian Islands

The Ionian Islands are situated west of the Greek mainland and several host a rather high number of species. They are characterised by a somewhat milder climate than those in the Aegean Sea, giving them a greener appearance – especially on Cephalonia with its impressive forest of Greek Fir *Abies cephalonica*. Some combinations of coexisting species are not found on the mainland, such as that of two *Algyroides* species on Cephalonia and Ithaca – the Greek Algyroides *Algyroides moreoticus* and Dalmatian

The Ionian Islands are somewhat greener than the Aegean Islands. Well-vegetated olive groves, such as this one on Cephalonia, provide habitat for many species, including the Dalmatian Algyroides (ssp. *kephallithacius*).

Algyroides *Algyroides nigropunctatus kephallithacius*. The latter may be abundant on islands where climbing wall lizard species are absent. The former is basically endemic to the Peloponnese, but also occurs on the southern Ionian Islands. The Peloponnese Slow Worm *Anguis cephallonica* can be found on Zakynthos and Cephalonia. With its diverse topography and habitats, Corfu is the most species-rich Greek island (eight amphibian and 24 reptile species), including additional mainland species such as the Greek Slow Worm *Anguis graeca* and Epirus Water Frog *Pelophylax epeiroticus*. A speciality of these islands is the presence of nesting beaches of Loggerhead Turtle *Caretta caretta*, particularly on Zakynthos. Although the sustainability of these localised breeding populations is under constant pressure, turtles may be spotted quite easily, not only on Zakynthos but also, for example, on Cephalonia and Lefkada.

Aegean Islands

A special attraction for European herpetofauna enthusiasts lies in the middle of the Aegean Sea – the Milos Archipelago. While in terms of landscape, habitat and number of species a fairly 'ordinary' Greek island, Milos is home to a number of endemic taxa. The colourful Milos Wall Lizard *Podarcis milensis* is found only here, as well as an endemic subspecies of the Balkan Green Lizard *Lacerta trilineata hansschweizeri*, Grass Snake *Natrix natrix schweizeri* and the only European populations of Blunt-nosed Viper *Macrovipera lebetina schweizeri*, formerly treated as a separate species.

The Skyros Archipelago, as well as the Piperi Islet, are home to the endemic Skyros Wall Lizard *Podarcis gaigeae*. The main island also hosts the Marginated Tortoise *Testudo marginata* and is (together with a number of other Aegean Islands) home to a dwarf morph of the Four-lined Snake *Elaphe quatuorlineata*.

Crete

Crete is the largest Greek island. The fact that it has been separated from the mainland for millions of years partially explains the relative low number of species found here. Two endemic species are Cretan Water Frog *Pelophylax cretensis* and Cretan Wall Lizard *Podarcis cretensis*. Populations of other species belong to distinct subspecies, like Kotschy's Gecko *Mediodactylus kotschyi bartoni* (surprisingly scarce on the main island itself, but not on most nearby islets), Balkan Green Lizard *Lacerta trilineata polylepidota* and the pale subspecies *pallidus* of the Cat Snake *Telescopus fallax*. Cretan sandy beaches provide some of the most important European nesting beaches for Loggerhead Turtle *Caretta caretta*. While significant parts of the island have irreversibly been turned into biological deserts due to overgrazing, other areas provide a wealth of typical Greek extensively managed olive orchards. These feature a rich herbaceous undergrowth and dry-stone walls which are home to several reptile species. Restricted to larger islands with wetlands or other sources of (semi-)permanent fresh water, the Common Tree Frog *Hyla arborea* also occurs on Crete.

In between Crete and the Peloponnese, at about 8 km north of Antikythira, two tiny islets are home to a relict lineage of wall lizard – the Pori Wall Lizard *Podarcis levendis*.

Sunny, shrub-covered hillsides with rocky outcrops on Milos harbour Blunt-nosed Viper (ssp. *schweizeri*), Milos Wall Lizard and Balkan Green Lizard (the debatable ssp. *hansschweizeri*), as well as other reptile species.

A large number of islands as yet unmentioned (but excluding those in the next section) are occupied by Erhard's Wall Lizard *Podarcis erhardii*, making it the most widespread of the Greek insular lacertids. Some islands may host quite colourful populations with green and blue colours, as on Mykonos. The group of central Aegean Islands surrounding Naxos is also inhabited by this species, as well as by the introduced Starred Agama *Laudakia stellio* and a dwarf morph of Nose-horned Viper *Vipera ammodytes*.

Each island may be different and sometimes the abundance of a species may be higher than on the mainland, perhaps partially due to the absence of competing species.

Eastern Islands (Dodecanese etc.)

Due to their proximity to the western Turkish coast, the eastern Aegean Islands (some of the larger ones being Lesbos, Samos, Chios and Rhodes) are geographically part of Asia instead of Europe and are home to a number of typically Anatolian species. These include two Anatolian rock lizards *Anatololacerta* spp., Starred Agama *Laudakia stellio*, Snake-eyed Lacertid *Ophisops elegans*, Levant Skink *Trachylepis aurata*, Anatolian Worm Lizard *Blanus strauchi*, Black Whip Snake *Dolichophis jugularis*, Coin-marked Snake *Hemorrhois nummifer* and Ottoman Viper *Montivipera xanthina*. The only stable Greek population of the Mediterranean Chameleon *Chamaeleo chamaeleon* occurs on Samos. After Corfu, Samos is the second most speciose Greek island, with four amphibian and 24 reptile species, Lesbos being inhabited by only a couple fewer species.

Located in the extreme southeast of our area, the limestone soil of the Karpathos Archipelago is home to the endemic Karpathos Salamander *Lyciasalamandra helverseni*, while the tiny island of Kastellorizo (also known as Megisti) is inhabited by Luschan's Salamander *Lyciasalamandra luschani*. Several related salamander species occur on the nearby Turkish mainland. Kastellorizo is quite distant from any other Greek island, but very close to the Turkish mainland. As such, its species diversity is rather high given its small size.

Dry-stone walls and mountains on several Dodecanese Islands are not only home to reptiles, but three of them also host abundant populations of Karpathos Salamander. Karpathos, Greece.

Artificial lakes or reservoirs may attract a diverse herpetofauna on the otherwise fairly dry Dodecanese Islands. Samos, Greece.

WESTERN BLACK SEA COAST

Along the western Black Sea coast, and particularly along stretches in Romania and Bulgaria, a myriad of different ecosystems can be found in very close proximity to each other. Dune areas and steppe regions are interspersed with rocky coastal hillsides, forests, swamps and wide river deltas. These conditions provide suitable habitats for many amphibian species, and the south-eastern region of Bulgaria hosts an especially high number of reptiles.

Along the Black Sea coast, broad, sandy shores covered by sparse vegetation provide typical habitat for Steppe Runner and Sand Lizard (ssp. *chersonensis*).

The temperate climate and low elevation of the region allows a number of southern species to reach further north than they do inland. It is an important stronghold for species like the Danube Crested Newt *Triturus dobrogicus*, Eastern Spadefoot Toad *Pelobates syriacus balcanicus*, Steppe Runner *Eremias arguta*, Balkan Wall Lizard *Podarcis tauricus*, Balkan Green Lizard *Lacerta trilineata dobrogica*, the hard to find Blotched Snake *Elaphe sauromates*, Snake-eyed Skink *Ablepharus kitaibelii*, Spur-thighed Tortoise *Testudo graeca ibera*, Caspian Whip Snake *Dolichophis caspius*, Dice Snake *Natrix tessellata*, Nose-horned Viper *Vipera ammodytes* and Meadow Viper *Vipera ursinii moldavica*. Some of these species stretch inland along the Danube, which forms a natural border between Romania and Bulgaria. The Sand Boa *Eryx jaculus* is without doubt the rarest snake, if not herpetofauna species, of Romania, with very few recent records following

a long period without any sightings at all. The Steppe Runner is restricted to a limited number of open, sandy sites, some of which are situated inside the Danube Delta on the estuarine islands called 'grinduls'. On these sites, it may be accompanied by abundant Sand Lizard *Lacerta agilis* populations, but also by a lowland morph of the rarer Meadow Viper. Whereas the topography of the river mouth offers some natural protection for these snakes, intensive agricultural land use threatens the limited number of small inland populations.

Several species of frogs and toads occur in great abundance in the Delta area – Eastern Spadefoots, but also Common Spadefoot Toad *Pelobates fuscus*, Green Toad *Bufotes viridis*, Eastern Tree Frog *Hyla orientalis*, Marsh Frog *Pelophylax ridibundus* and both of the other widespread European water frogs may occur in large numbers. The melancholic call of the Fire-bellied Toad *Bombina bombina* is also a common sound in the area, although it may be masked by a mixture of calls of other species.

Similarly, a number of wetlands along the Black Sea coast in Bulgaria provide excellent habitat for several amphibian species. In addition to the many aforementioned species, Buresch's Crested Newt *Triturus ivanbureschi* and Levant Water Frog *Pelophylax* cf. *bedriagae* can also be found along the Bulgarian southern Black Sea coast. The mixture of marshes, rivers and coastal dunes also provides excellent habitat for turtles and tortoises, with healthy populations of the European Pond Terrapin *Emys orbicularis*, Balkan Terrapin *Mauremys rivulata*, Hermann's Tortoise *Testudo hermanni* and Spur-thighed Tortoise *Testudo graeca*. In addition to the snake species also occurring along the Romanian Black Sea coast, the southern Bulgarian coastal area probably holds the only European population of the Reddish Whip Snake *Platyceps collaris*, fragmented in small, hot and rocky microhabitats. Slightly further inland, the edges of woods and clearings provide habitat for the Meadow Lizard *Darevskia praticola*.

CRIMEAN PENINSULA

Practically unexplored by western visitors, let alone amphibian and reptile enthusiasts, the Crimean Peninsula hosts lush, Mediterranean landscapes and a mixture of Mediterranean and eastern European species, which is topped with a number of central Asian specialties. The majority of the peninsula is covered by steppe and inhabited by species typically found in this habitat, such as the Steppe Runner *Eremias*

Cape Fiolent, Crimea. Habitat of Crimean Rock Lizard, Glass Lizard and Caspian Whip Snake.

Kutuzovskoe Lake, in the south of Crimea, is home to Karelin's Crested Newt, Eastern Tree Frog and Levant Water Frog.

arguta, Sand Lizard *Lacerta agilis exigua*, Blotched Snake *Elaphe sauromates* and Steppe Viper *Vipera renardi*. The north-eastern coast is characterised by sizable swathes of farmland, bordering several marshes. The wetlands harbour widespread freshwater-loving species such as the Grass Snake *Natrix natrix* and European Pond Terrapin *Emys orbicularis*. These areas also host Fire-bellied Toad *Bombina bombina* and Pallas's Spadefoot Toad *Pelobates vespertinus*. Ponds, especially in the south of the peninsula, are home to Karelin's Crested Newt *Triturus karelinii* (which is widespread in the Caucasus region and northern Iran but only extends into our area here), Eastern Tree Frog *Hyla orientalis* and Levant Water Frog *Pelophylax* cf. *bedriagae.* The south-eastern coast of the peninsula is flanked by a mountain range inhabited by the endemic Crimean Rock Lizard *Darevskia lindholmi*. Sheltered by the extreme continental climate north of the mountains that scorches the steppes in summer, the Crimean Riviera offers a less harsh climate with Mediterranean features, providing a suitable environment for several species mostly found in the Balkans, such as Kotschy's Gecko *Mediodactylus kotschyi*, Balkan Wall Lizard *Podarcis tauricus*, Glass Lizard *Pseudopus apodus*, Caspian Whip Snake *Dolichophis caspius* and Leopard Snake *Zamenis situla*. To the northeast of Crimea, the range of the Steppe Snake *Elaphe dione* starts, although this species is said to be restricted and relatively rare in our area.

The jagged Dolomites host several distinct lineages of the Alpine Salamander, such as the subspecies *Salamandra atra pasubiensis*. Pasubio Massif, Italy.

Man-made water troughs are typical habitats for Common Midwife Toad in north-western Europe. Alpine Newt and Smooth Newt reproduce in this example in Limburg, Belgium.

Heathland represents an important herpetofauna habitat throughout western, central and northern Europe. This site provides habitat for Smooth Newt, Alpine Newt, Natterjack Toad, Moor Frog, Pool Frog and Viviparous Lizard. Similar habitat in this part of the continent may also be inhabited by Sand Lizard, Smooth Snake, Adder, and others. North Brabant, the Netherlands.

Fish-free ponds are a key amphibian habitat throughout Europe. The picture shows a freshly dug pond which was rapidly colonised by Smooth Newt, Alpine Newt, and various water frog species. Other amphibian species which may make use of this type of pond in western, central and northern Europe include Great Crested Newt and other pond newt species, Common Spadefoot Toad and Common Tree Frog. North Brabant, the Netherlands.

Amphibian eggs and larvae

Amphibian eggs

The vast majority of salamanders, frogs and toads deposit their eggs in water enclosed in a gelatinous capsule in the shape of a sphere, band or strand. These eggs can be laid singly, but also in strands or clumps. Fire and Alpine Salamanders *Salamandra* spp., as well as Karpathos and Luschan's Salamanders *Lyciasalamandra* spp. are exceptions, as they do not lay eggs but either deposit larvae directly into the water or give birth to fully developed juveniles. Additionally, the males of midwife toads *Alytes* spp. carry their eggs wrapped in strands around their hind legs, which they release into the water when the larvae are about to hatch. Consequently, the eggs of these species have not been incorporated into the key below.

Amphibians use a wide variety of strategies to deposit their eggs. Those species inhabiting streams often 'glue' their eggs to the lower surface of submerged stones or branches to prevent them from floating away. Most newts use their hind feet to fold a protective case of submerged leaves or aquatic vegetation around each individual egg. In contrast, the large, floating egg-clumps of frogs can be highly conspicuous and may cover several square metres of a pond's surface.

The period during which amphibian eggs can be found differs by region and by altitude. While most northern European species reproduce during spring or early summer, many Mediterranean species deposit their eggs during winter when waterbodies are more readily available. Mountain populations of both frogs and salamanders may only deposit their eggs during summer.

When identifying eggs, attention should be paid to their location, colour, shape of the gelatinous capsule, and whether they are deposited singly or in clumps. The colour of the eggs can change during development (for instance, from light to dark), while eggs of closely related species often closely resemble each other. Moreover, the number of eggs deposited may differ between different populations of the same species living, for example, in lowland or mountain areas. In case of confusion, this key should be used in combination with the distribution information provided in the species accounts.

Key to amphibian eggs			
1	**a**	Foothills of the Ural Mountains only. Multiple eggs in a single, large gelatinous capsule ('egg-sac').	Siberian Salamander *Salamandrella keyserlingii* (p.46)
	b	Eggs deposited singly or in small clumps, either in water or on land.	**2**
	c	Eggs deposited in large clumps, bands or strands in water.	**6**
2	**a**	SE France, NW and C Italy, Sardinia. 5–15 separate, terrestrial eggs; 5–6.5 mm diameter placed together; white at first, turning black during development; usually found in deep crevices or under heaps of stones; often guarded by the mother.	Cave salamanders, *Speleomantes* spp. (p.46)

	b	Iberian Peninsula, Tyrrhenian region, Sicily, Malta. Single layer ('carpet') of large aquatic eggs; 1–1.5 mm, in a capsule 3–4 mm; dark above, pale below; on bottom of waterbody.	Painted frogs, *Discoglossus* spp. (p.46)
	c	Aquatic eggs completely pale or brownish above and pale below; 3–2 mm, in a capsule 4–4.5 mm; attached singly to vegetation or branches underwater, often folded into leaves.	**3**
	d	Pale or light yellow eggs; 2–5 mm, in a capsule 3–12 mm; deposited singly, but often up to 20 placed together; in caves, springs or streams; usually hidden under submerged rocks.	**4**
	e	Eggs dark above and pale below; 1.5–2 mm, in a capsule 3–8 mm; deposited in clumps of 10–30 eggs, occasionally up to 100; generally attached to submerged branches or vegetation.	**5**
3	a	Eggs uniformly yellowish or greenish white; 1.8–2 mm.	Large-bodied newts, *Triturus* spp. (p.46)
	b	Eggs bicoloured; 1.3–1.8 mm.	Small-bodied newts, *Lissotriton* spp. and *Ichthyosaura alpestris* (p.46)
4	a	Caves from NE Italy to Montenegro only. Eggs large in size; only rarely found.	Olm *Proteus anguinus* (p.46)
	b	Apennine axis of Italian mainland only. In small, shady streams or springs.	Spectacled salamanders *Salamandrina* spp. (p.46)
	c	NW Iberian Peninsula. Occasionally also terrestrial on moist cave walls.	Golden-striped Salamander *Chioglossa lusitanica* (p.46)
	d	Pyrenees and Montseny Massif.	Pyrenean Brook Newt *Calotriton asper* or Montseny Brook Newt *Calotriton arnoldi* (p.46)
	e	Corsica and Sardinia.	Corsican Brook Newt *Euproctus montanus* or Sardinian Brook Newt *Euproctus platycephalus*
5	a	Eggs 1.5–2 mm, in a broad capsule 5–8 mm; clump of up to 20 eggs. On Iberian Peninsula; usually in stagnant water.	Sharp-ribbed Newt *Pleurodeles waltl* (p.46)
	b	Eggs 1.5–2 mm, in a broad capsule 5–8 mm; clump of up to 30 eggs. Not on Iberian Peninsula.	Fire-bellied toads *Bombina* spp. (p.46)
	c	Eggs 1.5–2 mm, in a capsule 3–4 mm; clump of 60–100 eggs; turning lighter during development.	Tree frogs *Hyla* spp. (p.46)
6	a	Brown to black eggs; 1.5 mm in bands 3–4 mm wide, up to 20 cm long (but often much shorter); attached in a spiral to submerged branches or other vegetation. Only in France, NW Italy and Iberian Peninsula.	Parsley frogs *Pelodytes* spp. (p.46)
	b	Grey to brown eggs; 1.5 mm in large bands 1.3–2 cm wide and up to 1,000 cm long; with a light spot below when recently deposited. Only in stagnant waters.	Spadefoot toads *Pelobates* spp. (p.47)
	c	Dark eggs; 1–2 mm in long, thin strands.	**7**
	d	1.2–4 mm in a capsule up to 12 mm; in large clumps of more than 100 eggs.	**8**
7	a	Black eggs; 1.5 mm in a strand 5–8 mm wide; partially woven through vegetation.	Common Toad *Bufo bufo* or Spiny Common Toad *Bufo spinosus* (p.47)
	b	Brown to black eggs; 1.5 mm in a strand 4–6 mm wide; often deposited on bottom of temporary or sparsely-vegetated waterbodies.	Natterjack Toad *Epidalea calamita* or green toads *Bufotes* spp. (p.47)
8	a	Large layer of eggs, covering a surface of up to 1 sq m; floating on the surface of the water; underside of eggs lighter coloured.	American Bullfrog *Lithobates catesbeianus*
	b	Eggs pale, lighter below; clumps usually attached to submerged vegetation; occurring relatively late in the season compared with other species present.	Water frogs, *Pelophylax* spp. (p.47)
	c	Eggs dark brown to black; large clumps floating freely or smaller clumps attached to submerged rocks or vegetation.	**9**

continued overleaf

Key to amphibian eggs *continued*			
9	**a**	Clumps with up to 4,500 eggs, usually fewer; eggs black above, slightly paler below; 1.7–2.8 mm, in a capsule 8–10 mm; generally several clumps floating on surface together, but may sink to bottom. Found in myriad of stagnant and slow-flowing waterbodies.	Common Frog *Rana temporaria* (p.47)
	b	Clumps up to 3,000 eggs, usually fewer; eggs blackish to grey-brown above, lower third to half paler; 1.5–2 mm, in a capsule 6–8 mm; often several clumps together in shallow, well-vegetated waterbodies.	Moor Frog *Rana arvalis* (p.47)
	c	Clumps up to 2,000 eggs, usually fewer; eggs dark brown or black on top, with a pale spot below when freshly laid; 1.5–2.1 mm, in a capsule 9–12 mm; clumps in shallow water, attached to submerged branches or twigs which run through the middle of the clump; floating to surface upon hatching.	Agile Frog *Rana dalmatina* (p.47)
	d	Clumps up to 900 eggs; eggs dark brown or black on top, paler below; 1.5–1.8 mm, in a capsule 6–7 mm; clumps in shallow water, attached to submerged branches or twigs which run through the middle of the clump; in Ticino (Switzerland) or the Po Plain (N Italy and Istria).	Italian Agile Frog *Rana latastei* (p.47)
	e	Clump small, up to 150 eggs; eggs black, up to 3 mm; clumps attached or hidden under submerged rocks or other material in quiet parts of fast-flowing streams. Only in W-C Pyrenees.	Pyrenean Stream Frog *Rana pyrenaica* (p.47)
	f	Clumps up to 800 eggs, often (many) fewer, rarely more; black with contrasting whitish underside when freshly laid, turning to brown with pale underside during development; 2–3 mm, in a capsule 4–7 mm; clumps attached to or hidden under submerged rocks, trunks etc. in quiet parts of fast-flowing streams or mountain lakes. In NW and C Spain, peninsular Italy or S Balkans.	Iberian Stream Frog *Rana iberica* or Italian Stream Frog *Rana italica* or Greek Stream Frog *Rana graeca* (p.47)

Siberian Salamander

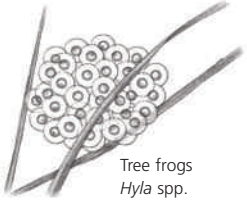
Cave salamanders *Speleomantes* spp., Spectacled salamanders *Salamandrina* spp., Brook newts *Calotriton* spp. and *Euproctus* spp., Golden-striped Salamander, Olm

Painted frogs
Discoglossus spp.

Crested and marbled newts
Triturus spp.

Small-bodied newts
Lissotriton spp.
Alpine Newt

Fire-bellied toads
Bombina spp.
Sharp-ribbed Newt



Tree frogs
Hyla spp.

Parsley frogs
Pelodytes spp.

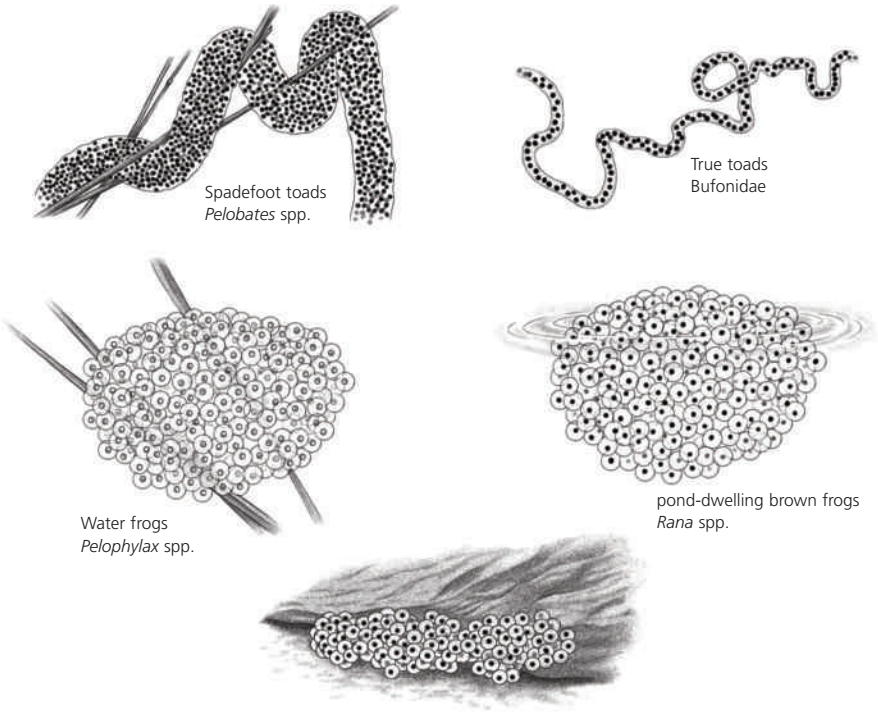


Fig. 1. Amphibian eggs.

Newt and salamander larvae

The larvae of newts and salamanders display the general body shape of the adult concerned, but feathery, external gills protrude from both sides of the base of the head. Not all European species have a larval phase – Cave Salamanders *Speleomantes* spp., Alpine Salamander *Salamandra atra*, Lanza's Salamander *Salamandra lanzai*, and the Lycian salamanders *Lyciasalamandra* spp. do not have free-living larvae.

The key overleaf only applies to 'ordinary' larvae which have already reached the four-legged phase. Because these larvae inhabit aquatic environments which are also likely to be home to a wide array of predators, damaged body parts may complicate identification.

Several species have been known to feature neotenous individuals, with animals leading extended aquatic lives in which they maintain gills into adulthood and breeding condition. These include the Alpine Newt *Ichthyosaura alpestris* (which may have largely or completely neotenous populations in parts of the Balkans), Palmate Newt *Lissotriton helveticus*, Smooth Newt *Lissotriton vulgaris,* Italian Newt *Lissotriton italicus* and more. To identify these, the features of larvae and adults should both be taken into account, as these individuals tend to exhibit a variable mixture of both.

Key to newt and salamander larvae			
1	a	Caves from NE Italy to Montenegro only. At most, 3 toes on front feet and 2 on hind feet. Swims by moving its body, rather than its tail. Hardly ever observed.	Olm *Proteus anguinus*
	b	Apennine axis of Italian mainland only. Both front and hind feet with 4 toes only.	Spectacled salamanders *Salamandrina* spp.
	c	Foothills of the Ural Mountains only. Both front and hind feet with 4 toes. Tail-fin very broad.	Siberian Salamander *Salamandrella keyserlingii*
	d	If undamaged and not incorrectly regenerated, front feet with 4 toes, but hind feet with 5 toes.	**2**
2	a	Stream type larva. Usually particularly slender. Tail-fin not very broad. Gills short compared with head. Usually in running water.	**3**
	b	Pond type larva. Tail-fin may be rather broad. Gills rather long in relation to head (often equally long or longer). Often in still water, but also in (slowly) running water.	**4**
	c	A rather intermediate type. Head rather wide. Gills not very short. Tail-fin low. Distinctive feature: pale, often yellowish, spot at the base of each leg.	Fire salamanders *Salamandra* spp.
3	a	NW Iberian Peninsula. Small head with very short gills. Body very slender and long. Tail-tip rounded; tail-fin low, not extending onto back. Swims by moving its body, rather than its tail.	Golden-striped Salamander *Chioglossa lusitanica*
	b	Pyrenees and Montseny Massif. Tail-tip rounded; tail-fin at its widest slightly wider than body; upper tail-fin extends up to level of hind legs.	Pyrenean Brook Newt *Calotriton asper* and Montseny Brook Newt *Calotriton arnoldi*
	c	Corsica; head narrow (in contrast to Corsican Fire Salamander *Salamandra corsica*). Upper tail-fin extends up to level of hind legs.	Corsican Brook Newt *Euproctus montanus*
	d	Sardinia. Head narrow. Upper tail-fin extends up to level of hind legs. No other free-living newt or salamander larvae on Sardinia.	Sardinian Brook Newt *Euproctus platycephalus*
4	a	Up to 8 cm (excluding wintering larvae and neotenous individuals, which may be larger).	**5**
	b	Up to 5 cm (excluding wintering larvae and neotenous individuals, which may be larger).	**7**
5	a	Iberian Peninsula only. Head relatively broad. Eyes rather small. Hind foot toes not particularly long and slender, Tail-tip not particularly long or sharply pointed; upper tail-fin extends onto head.	Sharp-ribbed Newt *Pleurodeles waltl*
	b	Widespread, Hind feet with particularly long and slender toes. Undamaged tail with long and narrow tip.	Large-bodied newts *Triturus* spp. – **6**
6	a	SW Europe only, from C France S onto Iberian Peninsula. 12–13 costal grooves on sides between legs. Upper parts greenish.	Marbled newts *Triturus marmoratus* complex
	b	Absent from much of S France and entirely absent from Iberian Peninsula. 15–16 costal grooves on sides between legs. Upper parts in larger larvae not greenish, but rather dark or orangey.	Crested newts *Triturus cristatus* complex
7	a	Upper and lower edges of tail-fin more or less parallel, tapering suddenly towards end; tip may have filament.	**8**
	b	Edges of tail-fin more curved, tapering gradually towards pointed tip without filament.	**9**
8	a	Carpathians and Tatra Mountains only. Tail-tip usually rather blunt and without (or with only a short) filament.	Montandon's Newt *Lissotriton montandoni*
	b	W Iberian Peninsula only. Tail-tip may have relatively broad filament, usually not particularly dark.	Bosca's Newt *Lissotriton boscai*
	c	Widespread, but on Iberian Peninsula practically only in N, W of Pyrenees. Tail-tip with fine thorny filament; often with dark pigmentation.	Alpine Newt *Ichthyosaura alpestris*
9	a	S Italian mainland only.	Italian Newt *Lissotriton italicus*
	b	Not in S Italy.	Smooth Newt *Lissotriton vulgaris* or Palmate Newt *Lissotriton helveticus*

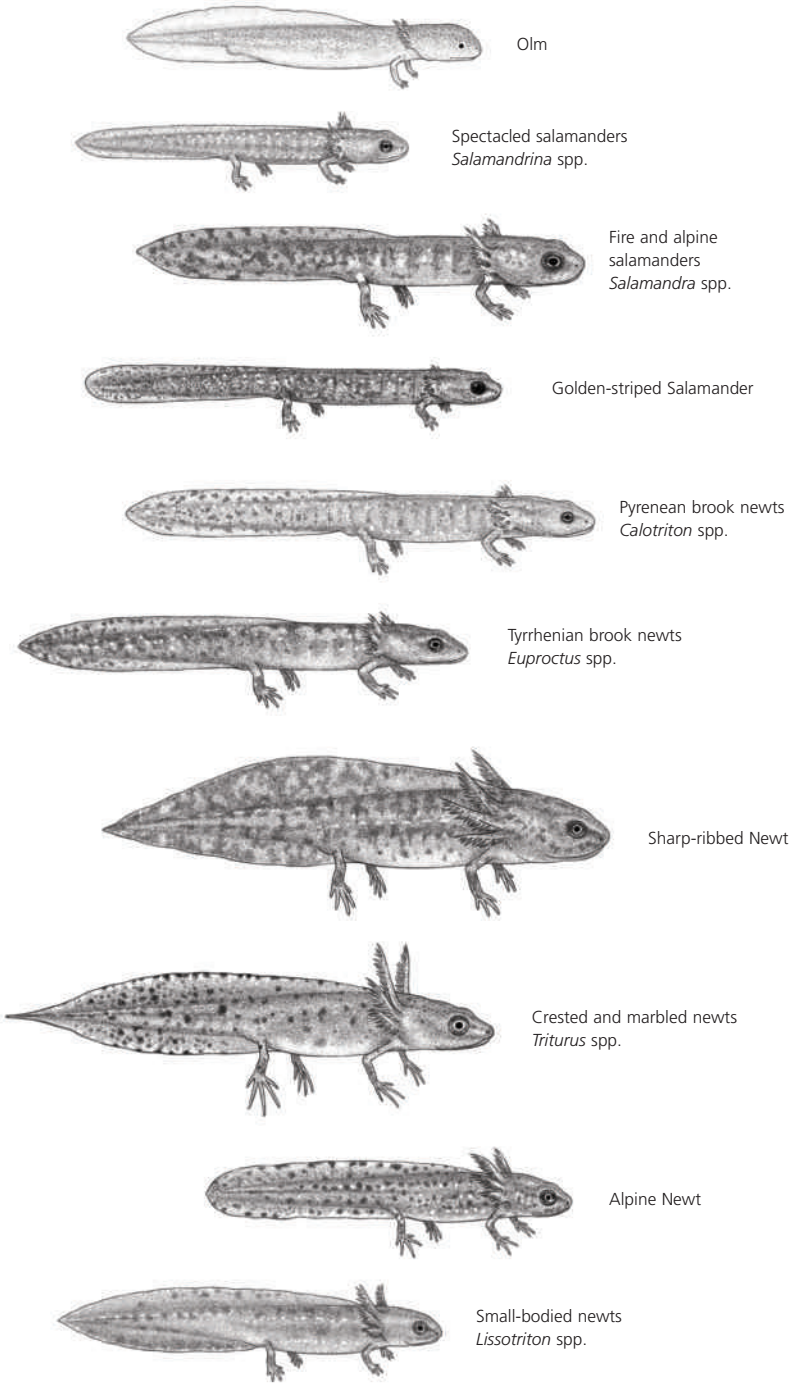


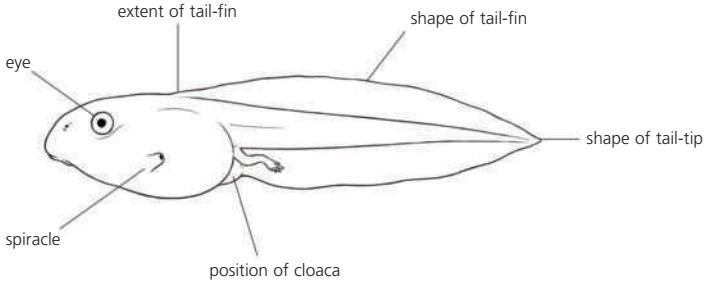
Fig. 2. Newt and salamander larvae.

Frog and toad larvae

All frog and toad species occurring in our area have aquatic larvae, commonly known as tadpoles. These larvae differ greatly in size and shape, but generally show more limited variation in coloration. Newly-hatched larvae do not have any limbs – these appear during development, starting with the hindlimbs. To some extent, tadpole size can be influenced by the presence of predators and the environmental conditions of the waterbody and its soil, and so this characteristic is often not reliable in identifying species in the field. The key below therefore only uses features such as body shape and colour pattern. Although highly diagnostic, it is often impractical to use the size and number of tooth rows of tadpoles in the field, especially when identifying tiny individuals. No tooth row formulae are therefore presented in the keys, although information on morphology of the oral disk is sometimes given to help identification of highly similar, related species. For additional information on tadpole mouth formulae we refer to Nöllert & Nöllert (1992 – see references).

In many European populations, the larvae of several frog and toad species may hibernate (in northern Europe) or aestivate (in southern Europe). In these cases, larvae can be observed year-round. However, large numbers of larvae can usually be observed in spring (in southern Europe) and early summer (in mountainous areas and in northern Europe). Their behaviour may differ between species. The larvae of common toads *Bufo bufo/spinosus* and water frogs *Pelophylax* spp. may be very active during the day and easily observed from the edge of a waterbody, while those of most stream-breeding species, such as the Italian Stream Frog *Rana italica* and Greek Stream Frog *R. graeca* often tend to hide among submerged rocks.

Fig. 3. Tadpole.



General key to frog and toad larvae			
1	**a**	Swims diagonally. Whiskers present.	African Clawed Frog *Xenopus laevis* (p.53)
	b	Swims horizontally. No whiskers.	**2**
2	**a**	Spiracle on centre of underside.	**3**
	b	Spiracle on left side of body.	**5**
3	**a**	Upper tail-fin barely/not extending onto body. Often with pale mid-ventral stripe. Up to 7–9 cm.	Midwife toads *Alytes* spp. – see genus key (p.51)
	b	Upper tail-fin extends onto body. Pale mid-ventral stripe usually absent. Up to 5.5 cm, usually smaller.	**4**

4	**a**	Spiracle central on underside. Iberian Peninsula, Tyrrhenian Islands (including Hyères), Tuscan Archipelago, Sicily, Malta	Painted frogs *Discoglossus* spp. – see genus key (p.51)
	b	Spiracle closer to cloaca than to head. Found elsewhere.	Fire-bellied toads *Bombina* spp. – see genus key (p.52)
5	**a**	Eyes on sides of head, visible from a ventral view.	**6**
	b	Eyes on top of head.	**7**
6	**a**	Upper tail-fin extends up to level of spiracle or further. Highest point of upper crest in the middle. Up to 5 cm. Green-golden colour.	Tree frogs *Hyla* spp. – see genus key (p.52)
	b	Upper tail-fin extends up to level of spiracle or less far. Highest point of upper crest towards the end. Up to 20 cm, usually less. Metatarsal tubercle on hind feet.	Spadefoot toads *Pelobates* spp. – see genus key (p.52)
7	**a**	Spiracle points straight backward. Upper tail-fin does not or only just reaches body. Tail-tip blunt. Underside black to dark grey often with inconspicuous tiny metallic speckles.	True toads Bufonidae – see family key (p.52)
	b	Spiracle points slightly upwards. Upper tail-fin extends onto body. Tail-tip blunt. Crest extends beyond tail-tip. Only in France, extreme NW Italy, Iberian Peninsula.	Parsley frogs *Pelodytes* spp. – species-level identification not possible; range description may provide clues (see species accounts) (p.53)
	c	Spiracle points slightly upwards. Upper tail-fin extends onto body; tail-tip pointed.	**8**
8	**a**	Underside similar colour to back or slightly lighter.	Brown frogs *Rana* spp. – see genus key (p.54)
	b	Underside bright white or yellow-golden.	**9**
9	**a**	Usually 8 cm or less, but wintering tadpoles may be larger.	Water frogs *Pelophylax* spp. – species-level identification not possible; range description may provide clues (see species accounts) (p.53)
	b	Very large, up to about 16 cm.	American Bullfrog *Lithobates catesbeianus* (p.53)

Key to larvae of midwife toads *Alytes* spp. (p.53)			
1	**a**	W Europe including Iberian Peninsula, not Mallorca.	**2**
	b	Mallorca, Tramuntana Mountains.	Mallorcan Midwife Toad *Alytes muletensis*
2	**a**	Spots on muscular part of tail form row(s). C and S Iberian Peninsula.	**3**
	b	Spots on muscular part of tail randomly distributed. W Europe, N half of Iberian Peninsula.	Common Midwife Toad *Alytes obstetricans*
3	**a**	Spots on upper muscular part of the tail form row. 3 tubercles on palm of front foot. SE Iberian Peninsula (E Andalucia, Murcia, SE Castilla-La Mancha).	Betic Midwife Toad *Alytes dickhilleni*
	b	Spots on muscular part of tail form 1 or 2 irregular lines. 2 tubercles on palm of front foot. C and SW Iberian Peninsula, including Sierra Morena.	Iberian Midwife Toad *Alytes cisternasii*

Key to larvae of painted frogs *Discoglossus* spp. (p.53)			
1	**a**	Tyrrhenian Islands, Hyères, Tuscan Archipelago.	**2**
	b	Regions excluding the above.	**3**
2	**a**	Papillae surround entire oral disk. Only on Corsica.	Corsican Painted Frog *Discoglossus montalentii*
	b	Papillae interrupted at upper part of oral disk.	Tyrrhenian Painted Frog *Discoglossus sardus*
3	**a**	Iberian Peninsula, but not NE.	Iberian Painted Frog *Discoglossus galganoi*
	b	N & E Catalonia, French Languedoc-Roussillon, Sicily, Malta.	Painted Frog *Discoglossus pictus*

Key to larvae of fire-bellied toads *Bombina* spp. (p.53)			
1	a	Upper tail-fin high; extends anteriorly close to or up to level of eyes. Often in deeper, well-vegetated waterbodies. In lowlands. E and parts of C Europe, not in Italy or France.	Fire-bellied Toad *Bombina bombina*
	b	Upper tail-fin low, extends to mid-body level, usually less. Usually in small, shallow waterbodies often devoid of vegetation. In hills/ mountains. C, E and SE Europe, including Italy.	Yellow-bellied Toad *Bombina variegata*

Key to larvae of spadefoot toads *Pelobates* spp. (p.53)			
1	a	Iberian Peninsula, SW and S France. Always with prominent golden flecks across entire body and parts of tail. Colour variable; often with large, dark spots on tail-fins.	Western Spadefoot Toad *Pelobates cultripes*
	b	Localised in S Balkans and E Romania, also on some Aegean Islands. Uniform greenish coloured; occasionally with small light specks across body; often with tiny dark dots on tail-fins.	Eastern Spadefoot Toad *Pelobates syriacus*
	c	Across most of E Europe, S to N Bulgaria and C Serbia, Italian Po Plain. Uniform brownish coloured; no spots on body or tail-fins.	Common Spadefoot Toad *Pelobates fuscus* or Pallas' Spadefoot Toad *Pelobates vespertinus*

Key to larvae of true toads Bufonidae (p.53)			
1	a	Small. Black with dark grey underside; light spot on chin present. Tail-fins low. With light dorsal stripe when close to metamorphosis.	Natterjack Toad *Epidalea calamita*
	b	Small, Black with very dark grey underside; light spot on chin absent. Tail-fins low.	Common Toad *Bufo bufo* or Spiny Toad *Bufo spinosus*
	c	Small. Black, grey, brownish or greenish tadpole with greyish-white underside; light spot on chin absent. Tail-fins low; with greenish spots when close to metamorphosis.	Green Toad *Bufotes viridis*
	d	Only on Sicily except NE. Small, black, grey, brownish or greenish tadpole with greyish-white underside. Light spot on chin absent. Tail-fins low. With greenish spots and dorsal stripe when close to metamorphosis.	African Green Toad *Bufotes boulengeri*

Key to larvae of tree frogs *Hyla* spp. (p.53)			
1	a	Upper tail-fin extends up to level of spiracle.	**2**
	b	Upper tail-fin extends up to level of eyes.	**3**
2	a	C, S, SW and NE Iberian Peninsula, S France, NE Italy, Menorca.	Stripeless Tree Frog *Hyla meridionalis*
	b	Corsica and Sardinia, including some surrounding islets, Capraia, Elba.	Tyrrhenian Tree Frog *Hyla sarda*
3	a	Iberian Peninsula, French Aquitaine.	Iberian Tree Frog *Hyla molleri*
	b	Swiss Ticino and Italy, excluding Trieste and SE Friuli but including Sicily.	Italian Tree frog *Hyla intermedia*
	c	W, C, E and SE Europe, excluding the areas above.	Common Tree Frog *Hyla arborea* and Eastern Tree Frog *Hyla orientalis* – see map; range delimitation insufficiently known

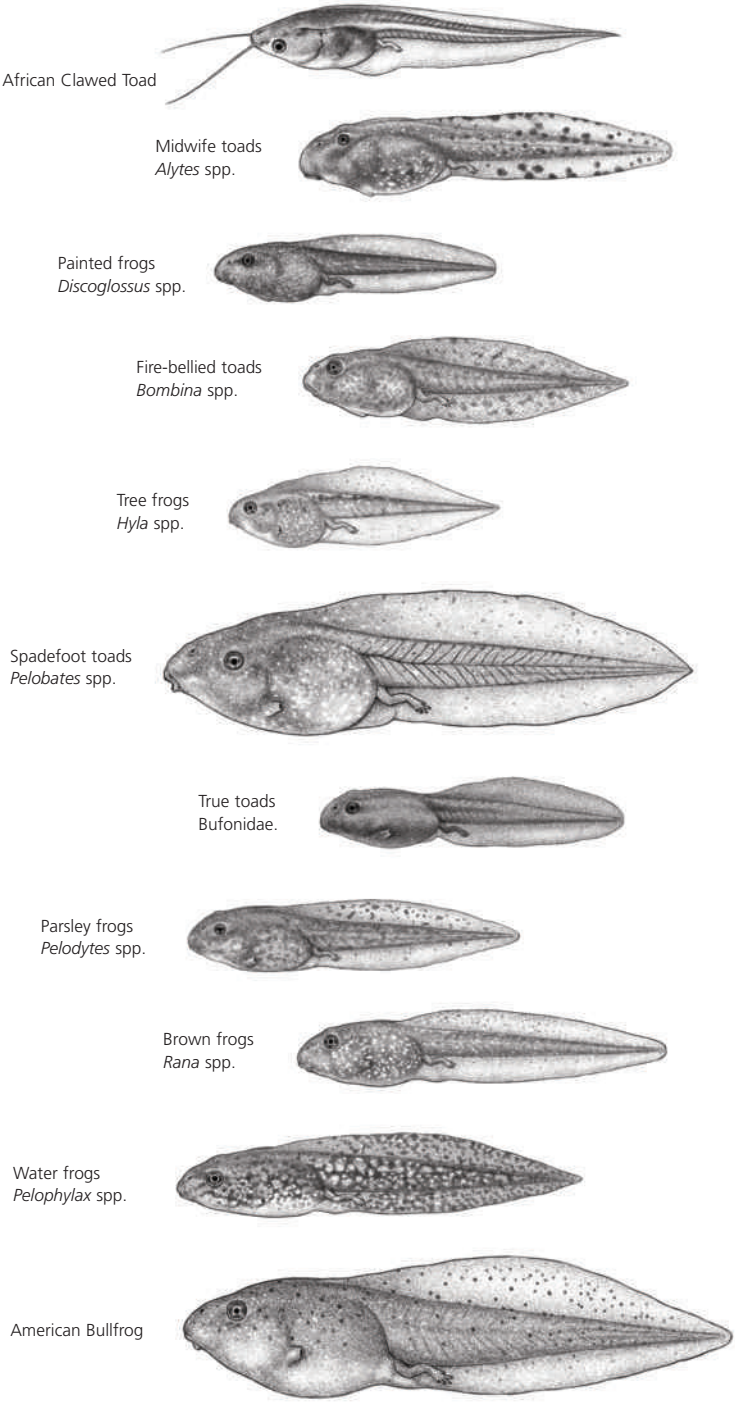


Fig. 4. Frog and toad larvae.

Key to larvae of brown fogs *Rana* spp. (p.53)			
1	a	C and W Pyrenees only. Grows very large. Jet-black, usually with (but occasionally without) conspicuous pale spots. Tail-tip blunt. In fast-flowing brooks.	Pyrenean Stream Frog *Rana pyrenaica*
	b	Widespread, also across Pyrenees. Not jet-black but dark to light brown, often with golden spots.	2
2	a	Undamaged tail ends in point. Upper tail-fin not elevated and starting towards end of body. Tail length about 1.5x length of trunk.	Moor Frog *Rana arvalis*
	b	Undamaged tail ends in a narrow point. Upper tail-fin high, starting near middle of trunk. Tail length 2–2.5x length of body.	Agile Frog *Rana dalmatina* and Italian Agile Frog *Rana latastei*
	c	Undamaged tail ends rather bluntly. Dorsal tail-fin not particularly high, starting towards end of trunk. Tail length 2x length of body or less.	Common Frog *Rana temporaria*, Iberian Stream Frog *Rana iberica*, Italian Stream Frog *Rana italica*, Greek Stream Frog *Rana graeca*








LEFT, FROM TOP TO BOTTOM: salamander and newt larvae: Golden-striped Salamander, Smooth Newt, Alpine Newt, Macedonian Crested Newt.
RIGHT, FROM TOP TO BOTTOM: tadpoles: Mallorcan Midwife Toad, Western Spadefoot Toad, Common Tree Frog (juvenile with remnant of tail), Pyrenean Stream Frog.

Checklist of European amphibians and reptiles

This checklist covers all the native species of amphibians and reptiles recorded in our area, as defined on p.10. Established alien species with wide-ranging and/or self-sustaining populations are also included and are marked with an asterisk (*). Localised alien species that are not yet well-established and which do not have full species accounts in the text are not listed here, but see p.14.

The taxonomy and nomenclature used in this checklist follows Speybroeck, J., Beukema, W. & Crochet, P.-A. (2010): A tentative species list of the European herpetofauna (Amphibia and Reptilia) – an update. *Zootaxa* 2492: 1–27. More recent relevant literature has been reviewed and, if desirable, followed. The names in English largely follow Arnold & Ovenden (2002): *A Field Guide to the Reptiles and Amphibians of Britain and Europe.* Names of more recently described taxa were adopted from suggestions in the scientific literature or are newly attributed here. Higher taxa are ordered traditionally and more or less reflect evolutionary relationships at family level and above. As many species relationships are insufficiently resolved, taxa are listed alphabetically below family level.

AMPHIBIANS (AMPHIBIA)

SALAMANDERS AND NEWTS (URODELA)

True Salamanders and Newts (Salamandridae)

- ☐ Montseny Brook Newt *Calotriton arnoldi*
- ☐ Pyrenean Brook Newt *Calotriton asper*
- ☐ Golden-striped Salamander *Chioglossa lusitanica*
- ☐ Corsican Brook Newt *Euproctus montanus*
- ☐ Sardinian Brook Newt *Euproctus platycephalus*
- ☐ Alpine Newt *Ichthyosaura alpestris*
- ☐ Bosca's Newt *Lissotriton boscai*
- ☐ Palmate Newt *Lissotriton helveticus*
- ☐ Italian Newt *Lissotriton italicus*
- ☐ Montandon's Newt *Lissotriton montandoni*
- ☐ Smooth Newt *Lissotriton vulgaris*
- ☐ Karpathos Salamander *Lyciasalamandra helverseni*
- ☐ Luschan's Salamander *Lyciasalamandra luschani*
- ☐ Sharp-ribbed Newt *Pleurodeles waltl*
- ☐ Alpine Salamander *Salamandra atra*
- ☐ Corsican Fire Salamander *Salamandra corsica*
- ☐ Lanza's Salamander *Salamandra lanzai*
- ☐ Fire Salamander *Salamandra salamandra*
- ☐ Northern Spectacled Salamander *Salamandrina perspicillata*
- ☐ Southern Spectacled Salamander *Salamandrina terdigitata*
- ☐ Italian Crested Newt *Triturus carnifex*
- ☐ Great Crested Newt *Triturus cristatus*
- ☐ Danube Crested Newt *Triturus dobrogicus*
- ☐ Buresch's Crested Newt *Triturus ivanbureschi*
- ☐ Karelin's Crested Newt *Triturus karelinii*
- ☐ Macedonian Crested Newt *Triturus macedonicus*
- ☐ Marbled Newt *Triturus marmoratus*
- ☐ Southern Marbled Newt *Triturus pygmaeus*

Lungless Salamanders (Plethodontidae)

- ☐ Ambrosi's Cave Salamander *Speleomantes ambrosii*
- ☐ Monte Albo Cave Salamander *Speleomantes flavus*
- ☐ Gené's Cave Salamander *Speleomantes genei*
- ☐ Imperial Cave Salamander *Speleomantes imperialis*
- ☐ Italian Cave Salamander *Speleomantes italicus*
- ☐ Sette Fratelli Cave Salamander *Speleomantes sarrabusensis*
- ☐ Strinati's Cave Salamander *Speleomantes strinatii*
- ☐ Sopramonte Cave Salamander *Speleomantes supramontis*

Asiatic Salamanders (Hynobiidae)

- ☐ Siberian Salamander *Salamandrella keyserlingii*

Olm (Proteidae)

☐ Olm *Proteus anguinus*

FROGS AND TOADS (ANURA)

Clawed Frogs (Pipidae)

☐ African Clawed Toad *Xenopus laevis* *

Midwife Toads (Alytidae)

☐ Iberian Midwife Toad *Alytes cisternasii*
☐ Betic Midwife Toad *Alytes dickhilleni*
☐ Mallorca Midwife Toad *Alytes muletensis*
☐ Common Midwife Toad *Alytes obstetricans*

Painted Frogs (Discoglossidae)

☐ Iberian Painted Frog *Discoglossus galganoi*
☐ Corsican Painted Frog *Discoglossus montalentii*
☐ Painted Frog *Discoglossus pictus*
☐ Tyrrhenian Painted Frog *Discoglossus sardus*

Fire-bellied Toads (Bombinatoridae)

☐ Fire-bellied Toad *Bombina bombina*
☐ Yellow-bellied Toad *Bombina variegata*

Spadefoot Toads (Pelobatidae)

☐ Western Spadefoot Toad *Pelobates cultripes*
☐ Common Spadefoot Toad *Pelobates fuscus*
☐ Eastern Spadefoot Toad *Pelobates syriacus*
☐ Pallas's Spadefoot Toad *Pelobates vespertinus*

Parsley Frogs (Pelodytidae)

☐ Iberian Parsley Frog *Pelodytes ibericus*
☐ Parsley Frog *Pelodytes punctatus*

True Toads (Bufonidae)

☐ Common Toad *Bufo bufo*
☐ Spiny Toad *Bufo spinosus*
☐ African Green Toad *Bufotes boulengeri*
☐ Green Toad *Bufotes viridis*
☐ Natterjack Toad *Epidalea calamita*

Tree Frogs (Hylidae)

☐ Common Tree Frog *Hyla arborea*
☐ Italian Tree Frog *Hyla intermedia*
☐ Stripeless Tree Frog *Hyla meridionalis* *
☐ Iberian Tree Frog *Hyla molleri*
☐ Eastern Tree Frog *Hyla orientalis*
☐ Tyrrhenian Tree Frog *Hyla sarda*

True Frogs (Ranidae)

☐ American Bullfrog *Lithobates catesbeianus* *
☐ Pool Frog *Pelophylax lessonae*
☐ Levant Water Frog *Pelophylax* cf. *bedriagae*
☐ Cretan Water Frog *Pelophylax cretensis*
☐ Epirus Water Frog *Pelophylax epeiroticus*
☐ Edible Frog *Pelophylax* kl. *esculentus*
☐ Graf's Hybrid Frog *Pelophylax* kl. *grafi*
☐ Iberian Water Frog *Pelophylax perezi*
☐ Marsh Frog *Pelophylax ridibundus*
☐ Albanian Pool Frog *Pelophylax shqipericus*
☐ Moor Frog *Rana arvalis*
☐ Agile Frog *Rana dalmatina*
☐ Greek Stream Frog *Rana graeca*
☐ Iberian Stream Frog *Rana iberica*
☐ Italian Stream Frog *Rana italica*
☐ Italian Agile Frog *Rana latastei*
☐ Pyrenean Stream Frog *Rana pyrenaica*
☐ Grass Frog *Rana temporaria*

REPTILES (REPTILIA)

TURTLES, TORTOISES AND TERRAPINS (TESTUDINES)

Tortoises (Testudinidae)

☐ Spur-thighed Tortoise *Testudo graeca*
☐ Hermann's Tortoise *Testudo hermanni*
☐ Marginated Tortoise *Testudo marginata*

Terrapins (Emydidae)

☐ European Pond Terrapin *Emys orbicularis*
☐ Red-eared Slider *Trachemys scripta elegans* *

Terrapins (Geoemydidae)

☐ Spanish Terrapin *Mauremys leprosa*
☐ Balkan Terrapin *Mauremys rivulata*

Sea Turtles (Cheloniidae)

☐ Loggerhead Turtle *Caretta caretta*
☐ Green Turtle *Chelonia mydas*

Leatherback Turtles (Dermochelyidae)

☐ Leatherback Turtle *Dermochelys coriacea*

SCALED REPTILES (SQUAMATA)

LIZARDS (SAURIA)

Agamas (Agamidae)

☐ Starred Agama *Laudakia stellio* *

Chameleons (Chamaeleonidae)

☐ African Chameleon *Chamaeleo africanus* *

☐ Mediterranean Chameleon *Chamaeleo chamaeleon*

Geckos (Gekkonidae)

☐ Turkish Gecko *Hemidactylus turcicus*
☐ Kotschy's Gecko *Mediodactylus kotschyi*

Geckos (Sphaerodactylidae)

☐ European Leaf-toed Gecko *Euleptes europaea*

Geckos (Phyllodactylidae)

☐ Moorish Gecko *Tarentola mauritanica*

True Lizards (Lacertidae)

☐ Spiny-footed Lizard *Acanthodactylus erythrurus*
☐ Pygmy Algyroides *Algyroides fitzingeri*
☐ Dalmatian Algyroides *Algyroides nigropunctatus*
☐ Spanish Algyroides *Algyroides marchi*
☐ Greek Algyroides *Algyroides moreoticus*
☐ Anatolian Rock Lizard *Anatololacerta anatolica*
☐ Pelasgian Rock Lizard *Anatololacerta pelasgiana*
☐ Bedriaga's Rock Lizard *Archaeolacerta bedriagae*
☐ Sharp-snouted Rock Lizard *Dalmatolacerta oxycephala*
☐ Crimean Rock Lizard *Darevskia lindholmi*
☐ Meadow Lizard *Darevskia praticola*
☐ Prokletije Rock Lizard *Dinarolacerta montenegrina*
☐ Mosor Rock Lizard *Dinarolacerta mosorensis*
☐ Steppe Runner *Eremias arguta*
☐ Greek Rock Lizard *Hellenolacerta graeca*
☐ Aran Rock Lizard *Iberolacerta aranica*
☐ Aurelio's Rock Lizard *Iberolacerta aurelioi*
☐ Pyrenean Rock Lizard *Iberolacerta bonnali*
☐ Cyren's Rock Lizard *Iberolacerta cyreni*
☐ Galan's Rock Lizard *Iberolacerta galani*
☐ Horvath's Rock Lizard *Iberolacerta horvathi*
☐ Peña de Francia Rock Lizard *Iberolacerta martinezricai*
☐ West Iberian Rock Lizard *Iberolacerta monticola*
☐ Sand Lizard *Lacerta agilis*
☐ Western Green Lizard *Lacerta bilineata*
☐ Schreiber's Green Lizard *Lacerta schreiberi*
☐ Balkan Green Lizard *Lacerta trilineata*
☐ Eastern Green Lizard *Lacerta viridis*
☐ Snake-eyed Lacertid *Ophisops elegans*
☐ Bocage's Wall Lizard *Podarcis bocagei*
☐ Carbonell's Wall Lizard *Podarcis carbonelli*
☐ Cretan Wall Lizard *Podarcis cretensis*
☐ Erhard's Wall Lizard *Podarcis erhardii*
☐ Maltese Wall Lizard *Podarcis filfolensis*
☐ Skyros Wall Lizard *Podarcis gaigeae*
☐ Guadarrama Wall Lizard *Podarcis guadarramae*
☐ Spanish Wall Lizard *Podarcis hispanicus*
☐ Pori Wall Lizard *Podarcis levendis*
☐ Lilford's Wall Lizard *Podarcis lilfordi*
☐ Catalonian Wall Lizard *Podarcis liolepis*
☐ Dalmatian Wall Lizard *Podarcis melisellensis*
☐ Milos Wall Lizard *Podarcis milensis*
☐ Common Wall Lizard *Podarcis muralis*
☐ Peloponnese Wall Lizard *Podarcis peloponnesiacus*
☐ Ibiza Wall Lizard *Podarcis pityusensis*
☐ Aeolian Wall Lizard *Podarcis raffoneae*
☐ Italian Wall Lizard *Podarcis siculus*
☐ Balkan Wall Lizard *Podarcis tauricus*
☐ Tyrrhenian Wall Lizard *Podarcis tiliguerta*
☐ Vaucher's Wall Lizard *Podarcis vaucheri*
☐ Geniez's Wall Lizard *Podarcis virescens*
☐ Sicilian Wall Lizard *Podarcis waglerianus*
☐ Large Psammodromus *Psammodromus algirus*
☐ Edwards's Psammodromus *Psammodromus edwarsianus*
☐ Spanish Psammodromus *Psammodromus hispanicus*
☐ Western Psammodromus *Psammodromus occidentalis*
☐ Moroccan Rock Lizard *Teira perspicillata* *
☐ Ocellated Lizard *Timon lepidus*
☐ Sierra Nevada Ocellated Lizard *Timon nevadensis*
☐ Viviparous Lizard *Zootoca vivipara*

Skinks (Scincidae)

☐ Snake-eyed Skink *Ablepharus kitaibelii*
☐ Bedriaga's Skink *Chalcides bedriagai*
☐ Italian Three-toed Skink *Chalcides chalcides*
☐ Ocellated Skink *Chalcides ocellatus*
☐ Iberian Three-toed Skink *Chalcides striatus*
☐ Limbless Skink *Ophiomorus punctatissimus*
☐ Levant Skink *Trachylepis aurata*

Slow Worms (Anguidae)

☐ Peloponnese Slow Worm *Anguis cephallonica*
☐ Eastern Slow Worm *Anguis colchica*
☐ Slow Worm *Anguis fragilis*
☐ Greek Slow Worm *Anguis graeca*
☐ Italian Slow Worm *Anguis veronensis*
☐ Glass Lizard *Pseudopus apodus*

WORM LIZARDS (AMPHISBAENIA)

Worm Lizards (Blanidae)

☐ Iberian Worm Lizard *Blanus cinereus*
☐ Maria's Worm Lizard *Blanus mariae*
☐ Anatolian Worm Lizard *Blanus strauchi*

SNAKES (SERPENTES)

Blind Snakes (Typhlopidae)

☐ Worm Snake *Xerotyphlops vermicularis*

Sand Boas (Erycidae)

☐ Sand Boa *Eryx jaculus*

Colubrids (Colubridae)

☐ Smooth Snake *Coronella austriaca*
☐ Southern Smooth Snake *Coronella girondica*
☐ Caspian Whip Snake *Dolichophis caspius*
☐ Black Whip Snake *Dolichophis jugularis*
☐ Masked Dwarf Snake *Eirenis modestus*
☐ Steppe Snake *Elaphe dione*
☐ Four-lined Snake *Elaphe quatuorlineata*
☐ Blotched Snake *Elaphe sauromates*
☐ Algerian Whip Snake *Hemorrhois algirus* *
☐ Horseshoe Whip Snake *Hemorrhois hippocrepis*
☐ Coin-marked Snake *Hemorrhois nummifer*
☐ Balkan Whip Snake *Hierophis gemonensis*
☐ Western Whip Snake *Hierophis viridiflavus*
☐ Iberian False Smooth Snake *Macroprotodon brevis*
☐ Algerian False Smooth Snake *Macroprotodon cucullatus* *
☐ Reddish Whip Snake *Platyceps collaris*
☐ Dahl's Whip Snake *Platyceps najadum*
☐ Ladder Snake *Rhinechis scalaris*
☐ Cat Snake *Telescopus fallax*
☐ Aesculapian Snake *Zamenis longissimus*
☐ Italian Aesculapian Snake *Zamenis lineatus*
☐ Leopard Snake *Zamenis situla*

Water Snakes (Natricidae)

☐ Iberian Grass Snake *Natrix astreptophora*
☐ Grass Snake *Natrix natrix*
☐ Viperine Snake *Natrix maura*
☐ Dice Snake *Natrix tessellata*

African Sand Snakes (Psammophiidae)

☐ Eastern Montpellier Snake *Malpolon insignitus*
☐ Western Montpellier Snake *Malpolon monspessulanus*

Vipers (Viperidae)

☐ Blunt-nosed Viper *Macrovipera lebetina*
☐ Ottoman Viper *Montivipera xanthina*
☐ Nose-horned Viper *Vipera ammodytes*
☐ Asp Viper *Vipera aspis*
☐ Adder *Vipera berus*
☐ Greek Meadow Viper *Vipera graeca*
☐ Lataste's Viper *Vipera latastei*
☐ Steppe Viper *Vipera renardi*
☐ Seoane's Viper *Vipera seoanei*
☐ Meadow Viper *Vipera ursinii*
☐ Walser Viper *Vipera walser*

Chorus of breeding Moor Frogs. N Croatia.

Species accounts

Amphibians (Amphibia)

More than 7,000 species of amphibians exist today. Most live in tropical areas, while temperate zones are generally characterised by lower species diversity. More than 80 species occur in our area, of which many are endemic. Amphibians are characterised by a lack of scales (in contrast to reptiles). They are divided into three groups – salamanders and newts (Urodela), frogs and toads (Anura) and caecilians (Gymnophiona), of which only the first two have European representatives.

Most species are mainly active during the night, although the fire-bellied toads (Bombinatoridae) and water and brown frogs (Ranidae) are largely diurnal. Night activity, including reproduction, may be strongly related to the degree of cloud cover and the phase of the moon, with some species avoiding clear, moonlit nights, while others increase their activity at these times. All amphibians have skin toxins, which can be harmful when ingested or if they come into contact with the eyes after handling, although the European species pose no serious threat. Amphibians need water to reproduce, into which they deposit either eggs or larvae. European exceptions to this rule are several terrestrial salamander species, which either deposit eggs on land (Plethodontidae), or produce fully-developed juveniles instead of larvae (genus *Lyciasalamandra*, the alpine salamanders, and several fire salamander populations). As a consequence, nearly all species are generally found in or near bodies of water.

Key to orders of European amphibians	
Tail present in both larvae and adults. Moist smooth or dry granular skin.	Newts and salamanders (Urodela)
Tail lacking in adults. Moist smooth or dry warty skin.	Frogs and toads (Anura)

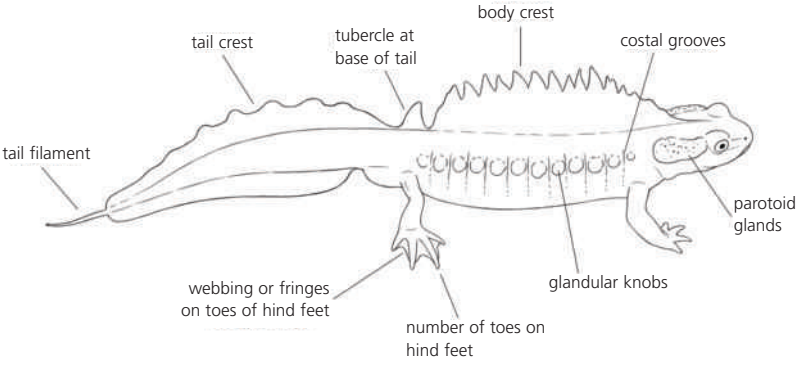


Fig. 5. Useful features for salamander and newt identification.

SALAMANDERS AND NEWTS (URODELA)

The order Urodela consists of approximately 650 species which occur on all continents except Antarctica and Australia. It is often divided into two groups; salamanders, which are characterised by a largely terrestrial lifestyle, and newts, which spend considerable time in the water. About 40 species occur within Europe and the Mediterranean Basin, and are distributed into four families. The largest of these, the Salamandridae, comprising both salamanders and newts, has diverged into a large variety of species, occupying a wide range of habitats. The lungless salamanders (Plethodontidae) contain a small number of species endemic to Italy and France. The Asiatic salamanders (Hynobiidae) are represented only marginally in Europe, by a single, widespread species. Finally, the Proteidae comprises only a single, ancient member, which occurs in subterranean streams along the eastern Adriatic coast. Salamanders and newts are characterised by front and hind legs of approximately similar length, a tail, and generally wet skin, which can turn dry in newts outside of their reproductive period.

Key to Salamanders and Newts	
Strictly aquatic. Highly elongated body with comparatively small limbs and tail. Presence of reddish gills. Limited to caves and wells between NE Italy and Montenegro.	Olm – Proteidae (p.112)
Strictly terrestrial. Very slender body shape. Presence of nasolabial grooves and chin gland in males (see Fig. 7). Stubby, partially webbed toes of similar length (see Fig. 6). Limited to SE France, NW Italy and Apennines.	Lungless salamanders – Plethodontidae (p.105)
Both aquatic and terrestrial, Short, stocky body shape. Extremely short and blunt snout. Conspicuous costal grooves. 4 toes on hind feet. In our area only in Russia.	Asiatic salamanders – Hynobiidae (p.110)
Both aquatic and terrestrial. Hind feet toes generally longer than front feet toes. Hind feet only webbed in some small aquatic individuals. In entire area except most Mediterranean islands, but present on Corsica, Sardinia, Corfu, Euboea, some Ionian Islands and several Croatian islands.	True salamanders and newts – Salamandridae (p.61)

Fig. 6. Hindfoot of cave salamander *Speleomantes* spp.

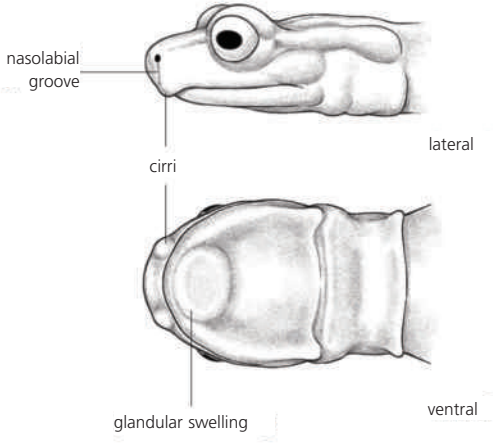


Fig. 7. Head of male cave salamander *Speleomantes* spp.

■ True Salamanders and Newts (Salamandridae)

The family Salamandridae comprises over 100 members, of which approximately one-third occur in the area covered by this field guide. Three major taxonomic groups can be distinguished within this family – the subfamilies Pleurodelinae (covering all newts), the Salamandrinae (comprising all salamanders) and the Salamandrininae, which contains the spectacled salamanders *Salamandrina* spp. This Salamandrininae separated from the other salamandrids some 60 million years ago, making it a unique and ancient lineage. It originated in Europe, after which the Asian and North American continents were colonised. Within Europe and the Mediterranean, salamandrids can be found in most countries, including islands. Species richness slightly decreases in southern regions, where it is less common to find several species together.

As illustrated by their taxonomic subdivision, members of the Salamandridae exhibit two different lifestyles. Newts are generally small or medium-sized, and spend their breeding period in waterbodies. Accordingly, these species develop dorsal

Key to True Salamanders and Newts			
1	a	4 toes on front and hind feet. Small salamander with dry skin. Dark above; white with dark and red colours below; conspicuous light spot on head. Only in peninsular Italy.	Spectacled salamanders *Salamandrina* spp.
	b	5 toes on the hind feet, 4 on the front feet.	**2**
2	a	Parotoid glands present.	**3**
	b	Parotoid glands absent.	**4**
3	a	Upper half of iris lighter than lower half. Fully terrestrial. Only on Karpathos, Saria, Kasos and Kastellorizo.	Karpathos and Luschan's Salamanders *Lyciasalamandra* spp.
	b	Iris completely dark. Body either completely black in colour, or with yellow and sometimes also red spots. Fully terrestrial.	Fire and alpine salamanders *Salamandra* spp.
4	a	Elongated body shape with tail 2x as long as body. Only N and NW Iberian Peninsula.	Golden-striped Salamander *Chioglossa lusitanica*
	b	Normal body shape with tail about same length as body.	**5**
5	a	With conspicuous series of orange dorsolateral warts. Head flat. Aquatic and terrestrial. Only Iberian Peninsula.	Sharp-ribbed Newt *Pleurodeles waltl*
	b	Without series of orange dorsolateral warts.	**6**
6	a	With one or three grooves on head (see Fig. 8). Small-bodied; both terrestrial and aquatic.	Small-bodied newts *Lissotriton* spp.
	b	Grooves on head absent.	**7**
7	a	Dorsal skin slightly granular; smooth in aquatic individuals. Toes on front and hind feet similar size. Underside yellow to red without dark spots; throat similar to underside but with or without dark spots. Not in Pyrenees.	Alpine Newt *Ichthyosaura alpestris*
	b	Dorsal skin granular in terrestrial and aquatic individuals. Toes on hind feet distinctly longer than on front feet. Underside yellow to red with dark spots. Not in Pyrenees.	Crested and marbled newts *Triturus* spp.
	c	Dorsal skin granular or warty in terrestrial and aquatic individuals. Toes on front and hind feet similar size. Whitish-yellow to red colour restricted to mid-back with few dark points. Only in Pyrenees.	Pyrenean Brook Newt *Calotriton asper*
	d	Dorsal skin relatively smooth. Restricted to Montseny Massif. Generally with black toe-tips. In or near streams but generally aquatic.	Montseny Brook Newt *Calotriton arnoldi*
	e	Dorsal skin relatively smooth. Restricted to Sardinia. Generally with black toe-tips. In or near streams but generally aquatic.	Sardinian Brook Newt *Euproctus platycephalus*
	f	Dorsal skin relatively smooth. Restricted to Corsica. Generally without black toe-tips. In or near streams.	Corsican Brook Newt *Euproctus montanus*

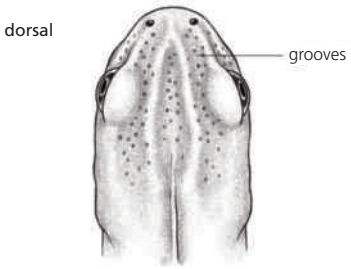


Fig. 8. Head of small-bodied newt *Lissotriton* spp.

crests, tail-fins or enlarged webbing between the toes in order to facilitate their aquatic way of life. In contrast, salamanders do not exhibit an aquatic stage after metamorphosis. Mating takes place on land, after which aquatic larvae are deposited in generally flowing waterbodies. In some cases, development of the larvae is completed within the female, who deposits fully-developed young. All species are mostly nocturnal, although newts can be observed during the day in waterbodies during the reproductive season. Salamanders often become active during humid or rainy weather, especially after a long drought.

Salamandrid species are generally found in humid, well-vegetated habitats, close to waterbodies. Newts may occur in a wide variety of open or semi-open habitats, such as agricultural land, heathlands, or riverine lowlands. Salamanders usually occur in mature forests but also in alpine meadows.

Species in north and central Europe hibernate, while those in the southern regions covered by this field guide (e.g. S Iberian Peninsula, Greece) reproduce during the winter and early spring and aestivate during summer.

Because all salamandrid species possess skin toxins as a general defensive mechanism, one should wash one's hands after touching them. However, several other defensive mechanisms have been described. When disturbed, spectacled salamanders may additionally curve their tail over the body towards the head, showing the bright red coloration on the underside. Conversely, the Sharp-ribbed Newt *Pleurodeles waltl* may protrude the sharp tips of its ribs through its dorsolateral warts, while the Golden-striped Salamander *Chioglossa lusitanica* may cast its tail, like many lizard species. Newts of the genera *Lissotriton*, *Ichthyosaura* and *Triturus* may curve their body sideways while rolling up their tail and pointing it upward, showing the bright yellow or red coloration similar to that of the spectacled salamanders. Finally, alpine, fire, and Lycian salamander species may direct their parotoid glands towards the predator by pointing their head towards the ground; in exceptional cases they may squirt toxins from both their dorsal glands and parotoid glands.

Defensive pose of a Great Crested Newt. Germany.

Fire Salamander *Salamandra salamandra*

(Linnaeus, 1758)

Corsican Fire Salamander *Salamandra corsica*

Savi, 1838

DESCRIPTION

TL: 20 cm and above. Medium-sized to (very) large salamanders (see Variation). Skin smooth and shiny. Conspicuous parotoid glands behind the eyes. Rows of dorsolateral glandular knobs. Continuous double vertebral line of pores, continuing onto the tail. Legs and toes short. Male cloaca swollen, especially in breeding season. Back black (or very dark brown) with varying degree of yellow to orange spots or blotches. W European and NW Iberian populations often characterised by pattern of two discontinuous dorsolateral stripes. E European populations are usually irregularly spotted. Several Iberian and Greek populations show additional red spots. Yellow spots nearly always present on eyes, parotoid glands and legs.

Corsican Fire Salamander most often shows large, rounded blotches which increase with age and is relatively stout with seemingly shorter and stronger legs and toes. Also see Variation.

DISTRIBUTION

Fire Salamander: Widely distributed over most of Europe, but absent from the British Isles, much of N and E Europe and the major Mediterranean islands. See Variation for detailed distribution.

Corsican Fire Salamander: Corsica only.

VARIATION

Several Fire Salamander subspecies are recognised.

S. s. salamandra: E Europe, up to C Germany, Alps, N and C Italy. Large to very large, especially in the Balkans (TL > 20 cm). Irregular yellow blotches.

S. s. almanzoris: Generally at high altitudes in the Sierra de Gredos and Guadarrama, Spain, but also in some isolated lowland locations. Large in size (TL: 20 cm). High-altitude individuals may show restricted pattern of yellow spots. No red spots.

S. s. bejarae: Low altitudes in Sistema Central and more southern mountain areas. Boundary with *S. s. gallaica* unclear. Very large (TL > 20 cm). Short, pointed snout. Very short tail and toes. Pattern highly variable, usually with restricted irregular yellow and red spots.

S. s. bernardezi: Common throughout W Cantabria, Asturias and extreme N Galicia, Spain. Medium-sized (TL: 15 cm). Round snout. Highly variable pattern, usually with yellow dorsolateral stripes of variable extent. Nearly black or completely yellow individuals exist. Dirty-yellow to brownish individuals occur between Oviedo and the Picos de Europa, which have been attributed to *S. s. alfredschmidti*. As these individuals are genetically indistinguishable and always coexist with ordinary *S. s. bernardezi* they are best considered part of this subspecies. Generally viviparous, although larvae can be

Fire Salamander

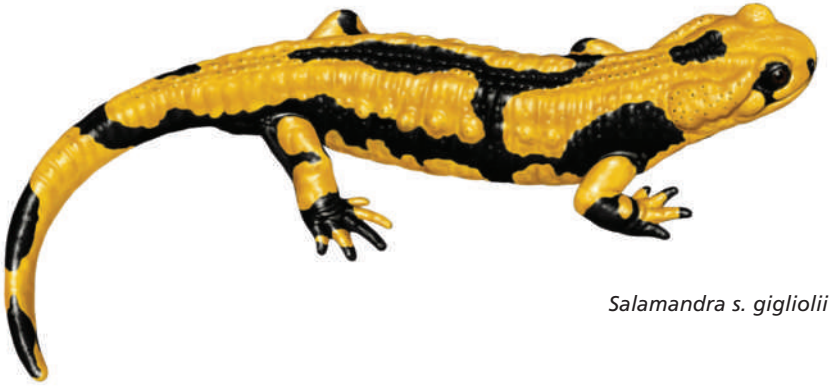
Salamandra s. salamandra

Salamandra s. terrestris

Salamandra s. gallaica

Fire Salamander

Salamandra s. fastuosa



Salamandra s. gigliolii

Corsican Fire Salamander

found throughout its distribution, especially in N Galicia.

S. s. crespoi: Occurs in S Portugal up to the Lisbon Peninsula; E to Guadiana River. Large to occasionally very large (TL > 20 cm). Generally with conspicuously long toes and tail, but size, body shape and colour pattern highly variable. Tiny, whitish specks on underside. Northern populations very similar to *S. s. gallaica*, eastern populations to *S. s. morenica*.

S. s. fastuosa: W and C Pyrenees and adjacent N Spain. Large (TL: 20 cm), but smaller outside the Pyrenees. Legs and tail long. Yellow pattern extensive, most often with (dis)continuous dorsolateral stripes. High-altitude populations in the Pyrenees may resemble *S. s. terrestris*. Individuals in Navarra, Basque Country and Cantabria may show restricted red spots on the throat, legs and dorsum. Viviparous in the extreme W of its distribution.

S. s. gallaica: NW Spain, N and C Portugal. Very large (TL > 20 cm). Snout short and pointed. Toes and legs short. Pattern highly variable, most often characterised by both yellow and red blotches. In most populations a pattern of discontinuous yellow dorsolateral stripes can occur. Populations in C and N Portugal often with panther-like pattern. Several Galician island populations are viviparous.

S. s. gigliolii: Most of Italian mainland (in north along W coast up to Liguria). Large (TL: 20 cm). Head very flat. Extensive pattern of yellow blotches. Completely yellow individuals also occur. Usually red spots on the throat and underside.

S. (s.) longirostris: Hills and mountains of provinces of Cádiz and W Málaga, S Spain. Large (TL: 20 cm). Sharply pointed snout, often with minor overbite. Pattern of bright whitish to yellow blotches, without red. Tiny, whitish specks on underside. May represent a separate species.

S. s. morenica: Occurs in the Sierra Morena and isolated mountain massifs in N Andalucia, Murcia and Valencia, S and SE Spain. Large size (TL: 20 cm). Snout short and pointed. Toes and legs short. Pattern highly variable, but consists mostly of very small yellow and red spots.

S. s. terrestris: From E Pyrenees and NE Spain throughout France, Belgium, the Netherlands, Switzerland and most of (W) Germany. Large (TL: 20 cm). Typically with two dorsolateral rows of yellow spots.

S. s. werneri: Peloponnese, Greece. As *S. s. salamandra*, but may have additional red spots. Validity disputed.

Corsican Fire Salamander varies greatly in pattern, but no subspecies are recognised.

HABITAT

In N, E and C Europe mostly in hilly/mountainous deciduous or mixed forests, near small rivers or streams, combined with an abundance of shelters in the form of rocks and logs. Can occur above the tree line, especially on the Iberian Peninsula and the Pyrenees. To a certain degree, populations can also persist in agricultural

Mating Fire Salamanders. Flanders, Belgium.

landscapes when suitable breeding water is present. Mediterranean populations also inhabit open olive and (cork) oak forests, maquis shrubland and gardens. Waterbodies used for deposition of larvae include wells, streams, ponds and even flooded wheel tracks. Up to 2,300 m in S of range.

BIOLOGY

Mostly nocturnal, but can come out of its shelter during the day in case of high humidity or rain. May be active throughout the winter if conditions are suitable. Individuals from southern populations may aestivate through the dry summer months. Most readily seen at night after rain and when temperatures above 5°C. May ascend tree trunks to absorb rainwater flowing down. In C Europe, mating often takes place in summer and autumn, but this may differ between populations. At that time, males especially may be seen standing on stretched front legs while prospecting their surroundings for a potential mate. Especially during the reproductive period, males may engage in combat, wrestling or pushing their bodies upward while balancing on their tails. While mating, the male crawls underneath the female and grabs her forearms with his own, pressing himself against her belly. Males deposit a spermatophore which is taken up by the female. The aquatic egg phase, typical of most amphibians, does not exist, and larvae are deposited in well-oxygenated streams or forest ponds. However, several populations in N Iberia (see Variation) are viviparous and give birth to up to 20 fully developed juveniles, thus entirely skipping the aquatic stage. In contrast to popular belief, Fire Salamanders are quite able to swim across stagnant waterbodies. If molested, individuals may release a white toxin, which in rare cases can be sprayed up to 1 m. Feeds on a wide variety of invertebrates.

NOTE

The fungus *Batrachochytrium salamandrivorans*, originating from E Asia and first described in 2013, drove Dutch populations to the brink of extinction. It has also been found in Belgium and experiments have shown its potentially devastating impact on a myriad of European and North American newt and salamander species, while species from the Far East seem more able to cope with it.

Male Fire Salamanders may engage in combat in the reproductive season. Flanders, Belgium.

Alpine Salamander *Salamandra atra* Laurenti, 1768
Lanza's Salamander *Salamandra lanzai*
Nascetti, Andreone, Capula & Bullini, 1988

DESCRIPTION

TL: 15 cm (Alpine), 17 cm (Lanza's). Medium-sized to large salamanders. Overall slender appearance, especially Lanza's. Skin smooth and shiny. Head flat with a round snout. Conspicuous parotoid glands behind the eyes. A total of 12–13 costal grooves are clearly visible on the flanks. Two rows of dorsolateral knobs always present. Continuous double line of gland pores on the centre of the back running down to the tip of the tail present in Alpine Salamander but absent in Lanza's. Tail long, especially long in Lanza's, with round cross-section in Lanza's but more elliptical in Alpine. Male cloaca swollen. Dorsal colour black (occasionally very dark brown). A few NE Italian populations show a pattern of whitish to yellow blotches (see Variation).

DISTRIBUTION

Alpine Salamander: C and E Alps including an isolated westernmost occurrence in France, south-eastwards through isolated populations in the Dinaric Alps, where its distribution is not well known. Southernmost occurrence is in Albania, but might also occur in Macedonia. Many populations in the Italian distribution on the southern limit of the Alps occur on isolated mountain massifs. Lanza's Salamander: Restricted area in the Cottian Alps, along the border of France and Italy.

VARIATION

Four subspecies of Alpine Salamander are recognised.
S. a. atra: Alps southwestwards to at least N Slovenia.
S. a. aurorae: Altopiano dei Sette Comuni in Veneto, Italy. Always shows extensive whitish-yellow spots along the dorsum, head, legs and tail.
S. a. pasubiensis: Pasubio Massif, Italy. Shows more restricted but deeper yellow spots in comparison to *S. a. aurorae*. Completely black individuals also occur in this subspecies.
S. a. prenjensis: Isolated populations from C Slovenia to N Albania.

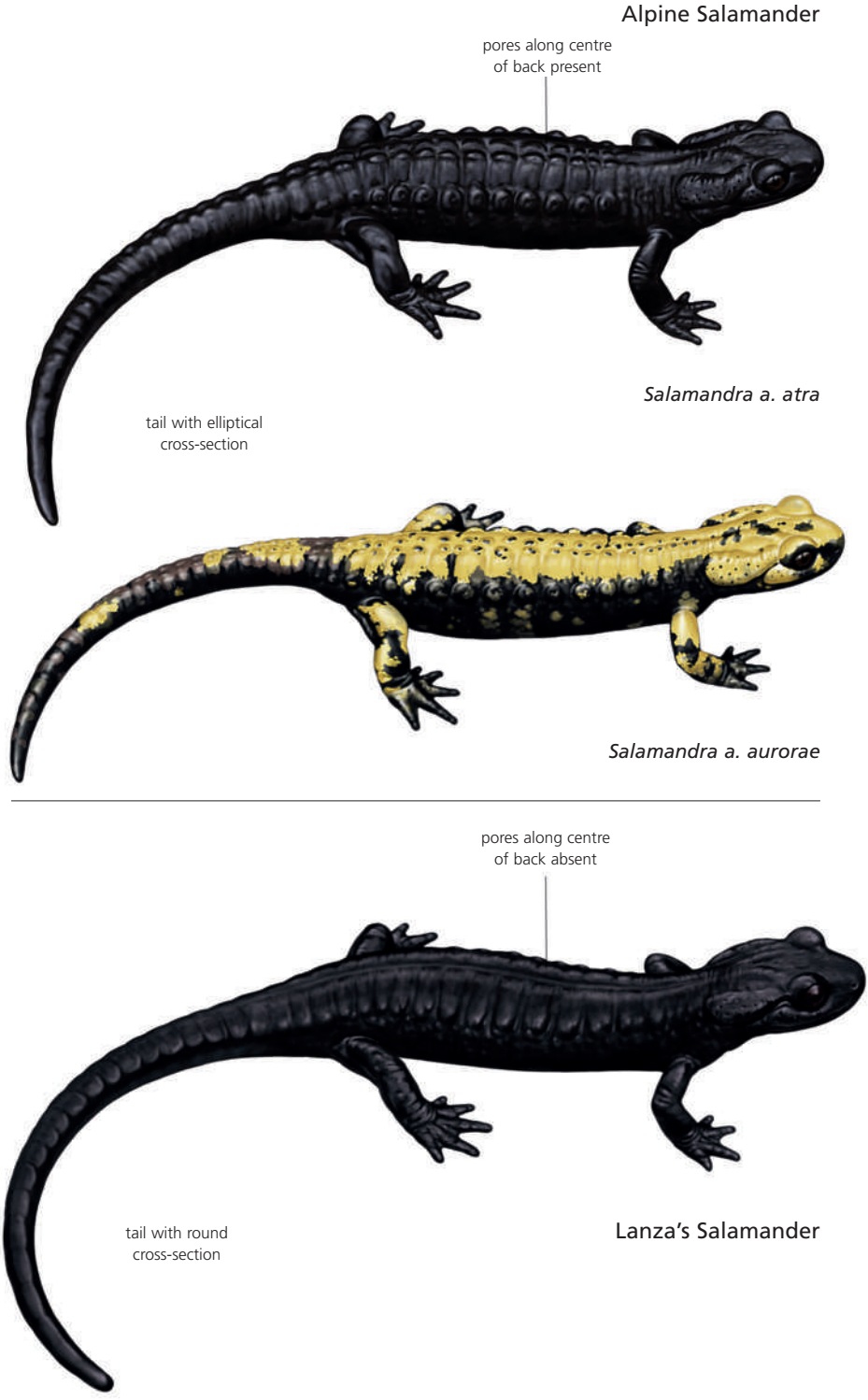
No subspecies have been described for Lanza's Salamander.

HABITAT

Characteristic inhabitant of rocky alpine meadows with scattered trees. Also occurs in mountainous beech and mixed forests, but is usually most common at the forest edge. In the southern Dinaric Alps almost exclusively known from rocky habitats above the tree line, sometimes interspersed with dwarf pines. Ranges between 400–2,800 m in the Alps, but only reaches the lower limit on the northern slopes of these mountains. Occurs mostly between 1,400–2,000 m in the Italian and Dinaric Alps.

BIOLOGY

High-altitude populations of Alpine and especially Lanza's Salamanders are nocturnal


Alpine Salamander
pores along centre of back present
Salamandra a. atra
tail with elliptical cross-section
Salamandra a. aurorae
pores along centre of back absent
tail with round cross-section
Lanza's Salamander

but also diurnal under humid or rainy circumstances. Populations at lower altitudes are strictly nocturnal. Local abundance may be very high. Active from late spring to early autumn, and strongly dependent on altitude; individuals at high altitude may hibernate for up to eight months. Mating takes place on land. The male crawls underneath the female and grabs her forearms with his own, pressing himself against her belly. Males deposit a spermatophore which is taken up by the female. Both species give birth to one to three fully developed young, omitting any aquatic phase as an adaptation to life at high altitude. Feeds on a wide variety of invertebrates. When disturbed, Alpine Salamanders rely on their toxic milky skin secretions and raise the front part of the body while lowering the head, thus presenting the parotoid glands to a potential predator.

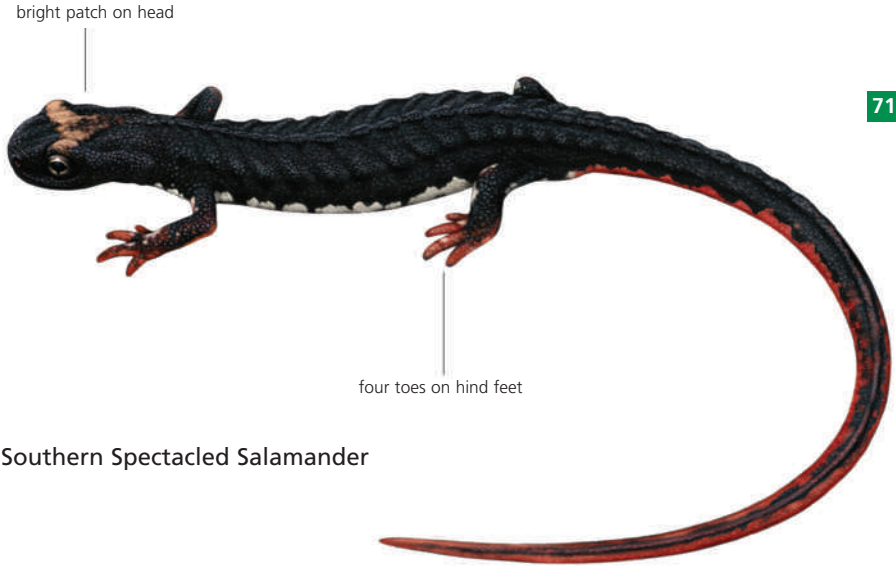
NOTE

Lanza's Salamander is listed as Vulnerable in the 2009 IUCN Red List of European Amphibians.

Alpine Salamander, ssp. *pasubiensis*. Pasubio Massif, Italy.

Lanza's Salamander. Cottian Alps, Italy.

Northern Spectacled Salamander
Salamandrina perspicillata (Savi, 1821)
Southern Spectacled Salamander
Salamandrina terdigitata (Bonnaterre, 1789)



Southern Spectacled Salamander

DESCRIPTION

TL: 8.6 cm (Northern), 8 cm (Southern). Small, highly similar salamanders. Skin finely granulated and dry. Head very flat. Snout stubby, short and rounded. Trunk flat on top, with clearly visible ribs. Conspicuous dorsal ridge. Tail longer than rest of the body, tail-tip pointed. Only four toes on the hind feet, a feature only shared in Europe with the Siberian Salamander *Salamandrella keyserlingii*. Dorsal colour dark brown or grey to black. Usually a bright conspicuous triangular white or golden patch on the head. Tail partially red, more extensively so in Southern. Underside blotched white, with a lots of red and black especially on limbs, anterior part and tail. Given the small differences, the two species are best identified by range.

DISTRIBUTION

Northern Spectacled Salamander: Apennine Mountains and hills of NW and C Italy, southwards to Caserta, Campania and N Apulia.

Southern: Southern peninsular Italy, not Sicily. Although a historical contact zone between the two species has been identified in C Campania, contemporary hybridisation seems to be highly restricted or non-existent.

HABITAT

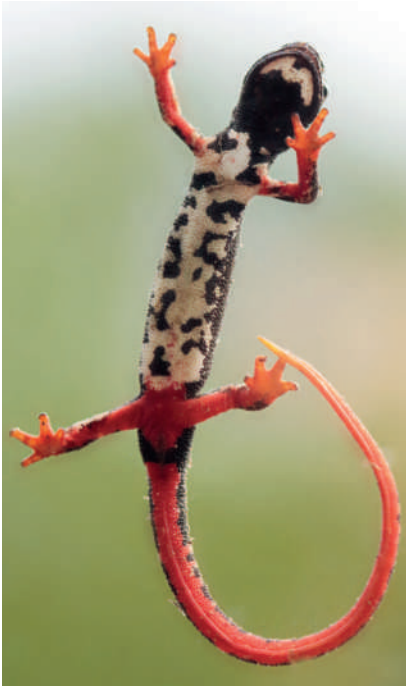
Spectacled salamanders occur in hilly and mountainous deciduous forests characterised by dense undergrowth, a thick layer of leaf-litter and lots of shelter (rocks and logs). Several populations also inhabit steep stream valleys in Mediterranean maquis scrub. Habitats modified by man are seldom occupied. Populations always occur in the vicinity of permanent, well-oxygenated water such as streams, wells and springs, but cattle troughs and small ponds may also be used for reproduction. Altitudinal distribution ranges from sea-level to about 1,500 m, although most populations are located below 600 m.

BIOLOGY

Usually nocturnal, but occasionally seen during daylight after rain. These are small, cryptic, inconspicuous species. Reproduction takes place in winter (S) or spring (N). Individuals living at higher altitudes may hibernate from November until February, while those occurring at generally lower altitudes may aestivate during summer. Courtship takes place on land. After taking up the male's spermatophore, the female moves towards, usually flowing, breeding water. Females submerge to lay up to 60 eggs (in groups of up to 20) attached to pieces of wood or rocks. When disturbed individuals elevate their head and limbs while curling their tail towards their head thus showing the bright red underside.

NOTE

The most ancient salamandrid lineage, separated from all other species for about 60 million years. Once more widespread in Europe, with fossil remains of relatives known from Greece and Sardinia.

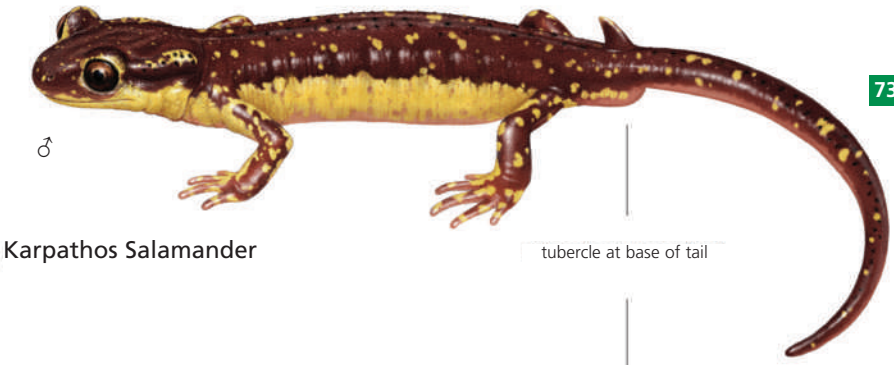


Northern Spectacled Salamander, underside. Liguria, Italy.

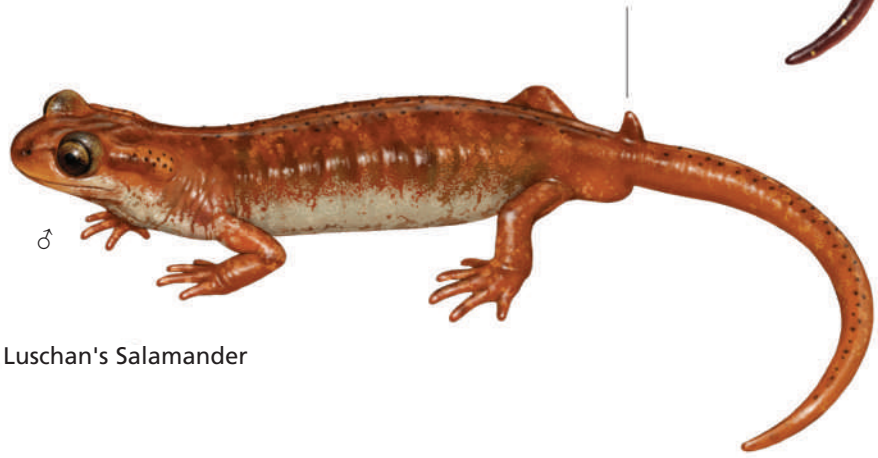
Southern Spectacled Salamander. S Italy.

Karpathos Salamander *Lyciasalamandra helverseni*
(Pieper, 1963)

Luschan's Salamander *Lyciasalamandra luschani*
(Steindachner, 1891)



Karpathos Salamander



Luschan's Salamander

DESCRIPTION

TL: 14 cm. Medium-sized salamanders with slender appearance and smooth skin. Head flat with large eyes. Two large parotoids behind the eyes. Tail about half of the total length. Males with conspicuous dorsal tubercle at the base of the tail, which can also be faintly visible in old females. During the breeding season males develop minute spiny spicules over the entire body. Dorsal colour dark reddish-brown or purple to black in Karpathos Salamander, interspersed with a pattern of small whitish to yellow spots. Flanks, chin and underside of limbs and body whitish to yellow. Some populations are characterised by much yellow coloration, while others completely lack pattern. Dorsal colour and pattern of Luschan's Salamander extremely variable. In our area, dorsal colour orange to red, often with vague pattern of large, brown blotches (especially in juveniles). Underside white. Completely uniform orange, pinkish or red-coloured individuals are not uncommon.

DISTRIBUTION

Karpathos Salamander: Endemic to the Greek Aegean Islands of Karpathos, Kasos and Saria.
Luschan's Salamander: In the area treated by this guide only on the Greek islet of Kastellorizo (Megisti), but also along the

Karpathos Salamander
Luschan's Salamander

Lycian coast in Turkey roughly between Fethiye and Kumluca.

VARIATION

The Kastellorizo population of Luschan's Salamander belongs to the subspecies *L. l. basoglui*.

HABITAT

Uncharacteristic compared with most other European salamanders. Karpathos Salamander generally occurs in open pine forests, Mediterranean maquis, agricultural areas bounded by dry-stone walls or rock faces in hilly terrain, always covered by lots of stones and characterised by deep subterranean karstic crevices. On Kastellorizo, Luschan's Salamander generally inhabits rocky fields. Both species are highly adapted and able to persist in high densities in villages, if abundant shelter is available. On Karpathos, can reach altitudes of up to 1,000 m.

BIOLOGY

Both species only come above ground during winter (roughly from October to April), mainly in wet rainy conditions, and can generally only be seen at such times. High numbers may appear immediately after sunset, when they can sometimes be seen even in dry conditions. Diurnal activity has been observed during very humid, cloudy weather. Local densities can be extremely high. Mating takes place on land. Males crawl under a female while grabbing her front legs with his own and pressing his head against her chin. The male stimulates the female's cloaca with the dorsal tubercle at his tail base, while emitting a milky substance. He sways his tail to the side and deposits a spermatophore, allowing the female to pick it up. Both species display advanced viviparity – larvae develop inside the female after which up to three fully developed juveniles are born. Feeds on all sorts of invertebrates such as caterpillars, slugs and worms.

NOTE

Karpathos Salamander is listed as Vulnerable in the 2009 IUCN Red List of European Amphibians.

Karpathos Salamander. Karpathos, Greece. An almost unspotted female.

Golden-striped Salamander *Chioglossa lusitanica*

Bocage, 1864

Golden-striped Salamander

DESCRIPTION

TL: 16 cm. Medium-sized salamander with a small, rather flat head and conspicuous eyes. Body long and very slender. Limbs short in comparison to body. Tail very long, usually 2–2.5x body length. Dorsal colour light brownish-orange to gold, often divided into two longitudinal stripes. Head, lateral and ventral sides dark in colour, sometimes bluish, usually with very faint whitish to golden mottling.

DISTRIBUTION

Confined to the humid northwest of the Iberian Peninsula. Ranges from extreme W Cantabria in Spain to the Serra da Estrela in C Portugal.

VARIATION

C. l. lusitanica: Serra da Estrela and the Serra da Lousã (C Portugal), N to the Mondego River.
C. l. longipes: Remaining part of species distribution.

A broad transition zone exists. Subspecies *lusitanica* possesses much smaller toes than *longipes* from Asturias.

HABITAT

This species is mainly found in highly humid microhabitats under stones or logs, within or in the immediate vicinity of (fast-flowing) streams or wells. The surrounding habitat usually consists of dense forests characterised by rich undergrowth. However, also occurs in *Eucalyptus* forests, even on sandy soils close to the sea, but then always very close to streams. Populations in drier, Mediterranean climatic conditions may occur close to or in caves or old mines. Occurs up to 1,200m in Portugal.

BIOLOGY

Nocturnal and found throughout the year. In summer, individuals are typically less active and stay closer to streams. During humid or rainy nights, individuals roam the forest floor, tree trunks, mossy rocks or vegetation. When disturbed, may flee exceptionally quickly compared with other European salamanders and wriggle away. Tail may be

cast as a defensive measure when molested. Typically found while lifting objects near or in streams. Mating usually takes place on land in autumn. The male crawls underneath the female, holding her front legs with his own. After stimulating her cloaca, he moves his tail to the side and allows the female to take up his deposited spermatophore. Females deposit up to 20 eggs on submerged rocks or roots or on moist rock walls, including those in moist caves. Larvae usually spend one winter before completing metamorphosis the next year, but may also take up to three years. Feeds on a wide variety of small invertebrates, which are caught with its long, sticky prehensile tongue.

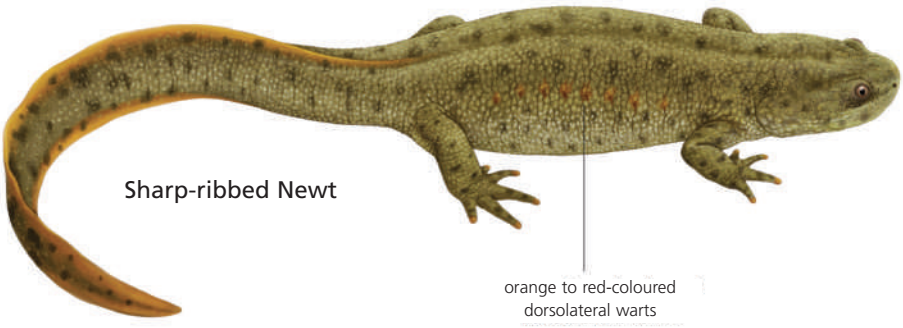
NOTE

Listed as Vulnerable in the 2009 IUCN Red List of European Amphibians.

Golden-striped Salamander, subspecies *lusitanica*. Serra da Estrela, Portugal.

Golden-striped Salamander, subspecies *longipes*. Galicia, NW Spain.

Sharp-ribbed Newt *Pleurodeles waltl* Michahelles, 1830



DESCRIPTION

TL: up to 30 cm, usually smaller. Large newt with a wide, flat head. Upward pointing eyes positioned on top of head. Upper lip usually hangs over the lower jaw. Body slightly elongated, skin relatively smooth. Row of orange to red dorsolateral warts on both sides. Tail long and flattened, slightly longer than body length. Dorsal coloration brown, grey or nearly black, interspersed with large dark spots. Coloration of lower flanks somewhat lighter than dorsal colour, often with small white specks. Underside cream-coloured with dark spots.

DISTRIBUTION

Iberian Peninsula, except the northern mountain areas. Occurrence is largely restricted to areas with a Mediterranean climate. Occurs also in Morocco.

VARIATION

Individuals may vary in size depending on environmental conditions.

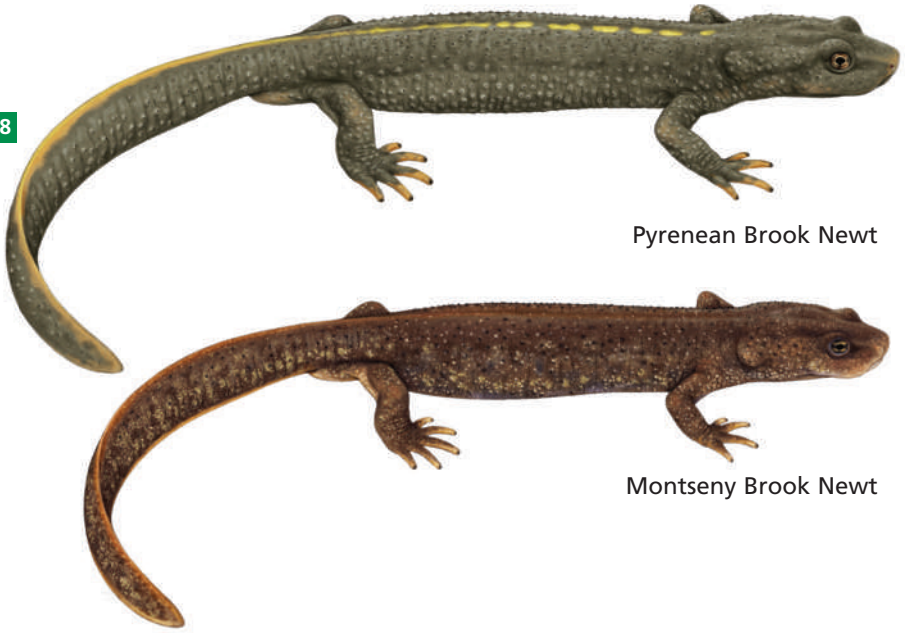
HABITAT

Opportunistic and relatively resistant to water pollution. Individuals can be found from near sea-level up to 1,500 m in the central and southern parts of the range. Well-vegetated ponds, swamps, lagoons, flooded fields, ditches, slow-flowing streams and wells provide aquatic habitats.

BIOLOGY

Highly aquatic newt. May spend the entire year in water, but aestivates on land when ponds dry up. Reproduction takes place throughout the year in suitable conditions but more typically in winter or spring. The male swims underneath the female and grabs her front legs with his, pressing himself against her belly. He may hold this position for up to two days. To transfer the spermatophore, he partially releases her and presses his cloaca against hers. Females lay over 1,000 eggs clustered in small groups on aquatic vegetation but also on rocks. Feeds on all sorts of smaller invertebrates, but also smaller newts, frogs and sometimes even snakes. May protrude its pointed ribs through the dorsolateral warts of its skin as a defensive mechanism, if molested.

Pyrenean Brook Newt *Calotriton asper* (Dugès, 1852)
Montseny Brook Newt *Calotriton arnoldi* Carranza & Amat, 2005



Pyrenean Brook Newt

Montseny Brook Newt

DESCRIPTION

TL: 14 cm (Pyrenean) and 12 cm (Montseny). Medium-sized, robust to rather small (Montseny) newt. Head flat with fairly conspicuous parotoid glands behind the eyes. Snout upturned. Relatively rough skin, but less so in Montseny Brook Newt. Tail long and flattened. Toe-tips dark and horned. Dorsal colour light to dark grey or (especially in Montseny Brook Newt) brown, often with an olive tinge. Whitish mottling often present on the lateral sides. Discontinuous, mid-dorsal yellow stripe occasionally present, especially in juveniles. Yellow dorsal and lateral spots may be present (also in Montseny Brook Newt, see 'Variation'). Belly with yellow to orange, fading towards the sides. Male cloaca more conical, female cloaca pointed backwards.

DISTRIBUTION

Pyrenean: Throughout the Pyrenees.
Montseny: Very small range; endemic to a small number of streams in the Montseny Massif, NE Spain.

VARIATION

The highly localised Montseny Brook Newt is separated into western and eastern populations by the Tordera River. The former are characterised by uniform brown coloration and occasionally have a white snout, while the latter show additional yellow dorsal and lateral spots.

HABITAT

Pyrenean Brook Newt may be encountered in high-altitude lakes, mountain streams and occasionally (temporary) ponds or even cattle troughs, all usually characterised by at least some water flow, low temperature and high oxygen levels. From 500 to 2,500 m, rarely lower. Surrounding habitat consists of deciduous or coniferous forest and alpine meadows.

Pyrenean Brook Newt
Montseny Brook Newt

Montseny Brook Newt occurs in small streams and seepages in old-growth, deciduous forests ranging between 600 and 1,200 m. These waterbodies can be fast-flowing in spring, but often almost disappear in summer. The surrounding forested habitat is usually characterised by abundant leaf litter and stones.

BIOLOGY

Highly aquatic newts. At higher elevations, winter may be spent on land. At lower elevations more typically aquatic throughout the year, but may also aestivate. Usually found under stones and logs in the water or on its banks. Rare neotenous populations of Pyrenean Brook Newt are known to exist in caves, as well as in high-altitude mountain lakes. Pyrenean Brook Newt reproduces throughout the year, but mostly in spring or autumn. Males search actively for a female or position themselves in the open with a raised tail to lure females. When a female approaches she is quickly grabbed by the male's jaws, as he holds her with his tail wrapped around her. Copulation may last as long as 30 hours (but usually fewer). While holding on to the female, the male stimulates her cloaca and massages up to four spermatophores into it. Females lay up to 40 eggs underneath rocks using their elongated cloaca. Reproduction in Montseny Brook Newt is not well documented but likely to be similar. Juveniles typically spend one winter in the water before completing metamorphosis. Feeds on all sorts of aquatic invertebrates. Both species, but especially Montseny Brook Newt, emit a foul-smelling milky fluid when handled.

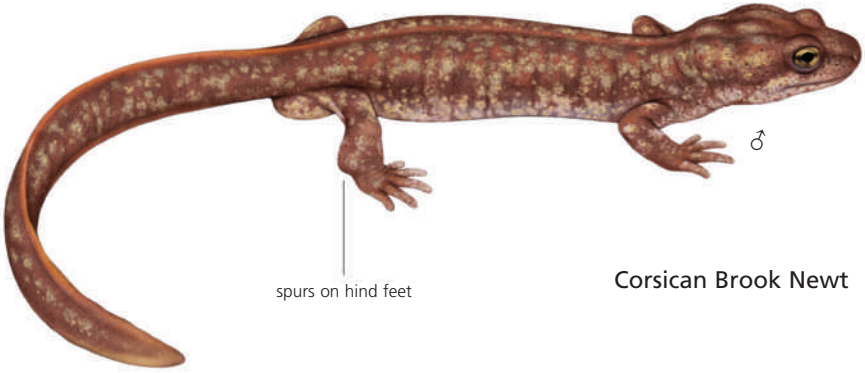
NOTE

Montseny Brook Newt is listed as Critically Endangered in the 2009 IUCN Red List of European Amphibians.

LEFT: Mating Pyrenean Brook Newts. France.

BELOW: Juveniles of the Montseny Brook Newt may show bright yellow spots. Montseny, Spain.

Corsican Brook Newt *Euproctus montanus* (Savi, 1838)



Corsican Brook Newt

DESCRIPTION

TL: 13 cm. Medium-sized brook newt. Skin rather smooth. Parotoid glands conspicuous, especially in males, giving the head a somewhat triangular appearance in a dorsal view. Snout round, often with minor overbite. Body relatively flat. Tail flattened. Relatively short limbs and toes. Dorsal colour grey, reddish-brown or olive, uniform or with olive or brown marbling. Conspicuous pink to red vertebral line may be present, which continues onto the upper tail. Underside and throat white, grey or yellowish, often with whitish dots. Males with spurs on hind feet and a conical cloaca.

DISTRIBUTION

Endemic to Corsica.

HABITAT

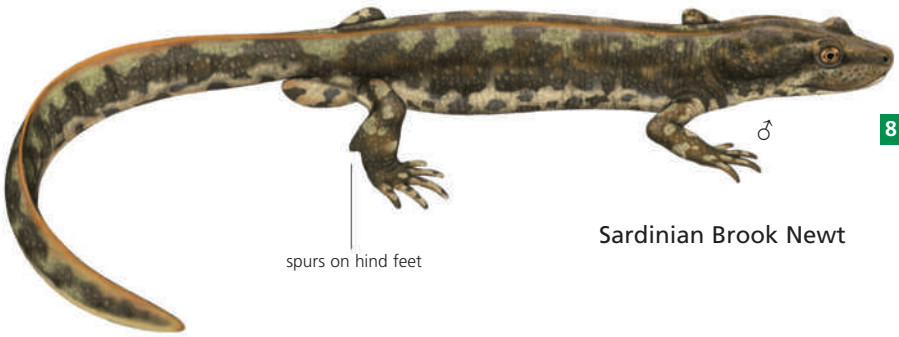
Rocky streams, rivers, small seepages and ponds in hilly or mountainous terrain. The adjacent landscape is often characterised by Mediterranean maquis, oak, beech and chestnut trees. Found throughout the island, but especially common at higher elevations. Altitudinal range from near sea-level to 2,300 m.

BIOLOGY

Highly aquatic, but hibernation is generally spent on land, typically between October and March. May be encountered by lifting objects such as rocks or logs in or near streams. In contrast to the coexisting Corsican Fire Salamander *Salamandra corsica*, which breeds in early spring, Corsican Brook Newt reproduces during the summer. Males grab females by the flanks with their jaws. The male massages up to two spermatophores into the female's cloaca using the spurs on the hind feet while covering her pelvic region with his tail. Copulation may last up to four hours. Females use their conical cloaca to lay up to 120 eggs underneath rocks, guarding them until they hatch. Larvae metamorphose at the end of summer but may also hibernate in the water to complete metamorphosis the next year. Feeds on all sorts of aquatic invertebrates.

Sardinian Brook Newt *Euproctus platycephalus*

(Gravenhorst, 1829)



Sardinian Brook Newt

DESCRIPTION

TL: 15 cm. Medium-sized newt. Skin rather smooth. Head flat with long snout, often with minor overbite. Tail flat. Toes relatively long. Dorsal colour grey, light to dark brown or olive, often with large grey or olive blotches. Blotches particularly conspicuous in younger individuals, and may disappear with age. Dorsal black spots may also be present. Often with prominent orange or red vertebral line which continues onto the tail. Lower flanks, underside and throat cream or white, interspersed with small and larger black blotches. Central part of underside often orange-coloured. Males with spurs on hind feet. Both sexes with conical cloaca.

DISTRIBUTION

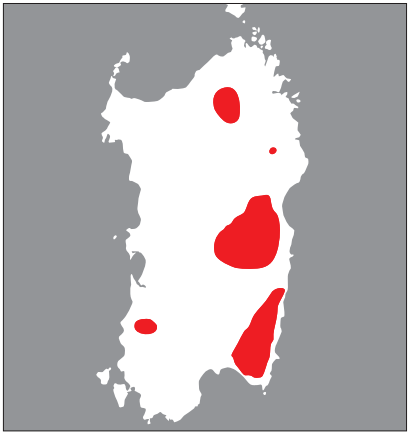
Endemic to Sardinia. Not as rare as presumed during the previous century, but distribution is fragmented and largely restricted to mountainous areas in the eastern part of the island. Some records exist from the central and south-western part. Former range may have been wider and the loss of populations may be related to the historical use of DDT and introduction of fish.

HABITAT

Flowing, well-oxygenated streams and small rivers characterised by an abundance of rocks. Aquatic habitats are generally located in hilly/mountainous terrain characterised by Mediterranean maquis, but mainly oak forests. Ponds and caves rather rarely inhabited. Altitudinal distribution from near sea-level to 1,800 m.

BIOLOGY

Aquatic year-round in areas where surrounding habitat is more inhospitable (less tree cover and harsher winter conditions). Active during the day and at night. Reproduction starts at the end of summer in lowland areas and at the end of winter at higher elevations. Males grab females by the



flanks with their jaws and may carry them to a suitable place to mate. The male massages a single spermatophore into the female cloaca using the spurs on his hind feet, with his tail folded around her pelvic region. Copulation may last up to three hours. Females deposit up to 220 eggs underneath rocks, using their conical cloaca to place the eggs in position. Feeds on small crustaceans and insect larvae.

NOTE

This species is listed as Endangered in the 2009 IUCN Red List of European Amphibians.

LEFT: Male Sardinian Brook Newt in the water. Monte Limbara, Sardinia, Italy.

BELOW: Habitat of Sardinian Brook Newt in Sette Fratelli forest. Sardinia, Italy.

Smooth Newt *Lissotriton vulgaris* (Linnaeus, 1758)

DESCRIPTION

TL: 11 cm, S European animals usually smaller. Small newt. Smooth skin. Long, flat head with somewhat pointed snout. Three long grooves on top of the head. Dorsolateral folds can be conspicuous in southern males only. Tail flat, ending in a point. Males are characterised by a large cloaca and horizontal black stripes on the head. Dorsal colour yellowish to dark brown, in males interspersed with a pattern of black dots. Chin, throat, lower flanks and underside white. Mid-underside orange. Underside mottled with large black spots in males, smaller black spots in females. Males develop a crest during the reproductive phase, as well as fringes on the hind feet. Crest often horizontally striped with blue and orange. See Variation for regional differences. Best distinguished from the often coexisting Palmate Newt *Lissotriton helveticus* by: 1) male reproductive features; 2) pattern and colour of the throat and underside (usually spotted and more intensely coloured vs. usually unspotted and pale-coloured in Palmate Newt); and 3) shallow hollow between the eye and nostril, which is absent in Palmate Newt. Additionally, tubercles at base of foot in females usually not whitish.

DISTRIBUTION

W Europe, including N France and the British Isles, C and S Scandinavia, and most of C and SE Europe, including N and C Italy. Outside our area, also extends far into Russia.

VARIATION

Several subspecies have been recognised, which differ genetically and can often be distinguished by male secondary sexual characteristics.

L. v. vulgaris: NW, N and NE Europe, southwards to Bosnia and Herzegovina, Serbia (but not N and S), parts of Romania and NW Bulgaria. Reaches the Adriatic coast from NW to central W Croatia, including E Istria. Body cross-section oval. Male crest high and with wavy edge.

L. v. ampelensis: Initially thought to be restricted to Transylvanian Alps of C Romania, but now known at least throughout most of C, N, and W Romania, N Serbia, E Hungary, SE Slovakia and SW Ukraine. Border with *L. v. vulgaris* unclear. Crest of male smooth, edge sometimes slightly wavy, vertically spotted. Fringes on hind feet moderately developed.

L. v. graecus: From S Croatian coast to Montenegro, S Serbia, Albania, Macedonia, SW Bulgaria and Greece. Small, body with truncate cross-section, male crest low and smooth, fringes on hind feet large and black. Males usually with long tail-filament. Both sexes often with extensive pattern of dark brown or black spots on the back. May deserve species status.

L. v. meridionalis: Extreme S Switzerland, Italy (S of Alps), W Slovenia, W and S Croatian Istria. Body with truncate cross-section. Crest of male small and smooth.

L. v. schmidtleri: Extreme NE Greece (including Samothrace), Turkish Thrace and at least SE and C Bulgaria, where it may be more widespread. Resembles *L. v. vulgaris*. Border with the latter not clear. May deserve species status.

HABITAT

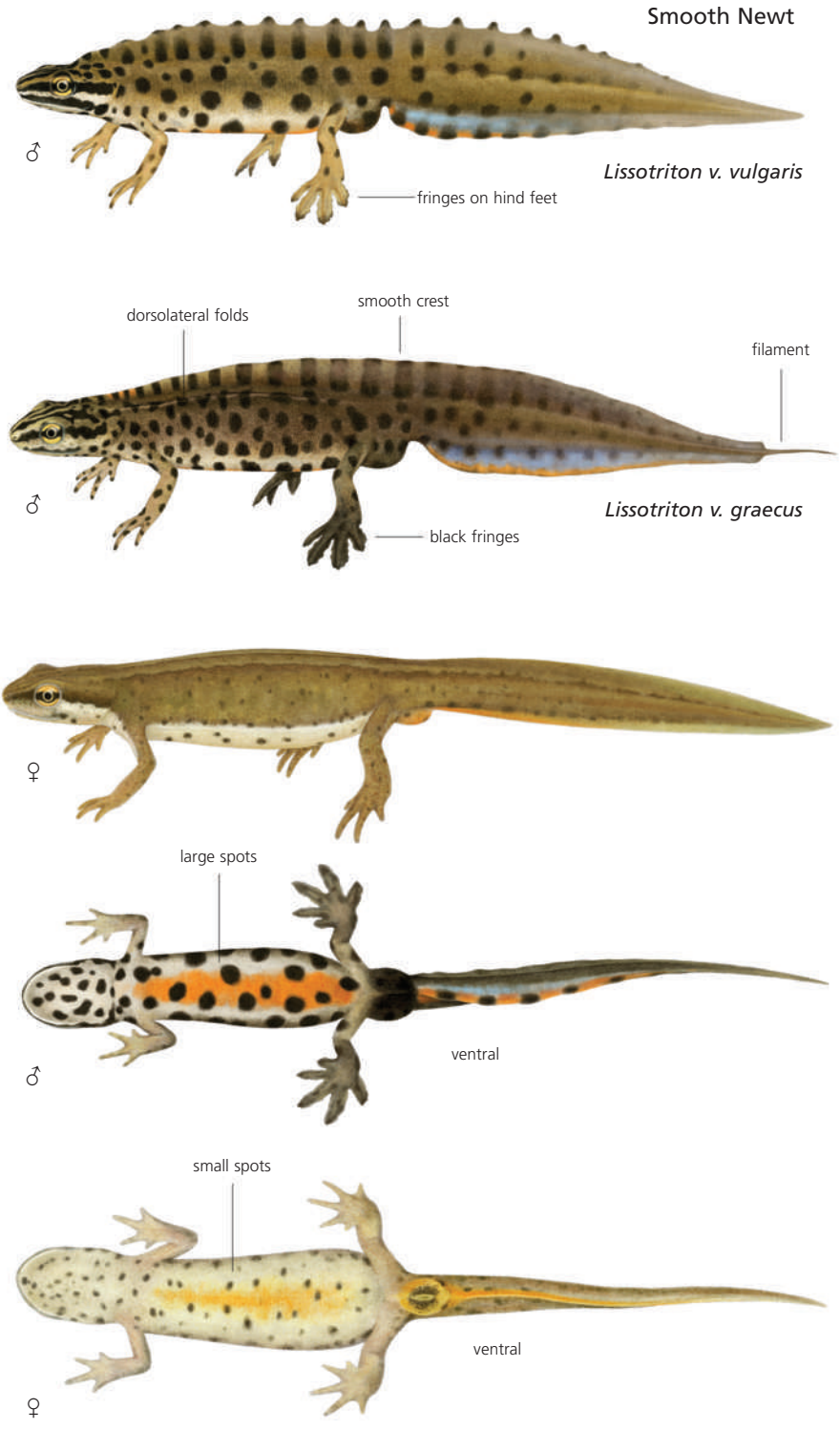
A generalist species, but with a preference for largely open landscapes, including agricultural land. During the aquatic period common in flooded fields, but mostly more permanent ponds, lakes, springs and slow-flowing streams are used. Rarely in brackish water.

BIOLOGY

During terrestrial phase usually encountered underneath logs or stones, but active at night following periods of rain. Usually hibernates on land in N of range, but sometimes in water. Active between February and November in most areas, but this varies widely with climate and sometimes active throughout the year. Reproduction may start in winter in S of range but more typically around March in N of range. Males court females by fanning pheromones from their cloaca towards potential mates using their tail-tip. A spermatophore is released and absorbed by the female. Females deposit up to 300 eggs individually, often folding aquatic vegetation around each egg. Freshly metamorphosed juveniles may be encountered in summer. At high elevations or in cold shady waters, larvae may spend the winter in the water to complete metamorphosis the subsequent year. Feeds on various arthropods, snails and worms, but also on the larvae of other amphibians. Like other newts, may be seen feeding on frog spawn in spring.

Male (left) and female of Smooth Newt, ssp. *schmidtleri*. NE Greece.

Female Smooth Newt, ssp. *graecus*. N Greece.


Smooth Newt
♂
Lissotriton v. vulgaris
fringes on hind feet
dorsolateral folds
smooth crest
filament
♂
Lissotriton v. graecus
black fringes
♀
large spots
♂
ventral
small spots
ventral
♀

Palmate Newt *Lissotriton helveticus* (Razoumowsky, 1789)

DESCRIPTION

TL: 9 cm. Small newt with smooth skin. Three grooves present on top of the head. Dorsolateral folds especially conspicuous in males. During breeding season, males develop a tail-filament. Dorsal colour light to dark brown, in males interspersed with a pattern of black dots on the flanks, which are more conspicuous in southern populations. Central part of side of tail often unspotted and orange, bordered above and below with large round spots. Lower lateral coloration paler – yellowish or white. Belly mostly yellowish or pale orange in the centre, throat often flesh-coloured or pinkish; usually unspotted. Males develop a tail-crest, low dorsal crest and extensive webbing on the dark-coloured hind feet during the breeding season. Best distinguished from the often sympatric Smooth Newt *Lissotriton vulgaris* by: 1) male reproductive characters; 2) pattern and colour of the throat and underside (unspotted and pale-coloured vs. spotted and brighter in Smooth Newt); and 3) no shallow hollow between the eye and nostril, which is present in Smooth Newt. Additionally, tubercles at base of foot in females usually pale.

DISTRIBUTION

NW and SW Europe including Great Britain. Southwards to C Portugal in isolated mountain massifs, eastwards to Germany, Switzerland and extreme W Czech Republic. A record from extreme NW Austria near the Bodensee relates to only two individuals which have been hypothesised to have been washed out from Switzerland.

VARIATION

Characters of the former Iberian subspecies *alonsoi* and *punctillatus* are ambiguous, and are therefore no longer considered valid.

HABITAT

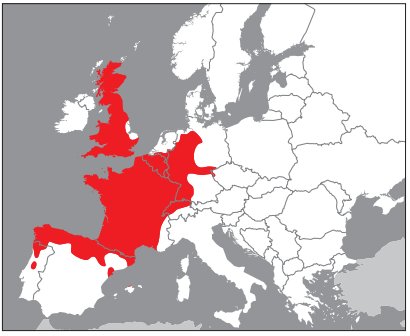
Opportunistic inhabitant of a variety of often small waterbodies including ponds, lakes, ditches, flooded wheel ruts, swamps, slow-flowing streams, heathlands and flooded meadows. Populations are often found in hilly agricultural or wooded landscapes. The species favours a temperate climate, and may therefore occur from near sea-level up to 2,400 m in the Pyrenees.

BIOLOGY

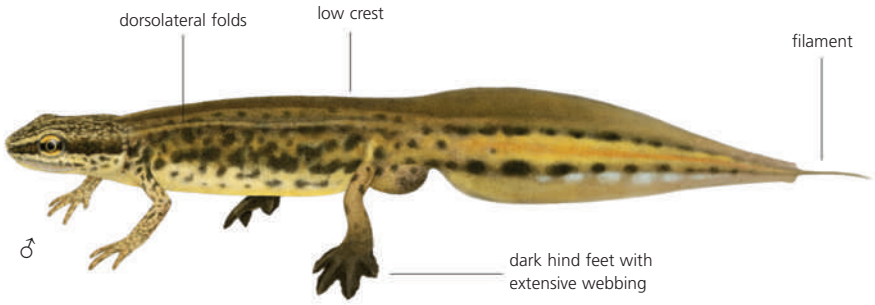
Terrestrial outside breeding season and then usually only encountered by lifting objects. Hibernates on land. Active between February and November, but also sometimes throughout the year depending on weather conditions. Reproduction may start in November in S of range or February in N of range. At high altitudes, activity may shift towards June. Males court females by fanning pheromones from their cloaca towards the latter using their tail-tip. A spermatophore is released and absorbed by the female. Females deposit up to 500 eggs individually on aquatic vegetation. Freshly metamorphosed juveniles may be encountered in summer. At high altitudes larvae may spend the winter in the water. Feeds on various arthropods, snails and worms.

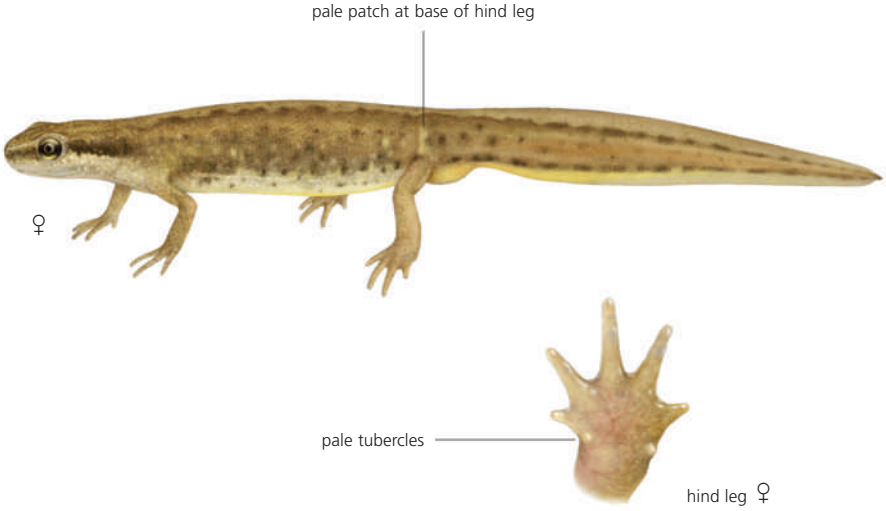
NOTE

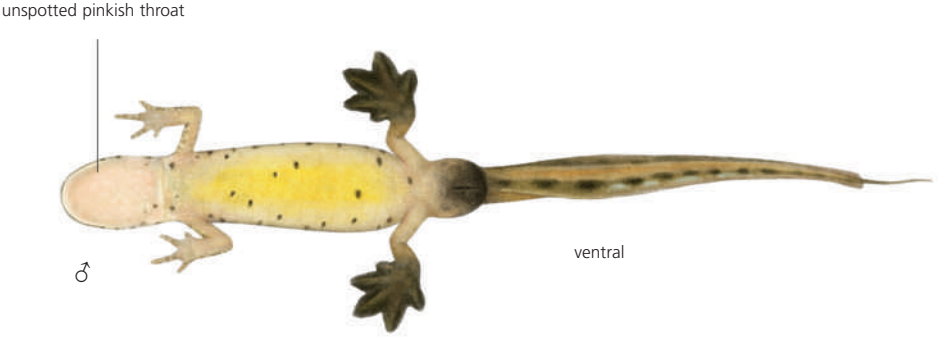
Fish have been introduced into the lake from which the no-longer valid *L. h. punctillatus* was described, driving this isolated population to the brink of extinction.



Palmate Newt







Italian Newt *Lissotriton italicus* (Peracca, 1898)

DESCRIPTION

TL: 8 cm, usually smaller. Small newt. Body shape truncate. Single groove present on top of head. Dorsolateral folds especially conspicuous in males. Dark red or brown mid-dorsal line occasionally prominent. Narrow pointed tail. Dorsal colour whitish, yellow, brownish or grey in males, grey or brown in females. Males often heavily spotted with black over the entire body, limbs and tail. Dorsal colour of females grey or brown, with inconspicuous dark markings. Lower flanks pale. Pale stripe on side of head, running from corner of mouth towards eye, and darker colour on the snout distinguish it from Smooth Newt. Underside yellow or orange, interspersed with small black spots. Throat somewhat darker coloured than belly. Ventral colour continues on the underside of the tail. Breeding males are characterised by swollen cloaca, while both sexes may develop narrow tail-fins during the breeding season; females also develop orange lower and upper tail-fins. Tail often ends in small filament, especially in males.

DISTRIBUTION

Replaces Smooth Newt in S and much of C Italy. Not on Sicily. North to S Lazio and C Marche.

VARIATION

Two distinct genetic lineages exist, but morphological differences are unknown.

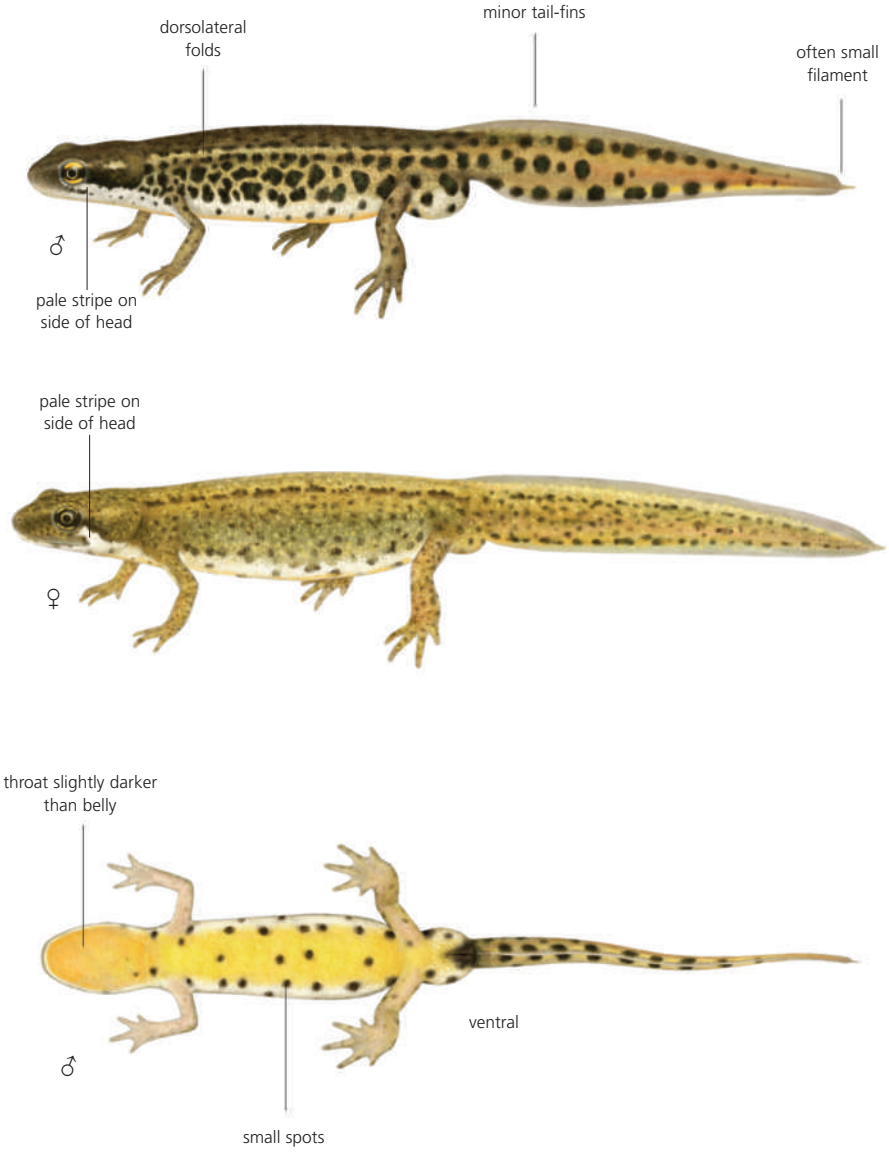
HABITAT

During the aquatic period this species can be found in a wide variety of waterbodies such as ponds, slow-flowing streams, cattle troughs, and temporary ponds. Altitudinal distribution ranges from sea-level usually up to 600 m, rarely up to 2,000 m.

BIOLOGY

May be active and even aquatic throughout the year in lowlands, but hibernates at higher altitudes or aestivates in dry areas. Terrestrial outside breeding season and then usually only encountered by lifting objects. Reproduction may start as early as January, but usually around April at higher elevations. Males court females by fanning pheromones from their cloaca towards them using their tail-tip or by raising the tail upright and waving its tip from side to side. A spermatophore is released and absorbed by the female. Females deposit up to 500 eggs individually in aquatic vegetation or folded between submerged grasses. Metamorphosed juveniles usually emerge during summer. Feeds on various arthropods, snails and worms.

Italian Newt



Bosca's Newt *Lissotriton boscai* (Lataste in Tourneville, 1879)

DESCRIPTION

TL: 10 cm, S Iberian populations smaller. Small newt with truncate body shape. Head flat, with short snout, somewhat longer in southern populations. Single groove present on top of the head. Dorsolateral folds especially conspicuous in males. Rather prominent mid-dorsal ridge. Dorsal colour grey, olive but most often brown, interspersed with larger or smaller black spots. Lower flanks and chin white or creamy. Underside yellow or orange, often delimited by two rows of black spots. Ventral colour runs onto the underside of the tail. Throat lighter coloured than belly, covered with dark spots. Males are characterised by a large cloaca and develop small tail-fins during the breeding season.

DISTRIBUTION

NW, W and SW Iberian Peninsula, eastwards along the Sistema Central and the Andalucian Sierra Morena.

VARIATION

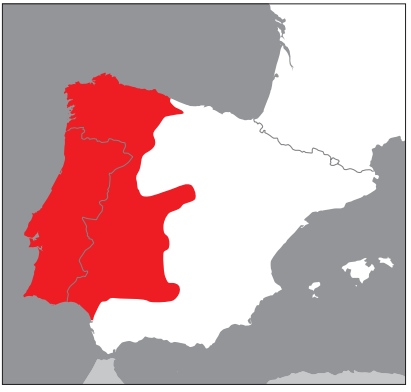
Previously hinted to consist of more than one species, but now considered monotypic.

HABITAT

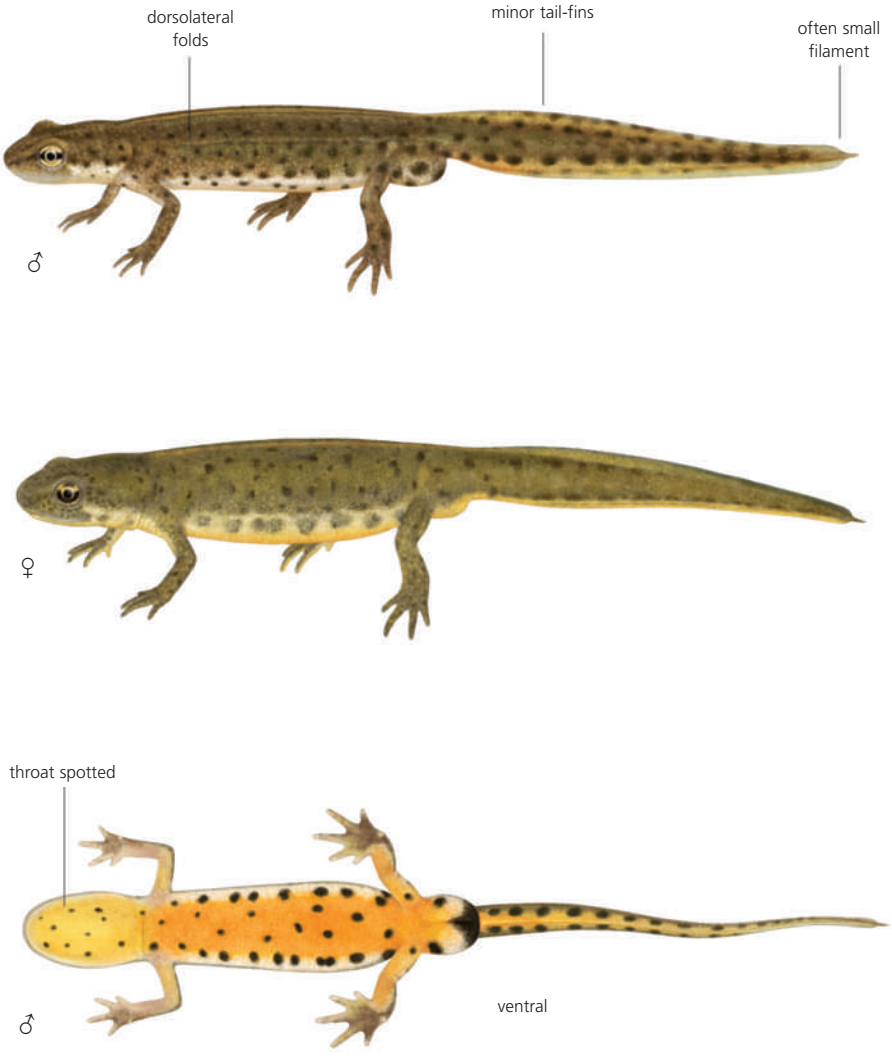
Characteristic species of temperate, Atlantic influenced or mountainous climates. Occurs in forests, heathland, agricultural land and coastal shrubland. Waterbodies used for reproduction include small ponds, (more rarely) lakes, slow-flowing brooks, springs and temporary ponds. Populations can be found from sea-level up to 2,000 m. Northern populations may remain aquatic year-round, while southern populations usually spend the summer on land.

BIOLOGY

Terrestrial outside breeding season and then usually only encountered by lifting objects. May be active throughout the year in lowland areas, but hibernates on land at higher altitudes. Migration towards breeding water may start around October in lowlands, but at higher altitudes more typically in early spring. Males court females by fanning pheromones from their cloaca towards potential mates using their tail-tip or by raising the tail upright and waving its tip from side to side. A spermatophore is released and absorbed by the female. Females deposit up to 250 eggs individually in aquatic vegetation, often folding leaves around each egg. Metamorphosed juveniles emerge during summer but at higher altitudes they may also hibernate in the water and complete metamorphosis the next year. Feeds on various arthropods, snails and worms.



Bosca's Newt


dorsolateral folds
minor tail-fins
often small filament
♂
♀
throat spotted
ventral
♂

Montandon's Newt *Lissotriton montandoni*

(Boulenger, 1880)

DESCRIPTION

TL: 10 cm. Small newt with smooth skin. Three grooves on top of the head. Dorsolateral folds especially conspicuous in males. Males have a swollen cloaca and often horizontal black stripes on the head. Dorsal coloration varies from light to dark brown, olive, yellow or reddish. Large darker dorsal spots are usually present in males. Belly uniform yellow to orange, usually unspotted. Tail of breeding males with filament, smooth-edged crest, reddish centre and black-and-white barred underside.

DISTRIBUTION

Endemic to the Carpathian and Tatra Mountains, restricted to S Poland, NE Czech Republic, N Slovakia, W Ukraine and N as well as C Romania.

VARIATION

Montandon's Newts may hybridise with Smooth Newts.

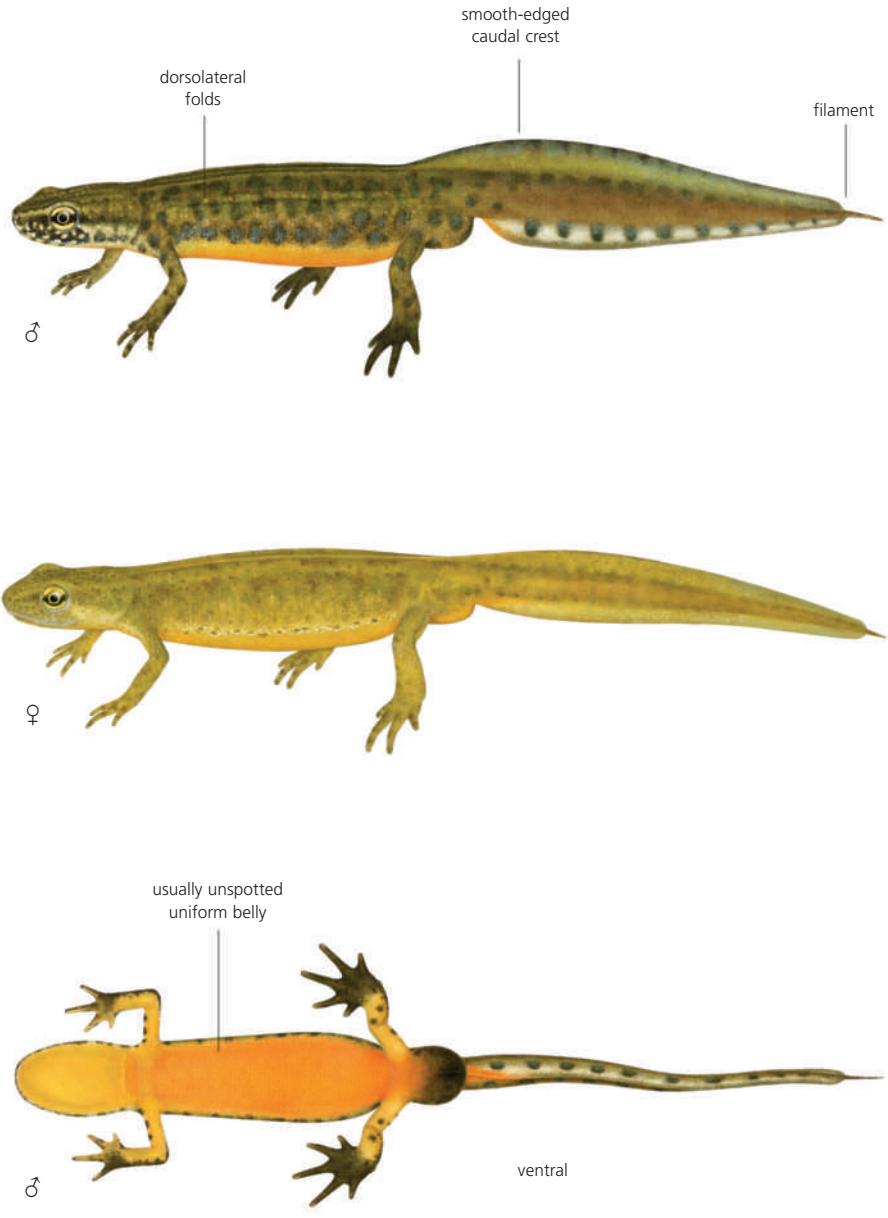
HABITAT

Opportunistic inhabitant of a variety of predominantly small waterbodies such as ponds, lakes, ditches, swamps, flooded meadows and even filled wheel-ruts. The surrounding habitat usually consists of coniferous or deciduous woodland. Occurs up to 2,000 m.

BIOLOGY

Terrestrial outside breeding season and then usually only encountered by lifting objects. Hibernates on land. Active from March to October. Migration towards breeding water may start around March, but more typically April and even considerably later at higher altitudes. Males court females by fanning pheromones from their cloaca towards potential mates using their tail-tip. A spermatophore is released and absorbed by the female. Females deposit up to 460 eggs individually in aquatic vegetation or folded between submerged grasses. Metamorphosed juveniles emerge during summer, but at high altitudes may also hibernate in the water and complete metamorphosis the next year. Feeds on various arthropods, snails and worms.

Montandon's Newt



Alpine Newt *Ichthyosaura alpestris* (Laurenti, 1768)

DESCRIPTION

TL: 12 cm. Medium-sized newt with skin smooth when in water and velvety during terrestrial phase. No dorsolateral folds. Upperparts in both sexes usually predominantly blue, greyish or black during terrestrial phase. Belly usually unspotted yellow, orange or red. During the breeding season, males usually with a white band with black dots running from the head along the lower flanks up to the cloaca with a blue band directly below it, a similarly chequered low dorsal crest, and a tail with different interspersed shades of blue and black. Otherwise, males usually fairly uniform above, while females often either uniformly dark coloured or covered with greenish blotches, including a less conspicuous spotted band on the lower flanks from head to cloaca.

DISTRIBUTION

Fairly widespread in much of NW, C, E and SE Europe, including isolated occurrences on the Iberian and Italian peninsulas. Outside native range encountered as an introduced species, e.g. in the Netherlands, Germany and the UK (not mapped).

VARIATION

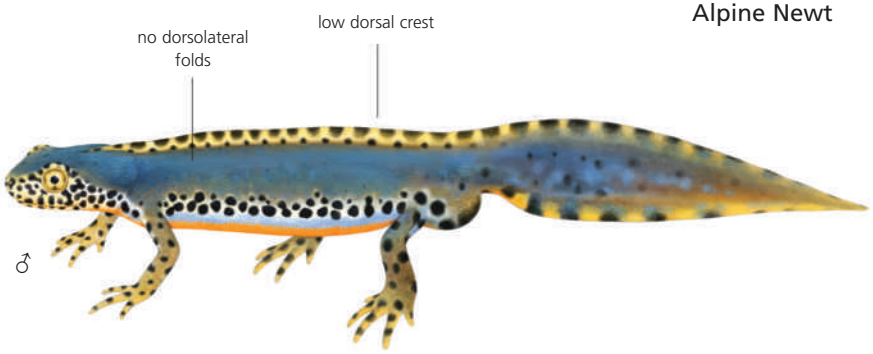
I. a. alpestris: NW and C Europe southwards to the Alps, Austria and the N Carpathians.
I. a. apuana: Italy but not the Alps: isolated populations in the Apennines, from Liguria to Calabria. The Calabrian *I. a. inexpectata* has been shown to be synonymous with *I. a. apuana*.
I. a. cyreni: NW Spain. Also introduced and breeding in Peñalara National Park, N of Madrid and in the Serra de Bufadors near Barcelona (not mapped).
I. a. montenegrina: at least in Bukumirsko Jezero and Zminicko Jezero, Montenegro, but probably also in surrounding areas. Partially neotenous. Includes populations formerly attributed to *I. a. serdara*.
I. a. reiseri: N and C Dinaric Alps and S Carpathians through Serbia and W Bulgaria.
I. a. veluchiensis: from N Albania south to mountains of the Peloponnese (S Greece).

A long-isolated relict population within the Rhodope Mountains (Vlasina, Serbia) may also deserve subspecies status. Populations from most of the Romanian Carpathians are more closely related to *I. a. reiseri* and *I. a. montenegrina* than to *I. a. alpestris*, although they overlap with the latter in N Romania; these might constitute a yet undescribed subspecies.

HABITAT

In many areas, typically in hilly or mountainous landscapes. Generally reproduces in relatively small waterbodies such as ponds, ditches, flooded fields, cattle troughs or even flooded wheel-ruts. However, in the southern part of its distribution, mountain lakes are often also occupied. Populations living in these lakes can be either neotenous or adopt a year-round aquatic lifestyle after metamorphosis, even during winter. The surrounding vegetation generally consists of forests or small-scale agricultural land in the western part of its distribution, but the species occurs above the tree line in mountain areas. Found from sea-level up to 2,500 m.

Alpine Newt


no dorsolateral folds
low dorsal crest
♂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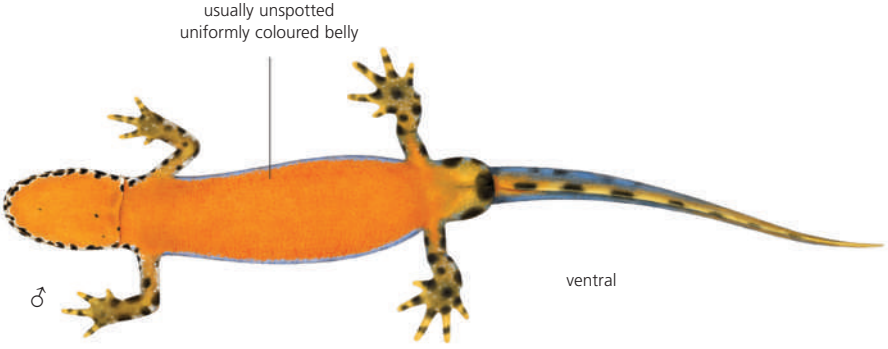

usually unspotted uniformly coloured belly
ventral
♂

BIOLOGY

Diurnal as well as nocturnal. During terrestrial phase usually encountered underneath objects or may be active at night in wet weather. May be aquatic throughout the year in some places, but usually terrestrial outside reproductive period. May start to migrate to breeding waters from February on, but considerably later at higher elevations, as late as May or June in some places. During courtship the male arches its back in front of the female, fanning pheromones from his cloaca towards her by vibrating his tail-tip. Subsequently, the male deposits a spermatophore which the female picks up with her cloaca. Females deposit up to 250 eggs individually in aquatic vegetation or folded between submerged grasses. During summer metamorphosed juveniles climb on land, but at higher elevations larvae may more commonly metamorphose in the following year. Feeds on a wide array of arthropods, snails, worms, etc. but also frog spawn, frog or toad larvae and even newt larvae. Terrestrial individuals may adopt a defensive posture with the tail aligned with the body and an arched back.

Male Alpine Newt, ssp. *veluchiensis*. Pindos Mountains, Greece.

Female Alpine Newt, ssp. *montenegrina*. Zminicko Jezero, Montenegro.

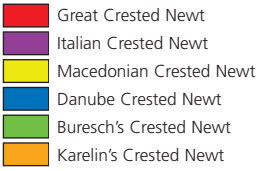
Crested Newts *Triturus* spp.

Great Crested Newt *Triturus cristatus* (Laurenti, 1768)
Italian Crested Newt *Triturus carnifex* (Laurenti, 1768)
Macedonian Crested Newt *Triturus macedonicus* (Karaman, 1922)
Danube Crested Newt *Triturus dobrogicus* (Kiritzescu, 1903)
Buresch's Crested Newt *Triturus ivanbureschi*
Arntzen & Wielstra, 2013
Karelin's Crested Newt *Triturus karelinii* (Strauch, 1870)

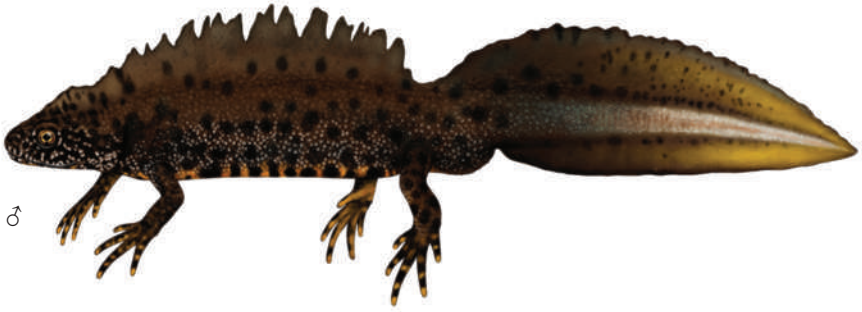
DESCRIPTION

TL: 18 cm, Danube Crested Newt usually only about 14 cm. Large newts with a rather rough skin, apart from Italian Crested Newt in which the skin is smoother. Body shape ranges from stocky (Buresch's, Karelin's) to elongated (Danube). Limbs well-separated from body; toes very long. Dorsal colour light brown to black, often interspersed with large round dark or greenish spots in lighter coloured individuals. Dorsal line yellow to orange in some females and juveniles, usually absent in males. Flanks, chin and sides of the head largely mottled white in Great and Macedonian Crested Newts, especially in males; extent of mottling is less in Danube, Buresch's and Karelin's Crested Newts, and nearly absent in Italian Crested Newt.

Underside yellow to red, generally orange, with pattern of large roundish (Great, Italian, Danube) or small and roundish/irregular dark spots (Macedonian, Buresch's, Karelin's). These spots can be greenish and poorly defined in Italian and Macedonian Crested Newts, while other species usually show well-defined dark brown or black spots. In Danube Crested Newt, these spots can be fused into two longitudinal rows. Throat variably coloured: (slightly) darker than belly with white mottling in Great Crested Newt; the same colour as the belly with dark spots but without white mottling in Buresch's and Karelin's Crested Newts; either dark or similar to belly with lots of white mottling in Italian and Macedonian Crested Newts; and dark with large angular white spots in



Great Crested Newt



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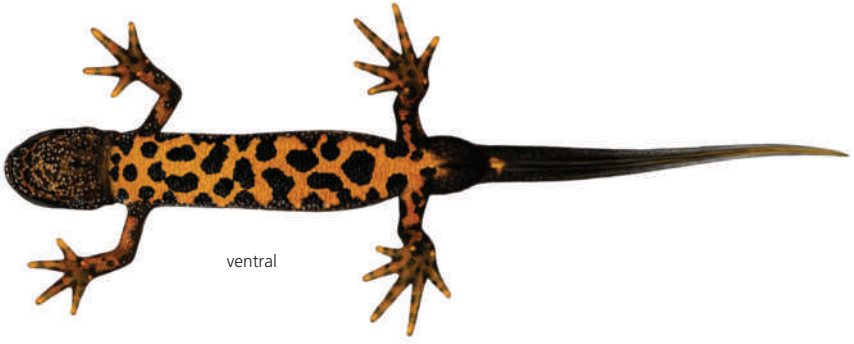
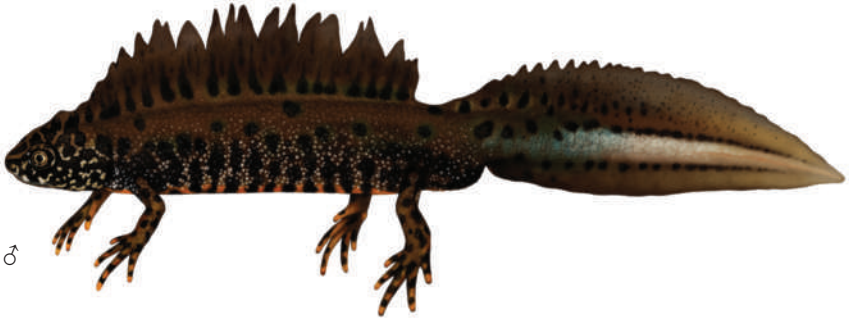


ventral

Danube Crested Newt



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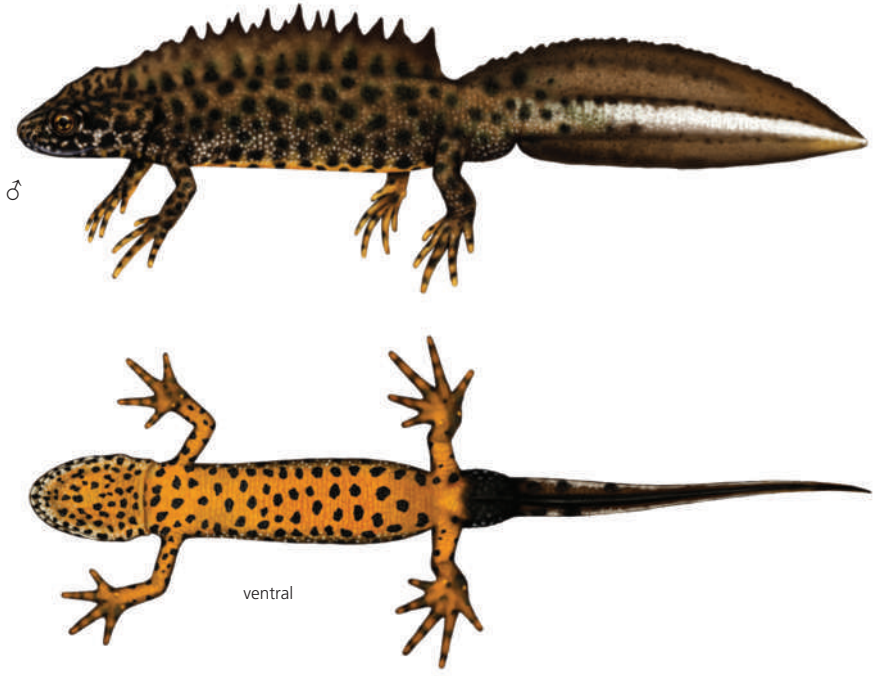
Italian Crested Newt

Buresch's Crested Newt



Macedonian Crested Newt. Prespes Lakes, Greece.

Danube Crested Newt. Males develop sharply indented crest on back and tail, and a white stripe along the tail during the aquatic reproductive season.

Newts found along the contact zones (see Distribution) should be identified taking both body shape and colour pattern (especially the underside and throat) into account.

DISTRIBUTION

Confusing: apart from Karelin's Crested Newt, all species overlap locally with other species, with which they readily hybridise thus creating identification problems. Such areas include especially C Serbia and NW Bulgaria, where four species meet, and NE Austria, where three species coexist. Hybrids show either a combination of colour patterns from both parent species, or largely resemble one or the other.

Great Crested Newt: large parts of NW, N and E Europe, including S Scandinavia and Great Britain. S border through S France (including isolated occurrence in S Rhône river valley), Switzerland, N Austria, Slovakia, most of Romania, E Serbia and extreme NW Bulgaria. Ranges through most of the Ukraine into Russia.

Italian Crested Newt: Italy (excluding Sicily), extreme S Switzerland (Ticino), Austria except W and N, Slovenia, N Croatia and extreme NW Bosnia and Herzegovina. Outside of its native range, introduced to the Veluwe (C Netherlands), Geneva Basin (SE France), Munich (S Germany) and Surrey (S England – not mapped).

Macedonian Crested Newt: E Bosnia and Herzegovina, Montenegro, W and S Serbia, Kosovo, Macedonia (except E), Albania, N and C Greece including Corfu. Records from SW Bulgaria most likely due to confusion with Buresch's Crested Newt. Southern limit of distribution not well known.

Danube Crested Newt: from E Austria, Hungary, S Slovakia, extreme SW Ukraine, NE Croatia following the Danube floodplain through E, N Serbia, N Bulgaria, S Moldova and W and S Romania. Isolated occurrence in S-C Ukraine.

Buresch's Crested Newt: Bulgaria except N and NE; E Macedonia, S Serbia, NE Greece and Turkish Thrace. Isolated occurrence in C Serbia.

Karelin's Crested Newt: within our area, only on S Crimean Peninsula. Also in Caucasus region and N Iran.

VARIATION

The subspecies *macrosomus* of the Danube Crested Newt is genetically and morphologically indistinguishable from the nominate subspecies, and is therefore best no longer recognised. Individuals used to describe the now invalid *T. (karelinii) arntzeni*, originating from the area in C Serbia where four crested newt species meet, have proved

to be hybrids with either Great, Danube or Macedonian Crested Newts. This error was corrected by re-describing the stockily-built crested newts from the SE Balkans formerly attributed to this (sub)species as Buresch's Crested Newt, using individuals from a genetically pure population in Bulgaria.

HABITAT

Great and Danube Crested Newts generally inhabit relatively deep and richly-vegetated waterbodies such as ponds, marshes and lakes, as well as rivers and associated oxbows in the case of the Danube Crested Newt. These waterbodies are often located in agricultural areas. Other species are more opportunistic, and can also be found in ditches, cattle troughs, flooded fields and slow-flowing streams. As such, these opportunistic species are more often found in hilly or even mountainous terrain up to 1,900 m, than the Great and Danube Crested Newts. Outside of the breeding season individuals hide under logs or rocks near waterbodies.

BIOLOGY

Aquatic reproduction takes place from early spring until early summer, depending on altitude. Mediterranean populations may reproduce during winter. In general, individuals leave the water after reproduction, but the Danube Crested Newt is especially aquatic, and may remain in the water for the majority of the year. During courtship, the male arches its back in front of the female while standing on its front feet, leaning towards the female. From this position, pheromones are transferred from the cloaca towards the female by waving his tail in her direction. The male then deposits a spermatophore which the female picks up with her cloaca. Females usually deposit up to 400 eggs individually between leaves of aquatic plants or in folded grass. Metamorphosed juveniles can be found in late summer, but (more rarely) larvae may also overwinter and metamorphose the following year. Feeds on a wide variety of arthropods, worms, snails and frog or toad larvae but adults may also feed on smaller newts and even their own larvae. Difficult to spot by day, when they either hide in the deepest part of waterbodies or under logs or rocks on land. More readily observed at night.

NOTE

The Great Crested Newt displays a zone of intergradation with the Marbled Newt *Triturus marmoratus* in C France. Hybrids, often characterised by their large size (TL > 18 cm) show a combination of colour patterns from both parental species, consisting of vague green marbling on the dorsal side and restricted orange coloration interspersed with tiny white dots on the underside. When initially discovered in 1858, these were wrongly taken to be distinct species – *Triton blasii* and *Triton trouessarti*.

Male Karelin's Crested Newt. Georgia.

Marbled Newt *Triturus marmoratus* (Latreille, 1800)
Southern Marbled Newt *Triturus pygmaeus* (Wolterstorff, 1905)

DESCRIPTION

TL: 16 cm (Marbled Newt) and 12 cm (Southern Marbled Newt). Medium to large newts with rather short, blunt snout. Skin rather rough in Marbled Newt, smoother in Southern Marbled Newt. Body stocky. Upperparts black or dark brown, with a green marbled pattern interspersed with tiny black dots. Dorsal line bright orange, continuous in females from head to tail, barred black in males. White mottling on the flanks, upper front legs and chin. Ground colour of underside variable, dark (black, greyish or brownish) in Marbled Newt, pinkish in Southern Marbled Newt, interspersed with large black dots. White mottling on the underside is (much) more extensive in Southern Marbled Newt than in Marbled Newt. Underside of tail black in Marbled Newt, partially pinkish-white in Southern Marbled Newt, especially near the base. Breeding males with high, slightly undulating, black and white barred crest, as well as a white stripe on the sides of the tail.

DISTRIBUTION

Marbled Newt: C and W France; the Rhône River acts as eastern barrier. Southwards to NW, N and NE Spain, and N Portugal. A small introduced population (not mapped) exists in the province of Drenthe in the Netherlands, where it hybridises with Great Crested Newt *Triturus cristatus*.
Southern Marbled Newt: C and S Portugal and SW Spain. Introduced and breeding near Crevillent (Alicante).

The distribution of these species is delimited by the Sierras de Guadarrama, Gredos and Gata in C Iberian Peninsula. The limits of their distribution in coastal and C Portugal are irregular, and the two species are roughly separated by the Tejo River; Southern Marbled Newt occurs along the coast northwards to Aveiro while Marbled Newt can be found in the interior and in an enclave near Caldhas da Rainha.

HABITAT

Marbled Newt: usually found in hilly/mountainous terrain (up to almost 2,000 m in southern part of distribution). Terrestrial habitat comprises forests, heathland, agricultural land and quarries but also stony plains, usually close to waterbodies. One of the more opportunistic large-bodied newts, reproduces in (temporary) ponds, wells, water troughs and flooded fields. Can also be found in slow-flowing brooks.
Southern Marbled Newt: as above. Up to 1,450 m, but also at sea-level in dune areas. Aquatic habitats range from small (temporary) ponds, roadside ditches, and cattle troughs to slow-flowing brooks.

Where Marbled Newt and Southern Marbled Newt meet, the former supposedly usually occupies smaller, more permanent ponds, tanks and wells, while the latter prefers larger, temporary ponds.

Marbled Newt

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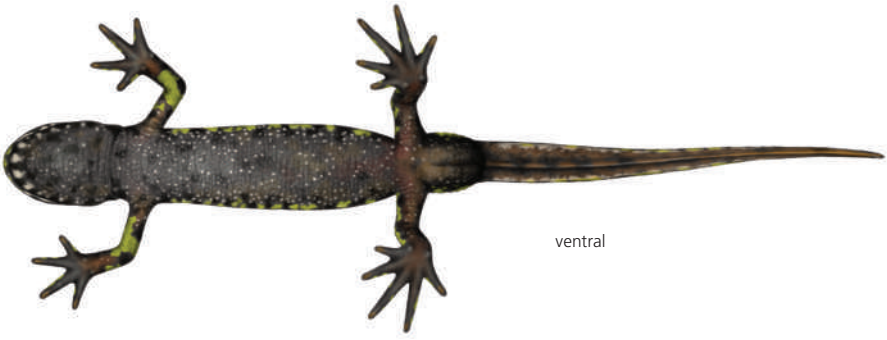


ventral

Southern Marbled Newt

ventral

BIOLOGY

May be found in water throughout the year, even hibernating aquatically in N of range. Aquatic period usually between February and June in Marbled Newt, sometimes including the winter period in southern, lower altitude parts of distribution; Southern Marbled Newt reproduces during winter. During terrestrial phase usually encountered underneath logs or stones or when active at night, usually after periods of rain. During courtship, the male arches his back and leans toward the female while standing on his front feet. Pheromones are transferred from his cloaca towards female by waving the tail in her direction. Next, the male deposits a spermatophore which the female picks up with her cloaca. Females deposit up to 400 eggs individually between leaves of aquatic plants or folded grass. Metamorphosed young can usually be found in late summer. Feeds on a wide variety of arthropods, worms, snails or frog and toad larvae but adults may also feed on smaller newts including their own larvae.

NOTE

Within C France, Marbled Newt overlaps with Great Crested Newt, quite often resulting in first generation hybrids. These are characterised by their large size (TL > 18 cm) and combination of colour pattern of both species. Marbled and Southern Marbled display restricted hybridisation in their narrow contact zones.

Female Marbled Newt in terrestrial phase. Serra da Estrela, Portugal.

Lungless Salamanders (Plethodontidae)

Plethodontids are mainly native to the Americas, but crossed the Bering Strait during the late Cretaceous, after which they migrated to Europe. The reason for the enormous gap between the distribution of the European species and their closest relatives (which occur in California) is not clear. European plethodontids are grouped into the genus *Speleomantes*, although different taxonomies have been advocated (e.g. placing them all together in a single genus with the American *Hydromantes* species or placing the species from SW Sardinia in the genus *Atylodes*, etc.). Eight species occur within the area covered by this field guide: three in SE France, NW, W and C Italy, and five on the Italian island of Sardinia. They are commonly known as 'cave salamanders', as they generally can be encountered in caves or cavities throughout the year. However, most populations are also found in forests or porous, barren limestone terrain where they are strictly nocturnal and can easily be found during the cooler and more humid parts of the year.

Cave salamanders are medium-sized, slender or thin salamanders, characterised by slender limbs with stubby toes and conspicuous bulging eyes. Males are distinguished from females by the presence of cirri along their nasolabial grooves; two small protuberances on the upper lip. Additionally, males possess a disc-shaped glandular swelling on the chin. All species deposit large eggs, deep inside crevices, from which fully-developed young hatch. Toxins in their skin have been shown to kill the chytrid fungus *Batrachochytrium dendrobatidis*, making them resistant to it – a feature so far unknown from any other amphibian species.

The patterns and colours of *Speleomantes* species are extremely variable, making identification using morphological characteristics problematic. Accordingly, the keys below are based on distribution only.

Mainland France and Italy

From SE France (including Monaco) and NW Italy through the Ligurian Alps and N Apennines. Southwards to N-C La Spezia and (extreme) W Massa Carrara provinces.	Strinati's Cave Salamander *Speleomantes strinatii*
E Liguria and NW Tuscany, from C La Spezia and Massa Carrara provinces to the S of the latter.	Ambrosi's Cave Salamander *Speleomantes ambrosii*
N and C Apennines, from S Massa Carrara province in Tuscany to N Abruzzo in the south	Italian Cave Salamander *Speleomantes italicus*

Sardinia

E Sardinia; NE Nuoro province on the Monte Albo Chain and just N of Siniscola.	Monte Albo Cave Salamander *Speleomantes flavus*
E Sardinia; SE Nuoro and N Ogliastra provinces. Largely limited to karstic, hilly areas.	Sopramonte Cave Salamander *Speleomantes supramontis*
C, E and SE Sardinia; NE Cagliari, Ogliastra, S Nuoro and E Oristano provinces. Fragmented occurrence in humid mountainous regions.	Imperial Cave Salamander *Speleomantes imperialis*
SE Sardinia; extreme SE Cagliari province (Monte dei Sette Fratelli) at medium and higher altitudes.	Sette Fratelli Cave Salamander *Speleomantes sarrabusensis*
SW Sardinia; mountainous areas of SW Cagliari, Carbonia-Iglesias and W Medio Campidano provinces.	Gené's Cave Salamander *Speleomantes genei*

Mainland Cave Salamanders *Speleomantes* spp.

Italian Cave Salamander *Speleomantes italicus* (Dunn, 1923)
Ambrosi's Cave Salamander *Speleomantes ambrosii* (Lanza, 1955)
Strinati's Cave Salamander *Speleomantes strinatii* (Aellen, 1958)

DESCRIPTION

TL: 12 cm. Medium-sized salamanders. Oval head with round snout, often with slight overbite. Eyes large. Conspicuous cirri sometimes present on upper lip, especially in males. Legs thin and clearly separated from body. Tail less than half of total length. Chin gland in adult males. Colour and pattern extremely variable. Dorsal colour yellowish to brown or even black, with white or yellow to red spots, speckles, patches or marbling.

DISTRIBUTION

Italian: N and C Apennines, from S Massa Carrara province in Tuscany to N Abruzzo in the south. Introduced to a small forest fragment in Lower Saxony, Germany (unmapped).
Ambrosi's: E Liguria and NW Tuscany, from C La Spezia and Massa Carrara provinces to the south of the latter.
Strinati's: From SE France (including Monaco) and NW Italy through the Ligurian Alps and N Apennines. Southwards to N-C La Spezia and (extreme) W Massa Carrara provinces.

VARIATION

S. ambrosii bianchii occurs in Tuscany and areas east of the Ligurian La Magra River. Many formerly recognised subspecies are now no longer considered valid.

HABITAT

Typically in or near cavities and caves, oak or beech forests and humid, forested brook valleys characterised by rich undergrowth and abundant shelters such as logs and rocks. Can be found from near sea-level up to about 1,600 m (Italian), 1,700 m (Ambrosi's) and 2,300 m (Strinati's).

BIOLOGY

Largely nocturnal and strictly terrestrial. Can be found in caves at high densities, especially during the warmer parts of the year. Juveniles tend to live closer to the entrance of caves, possibly to avoid cannibalism. Individuals can be encountered throughout woodlands and even maquis during cooler and wetter times of the year, where they hide under rocks during the day. Often observed climbing vertically up rock faces or dry-stone walls at night, even in villages, after prolonged periods of rain. Timing of reproduction may vary significantly between populations. Mating takes place on land, the male waving his tail, rubbing his chin against the female, and scraping his teeth against her skin. Afterwards he mounts her and holds her with his front legs, waving his tail base from side to side. A spermatophore is ultimately released and picked up by the female. Females usually lay up to 14 eggs in deep crevices and guard them against predators (including other cave salamanders), only briefly leaving them to forage. Her skin secretions protect the eggs against fungal infection. Fully formed juveniles emerge after up to nine months.

Italian Cave Salamander

Ambrosi's Cave Salamander

Strinati's Cave Salamander

Feeds mostly on a wide variety of arthropods, worms and snails. Prey items are found by smell or sight and caught by shooting out the long, sticky tongue to an average distance of 2.5 cm. If threatened, individuals adopt a C-shaped pose and elevate their tail, often presenting a white toxin secreted from small glands.

Sardinian Cave Salamanders *Speleomantes* spp.

Monte Albo Cave Salamander *Speleomantes flavus* (Stefani, 1969)

Sopramonte Cave Salamander *Speleomantes supramontis*
(Lanza, Nascetti & Bullini, 1986)

Imperial Cave Salamander *Speleomantes imperialis* (Stefani, 1969)

Sette Fratelli Cave Salamander *Speleomantes sarrabusensis*
Lanza, Leo, Forti, Cimmaruta, Caputo & Nascetti 2001

Gené's Cave Salamander *Speleomantes genei*
(Temminck & Schlegel, 1838)

DESCRIPTION

TL: up to 15 cm, Gené's is smaller. Relatively large salamanders. Oval head with round snout, often with slight overbite. Large eyes. Conspicuous cirri sometimes present on upper lip. Legs thin and clearly separated from body. Tail less than half of total length. Chin gland present in adult males. Coloration highly variable. Monte Albo, Imperial, Sette Fratelli and Sopramonte Cave Salamanders often with dark pinkish, olive, grey, or nearly black dorsal colour, either with a marbled pattern or individual whitish to golden spots. Marbled pattern may be extensive, especially in Monte Albo and Sopramonte Cave Salamanders, while other species are mostly spotted or blotched. Dorsal colour of Gené's Cave Salamander usually brownish or greyish, interspersed with very fine white to gold speckling, with occasionally larger blotches on the head, tail and dorsolateral areas. Speckling continuous on the flanks, which are otherwise white. Legs and tail of all species partially transparent, often pink to reddish coloured. Lower flanks and underside white, occasionally transparent so that abdominal organs are visible.

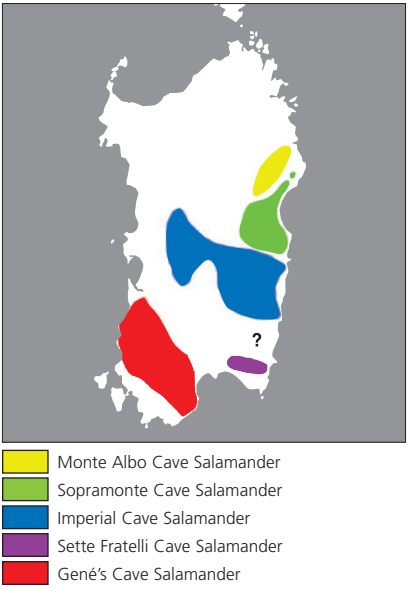
DISTRIBUTION

All are endemic to Sardinia.
Monte Albo: Largely continuous distribution throughout the Monte Albo and hills between Siniscola and the Posada River, NE Sardinia.
Sopramonte: Sopramonte and associated hills and forests including Monte Tuttavista near Orosei in eastern C Sardinia.
Imperial: Fragmented range, from E coast westwards throughout hilly and forested regions of C E and C Sardinia, up to Giara di Gesturi and Lago Omodeo.
Sette Fratelli: Medium and higher altitudes of SE Sardinia.
Gené's: Largely continuous distribution throughout the mountainous Iglesiente and Sulcis regions of SW Sardinia.

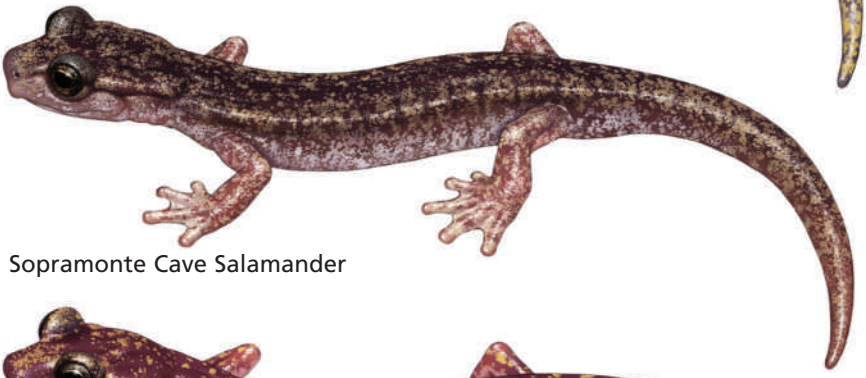
The border between Imperial and Sette Fratelli Cave Salamanders is not clear; the latter occurs with certainty S of Burcei.

VARIATION

Two morphs of the Imperial Cave Salamander have been described; the morph *imperialis* in the southern part of the range is characterised by extensive blotching and can be colourful (including purple, pink and/or



Monte Albo Cave Salamander



Sopramonte Cave Salamander

Imperial Cave Salamander

Sette Fratelli Cave Salamander

Gené's Cave Salamander

yellow), while the *funereus* morph in the northern part of the distribution often has no dorsal pattern and is duller.

HABITAT

Except for Sette Fratelli Cave Salamander, these species are mostly known from small cavities and caves in hilly/mountainous karstic limestone terrain. However, all species are also common in and near open oak forests, humid brook valleys, eroded rock faces, barren limestone plateaus and man-made structures such as dry-stone walls, and even in villages, provided that abundant shelters in the form of rocks are present. Sette Fratelli Cave Salamander is exclusively found in granite boulder fields in oak forests, and on eroded, high-altitude hills interspersed with scrubby vegetation and an abundance of shelter. Altitudinal distribution ranges from near sea-level up to approximately 650 m (Gené's), 1,100 m (Monte Albo and Imperial) or 1,400 m (Sopramonte).

BIOLOGY

See mainland cave salamanders (p. 106).

NOTE

Sopramonte (Endangered), Gené's (Vulnerable), Monte Albo (Vulnerable) and Sette Fratelli Cave Salamander (Vulnerable) are listed in the 2009 IUCN Red List of European Amphibians.

A largely unspotted specimen of the Imperial Cave Salamander. Lago Omodeo, Sardinia, Italy.

Gené's Cave Salamander. Masua, Sardinia, Italy.

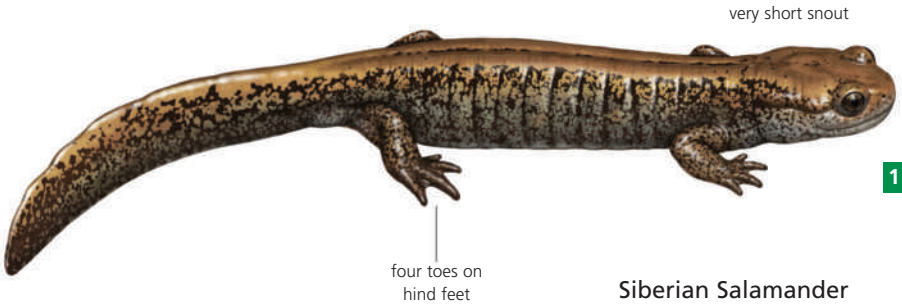
■ Asiatic Salamanders (Hynobiidae)

Salamanders of the family Hynobiidae were often regarded as primitive, due to their generalised body shape and close relationship to Asian and North American giant salamanders (Cryptobranchidae). However, Asiatic Salamanders have been shown to display a wide variety of shapes, sizes and habitat preferences, reflecting their wide distribution and the variety of environmental conditions in which they live.

Most species occur in China and Japan, although isolated populations are found as far southwest as Afghanistan and Iran. Despite the fact that hynobiids reproduce aquatically, they produce egg-sacs instead of attaching separate eggs to leaves or stones underwater. Only the Siberian Salamander *Salamandrella keyserlingii* occurs in our area. It is the species with the widest distribution of any extant amphibian.

Siberian Salamander *Salamandrella keyserlingii*

Dybowsky, 1870



Siberian Salamander

DESCRIPTION

TL: 16 cm. Medium-sized salamander. Skin smooth. Very short snout. Legs short. Only four toes on the hind feet, a feature within Europe only shared with the two spectacled salamander species *Salamandrina* spp. Tail relatively flat, ending in a point. Dorsal coloration bluish, grey, yellow, brown or black. Upper part of back brown or golden, delineated by discontinuous black pigmentation in the dorsolateral region. Upper dorsal colour runs from the head to the tail. Flanks often characterised by a combination of dorsal and upper back coloration, interspersed with black. Underside grey.

DISTRIBUTION

The world's most northerly ranging tailed amphibian. European range (located in NW Russia) not limited to the foothills of the Ural Mountains as previously thought; occurs in our area as far west as Archangelsk province in the north, through Kostroma province to the Mari El Republic in the south. Widespread across Russia, also in N China, N Mongolia, and on the islands of Sakhalin (Russia) and Hokkaido (Japan).

HABITAT

Generally occurs in open (birch) forests and barren taiga landscapes, near streams, river valleys or swamps. It is a highly opportunistic species, inhabiting a wide range of aquatic habitats during the breeding season, such as flooded fields, ponds, lakes, wells and river oxbows, as well as smaller waterbodies such as rain-filled wheel-ruts.

BIOLOGY

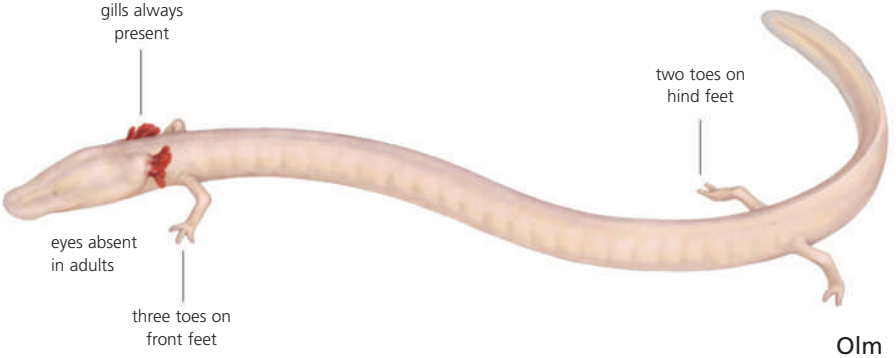
Activity is limited to the short summer. Terrestrial outside breeding season and not particularly rare within its vast range. After the snow melts, individuals migrate towards breeding water, sometimes (even) under the cover of snow. In S of range they may start to move in the second half of April, while in N of range they may start as late as June. Males exhibit an elaborate courtship ritual. While holding on to vegetation with their feet, they wave their tails from

side to side, sometimes for as long as six hours. Subsequently, females generally deposit two spiral-shaped egg-sacs, each containing up to 140 eggs, around submerged sticks or aquatic vegetation. The newly metamorphosed juveniles grow fast and climb onto land about two months after hatching. They may hibernate for as long as 220 days in N of range. Special blood components allow them to survive extremely low winter temperatures (minus 35–40°C).

■ Olm (Proteidae)

The family Proteidae currently consists of fewer than ten members, of which one, *Proteus anguinus*, is found in Europe. All species are aquatic throughout their lifetime and permanently retain their gills. The European species is found in subterranean waters and is therefore difficult to observe. *Proteus anguinus* can live for more than a century, and can go for extended periods without food. This species has highly developed non-visual sensory systems, which permit it to survive in its subterranean environment.

Olm *Proteus anguinus* Laurenti, 1768



Olm

DESCRIPTION

TL: up to 25 cm. Large, very slender and eel-like. Adapted to life in total darkness. Head flat and elongated, ending in a rectangular snout. Eyes absent in adults, present in juveniles. Reddish gills always present at the sides of the head. Body slender and highly elongated. Limbs short, toes only moderately developed (three on front feet, two on hind feet). Tail flattened, comprising about one quarter of the total length of the animal. Colour may be light grey, pink, or yellowish but is generally pale white.

DISTRIBUTION

Ranges from extreme SE Italy (Monfalcone-Trieste area) along the Adriatic coast southwards to Bosnia and Herzegovina and S Croatia. Occurrence in Montenegro has been suspected for a long time, and seems confirmed by (albeit preliminary) environmental DNA (eDNA) data. Introductions (not mapped) have been made to caves in at least NE Italy, France and Germany, some of which persist today, such as those in caves near Vicenza (N Italy), Moulis in the French Pyrenees and the German Harz.

VARIATION

P. a. parkelj has been described from SE Slovenia; this subspecies is characterised by a dark, pigmented skin and moderately developed eyes. Despite its different appearance, *P. a. parkelj* is a recently derived lineage, seemingly not deserving treatment as a distinct taxon.

HABITAT

Flowing and stagnant subterranean waterbodies in karstic limestone formations. Confined to clear oxygen-rich water, generally with a stable temperature of 5–15°C. Individuals of this species are characteristically observed in caves, occasionally in water near the entrance. However, Olms are probably widely dispersed in subterranean streams across their range where they are practically impossible to observe.

BIOLOGY

Completely aquatic and neotenous, although they may leave the water to feed or travel short distances between waterbodies. Flees and hides when subjected to light. Navigates using its sensory lateral line system and detects its prey both by this sense and by smell. Feeds mainly on small crustaceans, snails and insect larvae. Capable of surviving without food for up to ten years, an adaptation to scarce food resources. Males are territorial and defend their territories against intruders. Mating takes place between August and April. Males fan pheromones towards females and deposit a spermatophore that is taken up by the female. Egg deposition takes place between October and March. Up to 70 eggs are deposited in rock cracks and guarded by the females.

NOTE

In the Slovenian town of Postojna the Olm is depicted throughout the city in signs, street art and icons. Before the euro, the Olm was also depicted on the 10 stotinov coin. Listed as Vulnerable in the 2009 IUCN Red List of European Amphibians.

Adult Olm from Slovenia.

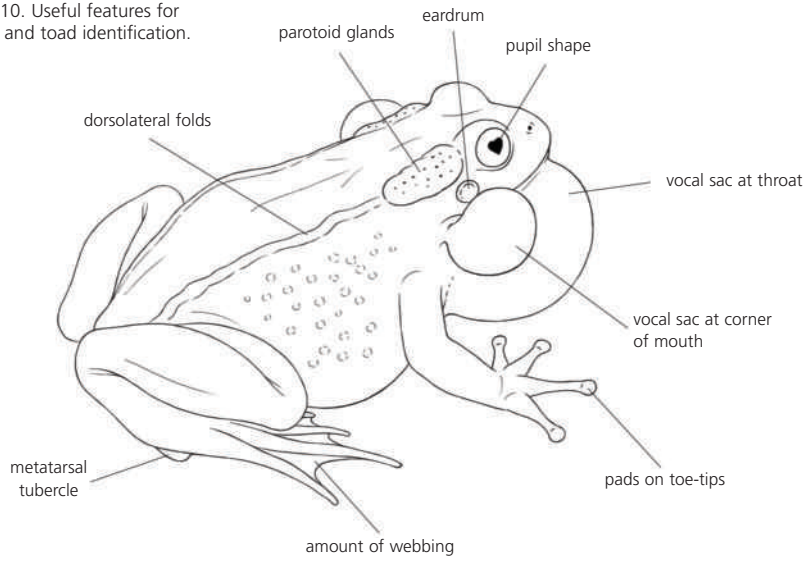
FROGS AND TOADS (ANURA)

The Anura comprise the largest amphibian order, containing nearly 6,500 species distributed over all continents except Antarctica. More than 40 species occur within the area covered by this field guide, of which the majority are endemic. Traditionally, toads have been separated from frogs based on their warty skin and predominantly terrestrial behaviour. However, this division is mostly subjective, with several ´toads´ showing highly aquatic behaviour, e.g. the fire-bellied toads (Bombinatoridae), or possessing a very smooth skin, e.g. the spadefoot toads (Pelobatidae). A total of eight families occur in Europe and the Mediterranean area. Frogs and toads generally possess longer hind legs compared with their front legs. Furthermore, they lack a tail, and males vocalise during the reproductive period.

Key to Frogs and Toads			
1	a	Toe-tips enlarged to pads. Pupil horizontal elliptic. Skin very smooth. Back generally green, rarely brownish or greyish.	Tree frogs – Hylidae (p. 157)
	b	Toe-tips not notably enlarged. Inner three toes of hind feet with black horny claws.	African Clawed Frog *Xenopus laevis*
	c	Toe-tips not notably enlarged. No horny claws on hind foot toes.	2
2	a	In daylight, pupils vertically-shaped like those of a cat.	3
	b	In daylight, pupils not vertically-shaped.	4
3	a	Plump body shape. Hard and enlarged metatarsal tubercle present. Skin smooth overall.	Spadefoot toads – Pelobatidae (p. 138)
	b	Plump body shape with short legs. Granular skin with warts that never form ridges but may be arranged in a line from eye to groin. Ranging from Iberian Peninsula and France N to the Netherlands and E to Switzerland and C Germany.	Midwife toads – Alytidae (p. 117)
	c	Slender body shape with long legs. Granular skin with warts that form ridges behind the eyes and occasionally on the back. Upper part of iris lighter coloured. Only on Iberian Peninsula, France and NW Italy.	Parsley frogs – Pelodytidae (p. 145)
4	a	Dorsolateral folds present.	True frogs – Ranidae (p. 164)
	b	Dorsolateral folds absent.	5
5	a	Parotoid glands behind the eyes present. Pupil horizontal elliptic. Skin usually rough and warty.	True toads – Bufonidae (p. 148)
	b	Parotoid glands behind the eyes absent.	6
6	a	Only on Iberian Peninsula, Mediterranean SW France, Tyrrhenian Islands, Malta and Sicily. Normal to slender body shape with long legs. Warts form ridges behind the eyes and occasionally on the back. Pupil round or inverse droplet-shaped. Upper part of iris lighter coloured.	Painted frogs – Discoglossidae (p. 127)
	b	In W, C, E and SE Europe, including peninsular Italy. Plump body shape with dull, warty back but smooth and shiny black with bright red or yellow patched underside. Pupil heart-shaped.	Fire-bellied toads – Bombinatoridae (p. 132)

Fig. 9. Pupil shapes in frogs and toads.

Fig. 10. Useful features for frog and toad identification.

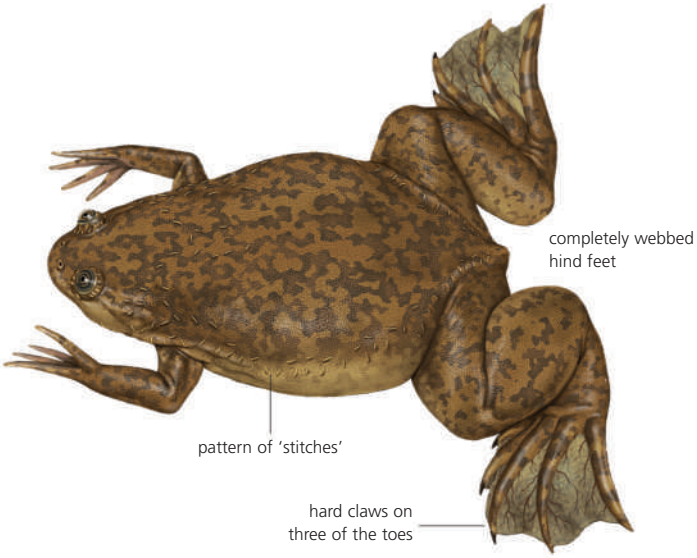


■ Clawed Frogs (Pipidae)

The Pipidae comprises approximately 40 species of primitive frogs, which are distributed in S America east of the Andes (Surinam toads), and sub-Saharan Africa (clawed frogs). Clawed frogs lack a tongue and have exceptionally flattened bodies with dorsally placed eyes. All species are habitat generalists, and can occur in nearly any type of waterbody. Some species of clawed frogs are popular pets and/or have been used as model laboratory organisms for decades, leading to occasional introductions outside their native range. The African Clawed Frog *Xenopus laevis* now occurs in several European regions as the result of introductions by man.

Hind foot of African Clawed Frog. C France.

African Clawed Frog *Xenopus laevis* (Daudin, 1802)



African Clawed Frog

DESCRIPTION

TL: 12 cm. Medium-sized to large frog. Head small with a short snout, eyes pointing upward. Body flat and oval-shaped, broadening towards the end. Skin very smooth. Pattern of 'stitches' running from the eyes along the sides of the body to the cloaca. Legs and hind feet very large, the latter being completely webbed up to the toes, three of which carry black, hard claws. Front legs small, toes without webbing. Dorsal colour brown, grey or black, usually with a marbled pattern of lighter coloured tiny and larger blotches. Belly white or brownish.

DISTRIBUTION

Native to S and C Africa. Naturalised (at least) at localities in the UK (but most likely now disappeared), C France, Portugal, Catalonia and Sicily. Individuals from Sicily are closely related to those from S Africa.

HABITAT

Highly tolerant regarding the nature of its aquatic habitat. Occupies both well-vegetated and murky, vegetation-free ponds, lakes and reservoirs in Europe.

BIOLOGY

In general, a fully aquatic species, although the history of its colonisation in France shows that it may move over land during wet weather. By day, only observed when individuals surface for air; easier to spot at night. Reproduction starts in spring and may last until summer. Males grab females at the loins. Females deposit up to 2,500 eggs in small piles or individually in vegetation. Larvae can be observed throughout summer. In

southern populations, reproduction may take place throughout the year. Feeds on all sorts of invertebrates and vertebrates including fish, small amphibians and even their own larvae. Like newts, they feed by quickly opening their mouths so the prey is sucked in. Clawed frogs are very slimy and their skin secretes toxins to protect them against predators.

NOTE

A widely used laboratory animal and a popular pet. Introduced throughout Europe and believed to act as a vector for the chytrid fungus *Batrachochytrium dendrobatidis*. Rapid reproduction contributes to the highly invasive nature of the species.

■ Midwife Toads (Alytidae)

The midwife toads are restricted to W Europe and NW Africa. Five species are currently recognised and four occur in our area. Some authors also place the painted frogs (*Discoglossus* spp. p.127) in this family. Three subgenera have been described within the genus *Alytes*: 1) *Alytes*, containing the Common Midwife Toad *Alytes obstetricans*; 2) *Ammoryctis*, comprising the long-recognised Iberian Midwife Toad *Alytes cisternasii*; and 3) *Baleaphryne*, consisting of the southern species: Betic Midwife Toad *Alytes dickhilleni*, Mallorcan Midwife Toad *Alytes muletensis* and African Midwife Toad *Alytes maurus*. All are relatively small with stout bodies and eyes with vertical pupils. As indicated by their common name, they display a characteristic type of paternal care. During mating, males attach a strand of eggs to their hind legs, which are carried and kept moist. Once they are ready to hatch, the male heads towards water, after which the larvae leave the eggs and enter the water.

All species are typical terrestrial inhabitants of dry, stony habitats, where they often use small, cold streams or springs for breeding. As the ranges of most species do not overlap, they are best distinguished by their distribution. However, the Common Midwife Toad might overlap with Iberian Midwife Toad in N, C and W Iberia, while the latter locally overlaps with Betic Midwife Toad in the easternmost Sierra Morena. In these areas, the amount of tubercles on the underside of the front feet can nearly always act as a reliable distinguishing feature.

Key to Midwife Toads	
NW, W Europe, N Iberian Peninsula. 3 tubercles on underside of front feet; often red dorsolateral warts; smooth or slightly rough skin.	Common Midwife Toad *Alytes obstetricans*
SE Iberian Peninsula. 3 tubercles on underside of front feet; never red dorsolateral warts; smooth skin.	Betic Midwife Toad *Alytes dickhilleni*
Mallorca. 3 tubercles on underside of front feet. Dorsolateral warts never red. Smooth skin.	Mallorcan Midwife Toad *Alytes muletensis*
S and E Portugal, W and C Spain. 2 tubercles on underside of front feet. Abundant red warts over the body. Rough skin.	Iberian Midwife Toad *Alytes cisternasii*

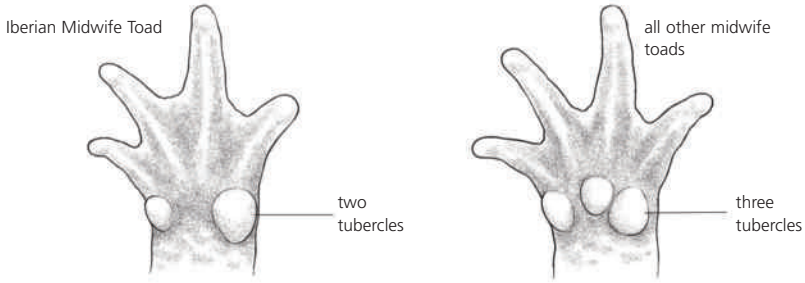


Fig. 11. Underside of front feet of midwife toads.

Common Midwife Toad — *Alytes obstetricans* (Laurenti, 1768)

Common Midwife Toad

DESCRIPTION

TL: 5.5 cm. Small, stockily-built toad with short hind legs and rather large eyes with vertical pupils. Skin warty, but relatively smooth compared to 'true toads' (Bufonidae). Small parotoid glands visible. A row of somewhat larger warts may run from the eyes towards the hind feet. Colour usually predominately grey but may be blotched; towards the south more variable and also tan, brown or greenish individuals occur (see Variation). Warts sometimes orange/reddish in colour. Underside grey or whitish; lower jaw and throat partially covered with dark spots. Front feet usually with three tubercles on underside.

DISTRIBUTION

SW Europe. N half of Iberian Peninsula, thus absent from S Iberia, where mostly replaced by Betic and Iberian Midwife Toads, although sometimes found together with the latter. Throughout France (though absent from the Italian border area and coastal regions in the southwest), reaching S half of Belgium, extreme S Netherlands, Switzerland and extending into Germany. Introduced populations (not mapped) exist outside natural range in the UK, Belgium, the Netherlands and Germany.

VARIATION

A. o. obstetricans: Most of France, as well as all of the species range in Belgium, the Netherlands, Luxemburg, Germany and Switzerland. In Spain; in Cordillera Cantábrica, west to the border with Galicia. Intergrades with *A. o. boscai* across most of Galicia.
A. o. almogavarii: NE Spain; mostly Catalonia, south to border with Valencia. Also Andorra and adjacent extreme SE France, but border with *A. o. obstetricans* in S France unclear. Warty dorsal skin, coloured yellow-brown or grey with irregular greenish spots. Dorsal parts of limbs yellowish with many dark spots.

Common Midwife Toad, ssp. *boscai*. Note the smooth skin. Serra da Estrela, Portugal.

Common Midwife Toad in amplexus. Limousin, France.

Female Common Midwife Toad transferring egg-strings to the male. Limousin, France.

A. o. boscai: Contains two genetic groups; one in Galicia and N Portugal (but not in NE) southwards to Porto, the other in C Portugal (incl. isolates on the Lisbon Peninsula) and the W Spanish Sistema Central, to the Sierra de Gredos. In contrast to other subspecies, skin generally smooth or granular, without warts or tubercles. Dorsal colour whitish to grey with greenish or brownish spots.
A. o. pertinax: C E Iberian Peninsula; from NE Portugal through N Castile and León, including Sierras de Gredos and Guadarrama, eastwards through the Sistema Ibérico (Soria, S Aragon) including the mountains of Castilla-La Mancha and Valencia. Dorsal pattern less contrasting than in other Iberian subspecies, often whitish or light grey; dorsal spots much smaller and roundish.

HABITAT

Rocky places with loose soil, mostly in hilly or mountainous terrain, such as stony slopes, open brook valleys, quarries and river embankments. Usually close to breeding waters which include ponds, drinking troughs and stagnant edges of rivers and streams. Also occurs near human habitation in gardens, parks, ruins and graveyards. Occasionally also in dune areas.

BIOLOGY

Nocturnal; larvae also active by day. Adult individuals hide by day underneath large objects such as stones and boulders but mostly use (self)excavated burrows. Active from February to November in S of range and from March to October in N of range or at higher altitude. Both males and females produce mating calls by night, in rainy weather and also by day. Calls are often given from hiding places, and the animals are difficult to locate. Together with its congeners, these are the only tailless amphibians in our area to lay eggs on land. After the male grabs and holds the female in front of her hind legs, individuals start to call softly and sway from side to side. Females lay up to 80 eggs in one strand and produce up to four strands per season. Adult males carry up to four different egg-strands around their hind legs, which may have been laid by different females. Males search for favourable conditions for the eggs and their skin secretions seem to have a positive effect in keeping the eggs free from fungi. As soon as the eggs are ready to hatch they are deposited in water by the male. Metamorphosed juveniles emerge during summer, but sometimes larvae hibernate and grow larger. Feeds on all sorts of invertebrates. When disturbed, usually inflates body and hides legs under body.

CALL

Like all midwife toads, a single high-pitched whistling note, which may carry quite far. Has been compared with submarine sonar sound. Usually given from inside a burrow or from underneath cover. Females may also call. Call be confused with that of Scops Owl *Otus scops*.

Iberian Midwife Toad *Alytes cisternasii* Boscá, 1879

Iberian Midwife Toad

DESCRIPTION

TL: 4–5 cm. Small, stockily-built toad with short legs, relatively short toes and rather large eyes with vertical pupils. Small parotoid glands behind eyes, slightly covering the conspicuously large eardrums. Colour predominately grey, brownish or sometimes reddish with a darker marbled pattern, which may be difficult to see in darker individuals. Legs generally lighter than body, while feet are whitish. Sides of the body, legs and to a lesser extent upper body and head covered with numerous small orange or red warts. Front feet have two tubercles on the underside.

DISTRIBUTION

SW and C Iberian Peninsula, as far E as Madrid, Montes de Toledo and the easternmost Sierra Morena.

HABITAT

Favours predominantly warm areas that are often quite dry. Typical habitats consist of rocky places interspersed with patches of loose soil, often in lowland areas including agricultural land near human habitation. Also common in hilly terrain, quarries and near river embankments. Usually does not occur far from breeding waters, which comprise wells and stagnant edges of rivers and small streams. Found up to 1,200 m in Sistema Central, Spain.

BIOLOGY

Adults nocturnal, larvae also active by day. Adult individuals hide by day underneath large objects such as stones and boulders but mostly use (self-)excavated burrows. Rather than jumping, Iberian Midwife Toads tend to walk/crawl when foraging. Active all-year round but may hibernate at higher altitudes and aestivate in particularly hot and dry parts of their range. Reproduction takes place from late summer or autumn until late spring. Behaviour and reproduction is similar to Common Midwife Toad *Alytes obstetricans*. Females lay strands of up to 60 eggs. Males may carry strands from up to four different females which hatch simultaneously.

CALL

Like all midwife toads, a single high-pitched whistling note, which may carry quite far. Has been compared with submarine sonar sound. Usually given from inside a burrow or from underneath cover. Females may also call. Call may be confused with that of Scops Owl *Otus scops*.

Iberian Midwife Toad. Doñana National Park, Andalucia, Spain.

Male Iberian Midwife Toad carrying eggs. Algarve, Portugal.

Betic Midwife Toad

Alytes dickhilleni

Arntzen & García-París, 1995

Betic Midwife Toad

DESCRIPTION

TL: up to about 5.5 cm. Small, sturdy toad, very similar to Common Midwife Toad *Alytes obstetricans*, but skin generally smoother and usually without orange/red spots. Large eyes with vertical pupils, small parotoid glands behind eyes. Colour predominately whitish, grey, brown or greenish, often with darker spots/markings. Hind legs often faintly barred, no distinct pattern on front legs. An irregularly shaped, pale grey or whitish spot is often present between the shoulders. A triangular spot of similar colour is present on the head, running from between the eyes towards the tip of the snout. Throat can be either spotted or completely light-coloured. Three tubercles on underside of front foot.

DISTRIBUTION

Restricted to a limited area in the SE Iberian Peninsula, roughly from the Sierra Nevada in the south, up to Sierra de Alcaraz in the north. Eastern limit in NW Murcia and an isolated occurrence in the Sierra Espuña, Murcia. Absent from drier lowlands.

VARIATION

Some variation in colour pattern has been described among populations in the species' fragmented mountainous range, but no subspecies are recognised. Individuals in the N part of the distribution (Alcaraz, Cazorla) show grey, whitish or brown dorsal coloration interspersed with large greenish marks, while those from the Sierra de Baza are uniform brown with lighter legs.

HABITAT

Prefers hilly or mountainous terrain. Often occurs on steep slopes in pine or oak forests, but sometimes even on barren, stony slopes. Usually does not occur far from (usually permanent) breeding water, which may

consist of (fast-)flowing rivers and streams, but also man-made structures such as springs and wells. Found from 340 m up to 2,100 m (Sierra de Baza).

BIOLOGY

Adults nocturnal, larvae also active by day. Adult individuals hide by day underneath large objects such as stones and boulders but mostly use self-excavated burrows. Can be active year-round, but hibernates at higher altitudes and remains well hidden under dry conditions. Reproduction starts in winter and lasts until summer.

CALL

Like all midwife toads, a single high-pitched whistling note, which may carry quite far. Has been compared with submarine sonar sound. Usually given from inside a burrow or from cover. Females may also call. Call may be confused with that of Scops Owl *Otus scops*.

NOTE

Genetically more closely related to the Mallorcan Midwife Toad *Alytes muletensis* than to the other European midwife toad species. Listed as Vulnerable in the 2009 IUCN Red List of European Amphibians.

Betic Midwife Toad. Note the light patches between the shoulders and on the head. Sierra de Segura, Spain.

Betic Midwife Toad. Sierra de Cazorla, Spain.

Freshly hatched egg-mass of the Betic Midwife Toad. Andalucia, Spain.

Mallorcan Midwife Toad

Alytes muletensis

(Sanchíz & Adrover, 1977)

Mallorcan Midwife Toad

DESCRIPTION

TL: up to about 4.5 cm; smallest midwife toad. A small frog-like toad with relatively long legs and toes, smooth skin and large eyes with vertical pupils. In contrast to other midwife toads, more slender and elegant and with longer toes on front feet. Colour predominately pale grey or whitish, often with green/brown markings.

DISTRIBUTION

Natural range restricted to the E Serra de Tramuntana Mountains, NW Mallorca, but has been successfully introduced to more westerly parts of the same mountain range.

HABITAT

Confined to limestone mountains in the N of Mallorca. Occurs in deep and narrow ravines which may have perennial water flow, or in summer often reduced to stagnant pools serving as breeding waters. Occasionally (especially at reintroduction sites) uses dry-stone walls and stone piles, breeding in drinking troughs and concrete basins. Found up to 850 m.

BIOLOGY

Adults nocturnal, larvae also active by day. Adults hide by day in cracks and fissures, more rarely underneath large objects such as stones and boulders, emerging at night to forage and mate. Hibernates only in extreme conditions and may be active (and calling) all year round. Females also call for males when gravid. Main breeding period lasts from February until August. Males with eggs are most easily seen between May and July. Unlike its congeners, this species usually carries a single clutch instead of several strands of eggs. A single clutch may contain up to 24 eggs but more typically around 14. Larvae metamorphose in the same year but may also hibernate and complete metamorphosis in the following year. Larvae are black when predation is absent but paler light grey when present.

CALL

Like all midwife toads, a single high-pitched whistling note, which may carry quite far. Call is slightly higher in pitch than in the other midwife toad species. Has been compared with submarine sonar sound. Usually given from inside a burrow or from underneath cover. Females may also call. Call may be confused with that of Scops Owl *Otus scops*.

NOTE

First described in 1977 from fossil material as *Baleaphryne muletensis*. Thought to be extinct, until two years later when live larvae and juveniles were found in the Mallorcan mountains; research assigned the species to the genus *Alytes*. Listed as Vulnerable in the 2009 IUCN Red List of European Amphibians.

Mallorcan Midwife Toad. Mallorca, Spain.

Mallorcan Midwife Toad, male with eggs. Mallorca, Spain.

Painted Frogs (Discoglossidae)

Painted frogs can be found in the W and E Mediterranean Basin, and six species are currently recognised. Four of these occur in our area, while the others inhabit NW Africa and the Near East. They are generally fairly inconspicuous and occur in temporary or small waterbodies during their breeding period. At other times, they are often found hiding under stones or other objects, rather than hiding in vegetation. Apart from the Corsican Painted Frog *Discoglossus montalentii*, all may occasionally be encountered in relatively dry microhabitats.

Painted frogs are small to medium-sized frogs. The pupil is triangular or shaped like an upside down droplet; the upper half of the eye is usually paler than the lower half. The eardrum is barely visible. Several lines of discontinuous warts are generally present along the back but may be inconspicuous. Pattern highly variable; all species can be uniformly coloured or spotted. Two species also may be striped (Painted Frog *D. pictus* and Iberian Painted Frog *D. galganoi*). A light triangular 'cap' may be present on the upper rear part of the head, running from the snout to the middle of the eyes. Due to their variable morphology, painted frogs are best identified by range, although two species coexist on Corsica and may even be encountered at the same site.

Some authors place the painted frogs in the Alytidae family with the midwife toads (p. 117).

Key to Painted Frogs	
Iberian Peninsula, excluding the NE coastal area.	Iberian Painted Frog *Discoglossus galganoi*
Sicily and Malta, NE coastal Spain and SW coastal Mediterranean France.	Painted Frog *Discoglossus pictus*
Corsica, usually at mid- or higher elevations. Relatively large head with blunt, round snout which has parallel upper and lower surfaces (in lateral view). Toes kinked and blunt.	Corsican Painted Frog *Discoglossus montalentii*
The Tyrrhenian Islands (including Corsica), Iles des Hyères, Monte Argentario and Giglio. Small head with sharp snout which decreases in height towards the point. Toes less blunt.	Tyrrhenian Painted Frog *Discoglossus sardus*

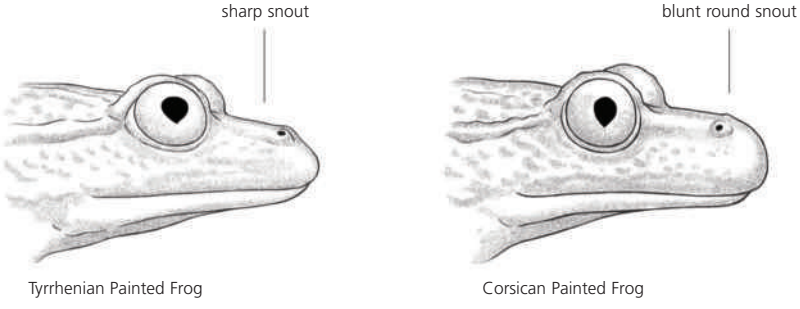


Fig. 12. Heads of painted frogs.

Painted Frog *Discoglossus pictus* Otth, 1837
Iberian Painted Frog *Discoglossus galganoi*
Capula, Nascetti, Lanza, Bullini & Crespo, 1985

Painted Frog

striped morph

Iberian Painted Frog

spotted morph

DESCRIPTION

TL: 8 cm. Painted Frog is a medium-sized frog with a relatively small head. Eardrum barely visible. Eyes with inverse droplet-shaped pupils. Skin smooth with some warts on back and limbs, occasionally forming longitudinal lines. Rows of dorsolateral glands often interrupted or even absent. Coloration highly variable, from pale brown to dark brown, reddish-brown, greyish or olive. Darker spots with lighter edges often present but some individuals may be uniform or have a vertebral stripe. Whitish below, sometimes with brownish spots. Males are characterised by more extensive webbing on the hind feet and, during breeding season, by black nuptial pads on thumbs and small, black, spiky warts on the underside and toes. Iberian Painted Frog is very similar to Painted Frog, with only minor differences. Eardrum is almost never visible, head slightly broader and snout more elongated. Coloration similar though uniform individuals are rare in this species.

DISTRIBUTION

Painted Frog: Sicily, Malta and Gozo. Introduced in ancient times from Algeria to NE Spain (Catalonia) and SW France. Also in N Africa.

Iberian Painted Frog: Almost throughout the Iberian Peninsula but occurrence seems more fragmented towards the north and east.

Painted Frog
Iberian Painted Frog

VARIATION

Painted Frog: Monotypic. Iberian Painted Frog: Two subspecies are recognised.

D. g. galganoi: Portugal, NW, SW and C Spain.

D. g. jeanneae: SE and E Spain. This subspecies was previously treated as a separate species.

In S Spain, these subspecies meet around the Guadalquivir River. Distribution further north is less clear, with *D. g. galganoi* occurring in the Sistema Central as far east as Madrid, while *D. g. jeanneae* is found as far northwest as Burgos.

HABITAT

Highly opportunistic species, found in or near a wide variety of small waterbodies including (temporary) ponds, ditches, springs and stagnant parts of rivers, preferably well-vegetated. Also frequent in man-made habitats such as cisterns, wells and reservoirs. May even be found in brackish water. Occurs up to 1,250 m (Painted) and 2,000 m (Iberian Painted – Sierra Nevada).

BIOLOGY

Active day and night, but more readily encountered at night. During summer spends more time in water or, when water is absent, aestivates in mud or under rocks. Usually very shy and quick to flee, hiding underwater in vegetation or mud. Active all year round under suitable conditions but may hibernate at high altitude or aestivate in dry conditions. Reproduction may take place year-round but usually in spring. Males hold females in front of their hind legs. Females lay loose clumps of up to 50 eggs which quickly fall apart in the water and sink, forming mats on the bottom. Each female may lay up to 1,000 eggs. Juveniles emerge most typically during summer. Feeds on all sorts of invertebrates most notably insects.

CALL

Like all Painted Frogs, fairly quiet, guttural grunting noises.

A pale-coloured Painted Frog from Malta.

Tyrrhenian Painted Frog *Discoglossus sardus*

Tschudi in Otth, 1837

Corsican Painted Frog *Discoglossus montalentii*

Lanza, Nascetti, Capula & Bullini, 1984

Tyrrhenian Painted Frog

Corsican Painted Frog

DESCRIPTION

TL: up to 7.5 cm. Coloration varies from light to dark brown, grey, black or reddish. Almost always with a pattern of lighter blotches and spots. Uniform individuals rarely occur; striped individuals have not been recorded. Large pale spot usually present between shoulders. Usually a large dark spot between eyes, with pale, straight anterior edge. Belly yellowish or whitish. Droplet-shaped pupils. Eardrum not clearly visible. Skin generally relatively smooth; smooth warts on back and limbs sometimes form lines. The two species are generally difficult to distinguish. Corsican Painted Frog differs from Tyrrhenian Painted Frog by its rounded snout with horizontal upper profile seen from the side (versus pointed and tapering - see Fig.12 on p. 127), and the end of the fourth toe on the front feet being broader than its base (versus narrower).

DISTRIBUTION

Both species are Tyrrhenian endemics. Tyrrhenian Painted Frog is found on both Corsica and Sardinia, including surrounding

islands such as Caprera, La Maddalena, San Pietro, Asinara and Lavezzi. Also on the Tuscan Archipelago on Montecristo, Giglio and Monte Argentario, and off the French Mediterranean coast on the islands of Port Cros and Ile du Levant (Hyères Islands). Corsican Painted Frog occurs only on Corsica.

HABITAT

Tyrrhenian Painted Frog is most often found near water and occupies a wide array of habitats such as temporary pools and ponds, slow-flowing streams and reservoirs in both dry maquis and humid coniferous forests. Seems rather tolerant of water quality, even occurring in slightly brackish water. From coastal habitats up to 1,300 m in Corsica and about 1,800 m in Sardinia. In contrast, Corsican Painted Frog is largely confined to pristine (mountain) brooks, although can occur near sea-level. Most populations are found between 300 m and 1,900 m. Habitats comprise flowing water, breeding in small stagnant pools near fast-flowing rivers or small streams, usually in forested, well-shaded areas. Both species coexist at several locations on Corsica.

BIOLOGY

Active during both day and night. By day, individuals may rest underneath rocks in streams or sit on the edge of waterbodies. When disturbed, they flee into the water and hide in mud or under rocks. Activity in hot summer months is usually substantially reduced, especially at low elevations. May hibernate at higher altitudes. Reproduction probably similar to other painted frog species. Eggs of Tyrrhenian Painted Frog may form dense mats in shallow water.

CALL

Like all painted frogs, Tyrrhenian Painted Frog produces fairly quiet, guttural grunting noises. The call of Corsican Painted Frog is remarkably different from that of all other *Discoglossus* species – short much more harmonic notes with longer pauses, somewhat resembling the call of the Fire-bellied Toad *Bombina bombina* or Yellow-bellied Toad *Bombina variegata*.

Tyrrhenian (left) and Corsican Painted Frog often coexist. S Corsica, France.

Fire-bellied Toads (Bombinatoridae)

Of the approximately ten species of fire-bellied toads, only two occur in Europe. All other members of the group can be found in E and SE Asia. The two species occurring in our area are characterised by their heart-shaped pupils and bright warning colour on the belly – which is red or orange in the Fire-bellied Toad *Bombina bombina* and yellow in the Yellow-bellied Toad *Bombina variegata*. Both species are largely diurnal. When disturbed, they may display an 'Unkenreflex' (originating from the German word 'Unke', the name given to these toads): the front feet are placed on the ground in front of the eyes while the hind leg 'ankles' are pointed upwards, revealing the bright colours of the underside.

While the Fire-bellied Toad is a typical inhabitant of larger, well-vegetated stagnant waterbodies in lowlands, Yellow-bellied Toad is mostly found in temporary stagnant or periodically flowing water in hilly or mountainous terrain. Despite these different habitat preferences, the two species hybridise over a sizeable area in C Europe.

Key to Fire-bellied Toads	
Hills and mountains of W, C and SE Europe, including peninsular Italy. Dark/grey underside with yellow patches; patches on limbs continuous with those on belly. Inner toes as well as toe-tips yellow.	Yellow-bellied Toad *Bombina variegata*
Lowlands of E Europe, ranging from E Denmark to Turkish Thrace. Dark underside with red patches and small white ring-shaped dots; patches on limbs not continuous with those on belly. Inner toes dark.	Fire-bellied Toad *Bombina bombina*
Where the ranges of the above species meet, throughout C and E Europe. Underside with orange patches resembling Yellow-bellied Toad or continuous orange patches running from the underside of the upper legs onto the pelvic area resembling Fire-bellied Toad. Mixture of large aposematic blotches and small white dots on the underside. Dark 'ring' on the base of the 1st toe.	hybrid Yellow-bellied × Fire-bellied Toad

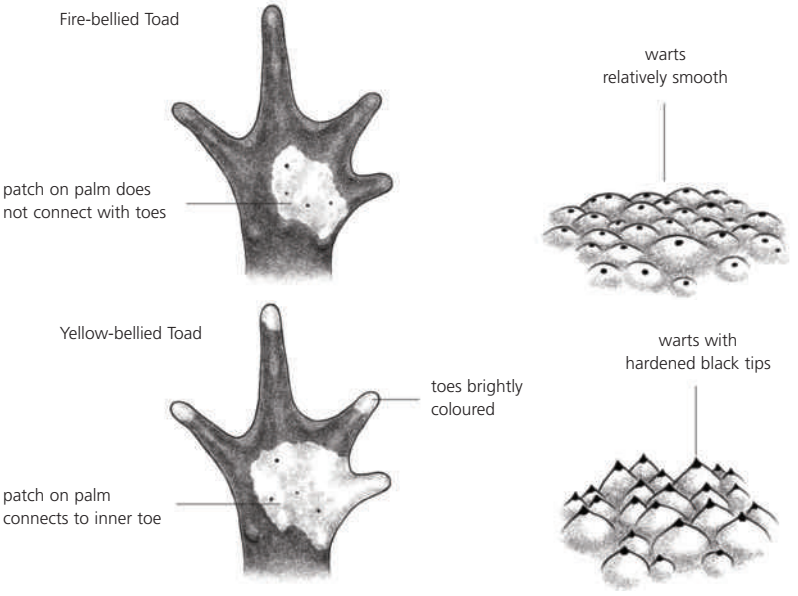
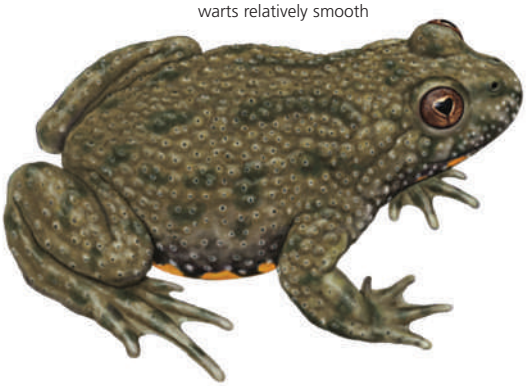
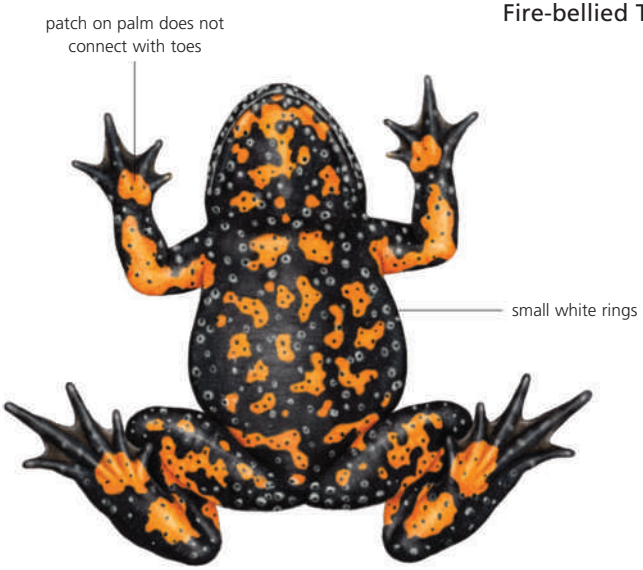


Fig. 13. Underside of front feet (left) and skin texture (right) of fire-bellied toads.

Fire-bellied Toad *Bombina bombina* (Linnaeus, 1761)



Fire-bellied Toad



DESCRIPTION

TL: 5 cm. Small toad. Head small, conspicuous eyes point upwards and often have heart-shaped pupils. Snout short and round. Body plump, oval-shaped. Extremities short. Moderate webbing between the toes of the hind feet. In comparison with Yellow-bellied Toad *Bombina variegata*, skin on back with relatively smooth warts. Back light brown to grey, sometimes greenish, often with sometimes rather inconspicuous large, round dark spots on back and legs. Underside may be yellowish but usually orange or red, interspersed with irregular black patches and often with small white ring-shaped dots. Toe-tips usually without bright coloration or at least not connected to central patch on underside of front feet.

DISTRIBUTION

Large parts of C, E and SE Europe. Isolated occurrences in Denmark and S Sweden represent its N limit. Southwards, similar isolated records are known from extreme

NE Greece as well as the Black Sea coast and W Turkish Thrace. Introduced locally to NE France (not mapped). Outside our area, ranges east into Russia and occurs in NW Anatolia, E of Istanbul.

VARIATION

The Fire-bellied Toad hybridises with the Yellow-bellied Toad in several areas in C Europe; hybrids display a mix of morphological characteristics from the parental species, including intermediate belly coloration.

HABITAT

Well-vegetated (often shallow) lakes, ponds, flooded fields, submerged woodlands and oxbow lakes. Occupied waterbodies are generally in sunny locations and may be (very) small and ephemeral. In contrast to Yellow-bellied Toad, predominantly a lowland species, reaching highest densities in plains. Has been found up to 730 m (Czech Republic).

BIOLOGY

Typically diurnal but may be equally active at night. May occur in high densities. Active from March to October while in S of range individuals may be active longer. Hibernates on land. Reproduction takes place between April and August. Males hold females in front of their hind legs. Females lay up to 300 eggs per season, in several small clutches attached to aquatic vegetation. Juveniles emerge on land during summer or autumn. Feeds on all sorts of small invertebrates. When molested, individuals may display the defensive so-called 'Unkenreflex'; the front feet are positioned in front of the eyes while the 'ankles' of the hind legs are pointed upwards, revealing the warning colour of the underside.

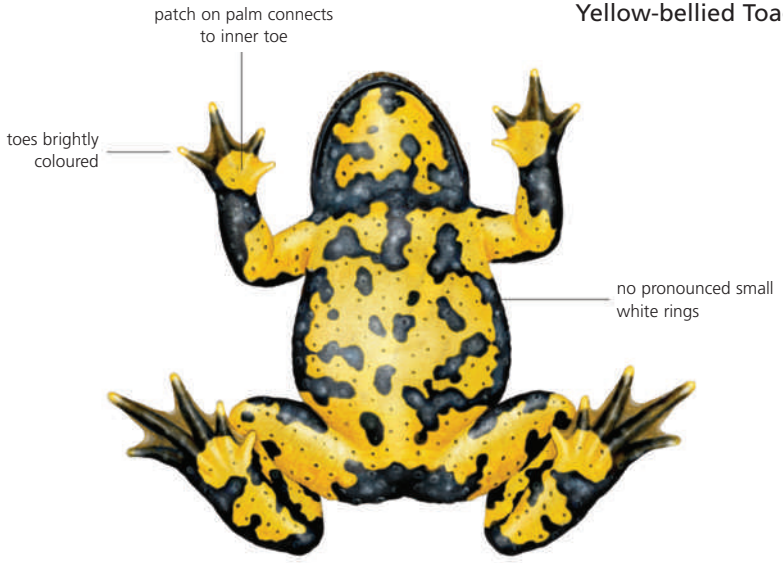
CALL

Single, soft, somewhat melancholic notes, less nasal than in Yellow-bellied Toad. Usually given while floating on water surface. Unlike other European frogs or toads, the call is produced when air is pressed from the vocal sacs into the lungs, and not in the opposite direction.

A green-backed and a normal coloured Fire-bellied Toad. Hortobágy, Hungary.

Yellow-bellied Toad *Bombina variegata* (Linnaeus, 1758)

Yellow-bellied Toad



DESCRIPTION

TL: 5 cm. Small, aquatic toad. Head small, with highly conspicuous eyes on top. Snout rounded, ending abruptly. Body plump, oval-shaped. Extremities short, especially the front legs. Moderate webbing between the toes of the hind feet. Back rough, scattered with warts, occasionally with hardened, black tips, colour light to dark brown or greyish. Underside yellow to light orange, with a pattern of irregular grey, bluish or black spots. In contrast to the related Fire-bellied Toad *Bombina bombina*, toes of front legs usually brightly coloured, bright coloration on underside of front feet connects to bright tip of inner toe, dorsal warts more pointed, and not pronounced, small white ring-shaped dots on belly.

DISTRIBUTION

W, C, E and SE Europe, including the Italian Peninsula (not present on Sicily). The E limit of its distribution is roughly the Carpathians.

VARIATION

B. v. variegata: W, C and E Europe, excluding peninsular Italy and S Balkans.
B. v. pachypus: Peninsular Italy. Previously treated as a separate species. While this subspecies is morphologically similar to the nominate, the yellow on the belly and legs is generally more extensive.
B. v. scabra: Balkan Peninsula southwards from extreme S Croatia, Bosnia and Herzegovina and Bulgaria. This subspecies is characterised by extensive grey and black coloration on the belly and the presence of warts with hard, black tips on the back.

Carpathian populations evolved separately at an earlier period than the previously mentioned subspecies, but are currently grouped with the nominate subspecies. The Yellow-bellied Toad hybridises with the Fire-bellied Toad in several areas in C Europe; hybrids display a mix of characteristics of the parental species.

HABITAT

Occurs mostly in temporary, sunny and disturbed habitats such as flooded wheel-ruts, cattle troughs, drainage ditches or quarries, but towards the south, becomes rather typical of small slow-flowing (mountain) streams or ponds. Characteristic pioneer of newly established or sparsely-vegetated waterbodies in hilly landscapes. Can occur up to 2,000 m in the southern part of its range.

BIOLOGY

Typical diurnal species, which can occur at high densities. Often spotted while floating on the water surface, sitting at the water's edge or hiding under objects. Active from March until October depending on local climate. Reproduction takes place throughout spring and summer, usually initiated by periods of rain. Individuals may travel up to 1 km between waterbodies during reproductive period. Males hold females in front of their hind legs. Females lay up to 170 eggs in clumps of up to 30 eggs. Egg-clumps are usually attached to submerged vegetation or branches. Juveniles typically metamorphose after one month and emerge during summer or autumn. Feeds on all sorts of small invertebrates. When disturbed, individuals

Pronounced hardened, black tubercles on the back are characteristic of the ssp. *scabra* of the Yellow-bellied Toad. Dadia Forest, Greece.

may display the so-called 'Unkenreflex'; the front feet are positioned in front of the eyes while the 'ankles' of the hind legs are pointed upwards, revealing the warning colours of the underside.

CALL

Single, somewhat nasal and melancholic notes; one second in length or less. Usually given while floating at the water surface.

NOTE

The Italian subspecies is listed as Endangered (and as a full species) in the 2009 IUCN Red List of European Amphibians.

Yellow-bellied Toad displaying 'Unkenreflex'. Etropole, Bulgaria.

Amplexus of the Yellow-bellied Toad, ssp. *pachypus*. Liguria, Italy.

Male quarrel in Yellow-bellied Toads. Carpathians, Romania.

Spadefoot Toads (Pelobatidae)

The Pelobatidae is a small family consisting of only five species, four of which occur in our area, while one is endemic to Morocco. Their common name refers to the presence of an enlarged, horned metatarsal tubercle which is used for burrowing. Additionally, vertical pupils and a stocky body-shape characterise all species. They occur in a wide variety of habitats, breeding in both deep, well-vegetated waters (Common Spadefoot Toad *Pelobates fuscus*) as well as temporary waterbodies (Western Spadefoot Toad *Pelobates cultripes*) or a combination of these (e.g. perhaps the most opportunistic species, the Eastern Spadefoot Toad *Pelobates syriacus*). Generally, all are confined to areas of loose soil in which they hide by burrowing, moving backwards using their hindlimbs. Spadefoot toads are strictly nocturnal, but display explosive breeding behaviour, at which time they may become active during daytime for a few days. Threat display includes inflating the body and producing loud mewing cries. The front legs of males are particularly swollen during the mating season. Spadefoot toads can extract moisture from the surrounding soil through the skin.

Key to Spadefoot Toads	
C, E and NE Europe; S to N Bulgaria, including Italian Po Plain. Metatarsal tubercle pale. Domed head. Hind feet fully webbed.	Common Spadefoot Toad *Pelobates fuscus*
NE and E Ukraine and the Crimean Peninsula.	Pallas's Spadefoot Toad *Pelobates vespertinus*
Iberian Peninsula, S France, isolated populations along French Atlantic coast. Metatarsal tubercle dark. Flat head. Hind feet fully webbed.	Western Spadefoot Toad *Pelobates cultripes*
SE Europe, northwards along the Black Sea coast and through Serbia. Metatarsal tubercle pale. Flat head. Hind feet fully webbed but highly indented.	Eastern Spadefoot Toad *Pelobates syriacus*

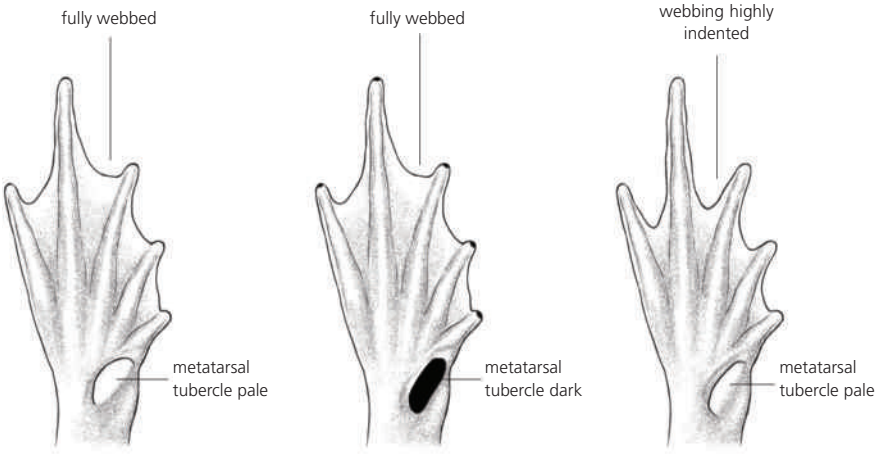


Fig. 14. Underside of hind feet of spadefoot toads.

Common Spadefoot Toad *Pelobates fuscus* (Laurenti, 1768)

Pallas's Spadefoot Toad *Pelobates vespertinus* (Pallas, 1771)

hind feet fully webbed

Common Spadefoot Toad

DESCRIPTION

TL: 8 cm. Medium-sized, plump-bodied toads with large, bulging eyes with vertical pupils. Head domed; snout round, pointing downwards. Skin loose and smooth. Hind feet fully webbed with large, pale metatarsal tubercle. Dorsal background colour highly variable, from yellowish, greyish or brownish to greenish or even reddish in extreme cases. Darker blotches on back often form four large longitudinal streaks which point towards head. Often with red dots on flanks and back, but more commonly in females than males. Males, especially in breeding season, with swollen lymphoid gland on upper front legs. Species should be identified by range, as they do not show morphological differences.

DISTRIBUTION

Common Spadefoot Toad: from S Sweden, Denmark, Germany, E Netherlands and NE Belgium towards extreme NE France. Isolated occurrences in N Italy (Po Valley) and C France. Also, large parts of E Europe including Hungary, NE Slovenia, Croatia and Serbia, extending as far as the Baltic States, Belarus and Ukraine (except E and Crimean Peninsula), S to N Bulgaria.

Pallas's Spadefoot Toad: In our area, NE and E Ukraine and the Crimean Peninsula. Also in Russia and Kazakhstan.

Common Spadefoot Toad

Pallas's Spadefoot Toad

The two species have a very narrow contact zone and restricted hybridisation in extreme NE Ukraine and the adjacent Kursk province, Russia.

VARIATION

The isolated N Italian subspecies *P. f. insubricus* has been revoked based on genetic data.

HABITAT

Mostly confined to flat, open lowland areas with loose soils such as dunes, open pinewoods, heathlands, river valleys and steppes. Also in man-made habitats such as quarries and agricultural areas, including fields of asparagus, corn or potatoes. Unlike other spadefoot toads *Pelobates* spp., seems to prefer breeding in quite deep, permanent waters, often nutrient-rich and with plentiful vegetation. Occurs up to 800 m.

BIOLOGY

Largely fossorial and almost exclusively nocturnal. During the day, hides in, for example, rodent burrows, mole heaps or under stones but mostly in self-excavated burrows about 10 cm deep. Most often encountered at night (usually after rain) near breeding waters. Disturbed individuals may smell faintly of garlic, make their body as compact as possible, inflate themselves or (more rarely) emit a distress call. Active from March to September. Reproduction usually lasts until late May. Males hold females in front of their hind legs. Females lay up to 3,400 eggs in a thick strand, up to 1 m long (but usually much shorter), wound around reeds, sticks or other vegetation. Juveniles emerge on land during summer but larvae may also hibernate and complete metamorphosis the following year. Fragmented populations in the NW of its range may consist of as few as 15–20 individuals. Feeds on a wide variety of invertebrates.

CALL

Like all spadefoot toads, a short series of short, fairly quiet croaking noises. Usually given from under the water, thus often hard to detect. Distress call is a surprisingly loud mewing sound, given with inflated body and gaping mouth.

Colour pattern variation in the Common Spadefoot Toad. Dobrudga, Romania.

Common Spadefoot Toad in amplexus. Drenthe, the Netherlands.

Western Spadefoot Toad

Pelobates cultripes

(Cuvier, 1829)

hind feet
fully webbed

Western Spadefoot Toad

DESCRIPTION

TL: 11 cm; our largest spadefoot toad species. Bulky with large bulging eyes and vertical pupils. Head not obviously domed. Skin loose and smooth. Hind feet webbed with large, black metatarsal tubercle. Dorsal background colour white, yellowish, greyish or olive-green, covered with pattern of darker, broken-up blotches and irregular spots, providing an overall spotted appearance. Pattern on lower head and legs usually more vague, giving a glazed appearance. Small, round warts may cover lower body, flanks and hind legs. No red spots on flanks and back. Belly and lower flanks pale, usually white. Males, especially in breeding season, with swollen lymphoid glands on upper front legs. Unlikely to be confused with any other species within its range.

DISTRIBUTION

Iberian Peninsula except much of north, although occurs in isolated populations along the W Galician coast. Distribution continues along French Mediterranean coast, somewhat following the Rhône Valley northwards. Isolated occurrences along the French Atlantic coast.

HABITAT

Like other spadefoot species, generally inhabits open, sandy areas such as open pinewoods, (coastal) dunes and agricultural areas characterised by loose soil. Also in more rocky areas interspersed with patches of sand, especially in the higher, C Spanish

part of its distribution. Usually breeds in clear and rather deep waters that are heavily vegetated, but also in temporary less-vegetated ponds, slow-flowing rivers and quarries. Occurs up to 1,800 m in C Spain.

BIOLOGY

Largely fossorial and almost exclusively nocturnal. Hides in rodent burrows, mole heaps or under stones but mostly in self-excavated burrows about 10 cm deep during the day. Most often encountered at night (usually after rain) near breeding waters. Disturbed individuals may make their body as compact as possible, inflate themselves or (more rarely) emit a distress call. Active throughout the year under optimal conditions, but generally hibernates in the north or aestivates in the south of its range.

Reproduction takes place between October and February in south of range, depending on winter rains. French populations breed in April or May. Males hold females in front of their hind legs. Females lay up to 3,400 eggs in a thick strand, up to 1 m long (but usually much shorter), wound around reeds, sticks or other vegetation. Juveniles emerge on land during summer but larvae may also hibernate and complete metamorphosis the following year. Feeds on a wide array of invertebrates.

CALL

Like all spadefoot toads, utters a short series of fairly quiet, short croaking noises. Usually given from under the water, thus often hard to detect. Distress call is a surprisingly loud mewing sound, produced with inflated body and gaping mouth.

ABOVE: Western Spadefoot Toad. Sagres, Portugal.

LEFT: Subadult Western Spadefoot Toad. Doñana, Spain.

Eastern Spadefoot Toad

Pelobates syriacus

Boettger, 1889

hind feet with indented webbing

Eastern Spadefoot Toad

DESCRIPTION

TL: up to 10 cm, but usually smaller. Medium-sized, plump-bodied toad with large eyes with vertical pupils and irregular medium to small darker blotches on its back. Head not clearly domed. Skin loose and very smooth. Hind feet webbed, but webbing highly indented. Metatarsal tubercle large and pale. Dorsal background colour white, greyish or yellowish. In contrast to Common Spadefoot Toad *Pelobates fuscus* dark blotches usually more scattered and broken up, often with a greenish tinge. Often small red dots on the flanks and lower back. Belly white. Males, especially in breeding season, with swollen lymphoid glands on upper front legs. When coexisting with Common Spadefoot, the Eastern Spadefoot Toad can be distinguished by partial webbing on the hind feet (versus more fully webbed) and a relatively flat head (versus clearly domed).

DISTRIBUTION

SE Europe, including E Serbia, Macedonia, S and E Romania, N, E and S Bulgaria and Turkish Thrace. In Greece present on N and NE mainland, Peloponnese and some islands including Limnos, Lesbos and Kos. Recently discovered in Albania. Overlaps with Common Spadefoot Toad in the Danube basin of Serbia, Romania, Bulgaria, and in Turkish Thrace. Tends to be less abundant towards the northern boundary of its range; uncommon at least in Serbia. Outside our area also found throughout Turkey, and in Israel, Lebanon, Syria and Iran.

VARIATION

Morphological and genetic evidence support several subspecies, two of which occur in our region.

P. s. syriacus: In our area, E Greek islands off the Turkish coast. Usually with a pattern of large, roundish spots.

P. s. balcanicus: Remainder of the range treated here, including Turkish Thrace. Generally characterised by smaller, more irregular spots in comparison to the nominate subspecies.

HABITAT

Usually in flat, open lowland areas with loose (sandy) soils, such as coastal dunes, estuaries, and river and lake shores, but also in areas with somewhat firmer substrates. Usually breeds in clear and rather deep waters with little vegetation. Breeding often takes place in temporary waters. Generally found up to 500 m, but somewhat isolated occurrence near the Prespes Lakes (where Greece, Albania and Macedonia border each other) up to about 800 m. Outside of our area up to 1,900 m in the Caucasus.

BIOLOGY

Largely fossorial and almost exclusively nocturnal, during the day hiding in rodent burrows or under stones but most likely in self-excavated burrows. Encountered at night (usually after rain) near breeding waters while migrating or foraging. Disturbed individuals inflate themselves or emit a distress call. Usually active from February until November with breeding taking place between February and April. Males hold females in front of their hind legs. Females lay up to 3,700 eggs in a thick strand, up to 1 m long, wound around reeds, sticks or other vegetation.

CALL

Like all spadefoot toads, a short series of fairly quiet, short croaking noises. Usually given from under the water, thus often hard to detect. Distress call is a surprisingly loud mewing sound, produced with inflated body and gaping mouth.

Large-blotched Eastern Spadefoot Toad of the nominate ssp. Limnos, Greece.

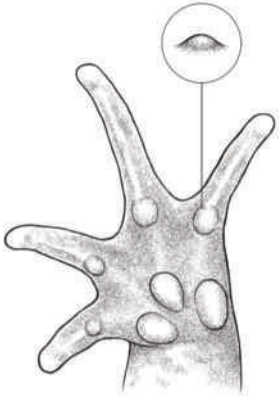
Eastern Spadefoot Toad burying itself in the soil. Alexandropouli, Greece.

■ Parsley Frogs (Pelodytidae)

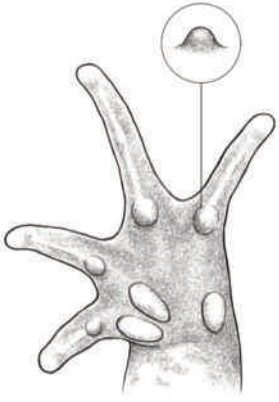
The parsley frogs are one of the smallest families of frogs and toads, comprising only three described species belonging to a single genus – two occur in Europe and the third is endemic to the Caucasus. Two additional undescribed candidate species occur on the Iberian Peninsula, which are distinguished by genetics, as well as size and advertisement call in at least one of the two. Parsley frogs are small and fairly secretive. Although all species can be active during the day in the breeding season, they are mostly nocturnal and often difficult to find, even while giving their advertisement calls, hidden in an upright position in the grass or other dense herbaceous, inundated vegetation. They readily breed in temporary or shallow waterbodies, but hide under stones or in cracks in the soil during the day and outside the breeding season. Aided by a belly skin texture not unlike that of tree frogs, they are quite good climbers.

Distinguishing the European species based on morphology is challenging, and range provides a more reliable identification.

Key to Parsley Frogs	
N, E and SE Spain, coastal S and W Portugal, W Europe and NW Italy. TL < 5 cm. Convex-shaped tubercles on underside of front feet. When folded forward, hind feet reach beyond the eye. This species includes at least 2 unnamed candidate species; see species text for more information.	Parsley Frog *Pelodytes punctatus*
Andalucia and Extremadura (Spain), SE Portugal. TL < 4 cm. Conical-shaped tubercles on underside of front feet. When folded forward, hind feet reach up to the eye.	Iberian Parsley Frog *Pelodytes ibericus*



Parsley Frog



Iberian Parsley Frog

Fig. 15. Underside of front feet of parsley frogs.

Parsley Frog *Pelodytes punctatus* (Daudin, 1802)
Iberian Parsley Frog *Pelodytes ibericus*
Sánchez-Herráiz, Barbadillo, Machordom & Sanchiz, 2000

long toes without real webbing

Parsley Frog

DESCRIPTION

TL: up to 5 cm (Parsley) or only 4 cm (Iberian Parsley). Small, slender frogs with vertical pupils (when seen in bright light). Head with rounded snout and bulging eyes. Eardrum small but usually visible. Multiple, discontinuous rows of elongated glandular warts on back. May show row of red warts on flanks. Limbs slender; toes long. Feet practically without webbing but hind toes lined with narrow fringe. Coloration often greyish, greenish or yellowish with distinct pattern of dark green spots. Amount of green may vary from virtually absent to covering the entire back. Limbs usually faintly barred. Underside whitish. Breeding males have horned dark-coloured growths on front feet, and chest and throat may be greyish or bluish. Distinguishing between both species based on external features is difficult, but some pointers have been mentioned: 1) when hind leg is folded forward, the heel reaches beyond the eye in Parsley Frog but only up to the eye in Iberian Parsley Frog; 2) underside of front feet have tubercles which are convex in Parsley Frog but conical in Iberian Parsley Frog; 3) in relation to its (smaller) body, Iberian Parsley Frog has a wider head and somewhat shorter snout.

DISTRIBUTION

Parsley Frog: Coastal S and W Portugal, NE and E Spain, southward to NE Andalucia and Murcia; France (except parts of N) and extreme NW Italy. Records from Belgium are unconfirmed and most likely erroneous. Iberian Parsley Frog: Andalucia and Extremadura (Spain) and SE and SC Portugal, nearly reaching the Atlantic coast south of Lisbon in the west and the western slopes of the Cazorla-Segura Massif in the east.

Parsley Frog
Iberian Parsley Frog

VARIATION

Recent research suggests two further candidate species within what is here considered as *P. punctatus* – one in Portugal and the other in Spain, with only Catalonia, France and extreme NW Italy still inhabited by 'true' *punctatus*.

HABITAT

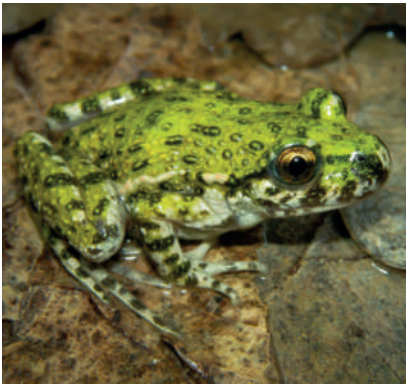
Often found near sunny, open waters – shallow or even temporary and often with abundant vegetation. These include ponds, pools in quarries, flooded agricultural land, ditches and slow-flowing streams. Sometimes occurs in brackish water or in man-made structures such as wells and cisterns. Prefers limestone or sandy soils. Both species occur up to almost 2,000 m in south of range.

BIOLOGY

Nocturnal and rather secretive species. Agile, able to jump great distances. Skilled climbers; can climb smooth surfaces and may be found climbing at night. During day typically found by turning objects such as rocks or trash near breeding waters. Disturbed individuals dive into the water and try to hide in the mud, giving the animal its scientific name (*Pelos* = dirt, *dytas* = diving). Active throughout the year in south of range with breeding starting in autumn and lasting until spring. In N of range hibernates from November until February and breeds from February to June. Under suitable conditions may have more than one reproductive period per year. Males call from a somewhat vertical position and may be exceptionally hard to spot in grassy vegetation. Males hold females in front of their hind legs. Females lay up to 1,600 eggs divided into several sausage-shaped clutches, wound around vertical sticks or grass stems with the hind legs. Each clutch contains up to 360 eggs and is about 20 cm long.

CALL

Short squeaking calls, neither loud nor musical. With some imagination, has been compared to squeaking of new shoes or of a cork coming out of a bottle. Often given from under the cover of vegetation and/or with body in vertical pose. May be confused with call of Corn Crake *Crex crex*.



ABOVE: Exceptionally green Parsley Frog from the La Brenne region, France.

LEFT: Iberian Parsley Frog from Cádiz, Spain.

True Toads (Bufonidae)

The true toads family contains nearly 600 species, occurring on all continents except Antarctica (but introduced in Australia). Five species occur in Europe, although the taxonomy of the European and Mediterranean true toads remains a topic of debate and ongoing research. The European true toads are generally opportunistic, occurring in a wide variety of habitats, and use an equally large variety of waterbodies for breeding. However, while the Common Toad often shows a preference for permanent, somewhat deeper waterbodies, the other species appear to be rather more resistant to arid conditions and also breed in shallow and temporary waters.

Key to True Toads	
Almost all of Europe except extreme N, Ireland, Balearics and Tyrrhenian Islands. Parallel or divergent parotoid glands. Paired tubercles on hind feet toes. No mid-dorsal stripe. Occasionally with dorsal and lateral red spots.	Common Toad *Bufo bufo* and Spiny Toad *Bufo spinosus*
SW, W, N and NE Europe. Parallel parotoid glands. Paired tubercles on hind feet toes. Usually with mid-dorsal stripe; occasionally dorsal and lateral red spots.	Natterjack Toad *Epidalea calamita*
Most of C and E Europe, including Italy, NE Sicily and the Balearics. Convergent parotoid glands. Tubercles on hind feet toes not paired. In areas where the previous species occurs close by, mid-dorsal stripe rare; often with lateral red spots.	Green Toad *Bufotes viridis*
Sicily except NE. Convergent parotoid glands. Tubercles on hind feet toes not paired. Quite often with mid-dorsal stripe; usually no lateral red spots.	African Green Toad *Bufotes boulengeri*

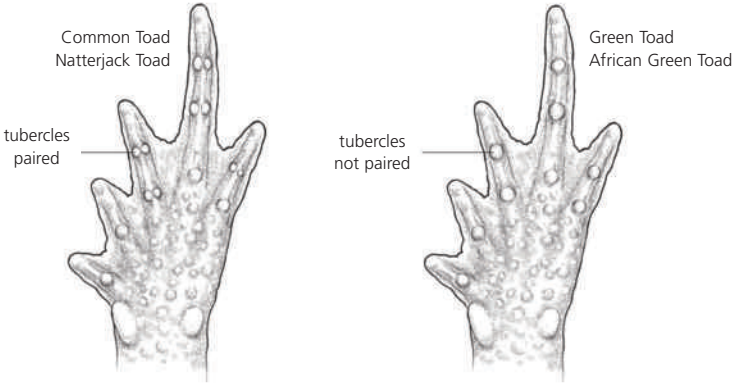


Fig. 16. Underside of front feet of true toads.

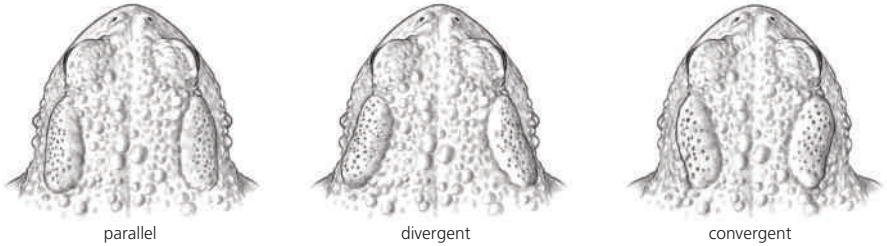


Fig. 17. Parotoid glands of true toads.

Common Toad
Spiny Toad

Bufo bufo (Linnaeus, 1758)
Bufo spinosus Daudin, 1803

Common Toad

both species highly variable in colour

Spiny Toad

DESCRIPTION

TL: up to 18 cm in S of range while up to 11 cm in N; largest European toads. Typical, bulky toads with warty skin. Eyes coloured copper to red, with horizontal pupils. Two large, parallel (Common) or divergent (Spiny) parotoid glands. Hind feet partially webbed; with paired tubercles at articulations of toes. Colour often homogeneous grey, brown or reddish but may also be yellowish or olivaceous-green; sometimes even blackish. Juveniles may be brick-red. Pattern often vaguely present, especially in Mediterranean areas, and consists of many red, white or darker spots and blotches which may form reticulated pattern. Belly often pale with vague marbled pattern. Females larger than males. Males also somewhat more slender, with bulkier front legs and black nuptial pads on inner thumbs during breeding season. No

Common Toad
Spiny Toad

external vocal sac. Metatarsal tubercle small and round in Common Toad, while large and narrow in Spiny Toad.

DISTRIBUTION

The species group occupies almost all of Europe, being only absent from Ireland, some parts of Scandinavia and most Mediterranean islands (except Sicily and a few Greek islands, e.g. Corfu, Thasos, Samos).
Common Toad: Europe except the SW. Outside our area also in W Anatolia, extreme NW and NE Kazakhstan and far into Russia.
Spiny Toad: Smaller range than previously thought – not the entire Mediterranean area but only Iberian Peninsula, S, W and C France, and the island of Jersey (UK). Boundary between the two taxa runs from NW to SE through France, with Spiny Toad occurring as far north as Normandy in the west, and in contrast to Common Toad reaches as far as the extreme SE French Mediterranean coast in the west. Narrow zone of overlap east of Caen. Also in NW Africa.

VARIATION

Northern individuals often smaller, more uniform in colour and warts rather smooth. In S of range, individuals grow larger, more vivid in colour and often have spiny warts, giving an overall rougher appearance. Parotoid glands of large Common Toads from the S Balkan Peninsula might appear divergent, similar to Spiny Toad.

HABITAT

Found in a very wide array of habitats, varying from fairly dry maquis, steppes or dunes to humid marshes, forests or alpine meadows. Not uncommon near human habitation and frequently inhabits gardens, city parks and ponds. Breeding occurs in an equally wide array of places but somewhat larger, deep waters with plenty of sun are preferred, such as large ponds, lakeshores, stagnant parts of rivers or river floodplains. Mediterranean populations regularly breed in slow-flowing parts of streams. May occur up to 2,600 m in S Spain.

BIOLOGY

Terrestrial, nocturnal toad, hiding by day underneath leaf litter, rocks or logs and frequently uses same shelter for long periods. Can walk slowly but hops when disturbed. Mass breeding occurs in early spring, especially in N of range, and animals start to move directly to breeding waters shortly after hibernation. Routes of travel may cross roads, resulting in high mortality. Females are more secretive than males during breeding season. Males grasp every moving object, potentially leading to pairing with other frogs or toads, or even newts, salamanders or fish. Males hold females in a firm grip behind their front legs, kicking at other approaching males with their hind legs. Sometimes several males may grab the same female, occasionally causing the female's death. Females lay two simultaneous egg-strands up to 5 m long and containing up to 8,000 eggs. Feeds opportunistically on all sorts of invertebrate prey, apparently more attracted by pale, elongated objects and beetles. Like many amphibians, may eat its own shed skin after moulting. May raise and inflate body and stretch legs when facing a predator. Apparent toxicity seems to deter many predators. In contrast to, for example, Common Frog *Rana temporaria*, their eggs also appear less palatable, and are eaten far less readily by fish or newts. Larvae may form huge shoals moving in the same direction.

CALL

Relatively high-pitched squeaking sounds, not very loud. Somewhat resembles some of the sounds made by Eurasian Coot *Fulica atra*. Males may give a similar-sounding distress call when handled.

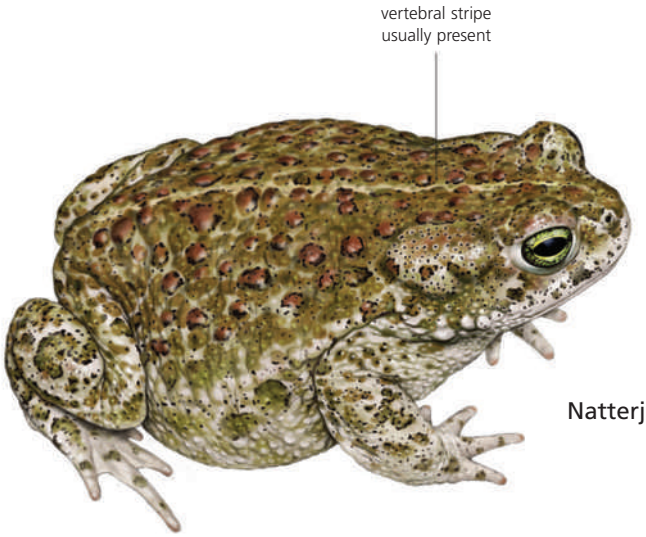
NOTE

Individuals with distinctly damaged, gaping nostrils can be found active during the day. These have been preyed on by a parasitic fly *Lucilia bufonivora*, whose larvae eat the mucous tissue from the nasal cavity and later also the flesh, resulting in mortality.

Common Toad in amplexus. North Holland, the Netherlands.

Spiny Toad. PN Alcornocales, Spain.

Natterjack Toad *Epidalea calamita* (Laurenti, 1768)



Natterjack Toad

DESCRIPTION

TL: 10 cm. Typical, medium-sized toad with warty skin. Eyes greenish or yellowish with horizontal pupil. Two large, parallel or posteriorly converging parotoids. Limbs rather short. Hind feet partially webbed; feet with paired tubercles at joints of toes. Pale brown, grey, yellowish or whitish often with pattern of large green blotches sometimes fused into marbled pattern. Often with red or orange spots across flanks and back. Bright, often yellow, vertebral stripe usually present. Uniformly coloured individuals are rather rare. Below white or greyish. Large single external vocal sac under chin visible in calling males; when not inflated, visible as bluish tinge on chin, while females have pale chins. Furthermore, males are smaller than females, more slender, with bulkier front legs and black nuptial pads on the inner thumbs during the breeding season.

DISTRIBUTION

Iberian Peninsula, France, Belgium, the Netherlands, Luxembourg, Germany, Denmark, extreme S Sweden, N Switzerland, Czech Republic, extreme NW Slovakia. Northwards across Poland and the Baltic states as far north as Estonia. Two very restricted areas in Austria and several isolated populations in the UK and Ireland.

VARIATION

Individuals from S of range usually larger, with more prominent pattern of green blotches on the back and often lacking pale dorsal line.

HABITAT

Especially in N of range, strongly associated with warm, open sandy areas that are often

Calling Natterjack Toad. North Holland, the Netherlands.

Natterjack Toads from southern parts of the range may be particularly colourful, sometimes reminiscent of green toads *Bufotes* spp. Sagres, Portugal.

fairly dry and have loose soil. These include sandy floodplains, riverbanks, inland and coastal dunes, heathland and even beaches. Also near human habitation, living in agricultural areas, quarries and on building sites. In south, occupies a wider range of habitats. In S Sweden inhabits rocky islands with no loose soil at all. Breeding usually takes place in shallow, temporary waters with little or no vegetation, such as flooded plains, temporary pools, ponds and ditches. Typically a lowland species but may occur up to 2,400 m in Spain.

BIOLOGY

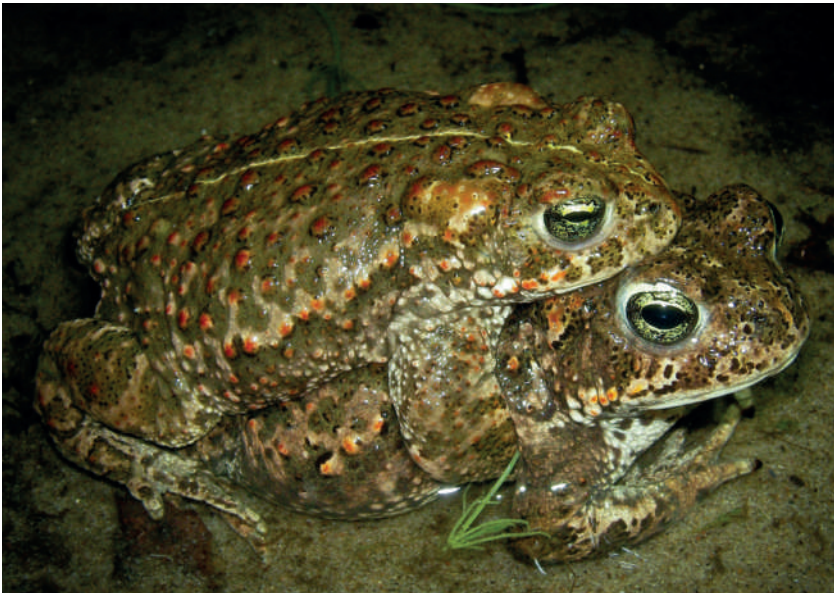
A typical pioneer species that may migrate for long distances and can occupy new habitat relatively quickly. Instead of walking or hopping, this toad may run for short distances, somewhat like a mouse. Strictly nocturnal, although males may call during warm, humid days in the breeding season. Freshly metamorphosed juveniles are also active by day. Adults usually hide by day in rodent burrows, self-excavated burrows or underneath objects such as logs and stones. May be active throughout the year in south of range and breeding starts with the first rains. In north of range hibernates on land between October and February, and breeding typically starts around April. This opportunistic breeder may breed several times throughout the warmer parts of the year, often initiated by rain. Males grab females behind their front legs. Females lay two egg-strands up to 2 m long and containing up to 7,500 eggs, typically laid on aquatic vegetation or on the bottom of the waterbody. Juveniles may complete metamorphosis within a month and can be seen clustering together to retain moisture.

CALL

Long, tonal, rattling and (very) loud. More metallic than Green Toad *Bufotes viridis*. Not likely to be confused with any other animal sound, but has been compared with the sounds of European Mole Cricket *Gryllotalpa gryllotalpa*, other crickets and Europaen Nightjar *Caprimulgus europaeus*. Given with raised front legs in shallow water.

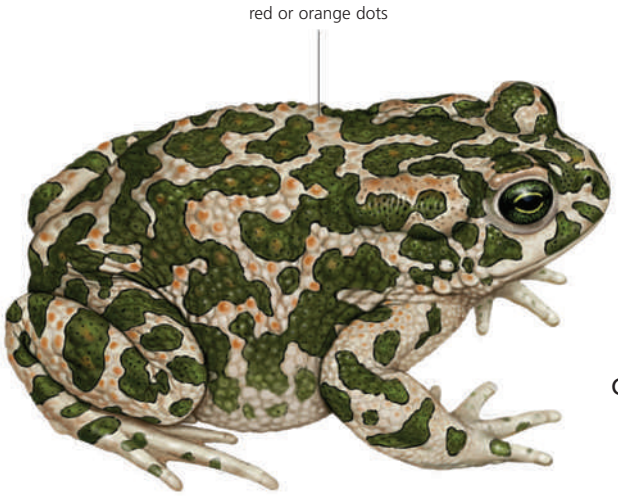
NOTE

Recent studies suggest the need for a split of the genus *Bufo*, with this species renamed as *Epidalea calamita*.



Natterjack Toad in amplexus. North Holland, the Netherlands.

Green Toad *Bufotes viridis* (Laurenti, 1768)
African Green Toad *Bufotes boulengeri* (Lataste, 1879)



Green Toad

African Green Toad

DESCRIPTION

TL: 10 cm. Typical, medium-sized toad with warty skin. Eyes greenish or yellowish with horizontal pupil. Two large, parallel or posteriorly converging parotoid glands. Sturdy hind legs; hind feet webbed and with single tubercles at joints of toes. Large single external vocal sac under chin, visible in calling males. When not inflated, visible as a bluish tinge on chin; females have pale chins. Males smaller than females, more slender, with bulkier front legs and black nuptial pads on inner thumbs during breeding season. Above whitish, greenish, pale grey, or yellowish to red (often darker in African Green Toad), with well-defined green patches. Patches with dark edges in females, but can consist of a blurry pattern of spots in males, sometimes giving a uniformly coloured appearance; female pattern generally more contrasting and attractive. Markings are often combined with brownish or reddish tones and small red or orange dots across upperparts, but especially on flanks in Green Toad, while African Green Toad usually lacks the latter.

Green Toad
African Green Toad

Vertebral pale stripe usually (but not always) absent in Green Toad, but common in African Green Toad.

DISTRIBUTION

Green Toad is widespread throughout C Asia, E Europe and the Balkans, including Greece and many Greek islands where it is often the only amphibian present. Also Denmark, S Sweden, Germany, Austria, extreme NE France, Italy, Tyrrhenian Islands, the Balearics and extreme NE Sicily. The remainder of Sicily is occupied by the African Green Toad, which also occurs on Ustica, the Aegadian Islands, and in N Africa. The two species have a narrow hybrid zone east of Mount Etna.

VARIATION

Some authors consider three additional species within this species complex, which we treat as subspecies here due to lack of study of contact zones and no comprehensive molecular data.

B. (v.) viridis: C-E Europe including NE Italy north of Po River and east of Lake Garda. Ranges to E Ukraine and south to Peloponnese and Crete. Seems to be replaced and (co)exist irregularly with *B. (v.) variabilis* throughout its European range.

B. (v.) balearicus: NW and peninsular Italy. Also on Tyrrhenian Islands and the Balearics. Insular occurrences (Balearics, Tyrrhenian Islands) probably at least partially due to introduction by humans. Interbreeds with *B. (v.) viridis* SE of Lake Garda along the Po River, and with *B. (b.) siculus* E of Mount Etna.

B. (v.) variabilis: In our area at least in N Germany and Denmark; also on Corfu and Peloponnese. Dominant taxon in Turkey, Middle East and the Caucasus. Might occur much more widely in E Europe.

B. (b.) siculus: In view of current knowledge, the Sicilian populations are best treated as a subspecies of *B. boulengeri*.

HABITAT

Preference for warm, arid lowland regions, often on sandy soils such as steppes, riverbanks, maquis, inland and coastal dunes and even beaches. Also occurs in meadows up to 2,400 m in S of range, man-made structures such as quarries and agricultural land, in towns and villages and open woods. Breeding takes place in temporary, shallow waters such as flooded fields, small ponds and ditches or stagnant parts of larger rivers and streams. Very tolerant of salinity and pollution.

Green Toad, (sub)species *balearicus*, in amplexus. Sardinia, Italy.

BIOLOGY

Terrestrial and nocturnal, spends daytime in self-excavated or rodent burrows, or underneath objects such as logs and rocks. May be seen foraging under streetlights for insects that are attracted to the light. Males may call during warm, humid days in the breeding season, and freshly metamorphosed juveniles are also active by day. Under dry conditions individuals replenish their lost water supplies by sitting in shallow puddles at night. May be active throughout the year in south of range where breeding typically takes place during the wet winter months. Hibernates from October until March in north of range where breeding starts in April, extending into summer. Males hold females behind their front legs. Females lay egg-strands up to 4 m long and containing up to 15,000 eggs, typically on aquatic vegetation or on the water bottom. Eggs are arranged in 2–3 rows.

CALL

Long to very long (over a minute), rattling and loud. Softer, more musical than Natterjack Toad *Epidalea calamita*. Has been compared with the sounds of European Mole Cricket *Gryllotalpa gryllotalpa*, other crickets and European Nightjar *Caprimulgus europaeus*. Often given with stretched front legs in shallow water.

NOTE

The split between *viridis* and *boulengeri* was in fact described as a split between *balearicus* and *boulengeri*. However, the split between *viridis* and *balearicus* on one hand and *boulengeri* and *siculus* on the other requires further substantiation.

Recent studies suggest the need for a split of the genus *Bufo*, with this species complex assigned to *Bufotes*, a name that has priority over the also attributed genus name *Pseudepidalea*.

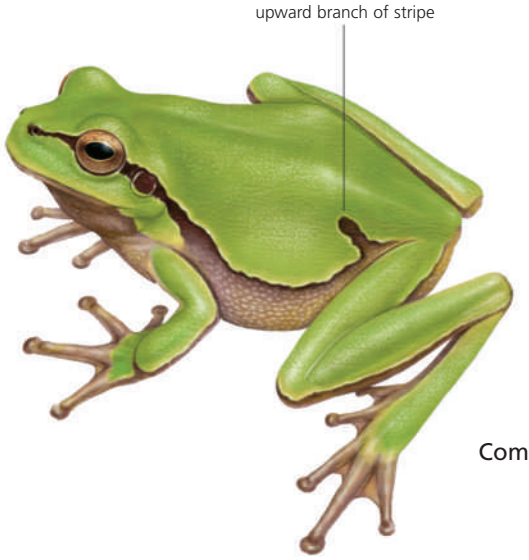
■ Tree Frogs (Hylidae)

The tree frog family includes nearly 1,000 species, which are mainly found in tropical Latin America, but also in Asia and Europe. Within our area, only the genus *Hyla* occurs, with six species. These European tree frogs look much alike, and are characterised by their usually uniform bright green colour, smooth skin and enlarged toe-pads used for climbing. All species prefer sunny, well-vegetated waterbodies for breeding. The Tyrrhenian Tree Frog *Hyla sarda* is an exception to these rules, and often shows a spotted dorsal pattern and even breeds in mountain streams. Tree frogs generally bask in the sun on high shrub vegetation during the day, while males give their loud calls at night, during their relatively long breeding season.

Due to the similar appearance and advertisement calls of most species, they are best identified by range. Individuals from the contact zones of Common Tree Frog *Hyla arborea* and Eastern Tree Frog *Hyla orientalis* in Poland and the Common Tree Frog and Italian Tree Frog *Hyla intermedia* in NE Italy can only be identified with certainty by molecular analysis.

Key to Tree Frogs	
W, C and SE Europe W of the Carpathians and Rhodopes, in Poland W of Vistula River. Dark lateral stripe present. Eardrum is half of eye diameter or less.	Common Tree Frog *Hyla arborea*
NE and SE Europe E of the Carpathians and Rhodopes, in Poland E of Vistula River. Dark lateral stripe present. Eardrum is half of eye diameter or less.	Eastern Tree Frog *Hyla orientalis*
N, W and C Iberian Peninsula, SW France. Dark lateral stripe present and is usually very distinct. Eardrum is half of eye diameter or less.	Iberian Tree Frog *Hyla molleri*
Italy except extreme NE, Swiss lowlands S of the Alps (Ticino). Dark lateral stripe present. Eardrum is greater than half of eye diameter.	Italian Tree Frog *Hyla intermedia*
S Iberia, NE Spain, S France and NW Italy. Dark lateral stripe usually absent. Eardrum is half of eye diameter.	Stripeless Tree Frog *Hyla meridionalis*
Tyrrhenian Islands including Elba and Capraia. Dark lateral stripe present. Eardrum is half of eye diameter or less.	Tyrrhenian Tree Frog *Hyla sarda*

Common Tree Frog *Hyla arborea* (Linnaeus, 1758)
Italian Tree Frog *Hyla intermedia* Boulenger, 1882
Iberian Tree Frog *Hyla molleri* Bedriaga, 1889
Eastern Tree Frog *Hyla orientalis* Bedriaga, 1890



Common Tree Frog

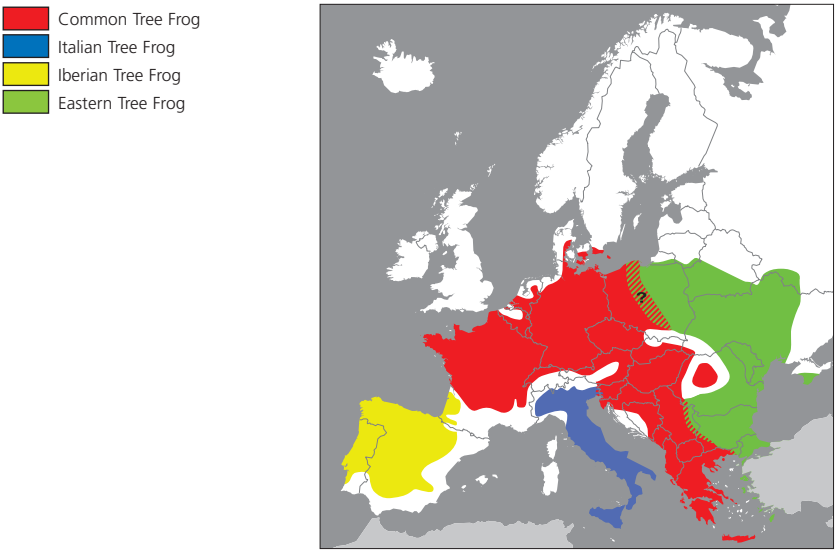
DESCRIPTION

TL: 5 cm, females usually larger than males. A complex of small tree frog species all of which are highly similar in appearance. Distinguishing diagnostic features are few and of limited practical value. Eardrum size is supposedly half of the eye diameter or less in all species except the Italian Tree Frog, in which the eardrum measures more than half the eye diameter. Dorsal skin smooth, ventral skin somewhat granular. Limbs and toes long, toes ending in round adhesive pads. Nearly always a characteristic dark stripe running from the nostril, across the eyes and the eardrum towards the flanks and loins, often with pale or white margins. Upward branch of stripe in front of hindlimbs, pointing forward. Colour usually bright green but may vary between individuals or even time of day, and may be grey, brown or yellow. White or greyish below. When deflated, the large (but smaller than in Stripeless Tree Frog *Hyla meridionalis*) single vocal sac of the males forms longitudinal folds. Two additional features are often given to distinguish the species in this complex, but appear to be of more doubtful general validity: 1) in Italian Tree Frog, stripe between nostril and eye often absent or very small, narrow between eye and eardrum (which is often only partially covered); and 2) vocal sac greenish-yellow in Italian Tree Frog, while more orange-tinged in Common and Eastern Tree Frogs.

Species best distinguished by range. Contact zones are poorly resolved. In particular, this is the case for contact between Common and Eastern Tree Frogs in C and SC Poland, SW Romania and extreme NE Greece, between Common and Italian Tree Frogs in NE Italy (around the Isonzo River), and between Common and Iberian Tree Frogs in French Aquitaine.

DISTRIBUTION

Common Tree Frog: Widespread across NW, C and SE Europe. Ranges throughout



most of France except S, reaching Italy only in Trieste and the Tarvisio area. Distribution continuous southwards across C Poland (Vistula River) and the Pannonian Plain east to the Carpathian Mountains, following the E Adriatic coast and most of Greece including the Ionian Islands and Crete. Introduced to several places outside its native range, e.g. the Netherlands (not mapped).
Italian Tree Frog: Italy, including Sicily; S Swiss lowlands (of Ticino).
Iberian Tree Frog: Iberian Peninsula except most of S and E, and SW France.
Eastern Tree Frog: Easternmost European lowlands, E of the Carpathian Mountains, southwards to Turkish Thrace. Also S Crimea and several Greek islands close to Turkey (e.g. Lesbos, Rhodes, Samos). To the NW, up to the Baltic Sea through C Poland. Also in the Caucasus, most of Anatolia and N Iran.

VARIATION

No subspecies recognised, although Italian Tree Frogs from the Po Plain and Switzerland

Calling male Eastern Tree Frog. Carpathians, Romania.

show genetic divergence from southern conspecifics, but there are no visible characters that might warrant subspecies status.

HABITAT

A large variety of breeding waters are used. Sunny, fish-free, well-vegetated waters are preferred, including stagnant parts of rivers, marshes, well-vegetated parts of lakes and even ponds in quarries, former swimming pools, etc. Terrestrial habitat usually equally sunny, often consisting of bramble bushes, reedbeds, hedgerows or meadows with abundant herbaceous vegetation. May climb up to 10 m in trees but usually found lower. Southern species can occur at over 2,000 m above sea-level.

BIOLOGY

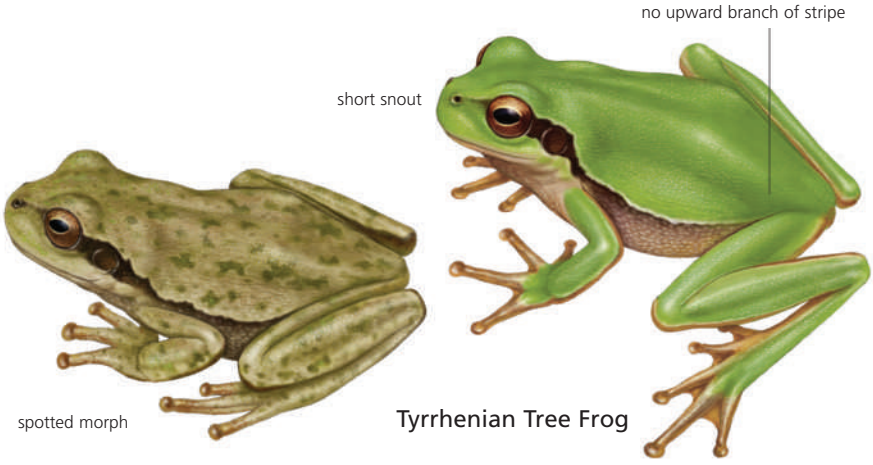
Fairly nocturnal species, but may be active by day in warm, humid conditions or at high altitude. May display decreased activity during clear, moonlit nights, as opposed to dark, cloudy nights. Spends the day resting, even basking (if not too hot), on leaves, reeds or twigs with feet folded underneath body. Males call especially during the breeding season but a second peak of calling activity may be heard in autumn. Colour may vary, depending on temperature or time of day, turning dark when colder. Active throughout the year in S of range, where individuals generally breed during the wet winter months. Northwards or at high altitudes active between March and November, with breeding taking place from April to June. During reproduction, males hold the females behind their front legs. Females produce up to 50 small egg-clumps per night, each clump consisting of up to 100 eggs, usually fewer. Females may lay up to 1,400 eggs in total in a season. The clumps are walnut-sized and attached to reeds or aquatic vegetation. The freshly metamorphosed juveniles emerge during summer. Feeds on all sorts of invertebrates.

CALL

Consists of a rather fast series of high-pitched, sharp metallic croaks, less than a second apart. Loud – may carry as far as 1 km or even further. May be given while floating or sitting on water's edge, but also from high up in vegetation. Calling may be triggered by a loud noise such as a low flying plane, hand-clapping or someone imitating the sound.

Calling Iberian Tree Frog. Galicia, Spain.

Tyrrhenian Tree Frog *Hyla sarda* (de Betta, 1853)



DESCRIPTION

TL: 5 cm, usually smaller; smallest tree frog species in Europe. Very variable pattern which may alter in response to surroundings and weather. Short snout ends abruptly. Skin generally more granular, legs shorter and head broader compared to other tree frog species. Lateral stripe often poorly developed, especially posteriorly, mostly vague between nostril and eye and lacking upward branch near hindlimbs. Colour varies widely; generally bright green but may also be brown, grey or yellow and often with darker spots on back. Underside white, throat in males brown or yellowish. Easily identified by range.

DISTRIBUTION

Endemic to the Tyrrhenian region, found on both Corsica and Sardinia as well as the larger surrounding islands such as Caprera, La Maddalena, San Pietro and Cavallo. Closer to the Italian mainland, occurs in the Tuscan Archipelago on Elba and Capraia.

HABITAT

Tolerant, generalist species. Often found perching on vegetation or in rock crevices near pools, ponds and slow- to fast-flowing streams. Also frequently found in cisterns, wells and springs. Usually confined to lowlands but may occur above 1,700 m in Corsica.

BIOLOGY

Mainly nocturnal but may be active by day under humid circumstances or in the breeding season. Active all year round in suitable conditions, e.g. at lower altitude. One of the most common amphibian species in its range – during the breeding season calling males can be heard practically everywhere at low and medium altitudes. May be found within 500 m of any water source. Calling males may be heard throughout the year, but breeding generally occurs from March to July. Metamorphosed juveniles can be found from July onwards.

Tyrrhenian Tree Frog. Sardinia, Italy.

CALL

Consists of a rather fast series of high-pitched, sharp metallic croaks, less than a second apart. Loud – may carry as far as 1 km or even further. May be given while floating or sitting at the edge of the water, but also from high up in vegetation.

Stripeless Tree Frog *Hyla meridionalis* Boettger, 1874

Stripeless Tree Frog

DESCRIPTION

TL: 6.5 cm, slightly larger than other European *Hyla* tree frog species. Typical tree frog with somewhat elongated appearance, females usually larger than males. Eardrum half the size of the eye diameter. Dorsal skin smooth, ventral skin somewhat granular. Hindlimbs and feet longer than in other tree frogs; lower leg longer than thigh. Tips of toes expanded into adhesive pads, as in other *Hyla* spp. Dark lateral stripe usually only from nostril to shoulder. If stripe also present on flanks, often broad, with less sharp edge and lacking upward pointing posterior branch. Stripe between nostril and eye may be (partially) absent as well.

Upperparts uniform bright green, occasionally with darker spots, but coloration may vary depending on environmental circumstances, and is sometimes brownish or even uniformly light blue. White below. Males have a single yellowish vocal sac, larger than in the other tree frog species. When deflated, the sac forms longitudinal folds. Usually best distinguished from Iberian Tree Frog, with which it may occur at a few sites in C Iberia, NE Basque Country and extreme SW France, by absence of the dark lateral stripe.

DISTRIBUTION

Two disjunct areas. The first comprises S Iberian Peninsula, S of the Sistema Central apart from an area in SE Salamanca province. The second area includes NE Spain, S France and NW Italy. Also on Menorca, the Canary Islands and in NW Africa. Molecular research showed that its presence within Europe is likely the result of multiple historical human-induced introductions from N Africa, seemingly explaining the discontinuous distribution of the species.

HABITAT

Mostly confined to lowlands but may occur up to 1,250 m in S Spain. Tolerates higher temperatures than related species. A large variety of waterbodies are used for breeding, such as flooded meadows, ponds, ditches and well-vegetated parts of swamps and lakes. Tends to be slightly more opportunistic than other mainland European *Hyla* tree frog species. Also tolerates poor water quality. Terrestrial habitat is similar to that of other tree frog species.

BIOLOGY

May be active throughout the year, although not very conspicuous and less readily encountered in winter. During the day basks on vegetation with limbs folded underneath body. It is less easily disturbed while calling than its congeners. Breeding starts in December in S of range or April in N of range. Males hold females above the front legs. Females lay up to 60 egg-clumps each containing up to 30 eggs. Egg-clumps are attached to aquatic vegetation.

CALL

Unmistakably different from other European tree frog species. A single, rather low-pitched rasping sound, lasting for about 1 second or less. May be given while floating or sitting at the water's edge, but also from high up in vegetation.

Calling male Stripeless Tree Frog. Andalucia, Spain.

True Frogs (Ranidae)

The family Ranidae consists of approximately 350 species which are distributed across the globe, apart for southern S America and most of Australia. Within Europe and the Mediterranean Basin two genera occur – *Rana* and *Pelophylax*, better known as brown frogs and water frogs. Both groups may be hard to tell apart with lack of experience. Water frogs may be brown, but brown frogs are almost never green.

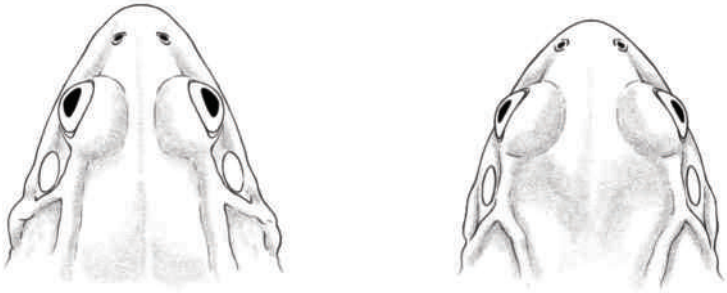
Key to True Frogs	
Dark stripe present running from the nostrils to the similarly coloured temporal area. Brown, yellow, red or dark dorsal coloration; never with green vertebral stripe. No external vocal sacs in males.	Brown frogs *Rana* spp. (p. 166)
Temporal area similar colour to back (but may be darker coloured in juveniles). Distance between the eyes small. Eyes on top of head as an adaptation to more aquatic lifestyle. Usually green coloured, otherwise often with yellow or green mid-dorsal stripe. External vocal sacs in males.	Water frogs *Pelophylax* spp. (p. 179)

Brown Frogs *Rana* species

The genus *Rana* comprises approximately 50 species, which are distributed throughout the temperate regions of North America, Europe and Asia. Eight species occur in the area covered by this field guide. In general, brown frogs occupy cool, largely shaded habitats and waterbodies, especially when compared with the more sun-loving water frogs (*Pelophylax*). Some commonly occur in more open habitats such as moors or above the tree line. Brown frogs are often the first amphibians to breed in spring, occasionally becoming active when patches of snow are still present around their breeding habitat. Communal egg-laying by several females in warm sections of waterbodies is a common phenomenon. While Common Frog *Rana temporaria*, Moor Frog *Rana arvalis*, Agile Frog *Rana dalmatina* and Italian Agile Frog *Rana latastei* generally reproduce in stagnant or slow-flowing waters where they deposit large egg-masses; all other species usually reproduce in streams where they attach small egg-clumps to rocks or branches underwater.

Special caution should be taken when identifying brown frogs in Navarra (Spain) where long-legged Agile Frogs, Common Frogs and Iberian Stream Frogs locally coexist. Similar situations have been described from C-E Europe where the Agile Frog, Common Frog and long-legged Moor Frogs *Rana arvalis wolterstorffi* may occur together.

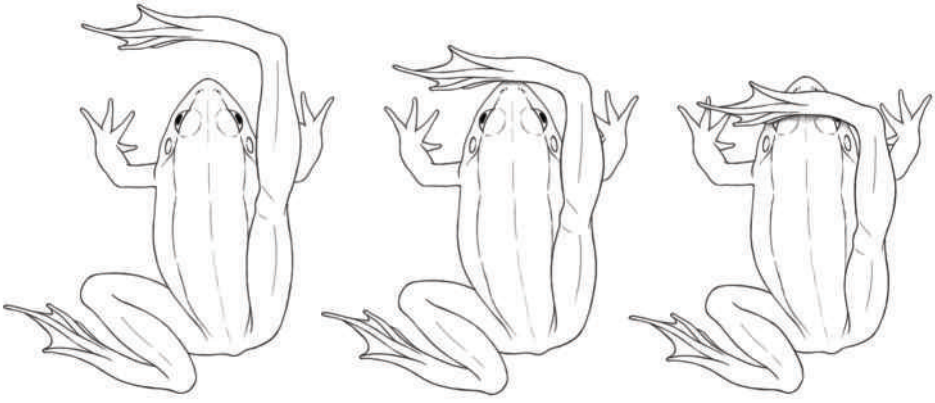
Male Common Frog mistaking a Fire Salamander for a female of his own species. Belgium.



small distance between eyes
Water frogs *Pelophylax* spp.

bigger distance between eyes
Brown frogs *Rana* spp.

Fig. 18. Head types of true frogs.

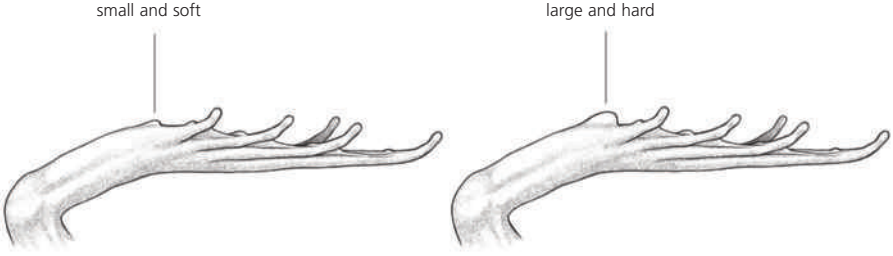


heel extends beyond snout

heel reaches snout

heel does not reach snout

Fig. 19. Checking leg lengths of frogs.



Common Frog

Moor Frog

Fig. 20. Metatarsal tubercles of brown frogs.

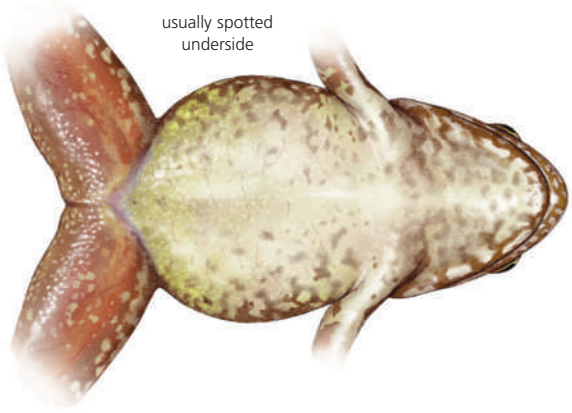
Key to Brown Frogs			
1	a	When legs stretched forward, heel reaches up to the eyes.	2
	b	When legs stretched forward, heel reaches up to the snout.	3
	c	When legs stretched forward, heel reaches beyond the snout.	4
2	a	Most of Europe incl. Pyrenees (but not Iberian Peninsula), N Apennines and Dinaric Alps. Snout short and blunt. Metatarsal tubercle small and soft. Eardrum diameter 3/4 or same as that of the eye.	Common Frog *Rana temporaria temporaria*
	b	N, NW Europe (excluding the British Isles and most of France). Small, plump frog. Snout short and pointed. Metatarsal tubercle large and hard. Eardrum diameter 2/3 that of the eye. Often with light mid-dorsal stripe.	Moor Frog *Rana arvalis arvalis*
3	a	C and W Pyrenees only. Small frog. Snout short and blunt. Eardrum highly inconspicuous. Hind feet fully webbed.	Pyrenean Stream Frog *Rana pyrenaica*
	b	N Iberian Peninsula, not in Pyrenees. Snout short, blunt. Eardrum diameter 3/4 or same as that of the eye. Hind feet partially webbed.	Iberian Common Frog *Rana temporaria parvipalmata*
	c	C E Europe. Small to medium-sized, plump frog. Snout short and pointed. Eardrum diameter 2/3 that of the eye. Often with light mid-dorsal stripe.	Moor Frog *Rana arvalis wolterstorffi*
4	a	Eardrum diameter same size or slightly larger than that of the eye. Snout relatively long, pointed. Underside light, generally uniform apart from occasional tiny spots on sides of the throat. W, C, and S Europe, including the Balkans and Italy.	Agile Frog *Rana dalmatina*
	b	Eardrum diameter distinctly less than that of the eye. Snout short and blunt or slightly pointed. Throat dark mottled/patched in comparison to pale underside of body; often with light central stripe and lighter spots.	5
5	a	Ticino (Switzerland), the Po Plain (N Italy) and Istria. Slender, small to medium-sized frog. Upper lip dark coloured.	Italian Agile Frog *Rana latastei*
	b	Italian Apennines. Usually in or near flowing water.	Italian Stream Frog *Rana italica*
	c	NW Iberian Peninsula and C Iberian mountains. Usually in or near flowing water.	Iberian Stream Frog *Rana iberica*
	d	From S-C Bosnia and Herzegovina and C Serbia south-eastwards to Greece (including Peloponnese) and SW Bulgaria. Usually in or near flowing water.	Greek Stream Frog *Rana graeca*

Common Frog *Rana temporaria* Linnaeus, 1758

DESCRIPTION

TL: up to 11 cm, but usually smaller. Medium to large brown frog. Snout relatively short and blunt, especially in adults. Eardrum about 3/4 of eye diameter. When the hind leg is stretched forward along the body (see Fig. 19), the heel reaches the eye. Hind feet partially webbed. Upper lip white but darker and mottled towards the snout. Dorsolateral folds may be conspicuously light coloured. Pale yellow mid-dorsal stripe may be present. Dorsal colour highly variable: pale brown to black, occasionally red or yellowish; females can turn reddish during the breeding season while males can develop a bluish shine. Dark spots or patches may cover back, which is especially common at high altitudes. Hind legs with dark bars. Underside pale coloured, generally mottled with darker patches, but highly variable, sometimes with red speckles on yellow background. Coexists with practically all other brown frogs *Rana* spp. Distinguishing features include eardrum size (smaller in all other species, but larger in Agile Frog *Rana*

Common Frog



dalmatina, which has eardrum similar in size to the eye diameter), hind leg length (longer in all other species, although not obviously so in most Moor Frog *Rana arvalis* individuals) and webbing of the hind feet (fully webbed in all other species, except Agile Frog and Italian Agile Frog *Rana latastei*). Moor Frog is most similar. Common Frog can be distinguished by blunt snout (versus sharp in Moor Frog), spotted underside (versus usually but not always pale and unspotted in Moor Frog), small metatarsal tubercle (versus large in Moor Frog - see Fig. 20). In NW Iberian Peninsula, the long-legged *R. t. parvipalmata* might be confused with both Agile Frog and Iberian Stream Frog *Rana iberica*. The large size of the eardrum and partial webbing of the hind feet are the most informative characteristics in this region.

DISTRIBUTION

Very widespread in most of N, W, C and E Europe. Southwards, limited to mountain ranges (N Iberian Peninsula, N Italian Apennines, Dinaric Alps, S to Rhodopes in N Greece). Outside our area eastward into Russia and extreme N Kazakhstan.

VARIATION

R. t. temporaria: Throughout Europe except NW Iberian Peninsula.
R. t. parvipalmata: NW Iberian Peninsula between Galicia and the Basque Country.

Formerly recognised subspecies occurring in or near major European mountain ranges (*canigonensis, honnorati* and the species *Rana aragonensis*) are no longer considered valid.

HABITAT

A widespread, fairly opportunistic and often abundant species which inhabits various stagnant waterbodies such as ponds, lakes, ditches, flooded meadows and swamps. Quite often in or near forests, but also common in garden ponds as well as mountain lakes above the tree line, occurring as high as 2,800 m. Outside the breeding season often encountered in humid forests or shaded meadows.

BIOLOGY

Terrestrial and fairly nocturnal but also encountered during the day, especially in humid conditions. Active throughout the year in the SW of its range but more typically hibernates, either on land or in water. Often one of the first amphibians to breed at the onset of spring. In much of C Europe, this is around February while in Galicia (NW Spain) breeding starts as early as October. In the far N of its range, breeding starts as late as May. Aggregations of males can even be found in their breeding water while remnants of snow are still present. Breeding occurs explosively, with hundreds of frogs sometimes gathering in a single corner of a waterbody. Males hold females behind their front legs. Females lay up to 4,500 eggs in a single clump. More rarely, two clumps are deposited. Eggs float on the water surface and may form enormous mats. Interestingly, males which are unsuccessful in finding a mate may try to fertilise egg-clumps after they have been abandoned by the pair that produced them, leading to different fathers within a single clump. Eggs can withstand short periods of frost. In most of its range freshly metamorphosed juveniles emerge on land over the course of summer, usually in July and often in large numbers. Sometimes larvae spend winter in the water and metamorphose the following year. In

contrast to the comparably common and widespread Common/Spiny Toads *Bufo bufo/spinosus*, may breed more readily in shaded and shallow water in much of its range, and its eggs are more readily taken by aquatic predators such as fish and newts.

CALL

Relatively short, low-pitched, guttural rasping roar of 2–5 seconds or even less; not very loud. Distress call consists of high-pitched screaming noise.

Common Frog, ssp. *parvipalmata*. Covadonga, Spain.

Common Frog may show dark blotches across its body. Belgium.

Groups of Common Frogs may deposit their egg-masses together. London, United Kingdom.

Moor Frog *Rana arvalis* Nilsson, 1842

DESCRIPTION

TL: up to 8 cm, but usually 6 cm or less. Medium to large, stout brown frog. Snout short (slightly longer in *R. a. wolterstorffi*), but relatively pointed. Eardrum medium-sized, about 2/3 of the diameter of the eye. When the hind legs are stretched forward along the body, the heel joint reaches just beyond the eyes in *R. a. arvalis*, but up to the snout in *R. a. wolterstorffi*. Hind feet partially webbed. Upper lip white up to the point of the snout. Dorsolateral folds usually conspicuously light coloured, often bordered with dark speckling. White or creamy coloured dorsal stripe usually (but not always) present. Back colour pale to dark brown, yellow or reddish. Small black patches can occur over the entire body, but usually fewer than in Common Frog *Rana temporaria*. Hindlimbs faintly barred with dark patches. Belly usually pale coloured. Underside of the legs usually brown or pink. During breeding season, males turn completely blue for just a few days. Coexists with Common Frog throughout much of its range. Confusion between these two species is common, as both have relatively short hind legs and show a variable dorsal pattern. See Common Frog for distinctions. Additionally, across a large area in C-E Europe, *R. a. wolterstorffi* can be confused with Agile Frog *Rana dalmatina* due to similar morphological characteristics. Both taxa are best distinguished by eardrum size (larger in Agile Frog, about the size of the eye) and length of the legs (heel joint reaches the snout in *R. a. wolterstorffi*, while it reaches beyond in Agile Frog).

DISTRIBUTION

N, C and E Europe. The southern limits comprise NE France, Croatia and the northernmost Balkan Peninsula. Outside our area, occurs eastwards into Russia, N Kazakhstan and extreme NW Mongolia.

VARIATION

R. a. arvalis: Occurs in most of range.
R. a. wolterstorffi: Occurs south-eastwards from E Austria, Slovakia, Croatia and SW Poland onto the northern part of the Balkan Peninsula.

HABITAT

Heathlands, moors, submerged forests and flooded meadows in open, humid landscapes. Lakes, ponds, and even temporary dune ponds are occasionally occupied in the NW part of its distribution. Inhabits humid, sunny areas outside of the breeding season. Up to 800 m in our area but generally a lowland species.

BIOLOGY

Terrestrial and fairly diurnal, with a short, explosive breeding period. Secretive outside of breeding season. Active between February and October but in N of range this period may be considerably shorter. Breeding takes place shortly after hibernation. Males may call during both day and night, especially during warmer periods. Males clasp females behind their front legs. Females lay up to 3,000 eggs in a single clump (more rarely two), on top of submerged aquatic vegetation. The freshly metamorphosed juveniles emerge on land between May and July. Feeds on all sorts of invertebrates.

short-lasting breeding colours

underside usually pale

CALL

A short series of soft, rather high-pitched, not very loud sounds that may be transcribed as *woop-woop-woop*. One of the earliest species to breed.

Moor Frog, ssp. *wolterstorffi*. Note the long hind legs in this subspecies. Covasna, Romania.

Pyrenean Stream Frog *Rana pyrenaica* Serra–Cobo, 1993

Pyrenean Stream Frog

DESCRIPTION

TL: 5 cm. Small and usually particularly uniformly coloured brown frog, although sometimes with tiny reddish dots on upper surfaces of body and legs, or scattered restricted black dots on back. Snout short and blunt. Eardrum small and inconspicuous. Hind feet fully webbed. When the hind leg is stretched along the body, the heel joint reaches beyond the snout. Dorsolateral folds often darker than dorsal colour. Dorsal colour light brown to reddish, sometimes with vague pattern of round brown spots, but generally more uniform than in related species. Legs occasionally faintly barred with darker patches. Underside pale. White colour

on upper lip highly extended, bordering the lower eye. Best distinguished from coexisting Common Frog *Rana temporaria* by smaller size, smaller eardrum, longer hind legs, and uniform colour (versus darker and often mottled in Common Frog).

DISTRIBUTION

Small area in W Pyrenees, mostly on the Spanish side and directly adjacent French border areas, although apparently isolated populations have been recorded lower along the French Atlantic slopes. Additional research may be needed to confirm the distribution of the species, especially in France.

HABITAT

Small to medium-sized flowing, well-oxygenated streams, especially their slower, deeper sections such as those created by small waterfalls. These waterbodies are generally located in deciduous woods at 1,000–1,700 m, although occurrence above the tree line is not uncommon. In contrast to Common Frog, more usually an inhabitant of torrents and rarely found in large and/or more stagnant ponds or lakes. Can be found between 800 m and 2,100 m in most of its range, but at 440–800 m in seemingly isolated locations on the N slopes of the Pyrenees.

BIOLOGY

A fairly cryptic species, whose presence is usually signalled by its distinctive larvae (see photo on p. 54) which are generally rather large and black with tiny dots (which may be absent). Adults are believed to be largely nocturnal, hiding under stones or logs in or next to waterbodies during the day, and may even lie completely buried in gravel under water, relying completely on oxygen absorbed through the skin. Daytime activity, however, has been observed, especially after rain or in clouded conditions. Breeds between February and April depending on altitude and time of snow melt. Females lay small clutches of up to 150 eggs underneath rocks, in crevices or at the bottom of slow-flowing streams.

CALL

Low intensity, low-pitched grunts. Rasping sound somewhat resembles that of sawing, or the toneless mechanical sound of bowing an acoustic stringed instrument such as a cello. Hard to detect given the species' limited range and the sound of running water in its usual habitat.

NOTE

This species is listed as Endangered in the 2009 IUCN Red List of European Amphibians.

Pyrenean Stream Frog. Pyrenees, France.

Agile Frog *Rana dalmatina* Fitzinger in Bonaparte, 1838
Italian Agile Frog *Rana latastei* Boulenger, 1879

DESCRIPTION

TL: up to 7.5 cm (Italian Agile) and 8 cm (Agile). Medium to large, slender brown frogs with long hind legs. Snout relatively long and sharp. Eardrum about the size of the eye in Agile Frog but small and inconspicuous in Italian Agile Frog. Hind feet partially webbed. When the hind leg is stretched forwards along the body, the heel reaches beyond the snout. Generally uniform light to dark brown above, sometimes reddish. Hindlimbs barred. Underside creamy white. Throat often mottled in Italian Agile Frog, but with pale central area, while the entire underside of Agile Frog is usually pale and without spots. Best distinguished by the dark-coloured upper lip in Italian Agile Frog which is white up to the snout in Agile Frog, and by the size of the eardrum. Italian Agile Frog has a limited range. See Moor Frog for confusion between Agile and the long-legged *R. arvalis wolterstorffi*. Other brown frog species coexisting with Agile Frog have blunter snouts and smaller eardrums. Common Frog has shorter legs, the heel not reaching beyond the snout when the leg is stretched forwards.

DISTRIBUTION

Agile Frog: Fairly widespread throughout C, W and SE Europe, including the Italian Peninsula and a number of isolated S Scandinavian populations; also occurs on the Channel Island of Jersey (UK). Outside our area also in NW Turkey. Introduced to Drenthe, the Netherlands (not mapped). Italian Agile Frog: Limited to the Italian Po Basin, S Switzerland (Tessin/Ticino), W Slovenia, and Istria (Croatia).

HABITAT

Deciduous forests, generally humid and herbaceous (especially in Italian Agile Frog). Found either within the forests or in meadows adjacent to them. Various waterbodies are used in early spring for breeding, such as ditches, ponds, submerged meadows or woodlands, occasionally also in slow-flowing rivers. While Agile Frog can be found up to 1,500 m altitude, Italian Agile Frog is typically a lowland species, occurring only up to 500 m. Within the range of Italian Agile Frog, both species often coexist.

BIOLOGY

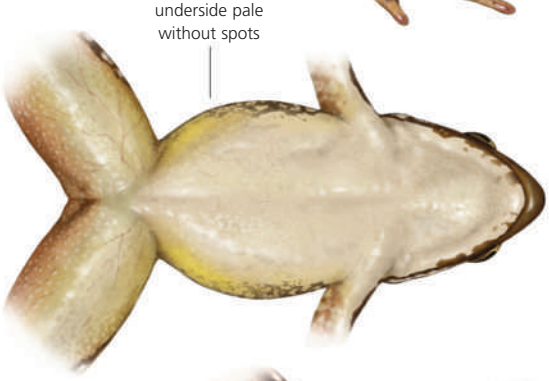
Terrestrial and encountered during both day and night. Individuals of both species are

Agile Frog

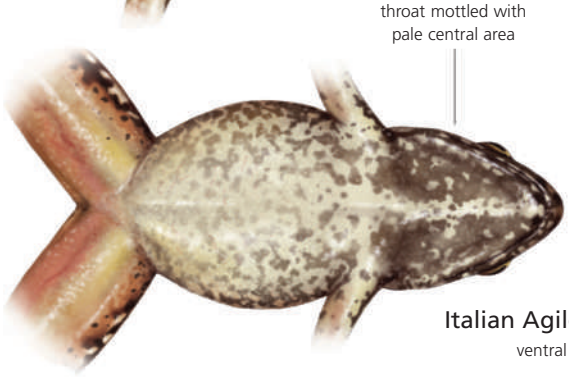
Italian Agile Frog

Agile Frog

Italian Agile Frog



Agile Frog
ventral



Italian Agile Frog
ventral

often found singly in meadows adjacent to woodland. When disturbed, they flee with impressive leaps of up to 2 m. Active throughout the year in S of range. Explosive breeding occurs earlier in the year than in most other coexisting frog and toad species. In S of range this may be as early as January but in C Europe usually around February. Males hold females behind their front legs. Females lay up to 1,800 eggs in a single clump which is attached at some depth around sticks or twigs. Does not form the large floating mats typical of some of the other coexisting *Rana* spp. Developed eggs start to float to the water surface in Agile Frog or stay submerged in Italian Agile Frog. Freshly metamorphosed juveniles emerge over the course of summer, mostly in June or July. An opportunistic feeder, but feeds mostly on beetles.

CALL

Agile Frog: A series of rather high-pitched, moderately loud sounds lasting up to 5 (or maybe 10) seconds. Somewhat similar to Moor Frog *Rana arvalis*, but less soft and more metallic and rasping. Calls in a series may become increasingly louder, longer and more widely spaced.
Italian Agile Frog: A rather loud, not particularly rasping 'cry' of about 1–2 seconds duration. May be reminiscent of certain cow sounds. Territorial calls are very low guttural grunts.

Agile Frog males call mainly during egg deposition, to attract females; in contrast, male Italian Agile Frogs call during the days before most eggs are deposited and develop a male hierarchy.

NOTE

Italian Agile Frog is listed as Vulnerable in the 2009 IUCN Red List of European Amphibians.

Iberian Stream Frog — *Rana iberica* Boulenger, 1879
Italian Stream Frog — *Rana italica* Dubois, 1987
Greek Stream Frog — *Rana graeca* Boulenger, 1891

DESCRIPTION

TL: up to 6 cm (Iberian Stream Frog) or 7 cm (Greek and Italian Stream Frogs). Small to medium-sized brown frogs. Snout relatively blunt, yet more pointed than in Common Frog, especially in Iberian Stream Frog. Eardrum size ranges from half to 3/5 of the eye diameter. When the hind leg is stretched forward along the body, the heel reaches well beyond the snout. Hind feet fully webbed. Temporal region dark brown or black, but often merging with dorsal colour at the edges. Lips creamy coloured, but usually interspersed with the dorsal coloration without clear demarcation, especially towards the snout. Grey, brown, reddish or nearly black above, may turn paler during the night. Individuals can show a conspicuous

Iberian Stream Frog

Italian Stream Frog

Greek Stream Frog

pattern of light, lichen-coloured spots, as well as black spots on the back, legs and sides. Small red spots on the back may occur. Legs faintly barred. Underside creamy but throat often grey, brown or black with a lighter central area. Underside of legs brown or pink. Confusion may occur especially between Agile Frog *Rana dalmatina* and Iberian Stream Frog in Navarra (Spain), or Agile Frog and Italian Stream Frog throughout Italy. These species are best distinguished by eardrum size, which equals the diameter of the eye in Agile Frog while it is small(er) in the other species. Also, the snout of Agile Frog is markedly longer. Furthermore, all species may be confused with Common Frog, which has much shorter legs (the heel only reaches the eye), a smaller eardrum (about 3/4 of the eye diameter) and only partially webbed hind feet. Adding to possible confusion, the heel of the NW Iberian Common Frog subspecies *R. t. parvipalmata* reaches beyond the snout – eardrum size and webbing of the hind feet are the most informative characteristics in this region.

DISTRIBUTION

Iberian Stream Frog: N, NW and C Iberian Peninsula, including the Sistema Central mountain ranges.
Italian Stream Frog: Occurs along the entire length of the Italian Apennines.
Greek Stream Frog: Balkan Peninsula, S Croatia, Bosnia and Herzegovina, SW Bulgaria, Serbia, Macedonia, Montenegro, Albania and mainland Greece, including the Peloponnese.

HABITAT

All species can be found near (fast-)flowing, well-oxygenated streams, rivers or springs with rocky banks in forested areas. Populations also occasionally occur above the tree line. May also be found in more stagnant waterbodies such as cattle troughs, ponds or flooded forests. Greek Stream Frog occurs up to almost 2,000 m, Iberian Stream Frog up to 2,400 m and Italian Stream Frog up to 1,400 m.

BIOLOGY

Terrestrial but more confined to aquatic habitats than other *Rana* spp. Individuals generally rest close to water during the day, underneath small waterfalls or rocks. When disturbed, they leap into the water and dive to the bottom. All species may hide in caves during warmer weather. Active throughout the year under suitable conditions, but typically hibernate at higher altitudes. Generally early breeders, between November and May depending on altitude. Males hold females behind their front legs. Females lay around 500 eggs per egg-clump and may produce several clumps per season. Egg-clumps are attached to rocks or roots.

Italian Stream Frog. La Spezia, Italy.

Pale-coloured Greek Stream Frog, photographed at night. Peloponnese, Greece.

CALL

Iberian Stream Frog: Short, low-pitched, rasping grunts. May sound somewhat like burping. Given at a rate of three calls per second or less.
Italian Stream Frog: Often given from underwater, so difficult to hear if at all, especially in habitats with running water. Three different short sounds may be produced, including a short harmonic 'cry'.
Greek Stream Frog: Similar to Italian Stream Frog.

WATER FROGS *PELOPHYLAX* SPECIES

The genus *Pelophylax* consists of approximately 20 species, native to the wider Eurasian continent. Nine of these occur in the area covered by this field guide, including some peculiar hybrids. While water frogs are amongst the best-known and most characteristic amphibian species, they are notoriously difficult to distinguish. Variability within each species is considerable. Hybrid individuals also occur in large parts of our area, and persist by interbreeding with either one of the parent species. *Pelophylax* species are highly aquatic, sun-loving frogs which can be found in a wide variety of generally well-vegetated and sunny waterbodies. The general size of water frog species can be greatly influenced by the environment, especially in S Europe where individuals that occur in dry regions and/or temporary waterbodies may be much smaller and dull-coloured compared with their relatives from other areas. During the lengthy breeding season males give loud advertisement calls, which are largely species-specific and as such useful for identification.

For identification purposes, three large zones can be defined in which several species occur:
1) N, C and E Europe;
2) S and SW France and the Iberian Peninsula;
3) the southern Balkans.

A detailed overview of the morphological characteristics for each species and the associated hybrids in each region is given below.

Water frogs in NE Greece and Turkish Thrace (the transition zone between Marsh Frog *Pelophylax ridibundus* and Levant Water Frog *Pelophylax* cf. *bedriagae*) are best identified by their advertisement calls.

The Cretan Water Frog *Pelophylax cretensis* occurs only on Crete, where no other water frog species has been introduced (but see American Bullfrog *Lithobates catesbeianus*). Other areas which naturally host only a single species also have introduced species, further complicating the situation.

The tables below do not contain ranges of length of body parts and their ratios because: 1) they are of limited practical use; 2) this information is not available for all species; 3) water frog morphology depends substantially on local environmental characteristics; and 4) the available data usually originates from small samples from (often) only a small number of populations.

1. N, C and E Europe, including Italy and Sicily

Character	Marsh Frog *Pelophylax ridibundus*	Edible Frog *Pelophylax* kl. *esculentus*	Pool Frog *Pelophylax lessonae*
Head shape	Long with sharp snout	Intermediate	Short with blunt snout
General body size	Large	Medium	Small
Skin	Rough	Intermediate	Smooth
Heel joint when leg pulled forwards (see Fig. 19)	Reaches beyond the eyes, usually beyond the snout	Reaches beyond the eyes, usually up to the snout	Reaches up to the eyes
Metatarsal tubercle height and shape (see Fig. 21)	Low, asymmetrically decreasing towards the leg	Medium, asymmetrically decreasing towards the leg	High, symmetrical
Pattern of the underside	Black or grey marbling	Grey marbling	Absent or vaguely present
Thigh colour (breeding period)	Grey or white spotted, rarely yellow	Vaguely yellow or orange spotted	Yellow or orange spotted
Vocal sac colour	Dark grey to nearly black	Light grey to grey	White, light grey or pinkish

2. Iberian Peninsula and S and SW France

It is extremely difficult to distinguish Iberian Water Frog from Graf's Hybrid Frog based on morphological features. Attention should be given to the height and shape of the metatarsal tubercle as well as to the extent of webbing on the hind feet. Additionally, Marsh Frog has been introduced in large parts of the range of Graf's Hybrid Frog. In most parts of the peninsula, however, Iberian Water Frog is the only species present. Edible Frog and Pool Frog do not occur (naturally) on the Iberian Peninsula.

Character	Marsh Frog *P. ridibundus*	Graf's Hybrid Frog *P.* kl. *grafi*	Iberian Water Frog *P. perezi*	Edible Frog *P.* kl. *esculentus*	Pool Frog *P. lessonae*
Head shape	Long with sharp snout	Long with sharp snout	Long with sharp snout	Intermediate	Short with blunt snout
General body size	Large	Medium	Medium	Medium	Small
Skin	Rough	Rough/ Intermediate	Intermediate	Intermediate	Smooth
Heel joint when leg pulled forwards (see Fig. 19)	Reaches usually beyond the snout	Reaches usually beyond the snout	Reaches usually beyond the snout	Reaches beyond the eyes, usually up to the snout	Reaches up to the eyes
Metatarsal tubercle height and shape (see Fig. 21)	Low, asymmetrically decreasing in height towards the leg	Slightly higher than in *P. perezi*; occasionally asymmetrical	Very low and flat	Medium, asymmetrically decreasing in height towards the leg	High, symmetrical
Webbing on the 4th toe	Up to the toe-tip	Nearly reaching the toe-tip	Never reaching the toe-tip	Up to the toe-tip	Up to the toe-tip
Pattern of the underside	Black or grey marbling	Grey or no marbling	Light grey or no marbling	Grey marbling	Absent or vaguely present
Thigh colour (breeding period)	Grey or white spotted, rarely yellow	Grey or white spotted, rarely yellow	Grey or white spotted, rarely yellow	Vaguely yellow or orange spotted	Yellow or orange spotted
Vocal sac colour	Dark grey to nearly black	Dark grey to nearly black	Dark grey to nearly black	Light grey to dark grey	White, light grey or pinkish

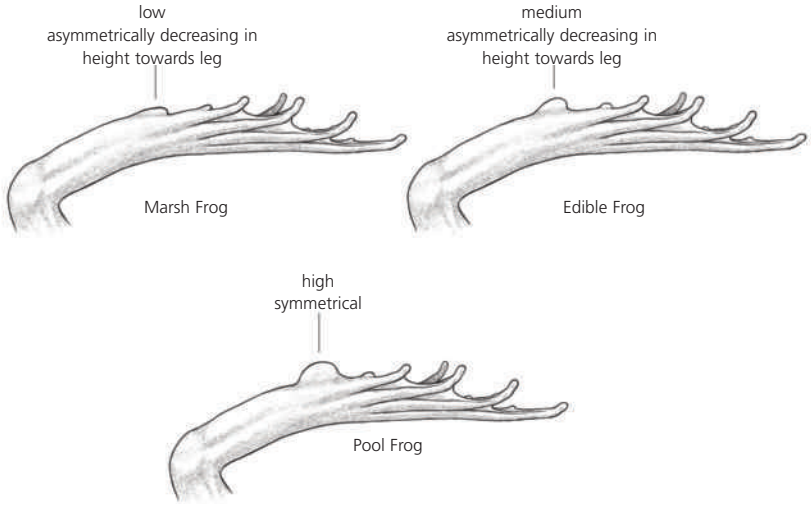


Fig. 21. Metatarsal tubercles of water frogs.

3. Southern Balkans

Because Marsh Frog and Epirus Water Frog readily hybridise and many of their morphological characteristics are similar, it is advisable to identify individuals using a combination of features (especially metatarsal tubercle size) and their strikingly different advertisement calls. Although the Marsh Frog and Albanian Pool Frog also hybridise throughout their ranges, the morphology of these hybrids has not yet been described in detail.

Character	Marsh Frog *Pelophylax ridibundus*	Albanian Pool Frog *P. shqipericus*	Epirus Water Frog *P. epeiroticus*	Hybrid Marsh Frog x Epirus Water Frog
Head shape	Long with sharp snout	Medium length and sharp	Medium length and blunt	Medium length, moderately sharp
General body size	Large	Small to medium	Small to medium	Medium to large
Skin	Rough with warts and/or ridges	Smooth	Smooth	Smooth with inconspicuous warts and/or ridges
Heel joint when leg pulled forwards (see Fig. 19)	Reaches beyond the eyes, usually beyond the snout	Reaches beyond the eyes, usually beyond the snout	Reaches the eyes	Reaches to area between the eyes and snout
Metatarsal tubercle height and shape (see Fig. 21)	Low	High	Very low and small	Low and small
Pattern of the underside	Black or grey marbling	Vague grey marbling	Vague grey or no marbling	Vague grey marbling
Thigh colour (breeding period)	Grey or white spotted, rarely yellow	Yellow spotted	Yellow spotted	Grey or white spotted, rarely yellow
Eardrum colour	Brown	Green to greenish-brown, sometimes bronze	Green	Bronze
Vocal sac colour	Grey	Grey to olive	Dark grey to nearly black	Grey to dark grey

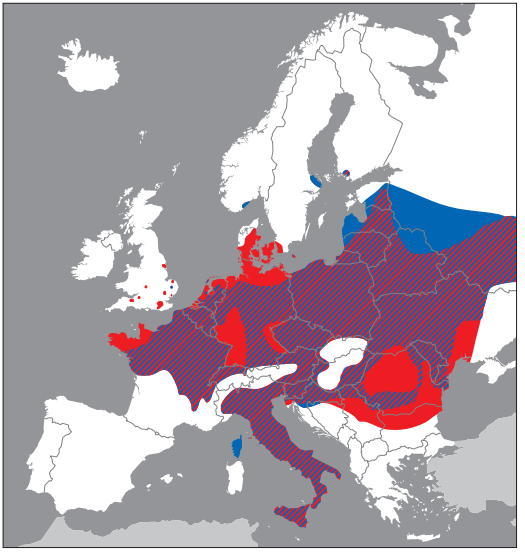
Pool Frog *Pelophylax lessonae* (Camerano, 1882)
Edible Frog *Pelophylax* kl. *esculentus* (Linnaeus, 1758)

DESCRIPTION

TL: 8 cm (Pool) and 10 cm (Edible). Small to medium-sized water frogs. Smooth, shiny skin. Conspicuous dorsolateral folds present. Vocal sacs of the male white in Pool Frog, whitish, grey or blackish in Edible Frog. The colour of both species is highly variable; dorsal colour varies from light to dark green, legs may be partially brown. Upper body and head of male Pool Frog may turn bright yellow during the breeding period. Juveniles and females may occasionally be largely brown. Dorsal green stripe generally present. Usually large black patches on the lower back, legs and flanks. Thighs barred, yellow and dark coloured, especially during breeding period. The two 'species' can best be distinguished by: 1) size; 2) blunt, short snout in Pool Frog (sharper and elongated in Edible); 3) when the hind leg is stretched forwards along the body, the heel reaches the eye in Pool Frog, while it extends up to the snout in Edible Frog; and 4) the metatarsal tubercle of Pool Frog is large (in relation to the toe length) and symmetrically round, while in Edible Frog it is medium-sized and asymmetrical, slightly decreasing in height towards the base of the toe. Both species can be confused with the Marsh Frog *Pelophylax ridibundus*, which is (much) larger, has a small, low asymmetrical metatarsal tubercle, and a heel generally reaching beyond the snout. Because identification often remains troublesome and both species may also overlap with Iberian Water Frog *Pelophylax perezi* and potentially Graf's Hybrid Frog *Pelophylax* kl. *grafi* in S France, a detailed table of comparative identification characteristics can be found on p. 180.

DISTRIBUTION

Both species occur in much of W, C and E Europe, including parts of the UK, mainland Italy and Sicily, and often coexist. Apart from some unidentified occasionally introduced water frogs, the Pool Frog is the only species found on Corsica, and no water frog species



Pool Frog
Edible Frog
Overlap zone of both species

blunt short snout

Pool Frog

sharp elongated snout

Edible Frog

occur naturally on Sardinia. Outside our area, both species also occur in W Russia.

VARIATION

Pool Frog: The nominate race occurs throughout most of the range except in the south.
P. l. bergeri: Corsica and the Italian Peninsula, more or less southwards of a line from Genoa to Ancona. A yet undescribed subspecies of the Pool Frog occurs on Sicily.

HABITAT

Pool Frog occupies small waterbodies such as ponds, ditches and flooded wheel-ruts in agricultural land, forests or heathland. To the north, largely confined to oligotrophic ponds and fens in bogs and similar habitats, more widespread towards the south. Often associated with loose soils. Edible Frog is much more widespread and may be found in small, medium or large waterbodies in a wide variety of locations, ranging from dune marshes to hilly or mountainous terrain. Both species can be found from sea-level up to 1,500 m in the southern part of their distribution.

BIOLOGY

Chiefly aquatic and sun-loving, active at night as well as during daytime. After sunset individuals may disperse into the surroundings of their aquatic habitat to forage. Both species hibernate on land, but especially Edible Frog may also hibernate in water. Active between March and October with breeding taking place in May and June. Males hold small territories and defend these against other males. Males clasp females behind their front legs. Females lay up to 4,500 eggs (up to 8,000 eggs in Edible Frog) in several small clumps between vegetation. Freshly metamorphosed juveniles emerge onto land in late summer. Feeds on all sorts of invertebrate prey but cannibalistic behaviour has been observed.

CALL

Pool Frog: A rather loud, long, rattling sound which may last for several seconds; relatively soft and rasping, rather flat. Territorial calls are short and squeaking.
Edible Frog: A rather loud, long, rattling sound which may last for several seconds; relatively hard and rasping, with clearly audible fast pulse groups. Territorial calls are short and squeaking.

Pool Frog, ssp. *bergeri*, in amplexus. Corsica, France.

Marsh Frog *Pelophylax ridibundus* (Pallas, 1771)
Iberian Water Frog *Pelophylax perezi* (Seoane, 1885)
Graf's Hybrid Frog *Pelophylax* kl. *grafi*
(Crochet, Dubois, Ohler & Tunner, 1995)

Marsh Frog

DESCRIPTION

TL: up to 15 cm. Large water frogs, although Iberian Water Frog is usually somewhat smaller. Snout ending in a sharp point. Vocal sacs of male typically described as grey or dark coloured, while exceptionally very pale vocal sacs have been observed in Marsh Frog. Skin relatively rough. Conspicuous dorsolateral folds present. When the hind leg is stretched forwards along the body, the heel always reaches beyond the eye, usually beyond the snout. Colour extremely variable; back varies from light grey to brown or light to dark green; occasionally even practically black. Dorsal green stripe often present. Back and flanks often with dark green/brown to black roundish or square patches; legs barred with similar coloration. Limbs can be partially brown, but thighs generally cream or white. Underside also cream to white, often with grey mottling especially on lower part. Best distinguished by distribution (see below). Contact between both species has given rise to Graf's Hybrid Frog, which often coexists with Iberian Water Frog. It is extremely difficult to distinguish these two forms by appearance. However, the metatarsal tubercle is small and flat in Iberian Water Frog and slightly higher in Graf's Hybrid Frog. The webbing on the hind feet does not extend to the tip of the fourth toe in Iberian Water Frog, while it nearly reaches the tip in Graf's Hybrid Frog. Adding to the confusion, Marsh Frog has been introduced to numerous sites within the range of Graf's Hybrid Frog, often resulting in a mixture of the three taxa. Furthermore, all may coexist with Edible and Pool Frog in S France, especially along the Atlantic coast and the Rhône Valley.

DISTRIBUTION

Marsh Frog: occurs in NW (the Netherlands), N (with exception of Scandinavia), E and SE Europe, but this species and its relatives (including those from N Africa and the Near East) have been widely introduced into several W European countries (southern UK, the Netherlands, Belgium, France, Sardinia, NW Italy, etc.). Also W Russia.
Iberian Water Frog: Iberian Peninsula, ranging north- and westwards along the French Atlantic and Mediterranean coasts.

Introduced to some Balearic Islands where it is widespread. Also introduced to the UK and outside our area to the Canary Islands. Graf's Hybrid Frog: restricted to Mediterranean, S and Atlantic W France as well as NE Spain.

VARIATION

Colour patterns and general sizes can vary greatly within as well as among populations; this variation is largely environmentally induced, with populations inhabiting drier areas generally remaining smaller. Based mainly on call differences, Marsh Frogs from S Albania, S Macedonia, SW Bulgaria and Greece have been attributed to a separate species, Greek Marsh Frog *Pelophylax kurtmuelleri*. Molecular data, however, hints it is best treated as a subspecies.

HABITAT

Typically inhabit deeper ponds, rivers and similar larger waterbodies, especially Marsh Frog. Iberian Water Frog inhabits comparable habitats, but is much more widespread and can also be found in small streams, (temporary) ponds, ditches, swamps and other flooded environments. Both species can be found from sea-level up to 2,000 m, or even 2,400 m (Iberian Water Frog). Graf's Hybrid Frog can be found in all the aforementioned waterbodies and is mainly a lowland form. All of these taxa, however, are highly versatile and may occupy a very wide variety of habitat types, especially when young, with the strict habitat characterisations above typically applying better in regions where other species, such as Pool Frog, also occur.

BIOLOGY

Large, conspicuous, diurnal frogs throughout most of their range, which produce loud calls and show increased aquatic activity in the breeding period. Populations that inhabit smaller or temporary waterbodies are shyer, and may be secretive during the day while being more active at night. Iberian Water Frog may be active throughout the year in south of range but hibernates in the north. Marsh Frog typically hibernates between October and February but timing depends on climate. Hibernation usually takes place in mud under water. Reproduces in late spring or early summer but may breed throughout the year when conditions are right. Males clasp females behind their front legs. Females lay up to 12,000 eggs in several clumps in vegetation. Metamorphosed juveniles emerge over the course of summer. Larvae may also hibernate and complete

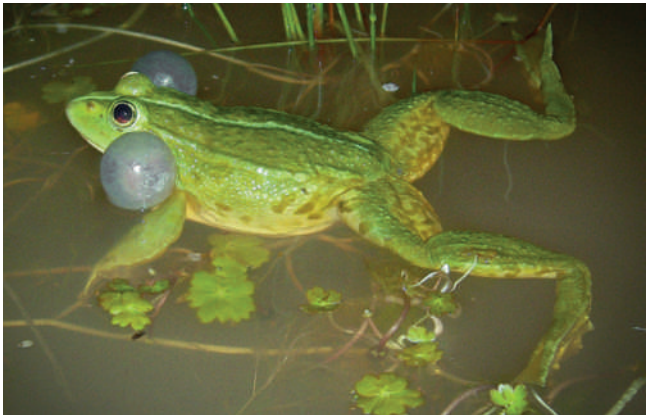
metamorphosis the following year. Feeds on all sorts of invertebrates and even catches flying prey. Large individuals also feed on frogs, fish, mice and fledgling birds. Their appetite makes them easy to lure with objects that resemble prey, such as reeds moved across the water surface.

CALL

Marsh Frog: In contrast to, for example, Pool *Pelophylax lessonae* and Edible Frog *P.* kl. *esculentus*, not a rattling sound, but a rather loud, fast series of short, clearly spaced, metallic, not very musical, squeaking sounds. Greek Marsh Frogs give series of only four calls on average, whereas the Marsh Frogs from E Thrace produce seven on average. Territorial calls are short and squeaking.

Iberian Water Frog: A rather loud, long, rattling sound which may last for several seconds. Relatively hard rasping sounds, usually with clearly audible fast pulse groups, so superficially more like that of Pool Frog or Edible Frog than that of Marsh Frog. Also, in Iberian Water Frog, the beginning of the call is higher pitched in comparison to that of the three former species. Territorial calls are short and squeaking.

Graf's Hybrid Frog: Intermediate to that of Marsh Frog and Iberian Water Frog. Territorial calls are short and squeaking.



RIGHT: Calling Marsh Frog from an alien, introduced population on Sardinia, Italy.

BELOW: Graf's Hybrid Frog. Southern France.

Albanian Pool Frog *Pelophylax shqipericus*

(Hotz, Uzzell, Günther, Tunner & Heppich, 1987)

Albanian Pool Frog

DESCRIPTION

TL: up to 7.5 cm. Small to medium-sized water frog. Skin smooth and shiny. Dorsolateral folds prominent. Metatarsal tubercle high, asymmetrically decreasing in height towards the leg. Dorsal colour either light to dark green or light brown, often with a thin mid-dorsal stripe. Upper body and head yellow in males during the breeding season. Vocal sacs of males grey to olive-green. Juveniles and females are occasionally largely brown. Large round dark brown or black spots are usually present on the back, legs and flanks. Underside vaguely grey marbled. Legs barred with dark patches, thighs often yellow. Yellow coloration can continue onto the lower body and flanks. The only other coexisting water frog species is Marsh Frog *Pelophylax ridibundus*. May generally be distinguished by smaller size and much higher metatarsal tubercle in Albanian Pool Frog. Also, usually grey to olive coloured vocal sacs (versus usually dark grey to black). Both species readily hybridise, and although hybrids are assumed to display intermediate characters between both parental species, they are yet to be properly described.

DISTRIBUTION

Fragmented areas in coastal SE Montenegro and coastal N and C Albania. Distribution requires further investigation, but occurs south at least as far as Orikum near Vlorë. A small introduced population exists in Umbria, C Italy (not mapped).

HABITAT

Somewhat in contrast to the related Pool Frog *Pelophylax lessonae*, not limited to small waterbodies. Inhabits well-vegetated canals,

ditches, ponds, swamps or marshes. Also on the shores of large, sparsely-vegetated lakes or partially submerged quarries. Generally below 500 m.

BIOLOGY

Highly aquatic species, which can often be observed basking and calling on partially-submerged vegetation, rather than from the shores of its habitat. Breeds in late spring and early summer, when calling most intensively.

NOTES

This species was previous considered to represent an isolated population of the Pool Frog. Albanian Pool Frogs are readily exported for consumption, which, together with destruction of their lowland habitat, makes them the most endangered water frog species in Europe.

CALL

Similar to that of Pool Frog – a long, loud rattling call, unlike the distinctly separated calls in each call series of Marsh Frog.

NOTE

This species is listed as Endangered in the 2009 IUCN Red List of European Amphibians.

ABOVE: Albanian Pool Frog. Skadarsko Jezero, Montenegro.

RIGHT: Habitat of Albanian Pool Frog. Montenegro.

Epirus Water Frog *Pelophylax epeiroticus*

(Schneider, Sofianidou & Kyriakopoulou-Sklavounou, 1984)

Epirus Water Frog

DESCRIPTION

TL: up to just above 8 cm. Medium-sized water frog. Skin smooth and shiny. Snout of medium length with blunt ending. Dorsolateral folds conspicuous. Metatarsal tubercle small and very low, asymmetrically decreasing in height towards the leg. Dorsal colour highly variable, often light to dark green or brown. Male vocal sacs dark grey to black during breeding period, otherwise olive-coloured. Juveniles and females are occasionally largely brown. Dorsal green stripe often present. Large irregular-shaped vague dark green or brown patches often present on the back, legs and flanks. Underside either white or indistinctly grey marbled. Legs barred with dark patches, thighs often yellow. Yellow coloration may continue onto the lower body and flanks. Coexists with the morphologically highly similar Marsh Frog *Pelophylax ridibundus* across most of its range. Both species readily hybridise. During identification, attention should be given to the metatarsal tubercle which is much smaller in Epirus Water Frog, the eardrum (supposedly green in Epirus Water Frog, brown in Marsh Frog and bronze in their hybrids), and the advertisement calls of both species. See the introductory chapter on water frogs for detailed morphological information.

DISTRIBUTION

S Albania, NW Greece including Corfu and NW Peloponnese. Lefkada, Cephalonia, Zakynthos and smaller nearby islands might also host this species. Mainland range is fragmented due to the conversion of suitable

habitats to agricultural use. Allegedly only in one small area in S Albania, but further research seems desirable.

HABITAT

Generally found in large well-vegetated waterbodies such as canals, lakes, swamps or marshes, occasionally also along the edges of larger rivers. Poorly-vegetated or man-made waterbodies may remain uninhabited or may host only low densities of individuals. Below 500 m altitude.

BIOLOGY

Highly aquatic species and quite shy. Often seen basking and calling on floating and partially submerged vegetation. Calling males often hold the body underwater with only the head visible, unlike other coexisting water frog species which usually call more in the open. Breeds in March and April. Females lay egg-clumps consisting of up to 2,900 eggs amongst vegetation or in open water.

CALL

A single, rather low-pitched, short rattling sound, clearly unlike the coexisting Marsh Frog. Among European frogs, perhaps most similar to call of Stripeless Tree Frog *Hyla meridionalis*. Territorial calls are short and squeaking. Hybrids with Marsh Frog produce calls highly similar to that of Edible Frog *Pelophylax* kl. *esculentus*.

NOTE

Listed as Vulnerable in the IUCN 2009 Red List of European Amphibians.

Epirus Water Frog. Peloponnese, Greece.

Levant Water Frog — *Pelophylax* cf. *bedriagae*

(Camerano, 1882)

Cretan Water Frog — *Pelophylax cretensis*

(Beerli, Hotz, Tunner, Heppich & Uzzell, 1994)

DESCRIPTION

TL: up to 10 cm (Levant) and 8.5 cm (Cretan). Medium to large frogs (although size is greatly influenced by their environment, see below). Skin relatively rough. Conspicuous dorsolateral folds present. Dorsal green stripe often present, especially in males, but rarer in Cretan Water Frog. Colour extremely variable; from light to dark green, brown or grey above, legs usually darker. Dorsal colour of Cretan Water Frog generally pale brown. Lower back, legs and flanks usually with large dark green to black patches. Legs barred with dark patches. Best identified by range (see below), although Levant Water Frog may be confused with Marsh Frog and hybridises with it. Although both latter species show similar morphology, they can be distinguished by their advertisement calls.

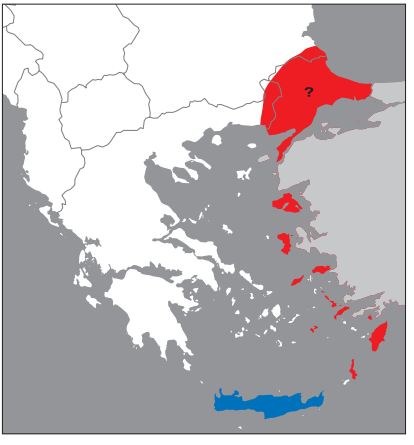
DISTRIBUTION

Levant Water Frog: A widespread species complex from Anatolia, the Middle East and the Nile Delta which occurs in our area across NE Greece, Turkish Thrace, SE Bulgaria and the Crimean Peninsula (not shown on map). Its presence has also been confirmed either by calls or genetic data from Samothrace, Lesbos, Chios, Ikaria, Samos, Karpathos, Rhodes, Andros and Astypalaia; populations on other North Aegean and Dodecanese islands probably belong to this species. Hybrids with Marsh Frog *Pelophylax ridibundus* may occur in the continental area. The introduced populations of water frogs on Malta and Gozo (not mapped) have been attributed to this species based on their calls. Cretan Water Frog: Endemic to Crete and the only water frog species there, although its distribution is fragmented across suitable coastal lowland areas and several inland lakes.

VARIATION

There is considerable genetic and morphological variation amongst E Mediterranean and Black Sea water frogs, which might lead to the description of new species in the future. Additionally, size and pattern are highly dependent on environmental conditions. Individuals occurring in small, temporary waterbodies are often smaller and show dull colours.

No subspecies of Levant and Cretan Water Frogs are recognised at present. Water frogs from Karpathos (TL: 5.5 cm) were formerly treated as a separate species, Karpathos Water Frog *Pelophylax cerigensis*, but are now considered part of Levant Water Frog. Genetically, the latter are highly similar to those of Rhodes and parts of SE Turkey. Genetic results of sampled Ikaria frogs have assigned them surprisingly to the Turkish *Pelophylax caralitanus*; further confirmation is needed.



Levant Water Frog

Cretan Water Frog

HABITAT

Levant Water Frog is opportunistic and occurs in permanent or temporary waterbodies of various sizes, such as cisterns, brooks, lakes, rivers and agricultural ponds over a wide altitudinal range, although in our area mainly found in lowlands. Cretan Water Frog is usually in wetlands, slow-moving rivers, streams, lakes and marshes below 100 m. As these are fairly limited on Crete, the species is relatively rare compared with other water frogs in many mainland areas. Additionally, the formerly large Cretan Water Frog population at the Agia Dam has been displaced by the invasive alien species, the American Bullfrog *Lithobates catesbeianus*.

BIOLOGY

Generally large, bold frogs which can be highly conspicuous during the breeding season, when the males produce very loud calls and both sexes show increased diurnal activity in waterbodies. Populations in suboptimal habitat, such as temporary streams (e.g. on Karpathos) may be much more secretive. Active throughout the year if conditions are right but generally much more active in spring and summer. Breeding takes place between March and June. On Crete freshly metamorphosed juveniles can be commonly seen in August.

CALL

Levant Water Frog: A much faster version of the call of Marsh Frog and roughly resembling the call of Edible Frog *Pelophylax* kl. *esculentus*. Territorial calls are short and squeaking.
Cretan Water Frog: Similar to Levant Water Frog, but separate squeaks may be higher in tone.

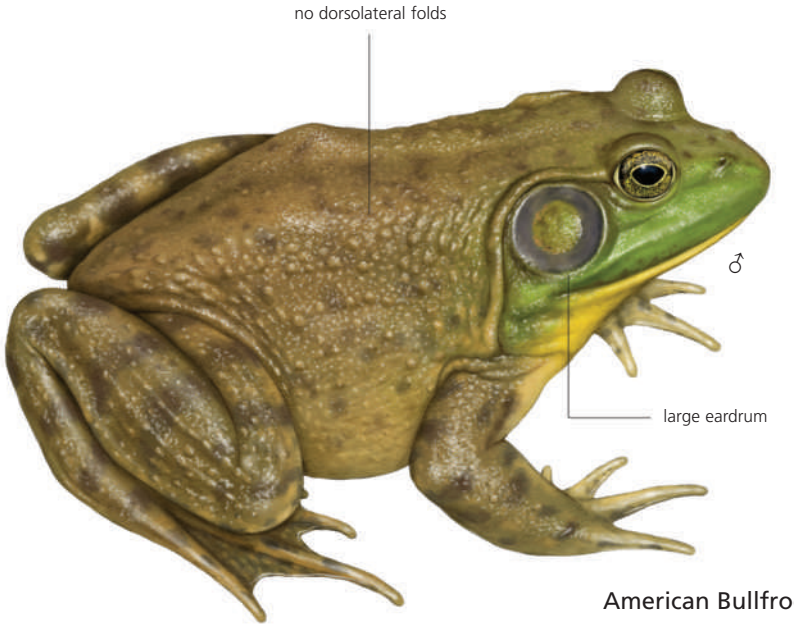
NOTE

Cretan Water Frog (Endangered) and the formerly separated Karpathos Water Frog (Critically Endangered) are listed in the 2009 IUCN Red List of European Amphibians.

Levant Water Frog. Samos, Greece.

American Bullfrog *Lithobates catesbeianus*

(Shaw, 1802)



American Bullfrog

DESCRIPTION

TL: 20 cm or even more. A very large frog. Head large compared to body, with conspicuously large eardrum. Body plump, extremities relatively long. No dorsolateral folds. Colour quite variable – often brown, greyish or green above; head generally brighter, while rear may be quite dark. Black spots occasionally present on back. Underside white, creamy or yellow. Can be distinguished from all European frog species by the presence of large eardrum (about four times the diameter of the eye in males), absence of dorsolateral folds, and large size.

DISTRIBUTION

Originates from E and C USA. Introduced into several European countries including Belgium, Italy (Po Plain and Tuscany), France, Germany, Spain, the UK and Greece (including Crete).

HABITAT

Usually in large, well-vegetated permanent waterbodies, such as ponds, lakes, slow-flowing rivers and reservoirs.

BIOLOGY

Considered an invasive alien species, eating practically anything that fits in its mouth.

Yet, the threat to native amphibians may be limited in some cases, as it often occupies larger, deeper waterbodies created by or significantly altered by man, which tend to be inhabited by fish rather than other amphibian species. A shy, highly aquatic frog, often readily taking flight and hiding underneath aquatic vegetation. As with many amphibians, more approachable at night. Active from April to October but may be active longer in S of range. Breeding occurs in late spring and summer. Males are territorial and defend their territories against intruders. Females lay up to 25,000 eggs in large floating masses. Feeds on all sorts of invertebrates, but also on other frogs, mice and even small snakes and fledgling birds.

CALL

Rather loud and very different from calls of native European water frogs *Pelophylax* spp. Comparable to the sound of a bull mooing in a bucket. Has been transcribed as *jug-o-rum*.

Failed mating attempt of a water frog with a subadult American Bullfrog. Flanders, Belgium.

Reptiles (Reptilia)

The group of animal species traditionally called 'reptiles' do not form their own branch in an evolutionary tree, but share their common ancestors with birds. More than 10,000 species of reptiles exist today. Most live in tropical areas, while temperate zones are generally characterised by lower species diversity. Roughly 120 species occur in our area, of which many are endemic. Reptiles are generally characterised by a scaled skin. While they may live in water, their skin is basically dry. Their higher level taxonomy has been the subject of debate, but four contemporary orders are generally accepted: 1) turtles (Testudines or Chelonii – approximately 400 species); 2) an ancient order nowadays only represented by a single species - the Tuatara *Sphenodon punctatus* from New Zealand (Rhynchocephalia); 3) the 'scaled reptiles' (Squamata); and 4) the crocodiles and their relatives (Crocodylia – about 25 species). In turn, the Squamata contains three suborders: lizards (Sauria), worm lizards (Amphisbaenia) and snakes (Serpentes). Only the turtles and 'scaled reptiles' are represented in Europe, but species belonging to all three groups of 'scaled reptiles' occur.

Key to higher taxa of European reptiles	
Body oval, dome-shaped with a hard, fused bony shell.	Turtles – Testudines (see below)
Body elongate. Most commonly with legs which may be small or even absent. If legless, with normal, closable eyelids.	Lizards – Sauria (p. 217)
Body elongate and legless, with clear rings around the body. Eyes reduced to small black dots covered with skin and without eyelids.	Worm lizards – Amphisbaenia (p. 347)
Body elongate and legless, without clear rings. Eyes always without closable eyelids.	Snakes – Serpentes (p. 351)

TURTLES, TORTOISES AND TERRAPINS (TESTUDINES)

There are some 300 extant species in the turtle order. They are one of the most ancient reptile groups and numerous prehistoric species are known only as fossils. The evolutionary relationships within the group are complicated and a matter of debate. Here, we group the European species following a pragmatic morphological (and linguistic) division, rather than a strictly systematic one. Our area contains three species of tortoise, three species of terrapin and one regularly breeding sea turtle species, as well as a number of vagrant turtles. In addition, we also include one exotic terrapin (Red-eared Slider *Trachemys scripta elegans* from the SE USA) that has established numerous feral and (in the south) breeding populations, while escaped or released individuals of several more species can be encountered as well.

Turtles have a bony shell, composed of the ribs and part of the backbone, which serves as a defensive shield against predators. The upper shell is called the carapace; the belly shell is called the plastron. Exceptionally

Key to families of Turtles, Tortoises and Terrapins			
1	**a**	Forelimbs transformed into paddle-shaped flippers without nails. Only in marine habitats.	Sea turtles – Cheloniidae and Dermochelyidae (p. 212)
	b	Forelimbs with nails. Not in marine habitat (but may occur in brackish marshes).	**2**
2	**a**	Terrestrial. Carapace strongly domed. No webbing between toes.	Tortoises – Testudinidae (p. 198)
	b	Semi-aquatic in fresh or brackish water. Carapace not strongly domed. Webbing between toes.	Terrapins – Emydidae and Geoemydidae (p. 206)

among vertebrates, the pectoral girdle is located inside the thorax. They lack teeth, and cut their food using the sharp edges of the mouth. Typically, males have longer tails than females.

Turtles occur on all continents except Antarctica, mostly in warmer areas.

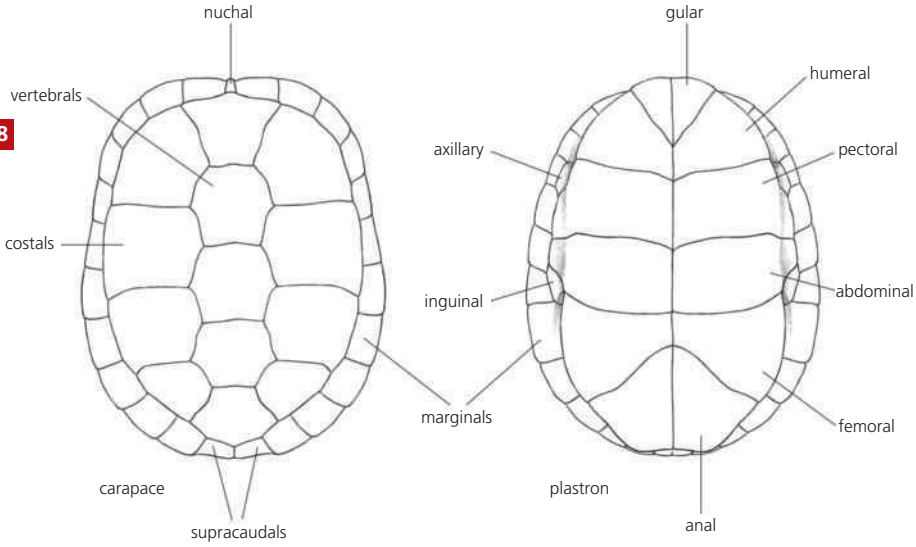


Fig. 22. Key features of a chelonian shell.

Tortoises (Testudinidae)

By 'tortoises' we mean the terrestrial turtles. Tortoises have a domed shell and short, sturdy legs with rough scales and firm claws. When walking, the carapace can be lifted clear of the surface. All are mainly herbivorous, though juveniles especially will also eat invertebrates and carrion.

While the status of some subspecies is debated, we cover the three traditional European tortoise species, all belonging to the family Testudinidae. There are some 50 extant species in this family, distributed throughout the warmer parts of the world, except the Australasian region.

Key to Tortoises			
1	a	Longitudinal horny 'nail' on the tail-tip. No spurs on the thighs;. Normally two supracaudal scutes. See species account for distribution.	Hermann's Tortoise *Testudo hermanni*
	b	No nail on the tail-tip; usually spurs on the thighs. Usually one supracaudal scute.	2
2	a	Carapace oval-shaped, but not clearly elongated. No obvious triangular blotches on plastron. Spurs often large. See species account for distribution.	Spur-thighed Tortoise *Testudo graeca*
	b	Carapace elongated with rear scutes upturned. Plastron with triangular dark blotches. Spurs relatively small or missing. See species account for distribution.	Marginated Tortoise *Testudo marginata*

Hermann's Tortoise *Testudo hermanni* Gmelin, 1789

DESCRIPTION

Carapace up to 25 cm, high-domed and slightly elongated; adults in W Europe are much smaller compared with those in E Europe. A long, horny, lengthwise split nail on the tail-tip. No spurs on the thighs. Normally two supracaudal scutes, sometimes only one in the east of its range. Scaling on the forelimbs is less coarse than that in the two other European tortoises. Carapace usually yellow, ochre, beige, yellow or pale orange, with extensive dark, usually black, markings.

DISTRIBUTION

S Europe. Rather small and isolated populations in NE Spain and SE France, the Balearic Islands, Corsica, Sardinia, Sicily, S and C Italy (Tuscany). All seem to have resulted from ancient introductions, except those on the Italian mainland and Sicily. More widespread along the Dalmatian Coast, Serbia, Macedonia, SW Romania, Bulgaria, Albania and Greece.

VARIATION

Hatchlings have less contrasting markings, and only start to show the typical adult markings after two years. Three subspecies have been described.
Western (*T. h. hermanni*): NE Spain and SE France, the Balearic Islands, Corsica, Sardinia, Sicily, S and C Italy (Tuscany); carapace yellow to ochre with contrasting black markings; black markings in the middle of the fifth (and last) vertebral scutes often in the shape of a keyhole; black blotches on the plastron merged into two broad longitudinal stripes.
Eastern (*T. h. boettgeri*): From most of coastal Montenegro and SW Romania through Bulgaria, Albania and Greece; carapace ochre to cinnamon with less contrasting markings, dark blotch on each scute of the plastron, often not merged.
Dalmatian (*T. h. hercegovinensis*): Dalmatian coast from W of Kotor Bay in Montenegro up to Istria in Croatia); intermediate coloration and, in contrast to the other two subspecies, usually lacks inguinal scutes. The validity of *T. h. hercegovinensis* is disputed.

HABITAT

Occupies a wide variety of typical Mediterranean biotopes up to an altitude of 1,800 m, especially dry or semi-humid habitats. Also inhabits rocky outcrops, somewhat more often than Spur-thighed Tortoise *Testudo graeca*.

BIOLOGY

Often seen basking or grazing on early mornings in spring at the base of bushes or in grassy or herbaceous meadows. May be heard moving through vegetation before it is seen. Unlike most reptiles, tortoises are almost exclusively vegetarian, feeding mostly on grasses and herbaceous plants, but snails, worms, carrion and even mammal dung may also form part of their diet. Active between February and November but some individuals may be seen on sunny days in winter. Contrasting with their otherwise tranquil lifestyle, male combat and courtship can be vigorous. The sounds produced by males and the sound of their carapaces

bumping into each other may be heard from a considerable distance. Mating takes place both in spring (between March and May) and in summer (August and September). Males use the horny tip of their tail to stimulate the female's cloaca. Females lay up to three clutches a year, each consisting of up to eight eggs. Juveniles usually emerge in September. Densities may be very high, especially on small islands.

NOTE

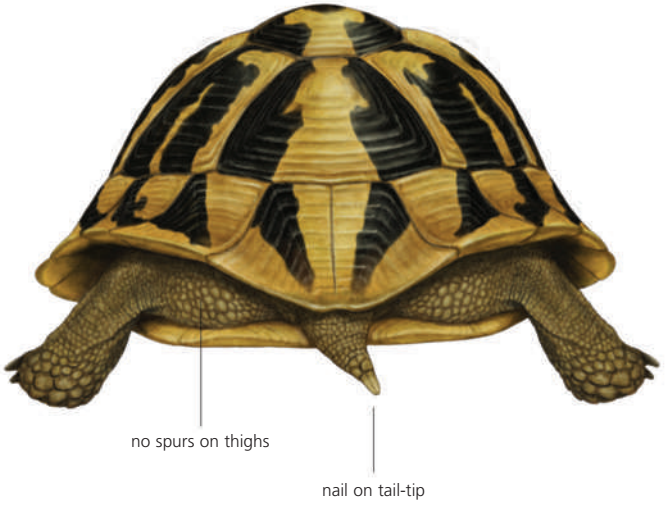
In the Balkans, tortoises often fall prey to Golden Eagles *Aquila chrysaetos* who carry them high into the sky to drop them on rocks, thus breaking the carapace. There are reports of eagles feeding their young almost exclusively on tortoises, bringing up to 100 individuals to the nest.

This species has been attributed to the separate genus *Eurotestudo*, but this conflicts with its close taxonomic relationship to the other *Testudo* species.

Habitat of Hermann's Tortoise, N Sardinia, Italy.

Hermann's Tortoise. Lake Volvi, Greece.

rear view



Spur-thighed Tortoise *Testudo graeca* Linnaeus, 1758

DESCRIPTION

Carapace up to 30 cm. Similar to Hermann's Tortoise *Testudo hermanni*, but differs from the latter in having spurs on the thighs, lacking a nail on the tail-tip and in most cases (but not always) one supracaudal scute. Scales on the front of the forelimbs very coarse. Vertebral scutes somewhat wider than in Hermann's Tortoise. Juvenile Marginated Tortoises *Testudo marginata* have the same carapace silhouette and coloration as Spur-thighed Tortoise but have triangular dark blotches on the plastron and do not have large spurs on the thighs.

DISTRIBUTION

Isolated populations in W Mediterranean: Coto Doñana near Sevilla, the Almeria-Murcia border area, and rare on Mallorca (and probably extinct on Ibiza and Formentera). More continuously spread in SE Europe: Dobrudja area (Romania), Bulgaria (especially E), Macedonia, S Serbia, Turkish Thrace, the Thrace and Macedonia regions of N Greece and the Greek islands of Thasos, Samothrace, Limnos, Lesbos, Chios, Samos, Levos, Kos, Symi and Salamis. Introduced to Sardinia. Outside our area, also in Turkey, the Caucasus, the Middle East and N Africa.

VARIATION

Contrasting views exist, with some authors giving species status to some of the subspecies listed here.
T. g. graeca (Spain): Carapace yellow to cinnamon with contrasting black markings; plastron very contrasting, more or less symmetrical blotches; head with yellow patches.
T. g. ibera (E Europe): Sand-coloured to brown carapace and plastron with less contrasting markings and a more uniformly coloured head.
T. g. nabeulensis (N Africa, introduced to Sardinia): Usually with distinct yellow on head.

HABITAT

Somewhat more confined to sandy soil than the two other European tortoises, including coastal dunes, open deciduous forest and Mediterranean heathland.

BIOLOGY

Similar to Hermann's Tortoise. Mainly herbivorous, but also sometimes found feeding on snails, worms, carrion or mammal dung. Tortoises are strictly diurnal; however, in summer they will avoid the hottest period of the day, seeking cover under bushes or

Spur-thighed Tortoise, ssp. *nabeulensis*. Sardinia, Italy.

rear view

in burrows. Hibernates in winter, activity ranging between February and November in Spain and March and October in Bulgaria. Mating takes place in spring and in autumn. Females lay up to three clutches, each consisting of up to eight eggs.

NOTE

This species is listed as Vulnerable in the 2009 IUCN Red List of European Reptiles.

Marginated Tortoise *Testudo marginata* Schoepff, 1792

DESCRIPTION

Carapace longer than 38 cm. The largest tortoise in our area. Adult carapace clearly longer than wide with rear scutes upturned. Background colour black with an ochre to cinnamon flare in the centre of each scute. One supracaudal scute; plastron ochre to cinnamon with triangular dark blotches. In juveniles, carapace has the silhouette and coloration of Spur-thighed Tortoise *Testudo graeca* but with triangular dark blotches on the plastron and no large spurs on the thighs.

DISTRIBUTION

Greek mainland, more dispersed towards the N and absent in the NE; also S Albania and some Aegean Islands (Euboea, Salamis, some Sporades (including Skyros) and Argosaronikos). Introduced to NE Sardinia and a number of sites on the Italian mainland, although thought to be extinct in the latter.

VARIATION

The Sardinian population has been described as *T. m. sarda*, but this subspecies is now rejected as it originates from several independent introductions over several thousand years (see Note). Individuals from the western slopes and adjacent lowlands of the Taygetos Mountains (Peloponnese) tend to be smaller, have a less contrasting carapace, and have been attributed to the debated subspecies *T. m. weissingeri*.

HABITAT

Typically occupies the Greek phrygana: sunny, shrub-covered hillsides with rocky outcrops, normally up to 800 m, sometimes up to 1,300 m. On Sardinia in karstic meadows in hilly country.

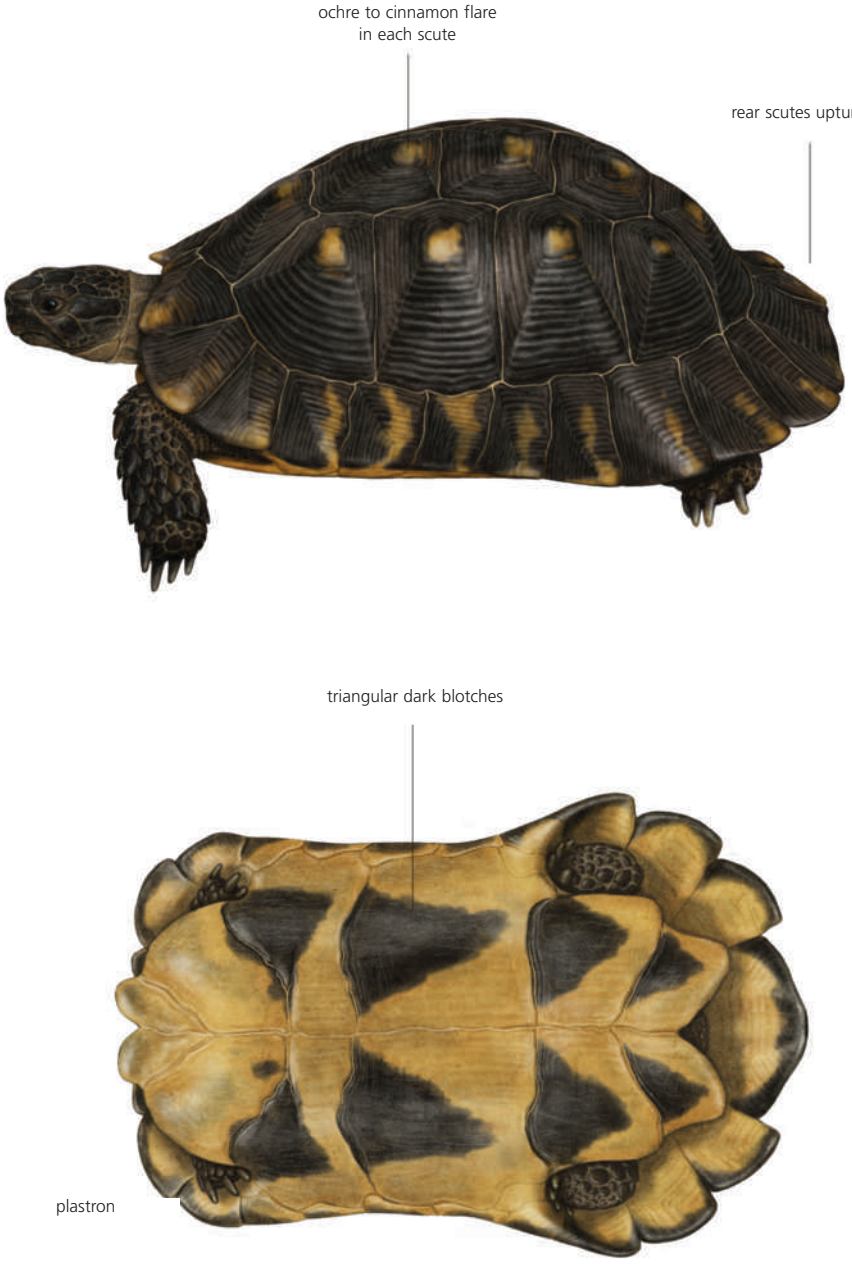
BIOLOGY

Similar to Hermann's Tortoise. Diurnal and active throughout the year, although activity is greatly reduced during winter. Individuals seek shade and become largely inactive during hottest parts of the day in the hot summer months. In contrast to their otherwise tranquil lifestyle, male combat and courtship during the mating season may be very vigorous. Males follow females over long distances, bumping into them with their shells and biting their limbs and neck to force them to stop. The calling of the males and the sound of the carapaces colliding can be heard from a considerable distance. Mating takes place in April and May and also in autumn. Females lay up to three clutches a year, each consisting of up to fourteen eggs.

NOTE

The presence of Marginated Tortoise shells in Greek artefacts from Etruscan ruins on the Italian mainland, and the timing of the first introduction of this species to Sardinia (several thousand years ago), make it likely that the Etruscans indeed founded these populations. Franciscan monks are believed to have made additional introductions of Marginated Tortoises to Sardinia.

Marginated Tortoise



Terrapins (Emydidae and Geoemydidae)

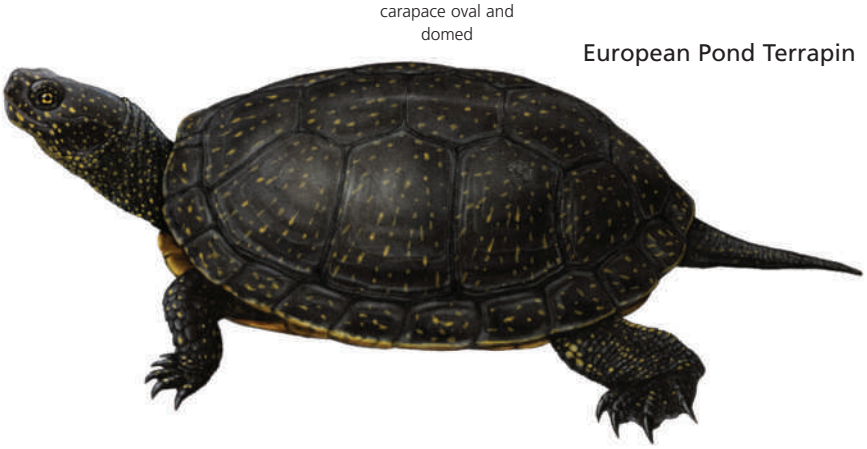
In this book, 'terrapins' refers to aquatic or semi-aquatic turtles living in fresh or brackish water. Terrapins have webbed feet with prominent claws. Unlike tortoises, their diet includes animal prey and they are basically omnivorous.

Two families of terrapin occur in our area: Emydidae and Geoemydidae. The Emydidae is represented in the Western Hemisphere by some 50 species in 10 genera and in our area by the European Pond Terrapin *Emys orbicularis*, as well as by alien N American species, such as the Red-eared Slider *Trachemys scripta*. The Geoemydidae is an Old World family with some 70 species in 20 genera, and is represented in our area by the genus *Mauremys*.

Key to Terrapins			
1	a	Bright yellow dots or streaks on neck, but no longitudinal stripes. No inguinal scutes. Plastron hinged in adults.	European Pond Terrapin *Emys orbicularis*
	b	Longitudinal stripes on the side of the neck. Inguinal scutes present. Plastron not hinged in adults.	2
2	a	Bright red streak on side of the head.	Red-eared Slider *Trachemys scripta*
	b	No red present on the head or neck.	3
3	a	Iberian Peninsula.	Spanish Terrapin *Mauremys leprosa*
	b	Balkan Peninsula.	Balkan Terrapin *Mauremys rivulata*

European Pond Terrapin *Emys orbicularis*

(Linnaeus, 1758)



DESCRIPTION

Carapace up to 25 cm; oval, domed and only keeled in young individuals. Usually olive to dark green, but often brown, reddish or practically black. Bright yellow dots or streaks on head, neck, legs and carapace, sometimes numerous and obvious, arranged randomly or radially on the scutes of the carapace, sometimes almost absent. Plastron yellow or orange to sometimes reddish, with variable brown or black pigmentation which may dominate at times. Iris usually yellow to (especially in males) orange (but see Variation) with a large contrasting black pupil.

DISTRIBUTION

The most northerly distributed turtle in the world. Found in the whole of the European Mediterranean area, including many of the larger islands, but not Crete. In the N, populations become more isolated, up to C France in the west and Latvia in the east. (Re)introduced in many areas in C Europe (Austria, Switzerland, Czech Republic, Slovakia, Germany and Denmark). Outside our area, also Turkey, Russia and almost continuously around the Black and Caspian Seas.

VARIATION

Several subspecies have been described.
E. o. orbicularis: N, W, C and SE Europe. Generally, N of Alps and N and E of Dinaric Alps, including C and E Balkans. In Greece, restricted to NE. On Iberian Peninsula, only immediately S of Pyrenees.
E. o. galloitalica: NE Spanish Coast, following the French Mediterranean to NW, W and SW Italy, down to Calabria. Also on Corsica and Sardinia. Coexists with *E. o. hellenica* throughout most of Basilicata and E Italian coast.
E. o. hellenica: From SE, E and NE Italian coast and lowlands to W Slovenia, southwards along the Adriatic Sea coast to Greece, including Peloponnese, Euboea and islands off the Turkish coast. Iris of eye white.
E. o. occidentalis: Iberian Peninsula, except NE. Also in N Africa. Based on molecular data, individuals of the Spanish *E. o. fritzjurgenobsti* are closely related to African populations, due to which the latter subspecies was rejected, and the range of *E. o. occidentalis* expanded to include the Iberian Peninsula.
E. o. trinacris: Sicily and S Calabria. Although described and still recognised at species level by some authors, this subspecies shows significant gene flow with populations of *E. o. galloitalica* and *E. o. hellenica* and is no more differentiated than some other subspecies.

Somewhat confusing contact zones between these subspecies include, among others, NE Spain S of the Pyrenees (*galloitalica*, *occidentalis* and *orbicularis*), and Calabria (*galloitalica*, *hellenica* and *trinacris*). As human (re)introduction of European Pond Terrapins has been extremely common, many populations throughout its range contain a mixture of different subspecies, e.g. along the SW French Mediterranean coast and near Rome.

HABITAT

Highly variable. Occurs from coastal brackish lagoons and associated marshes to narrow, slow-flowing rivers, ponds and lakes but also in smaller waterbodies such as ditches. These habitats are often characterised by sandy or muddy soil and lush vegetation. Less tolerant to water pollution than other European terrapins. Normally a lowland species, but in the S of its range up to 1,400 m.

BIOLOGY

An able swimmer, but relatively sluggish compared with other European terrapins. Predominantly aquatic, feeding underwater on invertebrates, amphibian larvae and carrion; adults take vegetable matter as well. Usually seen when basking on logs, stones or small reed islands in or near the water. Quite shy when disturbed; will try to hide in the mud at the bottom of the water. Active between March and October in N of range, but hibernation becomes considerably shorter further south or even non-existent (S Spain). Mating takes place between March and May. Females lay 4–20 eggs around May.

Juveniles hatch in late summer or autumn and may hibernate in the nest in N parts of range.

NOTE

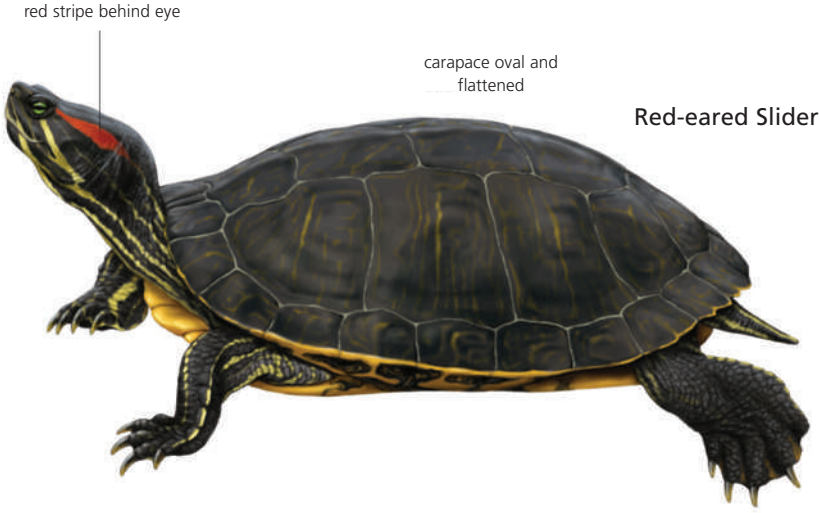
This species is listed as Near Threatened in the 2009 IUCN Red List of European Reptiles.

A reddish European Pond Terrapin. Evros, Greece.

Young and colourful European Pond Terrapin. NE Greece.

Red-eared Slider *Trachemys scripta elegans*

(Wied-Neuwied, 1838)



DESCRIPTION

Carapace up to 33 cm; oval and flattened, strongly keeled in juveniles, but only very slightly so in older adults. Juveniles are bright green with fine yellow lines on carapace, head, neck, legs and tail and a notable red stripe behind the eye. Carapace becomes more uniform dark green in adults and the red stripe may become less vivid in older animals.

DISTRIBUTION

Originally from the SW USA, but imported worldwide as pets. Released or escaped feral individuals may be found throughout Europe. Populations in S Europe have been found to be breeding at several locations. [No map]

VARIATION

The most widely imported subspecies is *T. s. elegans*, but after a European import ban, a myriad of other (sub)species of American terrapins have also been imported and may appear in the wild in Europe.

HABITAT

Generally an inhabitant of shallow, permanent water with abundant vegetation and a soft bed. Found in ponds, shallow coves within reservoirs, backwaters, and slow moving portions of rivers.

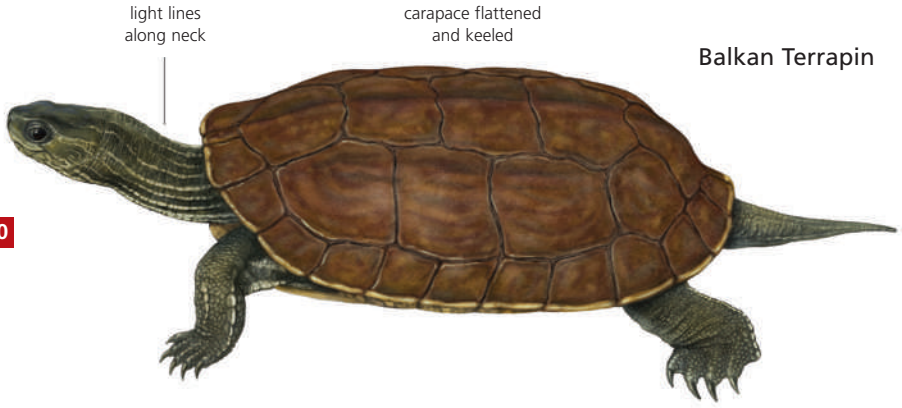
BIOLOGY

May be very shy in the wild, fleeing from approach at a much greater distance than other European terrapins. Usually seen basking on rocks above the surface far from shore, on floating logs or resting on top of emerging aquatic plants – rarely basks on the bank. Feeds on insects, snails, shellfish, amphibians, fish and vegetable matter. Active between February and November, depending on climate. Males may court females extensively, face to face while tickling them with their long claws. Mating takes place in spring while egg deposition has been reported in June and July. Females lay up to three clutches a year, each consisting of 2–23 eggs.

NOTE

A stronger and more agile terrapin than the European species, it usually outcompetes other terrapins, and sometimes completely displaces them. The name Red-eared Slider is specific to *T. s. elegans*, and the species as a whole is known as Pond Slider.

Balkan Terrapin *Mauremys rivulata* (Valenciennes, 1833)



DESCRIPTION

Carapace up to 20 cm; oval and flattened. Usually greenish-grey with light coloured lines along the neck, the one starting behind the eye and going along the temporal area being the broadest. Carapace with vertebral keel; less clearly developed keels to the costal scutes on both sides in juveniles, but smoother in older individuals. Iris greenish or brownish, often with a dark spot on each side of the pupil; pupil small and dark. Iris occasionally very dark, giving the eye an all-black appearance.

DISTRIBUTION

S Balkans. E Adriatic coast from S Croatia and Montenegro southwards, Albania, S Macedonia, S Bulgaria, Turkish Thrace and Greece, including many Ionian and Aegean islands and Crete. Outside our area, also in W Anatolia.

VARIATION

Some variation in coloration. As in most terrapins, colouring and markings on the carapace are sometimes difficult to observe because of a covering of algae.

HABITAT

Prefers slow-running waters, but can be found in all sorts of freshwater habitats and is very tolerant towards brackish or even polluted water. Mainly a lowland species, found up to 800 m.

BIOLOGY

Like other terrapins, often seen basking on rocks or logs near water, on vegetation or on banks but also floating at the surface in open water. Though quite shy in the wild, some populations near tourist areas may become accustomed to people and individuals will come begging for food. Capable of emitting a foul-smelling musk when handled. Feeds predominantly on invertebrates such as insects and snails but adults may also feed on carrion or plant material such as algae. May hibernate in winter, but can be seen basking on sunny days. Mating takes place in spring and females lay four to twelve eggs in early summer. Eggs hatch in late summer or autumn.

Spanish Terrapin *Mauremys leprosa* (Schweigger, 1812)

DESCRIPTION

Carapace usually less than 20 cm. Similar to the non-overlapping Balkan Terrapin *Mauremys rivulata* but often with a reddish-brown complexion and rather more stockily-built with a slightly broader head. Iris greyish or light blue. Skin grey to olive or dark yellow. Neck and front legs with yellow or whitish curlicues, which are less conspicuous or absent in adult individuals but distinct in juveniles. Plastron yellow to orange with dark blotches, which fade with age.

DISTRIBUTION

Iberian Peninsula, but only a few populations in the NW and Pyrenean area. Just enters France on the Mediterranean coast, extremely restricted there. Introduced on Mallorca, breeding in two different locations (not mapped). Outside our area, also widespread in NW Africa.

VARIATION

Some variation in coloration and shading, but no known subspecies in our area.

HABITAT

Inhabits both sparsely and well-vegetated ponds, ditches, rivers, small flowing streams (also those in the mountains in the S part of its distribution), lakes, quarries and other medium to large waterbodies. Occurs normally up to 650 m, but some records from around 1,000 m. Can be surprisingly common in level areas with numerous cattle-ponds.

BIOLOGY

Similar to Balkan Terrapin. Capable of emitting a foul-smelling musk when handled. Hibernates in N of its range, aestivates in the mud when occupied waterbodies dry out. Migrates over land during rainy periods, occasionally at night. Mating may take place between March and May and between September and October. Females lay up to three clutches a year consisting of up to thirteen eggs each. The eggs hatch in autumn.

NOTE

This species is listed as Vulnerable in the 2009 IUCN Red List of European Reptiles.

Sea Turtles (Cheloniidae and Dermochelyidae)

There are 7 species of sea turtle in the world. One of them (Loggerhead Turtle *Caretta caretta*) breeds in our area, two others (Green Turtle *Chelonia mydas* and Leatherback Turtle *Dermochelys coriacea*) occur regularly on migration, and two more (Kemp's Ridley *Lepidochelys kempii* and Hawksbill Turtle *Eretmochelys imbricata*) are vagrants. All but one species belong to the family Cheloniidae. The Dermochelyidae contains only a single species. (Leatherback Turtle).

Sea turtles are almost entirely aquatic and have flippers instead of feet. They use their front flippers like wings and the hindlimbs to steer, in more or less the same way as penguins or sea lions propel themselves through the water.

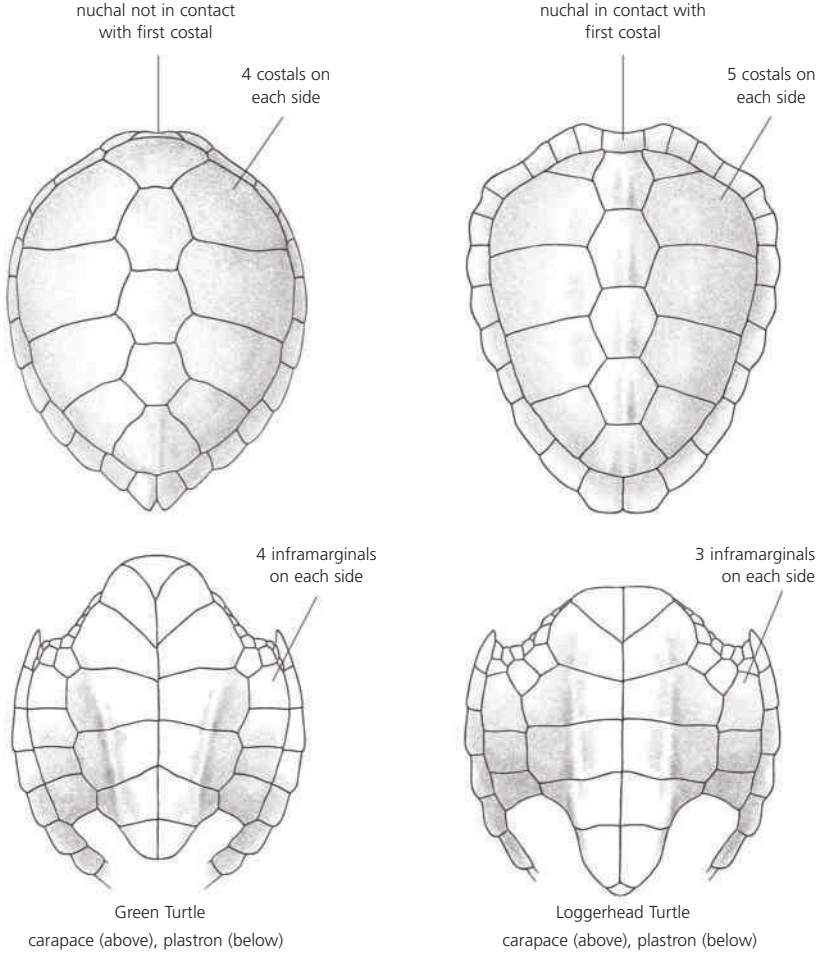
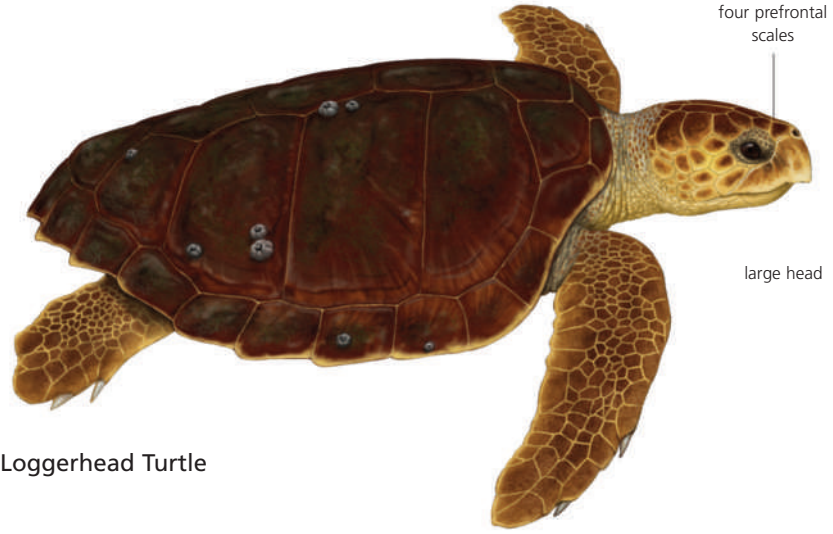


Fig. 23. Sea turtle shells.

Key to Sea Turtles			
1	a	Carapace with horny scutes.	2
	b	Carapace covered by leathery skin, stretched over 5–7 longitudinal ridges	Leatherback Turtle *Dermochelys coriacea*
2	a	5 costal scutes on each side. Nuchal scute in contact with first costal.	3
	b	4 costal scutes on each side. Nuchal scute not in contact with first costal.	4
3	a	Carapace clearly longer than broad. Underside with 3 pairs of inframarginal scutes without pores.	Loggerhead Turtle *Caretta caretta*
	b	Carapace almost as broad as long, sometimes even broader. Underside with 4 pairs inframarginal scutes, each with a pore.	Kemp's Ridley *Lepidochelys kempii*
4	a	One pair of prefrontal scales on snout. Scutes on carapace do not overlap.	Green Turtle *Chelonia mydas*
	b	Two pairs of prefrontal scales on snout. Anterior scutes on carapace overlap posterior ones.	Hawksbill Turtle *Eretmochelys imbricata*

Loggerhead Turtle *Caretta caretta* (Linnaeus, 1758)



Loggerhead Turtle

DESCRIPTION

Carapace usually less than 100 cm but occasionally up to 120 cm. Large sea turtle with a relatively large head. Body sand-coloured to brown; carapace reddish-brown; plastron yellow. Carapace with five vertebral scutes and five pairs of costal scutes bordering them; the nuchal scute touches the first costal scute; four prefrontal scales between the eyes. Young individuals have keels on the carapace scutes, with the keels on the vertebral scutes sometimes having a small protrusion on the back. Scutes of adults are unkeeled. All four flippers usually have two (rarely three) claws.

DISTRIBUTION

Cosmopolitan distribution, inhabiting the Atlantic, Indian and Pacific Oceans, as well as the Mediterranean Sea. The only sea turtle breeding regularly in our area. All breeding sites are in the E Mediterranean

Sea: the Ionian coast of the Greek mainland and the islands of Corfu, Lefkas, Kefallinia, Zakynthos, also the Peloponnese, Kythira, Crete, Rhodes and Kos. Also the Ionian coast of Calabria in S Italy. Outside our area, breeds on the coasts of Turkey, Cyprus, N Africa, and the Italian islands of Lampedusa and Linosa. Young individuals from N America can be seen near the Atlantic shores of W Ireland, W Britain, W France and Iberia; also in the W Mediterranean.

VARIATION

Populations from the Atlantic, Pacific and Indian Oceans are genetically distinct; individuals from the Mediterranean seem to have mixed origin.

HABITAT

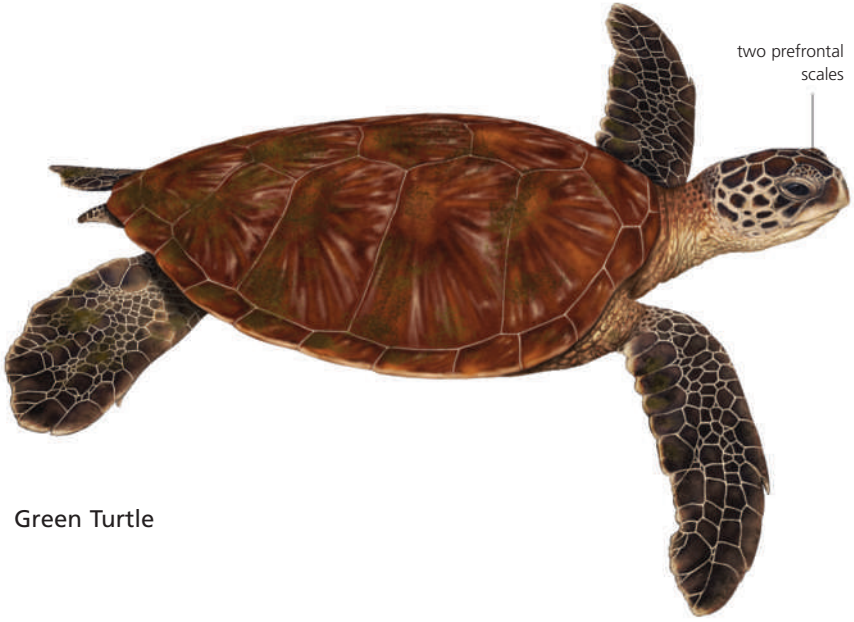
Hatchlings live where the currents take them and can be found in the open ocean where they live in and around floating seaweed mats. Juveniles and adults live along the continental shelves as well as in estuarine habitats. Pregnant females can remain in shallow coastal waters for weeks or months before visiting the sandy beach where they deposit their eggs.

BIOLOGY

Loggerheads feed mainly on bottom-dwelling plants and invertebrates, and spend most of their time submerged. A dive lasts almost half an hour on average, but can last up to four hours. In some places they are used to being fed and are thus easy to observe, e.g. on Cephalonia. Males may ride on the female's back for several hours during mating, holding on with the nails on their flippers. Females come ashore between May and September to lay up to 200 eggs in a 60 cm deep burrow on sandy beaches. During the early months of this period, females often make reconnaissance visits and do not lay eggs every time they come ashore. Juveniles emerge a month later.

A female Loggerhead Turtle on her way back to the sea. Crete, Greece.

Green Turtle *Chelonia mydas* (Linnaeus, 1758)



Green Turtle

DESCRIPTION

Carapace up to 100 cm but occasionally even 140 cm. Large sea turtle with an elliptical carapace composed of five central scutes flanked by four pairs of costal scutes. Nuchal scute does not touch the first costal scute. Two large prefrontal scales between the eyes. All flippers have one claw, although those on the hind flippers may be inconspicuous.

DISTRIBUTION

Atlantic, Indian and Pacific Oceans, as well as the Mediterranean Sea. Does not breed regularly in our area, but some breeding attempts have been recorded, yet never published, from Crete. Nesting beaches exist close to our area, in S Turkey and Cyprus. Can also be seen near the European Atlantic coast. Not mapped.

VARIATION

Individuals from the Mediterranean and Atlantic Ocean belong to the nominate subspecies. The carapace is browner than the (greenish) subspecies from the Pacific and Indian Oceans *Chelonia mydas agassizii*.

HABITAT

Typical inhabitant of shallow lagoons; migrates along the coast. Rarely seen in the open ocean, unless migrating to or from island breeding grounds.

BIOLOGY

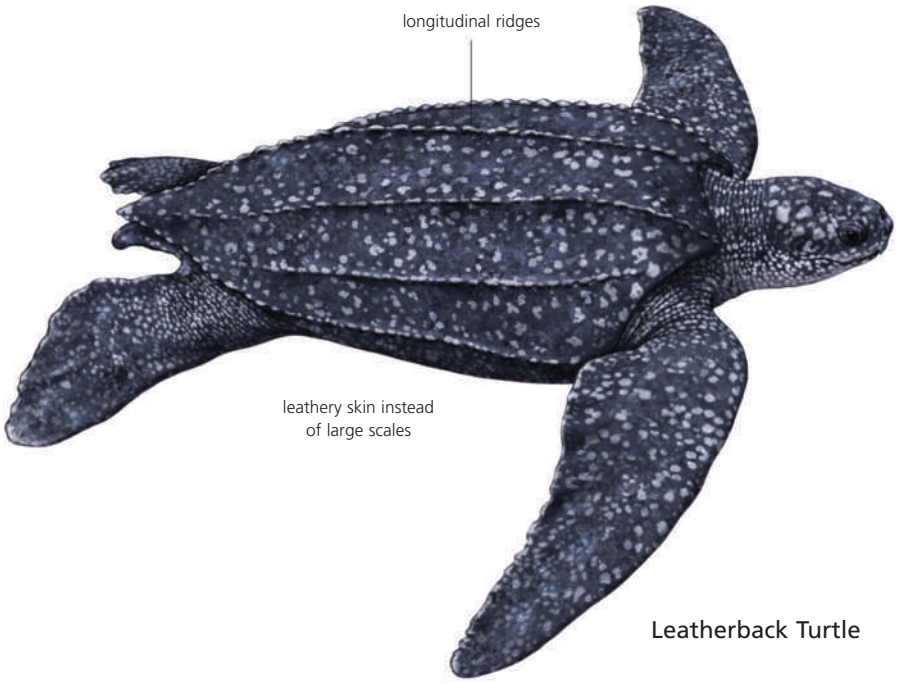
Adults are mainly herbivorous, feeding on different species of seaweed. Green Turtles are more susceptible to cold water than other turtles, and can sometimes be found sunbathing on the shore.

NOTE

The ‘green’ in its name mainly refers to its insides, which were used to make a hearty meal for seamen.

Leatherback Turtle *Dermochelys coriacea*

(Vandelli, 1761)



Leatherback Turtle

DESCRIPTION

Carapace up to 175 cm but sometimes even 220 cm. Very large sea turtle, which can weigh over 500 kg (largest, found in Wales, was 915 kg). Very distinctive. Distinguishable by lack of horny scutes on the carapace. Instead has a leathery skin, stretched over 5–7 longitudinal ridges. Carapace usually dark grey with white specks.

DISTRIBUTION

Found in all tropical and subtropical oceans, but also ranges into the Arctic Circle. Does not breed in our area, but individuals can be encountered in the Atlantic (up to Iceland and Scandinavia, but more commonly in the Irish Sea) and more rarely in the Mediterranean Sea. Not mapped.

VARIATION

Populations from the Atlantic, Pacific and Indian Oceans and in the South China Sea are genetically distinct.

HABITAT

Typically an open ocean species, favouring breeding sites on the mainland bordering deep water, and avoiding sites protected by coral reefs.

BIOLOGY

Feeds almost entirely on jellyfish, aided by backward-pointing spines in the mouth and oesophagus. Migrates over enormous distances (up to 10,000 km) following jellyfish populations. Can dive to depths of over 1,000 m.

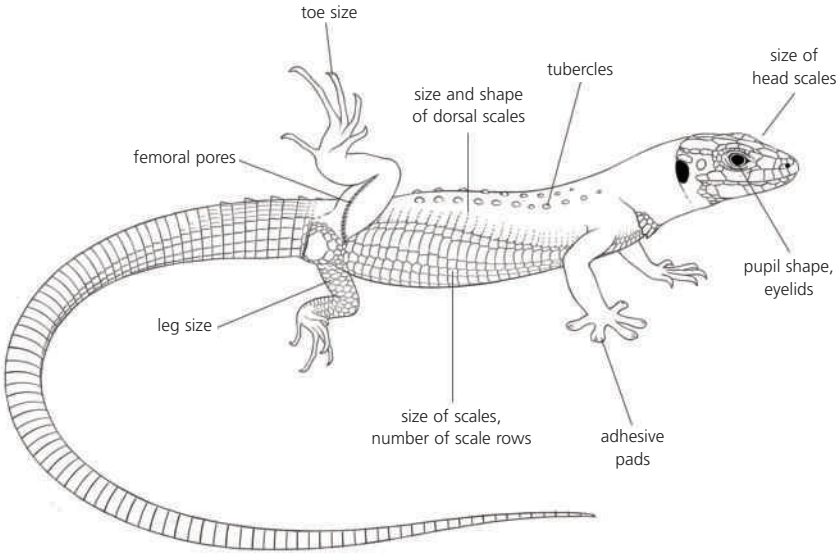
Leatherback Turtles are able to maintain a high body temperature using self-generated heat. They have an extremely high activity rate, and this constant swimming creates heat in the muscles in the front flippers. A system of counter-current heat exchangers brings this warmth into the well-insulated body. Adult Leatherback Turtles have been found swimming in water 18°C colder than their body temperature.

LIZARDS (SAURIA)

Also called Lacertilia, this group contains over 6,000 species worldwide. Most have legs, but some do not, or have only reduced or very small vestigial limbs. Over 80 species occur in Europe, belonging to eight families.

Key to European families of Lizards	
Only in restricted parts of Greece. Large with large head covered with only small scales. Dorsoventrally flattened. Spiny.	Agamas – Agamidae (p.218)
Only in limited coastal Mediterranean areas. Laterally flattened with mid-dorsal and mid-ventral ridge. Head casque-shaped. Large bulging eyes, mostly permanently covered with skin.	Chameleons – Chamaeleonidae (p.219)
Vertical pupil in good light. Largely nocturnal, climbing species. S Europe only.	Geckos – Gekkonidae, Phyllodactylidae and Sphaerodactylidae (p.223)
No legless species. Dorsal scales are very small, not very shiny and granular, or larger, triangular and keeled. Ventral scales larger, arranged in rows. Hind legs with femoral pores. Top of head with enlarged scales.	True lizards – Lacertidae (p.234)
Contains both legless species and species with legs, which may be minute. Body cylindrical with shiny semi-circular scales. Ventral scales identical to dorsal scales. Truly legless species only in S Greece, shiny, without prominent groove on sides, smaller than 20 cm and with 18 (rarely 20) scale rows around the mid-body, speckled with rows of small black dots. Hind legs without femoral pores.	Skinks – Scincidae (p.333)
All species legless. As in skinks, body cylindrical with more or less shiny scales. Ventral scales more or less identical to dorsal scales. More than 20 scale rows around the mid-body. One species may be very large (up to 120 cm) with armour-like scalation and a prominent groove along each side.	Slow worms – Anguidae (p.342)

Fig. 24. Useful features for lizard identification.



Agamas (Agamidae)

Agamas are a family of Old World lizards, occurring in Europe, Asia, Africa (but not on Madagascar) and Australia. In many ways, they represent the counterpart of the Iguanidae of the New World. Many species are rather large and robust, with a flattened body and spiny scales. Several are able to change colour, but less dramatically than the chameleons. Only a single species occurs in our area, with much of its current range resulting from human introductions.

Starred Agama *Laudakia stellio* (Linnaeus, 1758)

Starred Agama

DESCRIPTION

TL: up to 35 cm, half of which is composed of the tail. Large, robust lizard with a large head with obvious ear-openings. Body relatively short, wide and flattened. The whole body is covered with small scales which are in part particularly spiny, a typical feature of all agamas. Legs with long, clawed toes. If broken, tail does not regenerate as effectively as that of lacertid lizards. Colours vary greatly; usually dark grey, brown or black, quite often with three or four larger yellowish blotches on the back and cross-bar rings on the tail. Males can be especially colourful, including yellow, red, orange, blue, brown and black. Colours may change according to time of day and temperature.

DISTRIBUTION

European occurrence, except for E Aegean Islands, probably entirely due to ancient introductions. Restricted to Greece with a discontinuous range, occurring on the Chalkidiki Peninsula and wider surroundings (incl. Thessaloniki), NE Greece, Corfu, a number of the Cyclades islands (incl. Mikro Rhematiaris, Rhineia, Mykonos, Delos, Paros, Antiparos, Naxos) and many islands off the Turkish Aegean coast (incl. Samos, Thimena, Syrni, Chalki, Kalymnos, Kastellorizo (not mapped), Kos, Leros, Nisyros, Rhodes, Symi, Telendos, Tilos, Lesbos, Chios, Fourni, Ikaria).

Also more recently introduced to E Crete and possibly elsewhere (not mapped).

Fairly common over most of its European range, often present in high numbers, even on smaller islands. Outside our area, also in Cyprus, S Turkey, Middle East and Egypt.

VARIATION

Two subspecies have been considered for the populations within our area.
L. s. stellio: Cyclades, Sporades, Rhodes and Ionian Islands (Corfu).
L. s. daani: N Greek mainland and the E Aegean Islands.

HABITAT

Typically found in (very) warm, rocky environments, often with walls, rock piles or trees serving as lookout posts. In Europe, largely restricted to low elevations, but up to 2,000 m in the Middle East.

BIOLOGY

Diurnal and tolerant of high temperatures; may even be active when substrate temperatures reach 60°C. Feeds on plant matter and a wide variety of arthropods, and even smaller lizards. Climbs rocks and tree trunks quite easily. Often seen overlooking its habitat from a vantage point. Several individuals may be seen basking together. Males occupy territories inhabited by small groups of females and juveniles and defend these against other males. Territorial behaviour includes bobbing the head up and down. When approached, often retreats rapidly into crevices or other hiding places where it inflates its body to anchor itself. Active even on sunny winter days. Mating takes place in May. Oviparous; females lay 6–10 eggs that hatch after two to four months. Often abundant in suitable habitat but usually shy with a large flight distance, making binoculars useful for spotting and observing them.

NOTE

A morphological study placed this species in a new genus as *Stellagama stellio.* Pending more data and a molecular analysis, we retain the older name here.

Chameleons (Chamaeleonidae)

Chameleons are a family of secretive arboreal lizards, which are completely adapted to life in shrubs and trees, with their laterally flattened bodies, prehensile tails and feet modified into pincers. Colours may vary depending on the individual, body temperature, social situation (pregnancy, stress) and camouflage requirements. Eyes move independently. The family currently contains over 200 described species belonging to 12 genera. The great majority of these species are found throughout sub-Saharan Africa and Madagascar. A few species live outside this area in N Africa, the Arabian Peninsula, S India, Sri Lanka and on oceanic islands in the Indian Ocean, with only two species occurring along the Mediterranean coast. Chameleons are diurnal and use a 'cruise foraging' strategy to search for prey, moving short distances between stops to scan the environment for prey (and possible predators). Diet varies during the year in European species but prey consists largely of bees, wasps (spring) and grasshoppers (summer, autumn) which are taken using the long, projectile tongue. European species are oviparous, with mating taking place during late summer and egg-laying in autumn. During winter the European chameleons become largely inactive but may be seen basking on sunny days.

Key to Chameleons	
In Europe, SW Peloponnese only. Backwards pointing casque; no posterior lobes. Males with spur on hind feet.	African Chameleon *Chamaeleo africanus*
S Iberian Peninsula, Malta, Calabria, Apulia, Samos. Posterior lobes on back of head. No spur on hind foot of males	Mediterranean Chameleon *Chamaeleo chamaeleon*

Mediterranean Chameleon *Chamaeleo chamaeleon* (Linnaeus, 1758)

African Chameleon *Chamaeleo africanus* Laurenti, 1768

DESCRIPTION

TL: up to 30 cm in Mediterranean Chameleon (but usually smaller in Europe), and up to 46 cm in African Chameleon. Quite typical chameleons – distinctive lizards with laterally flattened bodies, prehensile tails, casqued heads and bulging eyes. Tail roughly half of total length. Feet modified into pincers. Eyes large but largely covered with skin, so eye opening small. No visible ear-openings. Scales granular. As typical for chameleons, colours vary greatly and may alter in a moment. Often green with pale markings forming an interrupted lateral line and darker spots covering the entire animal, but ground colour may also be brown, black or grey. Variability due to individual variation, camouflage, pregnancy, social interaction and body temperature regulation. Sleeping individuals usually uniformly pale, rapidly gaining colour upon waking. Apart from size, the two species are distinguishable by presence of spurs on the hind feet of males, often somewhat higher and more backward pointing casque, and lack of posterior lobe on casque in African Chameleon.

DISTRIBUTION

Mediterranean Chameleon: S Iberian Peninsula, roughly from the Algarve in Portugal following the coastline eastwards, extending into Murcia in Spain. Apparently absent between W Cádiz and W Málaga provinces. Discontinuities are most likely the result of multiple introductions. Also on Malta and Samos (Greece). European presence, except for Samos, probably resulting entirely from ancient (and recent) introductions. Small introduced populations occur elsewhere (e.g. Calabria and Apulia in S Italy). Records from Crete, Chios (Greece) and Sicily probably do not relate to breeding populations. Outside our area in S Turkey, Middle East, SW Arabia and N Africa. African Chameleon: European distribution is the result of an ancient introduction. Restricted to a small area in SW Peloponnese (Greece). Outside our area, mainly sub-Saharan Africa, discontinuously following the Nile north to the Mediterranean.

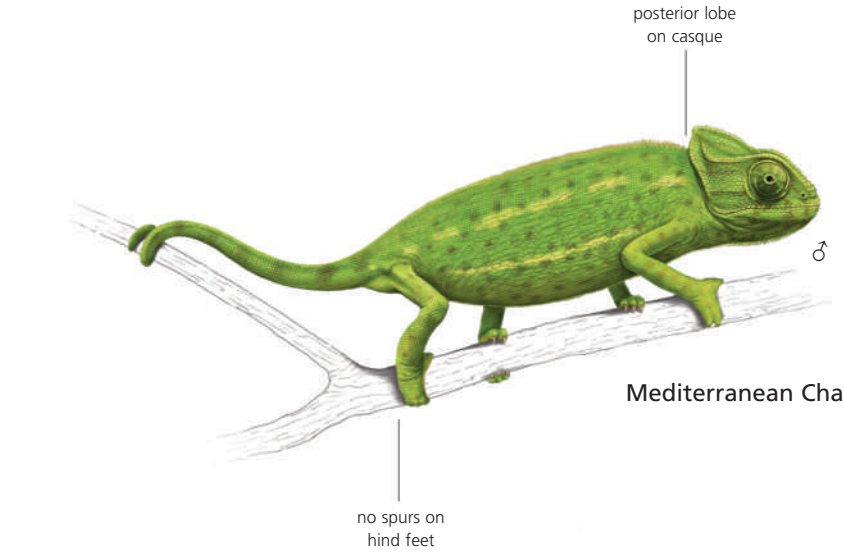
VARIATION

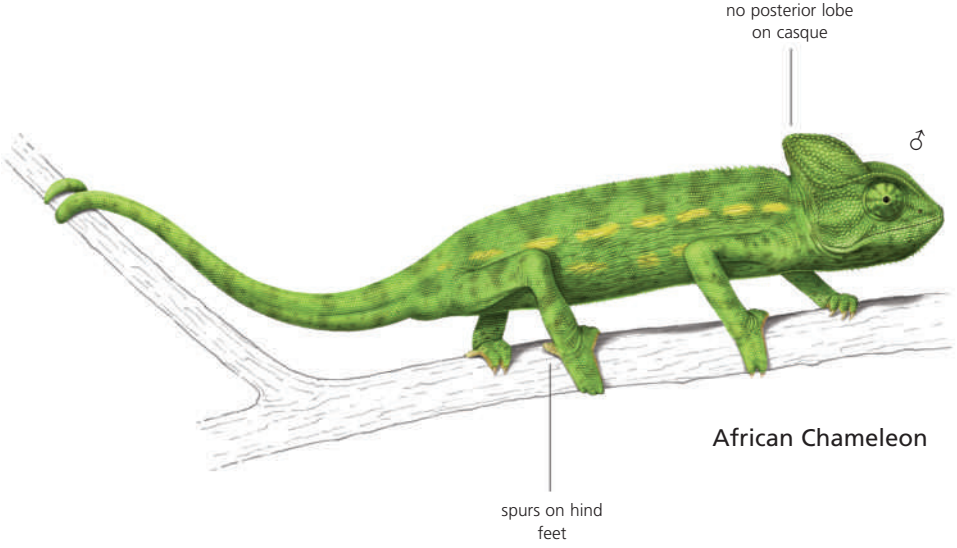
Populations of Mediterranean Chameleon from Samos (as well as the Turkish mainland) have been attributed to the subspecies *C. c. recticrista*. In contrast to the nominate subspecies, individuals have white ring-shaped markings with a dark centre on both flanks.

HABITAT

Favours warm, dry areas with sufficient vegetation and loose soils suitable for egg laying. Usually along the coast, in places such as dunes, pine forests, orchards, gardens, overgrown wastelands and reedbeds. Often climbs *Retama* bushes, tamarisk, pine or reeds. In Europe largely

Mediterranean Chameleon
African Chameleon


posterior lobe
on casque
♂
Mediterranean Chameleon
no spurs on
hind feet


no posterior lobe
on casque
♂
African Chameleon
spurs on hind
feet

restricted to frost-free, coastal elevations but occurs up to about 800 m in Spain, over 900 m on Samos and outside of Europe up to about 1,700 m in Morocco, and even 2,000 m in Yemen.

BIOLOGY

Diurnal, and tolerant of high temperatures. Generally solitary, territorial species. Territorial disputes may lead to fights, including mouth-gaping, biting and an increased display of dark colour pigments. Chameleons are skilled climbers. They rarely venture onto the ground other than during the mating season when males leave their territory looking for a female (August or September) or when females descend to lay their eggs in a self-dug burrow roughly 30 cm deep (around October). Females lay up to 46 (Mediterranean) or 90 (African) eggs that hatch in late summer. Such a long incubation time makes the nest vulnerable to trampling, and people searching for chameleons often damage the eggs or make the soil too compact for the juveniles to emerge from the nest. Both species are short-lived and rarely grow older than three years. Often sleep at the end of twigs and branches in order to avoid potential predators.

ABOVE: Mediterranean Chameleon, ssp. *recticrista*. Samos, Greece.

LEFT: African Chameleon, regaining colour briefly after waking up. Peloponnese, Greece.

■ Geckos (Gekkonidae, Sphaerodactylidae, Phyllodactylidae)

Previously treated as a single family, there are over 1,500 species of geckos worldwide, from among the smallest terrestrial vertebrates in the world (*Sphaerodactylus* in the Caribbean) to large tree-dwelling lizards (*Rhacodactylus leachianus* on New Caledonia). Only four species occur in Europe, belonging to four genera. Geckos are often characterised by large heads and eyes, granular skin and a plump body. Many species have adhesive pads under the toes which allow them to climb, even on smooth vertical surfaces, but the toes may be curled up when running on the ground. All geckos except the Eublepharidae lack eyelids. Unlike other lizards in Europe, geckos have vertical pupils which match their largely nocturnal lifestyle, although some European species (*Tarentola* and *Mediodactylus*) may be seen basking during the day, mainly in the morning. However, geckos are more often observed at night, often around artificial light sources, chasing insects attracted by the light. Skin colour may alter quite rapidly, usually becoming paler by night and/or matching the substrate. Geckos may communicate vocally, and make squeaking sounds, especially at night. The European species are now distributed across three families – Gekkonidae (Turkish Gecko *Hemidactylus turcicus* and Kotschy's Gecko *Mediodactylus kotschyi*), Phyllodactylidae (Moorish Gecko *Tarentola mauritanica*) and Sphaerodactylidae (European Leaf-toed Gecko *Euleptes europaea*).

Key to Geckos	
Tyrrhenian Islands and isolated populations in S France and NW Italy. Toes with adhesive pads only present at toe-tip; claws barely visible. No tubercles on back.	European Leaf-toed Gecko *Euleptes europaea*
Coastal areas in W Mediterranean Basin including Balearics and Tyrrhenian Islands, much more restricted in E Mediterranean. Toes with extensive, undivided adhesive pads; claws only present on 3rd and 4th toe of front feet. Tubercles on back.	Moorish Gecko *Tarentola mauritanica*
Coastal areas throughout the Mediterranean and on many islands including Balearics, Tyrrhenian Islands and Aegean. Adhesive pads divided and not extending to toe-tip; claws present. Tubercles on back.	Turkish Gecko *Hemidactylus turcicus*
S Balkans, including many Greek islands, including small ones. No adhesive pads. Narrow, elongated toes characteristically kinked. Tubercles on back.	Kotschy's Gecko *Mediodactylus kotschyi*

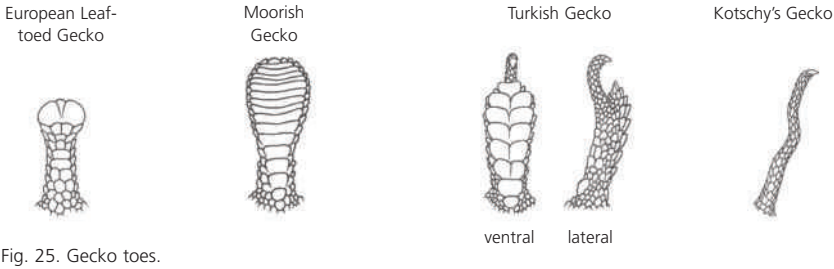
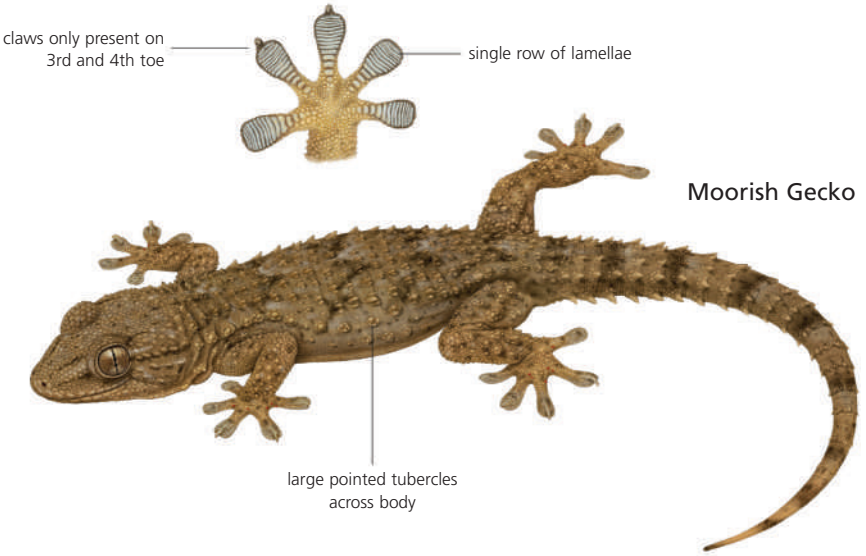


Fig. 25. Gecko toes.

Moorish Gecko *Tarentola mauritanica* (Linnaeus, 1758)



DESCRIPTION

TL: 16 cm; SVL: up to 9 cm. Medium-sized gecko with broad, flattened head and robust body. Dorsal coloration pale or dark brown or grey, sometimes with dark transverse bands, which are more evident in juveniles. May be more or less uniformly dark, especially when basking during daytime. Ten or more longitudinal rows of large, pointed tubercles run along body giving a rather spiny appearance. Enlarged tubercles above eye. Ventral parts white or yellowish. Toes with adhesive pads, being larger near the tip and covered below by a single row of lamellae. Claws only present on third and fourth toe. Often with minute red mites (*Geckobia*) between toes or around eyes.

DISTRIBUTION

Mostly confined to W Mediterranean, inhabiting most of the Iberian Peninsula (except extreme NW), S France, Italy, and far less continuously along the Adriatic coast (Croatia). Isolated on W and N Peloponnese. On many islands, including the Balearics, Corsica, Sardinia, Sicily, Malta, Gozo, and some Greek islands such as Cephalonia, Ithaca, Zakynthos and Crete. Also found on several tiny islets around these main islands. At least in Greece, presence most likely due to introductions. Also in N Africa and on the Italian islands of Pantelleria and Lampedusa.

VARIATION

Populations from at least Zakynthos and Strofades islets have been tentatively attributed to *T. m. fascicularis*, a subspecies originating from N Africa, which may warrant full species status. Three distinct genetic groups occur in Europe, of which

two also occur in N Africa. The most range-restricted of these, native to the western Baetic mountains of Cádiz and Málaga, separated from other Moorish Gecko populations more than five million years ago and may deserve species status. Confusingly, this group coexists locally with individuals of one of the two other groups, which are morphologically indistinguishable.

HABITAT

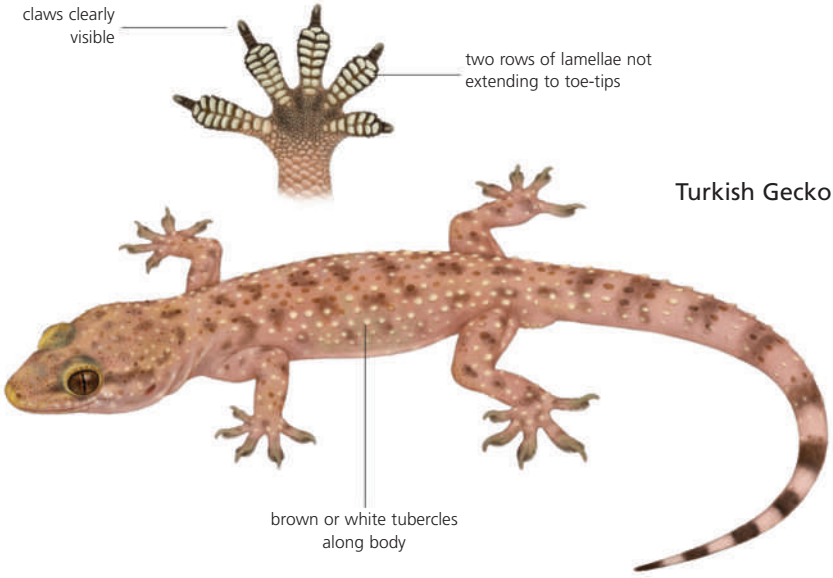
Rocky, usually lowland habitats, but extends inland in the Iberian Peninsula and Italy. Inhabits rocky outcrops, dry-stone walls, ruins or boulders in dry maquis or scrubland, as well as bare rock faces with little vegetation. Also around human habitation, where it is even found in houses and may be abundant. Usually below 400 m, but up to 2,350 m in Sierra Nevada, S Spain.

BIOLOGY

Predominantly nocturnal, but may also be seen during daytime when basking, especially in the morning or late afternoon. Feeds mainly on a wide variety of insects but may take small amounts of plant matter as well. Often seen on walls near lights, chasing and catching insects attracted to the light. Capable of running swiftly across walls and ceilings but may be ground-dwelling as well. Individuals may hibernate in large groups, while in the south of its range activity may continue throughout the year. A wide variety of clicking noises are produced to establish territories. Breeding takes place between spring and autumn. Oviparous; females lay several clutches usually of two eggs each throughout the reproductive period, underneath rocks or in cracks. Abundant over all of its range, reaching especially high densities on islands.

Moorish Gecko. Algarve, Portugal.

Turkish Gecko *Hemidactylus turcicus* (Linnaeus, 1758)



DESCRIPTION

TL: 12 cm; SVL: up to 5.5 cm. A typical and small to medium-sized gecko with a flattened and bulging head. Body often somewhat translucent with variable coloration, often pinkish, white or yellowish with slightly darker irregular cross-bands or markings on upperparts, ventral coloration uniformly white. Dorsal scalation is granular with brown or white tubercles. Slightly flattened tail, pale with darker cross-bands; particularly apparent in juveniles. Toes with adhesive pads with two rows of lamellae below. Lamellae do not extend to tips of toes; claws clearly visible.

DISTRIBUTION

All along the Mediterranean and on most of the larger and smaller islands. Predominantly in coastal lowland areas but occurs inland in S Spain and parts of Italy.

VARIATION

Morphological characteristics of the subspecies *H. t. spinalis* from Addaya Grande, an islet off Menorca, have proved to fall within the variation of the species as a whole, rendering it invalid.

HABITAT

Favours a great variety of warm, rocky habitats, such as rocky outcrops, dry-stone walls, dry riverbeds and cliffs. Also in dry maquis or sand dunes with loose rocks. Frequently found near human habitation, inhabiting walls, ruins, piles of rubbish, and even inside houses. Usually below 300 m, but locally occurs above 1,200 m (S Spain).

BIOLOGY

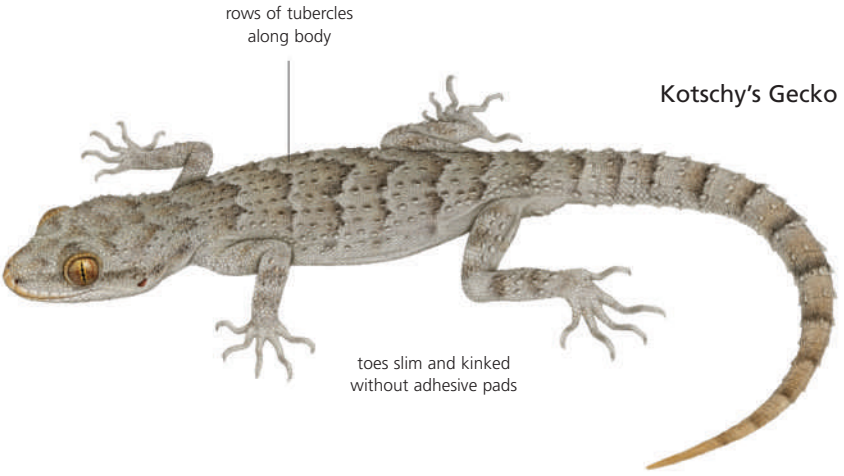
A predominantly nocturnal species, more so than Moorish *Tarentola mauritanica* and Kotschy's Geckos *Mediodactylus kotschyi*. Feeds mainly on insects and on smaller vertebrates such as juvenile lizards. Often seen catching insects attracted to lights. Capable of running swiftly across walls and ceilings. In S of range active throughout the year. May raise tail when cornered. A wide variety of clicking noises are produced during various social interactions. Mating usually takes place between April and July. Oviparous; females usually lay three clutches per year, invariably consisting of two eggs each. Deposition usually takes place underneath rocks, in cracks or under plant matter. Sometimes occurs alongside Moorish Gecko, where it is found lower down on walls, or even on the ground. In SE Europe, often found alongside Kotschy's Gecko.

Turkish Gecko of the invalid spp. *spinalis*. Addaya Grande, Menorca, Spain.

Turkish Gecko. Montenegro.

Kotschy's Gecko *Mediodactylus kotschyi*

(Steindachner, 1870)



DESCRIPTION

TL: 10 cm; SVL: 5.5 cm. A rather typical and relatively small gecko with a slender neck and large, flat head. Dorsal coloration often pale grey or grey-brownish, with several dark, V-shaped markings with pale edges running along upperparts which may continue onto tail. May be more or less uniformly dark, especially when basking during daytime. Longitudinal rows (8–14) of tubercles along body and tail. Regenerated tail smooth and without markings. Ventral coloration uniform whitish to orange. Toes slim and kinked, without adhesive pads. Males may have femoral pores in front of cloacal opening.

DISTRIBUTION

From S Albania, SW Serbia, Macedonia and S Bulgaria southwards into Greece, including most Aegean and Ionian islands, even small, practically bare islets. More isolated occurrences in S Crimea and Apulia, S Italy. Also Middle East and Cyprus. Interestingly, the distinct lineage found on Crete seems to be rare on the main island (although occurring at sea-level as well as on mountains which may have snow cover in winter), whereas it is abundant on most of its surrounding islets.

VARIATION

Many of the numerous described subspecies may be invalid, whereas the population from Crete and nearby islets (*M. k. bartoni*) has a long history of separate evolution, which might warrant treating it as a separate species.

HABITAT

Favours dry, rocky habitats but can also be found in trees. Usually inhabits rocky outcrops, dry-stone walls, cliffs, maquis, wastelands, etc. where it can be abundant. Sometimes in and around human habitation,

but somewhat less frequently so than Moorish *Tarentola mauritanica* and Turkish Geckos *Hemidactylus turcicus*. In northern parts of range more often found near human settlements than in southern parts. Often found at low altitudes, but up to 1,400 m on Peloponnese and Crete.

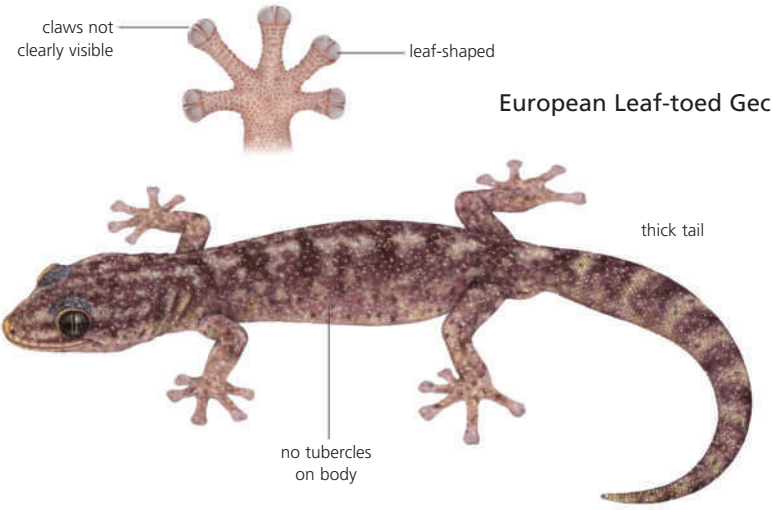
BIOLOGY

Predominantly a nocturnal species, but may bask near rock crevices in the morning or late afternoon, especially in spring or autumn. Feeds mainly on small invertebrates. Despite lack of adhesive toe-pads, climbs very well, even hanging upside down. Usually active between March and November, but may be active throughout the year in S of range. Communicates by series of clicking noises during various social interactions. Mating takes place in May. Oviparous; females lay two eggs, usually underneath rocks or in cracks. Eggs hatch between July and October. Very common in most of range, reaching high densities, especially on islands.

ABOVE: Kotschy's Gecko, ssp. *bartoni*. Crete, Greece.
BELOW: When active during daytime, Kotschy's Gecko often displays relatively dark colours. Kemer, Turkey.

European Leaf-toed Gecko *Euleptes europaea*

(Gené, 1839)



DESCRIPTION

TL: 8 cm; SVL: 4 cm. One of the smallest European lizards, with slender body and rather conspicuous thick, blunt tail. Most individuals have regenerated tails which are even thicker, as a result of tail loss during territorial fights. Neck relatively long and thin in relation to head width, especially compared with other European gecko species. In contrast to other species, no dorsal tubercles and has leaf-shaped lamellae on lower toes. Colour usually predominantly brownish, pinkish, purple or greyish, often with a marbled pattern of creamy markings. Markings may form an indistinct broad, pale vertebral streak with sideways extensions. Often bright dots across dorsal parts. Belly uniform, usually pale. Claw on each toe, but barely visible.

DISTRIBUTION

Endemic to Corsica and Sardinia and many nearby islets. Also highly restricted on the European mainland in SE France (including nearby islets in Gulf of Marseille, Iles d'Hyères and near Nice), Italy (limited mainland occurrence near Genoa and in Tuscany, and islands in Gulf of La Spezia, as well as Tuscan Archipelago). Also on three islands off the coast of Tunisia.

HABITAT

A species of rocky habitats, such as rocky outcrops, cliffs, dry-stone walls and boulders. Often on granitic substrates with relatively humid hiding places. Less frequently seen near human habitation than other European gecko species. In general, more commonly encountered fairly close to the sea, but occurs up to 1,510 m in Corsica.

BIOLOGY

A small, secretive, nocturnal species. Often regulates body temperature indirectly in

narrow crevices rather than on open rock surfaces, especially in exposed coastal sites where wind may render open spots less attractive. Coloration can be adjusted swiftly according to temperature and substrate, and it is often strikingly camouflaged on lichen-coloured rocks. Agile and capable of significant leaps. Tail-tip may be used while climbing. Feeds on a wide variety of small invertebrates, stalking its prey in a slow cat-like fashion before catching it in a final sprint. Active between April and November but may be seen on sunny days in winter. May give clicking sounds to communicate, supposedly usually in relation to territorial behaviour. Mating takes place in April and May and males fight intensively during the mating season. Oviparous; females lay 2–3 clutches per year, each consisting of two eggs. Deposition takes place underneath rocks and in cracks. Densities may be very high on small islands.

European Leaf-toed Gecko. Isola San Pietro, Sardinia, Italy.

A European Leaf-toed Gecko from one of the rare mainland populations, showing pale nocturnal colours. Genoa, Italy.

True Lizards (Lacertidae)

The true lizards are a family native to Europe, Africa and Asia. Several hundred species are attributed to over 40 genera. The majority of the European lizard species belong to this family. Many species occur naturally only in Europe, although some have been introduced by man elsewhere (e.g. USA). At least eight species of the genus *Darevskia*, including two occurring as aliens in our area, are parthenogenetic, solely created by clonal

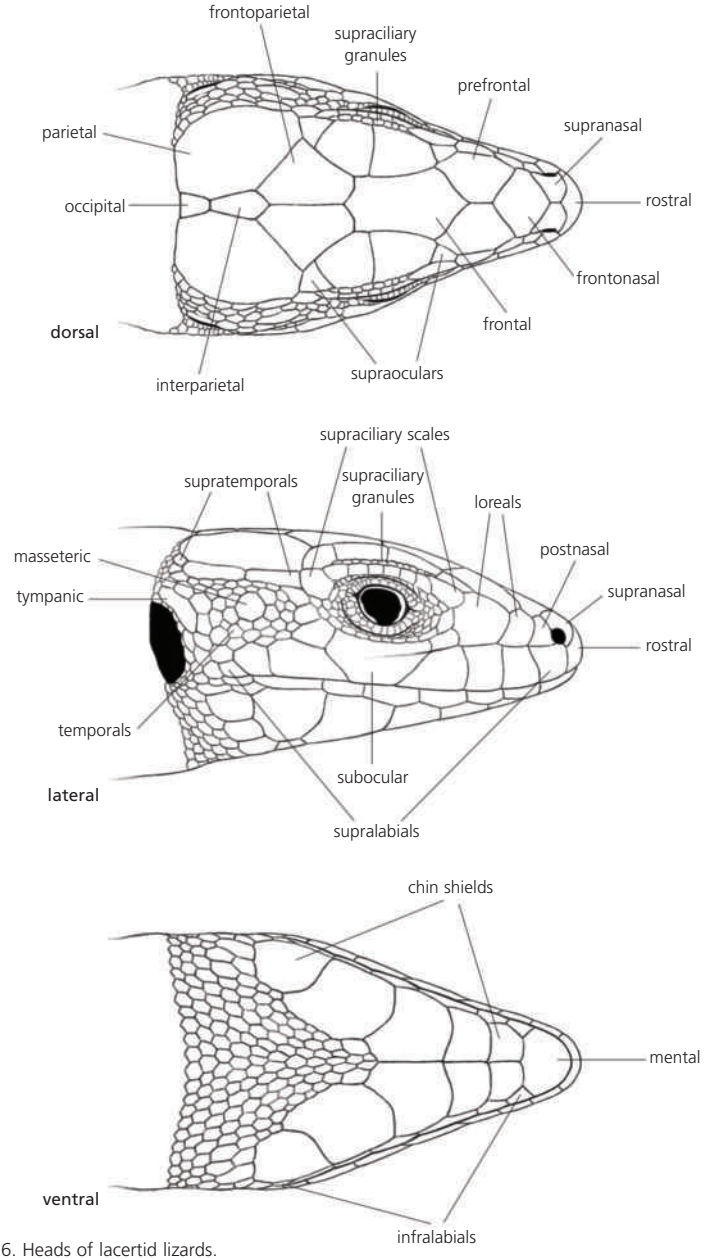


Fig. 26. Heads of lacertid lizards.

females. Very few species, including most of the populations of Viviparous Lizard *Zootoca vivipara*, do not lay eggs, but produce young which emerge through an embryonic membrane immediately after being laid. Most species are rather conspicuous and can often be observed easily while basking. When several species occur in a single area, different habitats are often preferred by the different species. Males have larger heads and usually a swollen tail-base.

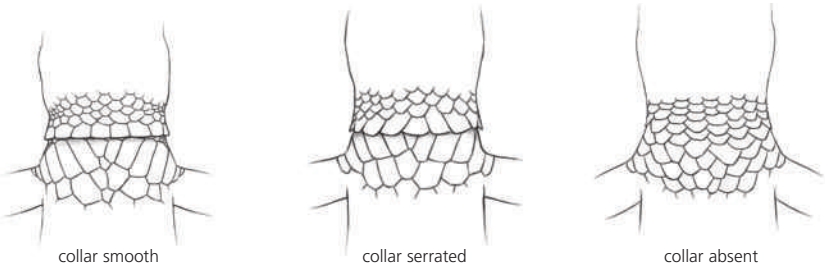


Fig. 27. Lacertid necks (ventral view).

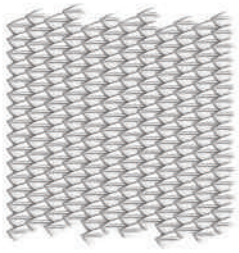


Fig. 28. Dorsal scales of *Algyroides* spp.

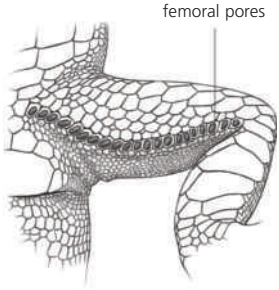


Fig. 29. Underside of lizard thigh.

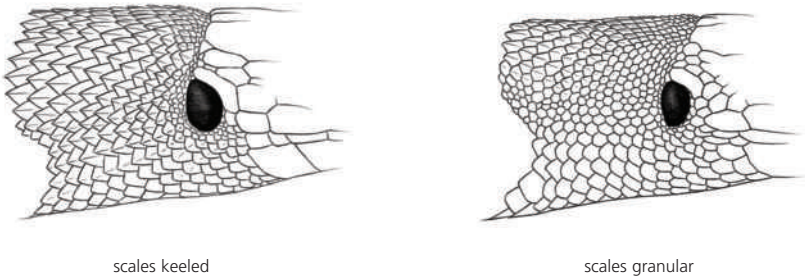


Fig. 30. Necks (lateral view) of *Psammodromus* spp.

Key to True Lizards			
1	a	Ventral view of neck with obvious collar. Back scales either small and granular, or large and keeled.	2
	b	Ventral view of neck without collar or an incomplete one at best. Back scales relatively large and keeled (but inspect carefully).	8
2	a	Scales on back of comparable size to those on tail, overlapping, triangular and with a transverse keel. Four species with restricted ranges.	3
	b	Scales on back much smaller than those on tail.	4
3	a	E Adriatic coast from NE Italy to W Greece including several islands. Dorsal scales rather blunt and much larger than lateral scales.	Dalmatian Algyroides *Algyroides nigropunctatus*
	b	Only in limited mountain ranges in SE C Spain. Dorsal scales rather blunt and much larger than lateral scales.	Spanish Algyroides *Algyroides marchi*
	c	Corsica, Sardinia and nearby islets. Dorsal scales rather pointed and rather similar in size to lateral scales. Small (SVL: up to 4 cm).	Pygmy Algyroides *Algyroides fitzingeri*
	d	S Greece (Peloponnese and some Ionian islands). Dorsal scales pointed and similar in size to lateral scales. Small (SVL: up to 5 cm).	Greek Algyroides *Algyroides moreoticus*
4	a	Only Spain, Portugal and eastwards from E Romania. No occipital scale. Subocular scale does not touch upper lip. Two ground-dwelling, fast-running species of open or semi-open, often sandy habitats.	5
	b	Occipital scale present; many species with only one with the subocular scale not touching the upper lip.	6
5	a	Only Spain and Portugal. 10, sometimes 8, rows of belly scales.	Spiny-footed Lizard *Acanthodactylus erythrurus*
	b	Only E Romania and further east. 14-20 rows of scales across belly.	Steppe Runner *Eremias arguta*
6	a	Neck collar clearly indented.	7
	b	Neck collar with relatively smooth edge.	Small lacertas (p.264)
7	a	Large and stout (SVL 7–21 cm). Ventral scales strongly overlapping and with angled sides. Often largely green above. Usually two postnasal scales and large supranasal scales. Juveniles (with large head with large eyes) not as green; often spotted or striped. Males may have blue on head or even entirely blue head.	Green lacertas (p.249) *Lacerta* spp. and *Timon* spp.
	b	Most species SVL 6 cm or less (but may be 9 cm). Ventral scales rectangular. Often brownish with somewhat darker flanks, but may also be green or differently coloured. Most species with only one postnasal scale. If green, supratemporal scales always narrow.	Small lacertas (p.264)
	c	SVL usually less than 9 cm, but may reach 10 cm. Stout with short head, short legs, feet and tail. Ventral scales almost rectangular. Breeding males green on flanks, not on back (except in parts of Romania and further E). Central back scales narrower than adjacent ones (but all small!). Rostral scale separated from nostril by supranasal scale. Often only one postnasal scale. Usually spotted and striped. Dorsolateral bands paler than surrounding areas and usually without spots. Young often with eye-shaped spots and pale narrow vertebral line. Supratemporal scales usually wider than in small lacertas. Widely distributed but absent from most of the Iberian Peninsula and Italy, and only in mountainous areas in S Balkans.	Sand Lizard *Lacerta agilis*
8	a	Extreme NE Greece, Turkish Thrace, Bulgaria and Aegean islands off Turkish coast. Eye without obvious eyelids; staring gaze as in snakes.	Snake-eyed Lacertid *Ophisops elegans*
	b	Spain, Portugal, and Mediterranean part of France. Eye normal, with closable eyelids.	9
9	a	Rather uniformly coloured, with pale dorsolateral lines and a similar line on each flank. Scales on sides of neck large, overlapping and keeled (like dorsal scales). No collar. SVL: to 8.5 cm	Large Psammodromus *Psammodromus algirus*
	b	Pattern of multiple black and white spots or (usually) interrupted stripes. Scales on sides of neck small and granular (smaller than dorsal scales). Incomplete collar. SVL: to 5.5 cm	Smaller psammodromus species *Psammodromus hispanicus* complex

Steppe Runner *Eremias arguta* (Pallas, 1773)

Steppe Runner

DESCRIPTION

TL: 22 cm; SVL: 8 cm. Rather squat, robust lizard, with a strong head. Base of tail broad, especially in males. Compared with other lizard species, tail relatively short in relation to body (often about the same length). Within Europe, usually grey or greyish with 4–10, occasionally interrupted, whitish lines running along the back, bordered by darker pigmentation, or broken into rows of more rounded, dark-edged pale whitish or yellowish spots. Temporal area with numerous, equal-sized small scales. Subocular scale does not touch edge of upper lip. Occipital scale lacking. Each eye with only two large supraocular scales. Differs from all other lacertid lizards within its range by presence of numerous (>14). rows of ventral scales

DISTRIBUTION

Within our area, from E Romania and Moldova through S and E Ukraine into Russia. Outside our area as far east as China and Mongolia.

VARIATION

European populations have been attributed to the subspecies *E. a. deserti*.

HABITAT

Dry lowland habitats, usually with a sandy substrate and often sparsely covered with herbs or shrubs, and including a significant amount of bare ground. Habitats include sandy beaches, river and coastal dunes, semi-desert and steppe. Usually below 300 m. In general, prefers more open areas than Sand Lizard *Lacerta agilis*, with which it may coexist.

BIOLOGY

Diurnal and fast moving lizard. Feeds on a whole range of small invertebrates. Easily overlooked until it moves and runs quickly

across open stretches of habitat, from one shrub to another, before hiding under plant cover. Able to submerge beneath loose sand and dig its own burrows. Entrance to burrow often underneath shrubs or rocks. Initially shy, but may be approachable and even tempted to investigate the observer after some habituation. May be quite abundant in suitable habitat. Active between March and October. Mating takes place in spring. Oviparous; females lay 1–12 eggs in July. Eggs hatch in late summer or autumn.

NOTE

This species is listed as Near Threatened in the 2009 IUCN Red List of European Reptiles.

Spiny-footed Lizard *Acanthodactylus erythrurus*

(Schinz, 1833)

Spiny-footed Lizard

DESCRIPTION

TL: 22 cm; SVL: 8 cm. Medium-sized, rather strongly-built lizard. Background colour usually orange, yellow or brownish, with 4–8 pale, sometimes interrupted stripes along back. Usually dark and pale spots in between stripes. Belly and lower flanks usually pale whitish. Young individuals usually with back vividly striped with black and white lines, and bright red or orange tail, fading with age. Females, however, may seasonally maintain orange or red colour on the underside of tail and hind legs. Base of tail markedly broad in males. Temporal area with numerous, equal-sized small scales. Subocular scale does not touch edge of upper lip. Occipital scale lacking. Each eye with only two (large) supraocular scales. Toes with fringes to facilitate movement over loose soil, but less pronounced than in related species from outside Europe.

DISTRIBUTION

Within Europe, only Spain and Portugal, but absent from most of N Spain and fairly restricted in Portugal. Outside our area occurs from W Morocco to NE Algeria.

HABITAT

Dry, warm, open lowland habitats, with limited, usually quite low, vegetation cover. Often, but not always, with a sandy

substrate, e.g. sandy beaches, coastal dunes, semi-desert or steppe with calcareous soil and aromatic herbs. Rarely in rockier or more vegetated areas at high altitudes where it appears more restricted to former human-disturbed areas such as quarries or even sandy footpaths. Mainly a lowland species, but reaches 1,750 m in S Spain and even 2,500 m in Morocco.

BIOLOGY

Diurnal and thermophilous. Often observed running quickly across open stretches of habitat, from one shrub to another, before hiding under plant cover. Often surveys its surroundings with stretched front legs and upright head. Can be found active in the open at temperatures over 30°C, when other coexisting lizard species seek shade. Usually a shy species that does not readily allow close approach. Active between February and November, but this period may be shorter in N of range. Juveniles are active longer and may be seen on sunny days in winter. Mating takes place between April and July. Oviparous; females lay 1–8 eggs, and older females may produce two clutches per year. Juveniles emerge between June and September.

Female Spiny-footed Lizard. Spain.

Large Psammodromus *Psammodromus algirus*

(Linnaeus, 1758)

Large Psammodromus

DESCRIPTION

TL: 31 cm; SVL: 8 cm. Medium to large lizard. Dorsal scales relatively large and keeled, in contrast to small granular scaling in most other lacertid lizards, giving the animal a rough appearance. Collar absent. Background dorsal colour usually brownish, but may be orange or reddish. Males sometimes with conspicuous red head (especially in W part of range), yellow belly and sometimes one or more blue spots at base of front leg. Hind legs and tail sometimes reddish, especially in subadults. Four yellowish or whitish stripes along body: two dorsolateral ones and one on each lower flank. Usually lacking dark spots, but dorsal darker vertebral line or area may be present.

DISTRIBUTION

Iberian Peninsula (except extreme N) and W Mediterranean France. Rhône Valley acts more or less as the eastern limit. Introduced and breeding in S Mallorca (not mapped). Outside our area, in Morocco, Algeria and Tunisia. Also on the Italian islet of Isolotto dei Conigli near Lampedusa.

HABITAT

Over most of its range, the most common lizard in a variety of warm habitats with varying degrees of vegetation cover. Most common in lowlands, but reaches 2,600 m. May be replaced by Spiny-footed Lizard *Acanthodactylus erythrurus* and the smaller *Psammodromus* species in more open environments, but just as likely to coexist with them.

BIOLOGY

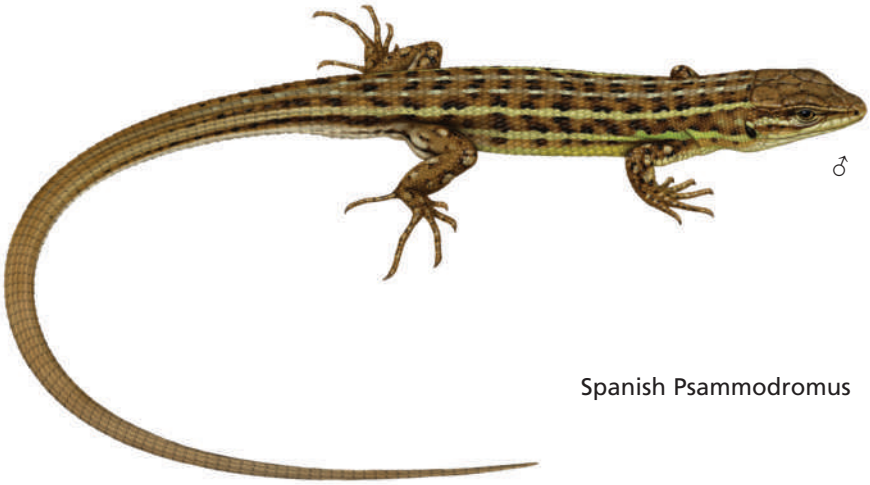
Diurnal, fast-moving and essentially ground-dwelling, but also climbs walls, trees, fences etc. Feeds on a range of small invertebrates but also takes plant matter. Often abundant and fairly conspicuous. Usually active between February and November but may be seen on sunny winter days in S of range. Mating takes place shortly after hibernation. Oviparous; females lay 2–11 eggs in May, but may lay a second or even a third clutch in summer in coastal areas. Juveniles emerge between August and October.

Smaller Psammodromus *Psammodromus* spp.

Western Psammodromus *Psammodromus occidentalis* Fitze, Gonzalez-Jimena, San-Jose, San Mauro & Zardoya, 2012

Edwards's Psammodromus *Psammodromus edwarsianus* (Dugès, 1829)

Spanish Psammodromus *Psammodromus hispanicus* Fitzinger, 1826



Spanish Psammodromus

DESCRIPTION

TL: 15 cm; SVL: 5 cm. Small to medium lizards. Dorsal scales relatively large and keeled, in contrast to small granular scaling in green, wall and rock lizards, giving a 'rough' appearance. Collar incomplete. Dorsal colour usually brownish, grey or blackish, but may be somewhat orange. Breeding males especially sometimes have greenish or yellowish colours on flanks and underside, and sometimes one or more blue spots at base of front leg. Four to

eight yellowish or whitish stripes along body, which are quite often broken up into white eye-shaped spots with dark lining.
Western Psammodromus: Always without supralabial scale below the subocular scale, nine to fifteen femoral pores, a rather blunt snout, usually with up to five ocelli, males usually with green nuptial coloration.
Edwards's Psammodromus: Always with supralabial scale below the subocular scale (subocular scale does not touch the upper edge of the mouth), more femoral pores, less extensive nuptial coloration, and slightly more pointed snout.
Spanish Psammodromus: Like Western, but more pointed snout, fewer femoral pores, and only a few or no ocelli. Head scalation seems highly variable.

Given the variability of these characters, identification best confirmed by range and may be hard if not impossible in contact areas.

DISTRIBUTION

Iberian Peninsula (except extreme N and NW), as well as W Mediterranean France. In contrast to Large Psammodromus *Psammodromus algirus*, also E of Rhône Valley. The ranges of the three species remain incompletely delimited.
Western: Portugal and W Spain.
Edwards's: Mediterranean France and E Spain, reaching as far as W of Granada.
Spanish: C Spain (probably the only species in N Castilla-La Mancha and E Castile and León). Populations from a zone of about 50–100 km wide stretching from Cádiz through Córdoba and Ciudad Real as far as S of Madrid are of uncertain identity. Range overlaps have been established between Western and Spanish (e.g. at *c.* 50 km NW of Madrid), as well as between Spanish and Edwards's.

Spanish Psammodromus
Edwards's Psammodromus
Western Psammodromus

HABITAT

Generally a species of warm habitats with low herbaceous vegetation, including open pine or oak forests, dry meadows, road banks and semi-deserts. They favour open situations such as sand dunes more than Large Psammodromus. Most common in lowlands below 800 m, but reaches 1,700 m where habitats may consist of predominantly grassy meadows with scattered bushes.

BIOLOGY

Diurnal and essentially ground-dwelling. Can be common, but usually fairly inconspicuous and therefore not as readily spotted as Large Psammodromus. Rather shy in areas with scarce vegetation such as sandy coastal areas, hiding under bushes and running from bush to bush seeking cover. Less shy in well-vegetated areas such as rocky maquis where they can be seen basking. Active between February and November but this may vary by region. Most readily observed in early spring; individuals may only be active during twilight hours during summer. Mating takes place in March and May. Oviparous; females lay 3–6 eggs and may produce two clutches per year. First clutch hatches in June and second clutch hatches in July or August. These are short-lived species that often do not get much older than two years.

NOTE

Due to an error by the original attributor, the spelling of the species name of Edwards's Psammodromus should be *Psammodromus edwarsianus* and not *P. edwardsianus*.

Snake-eyed Lacertid *Ophisops elegans* Ménétries, 1832

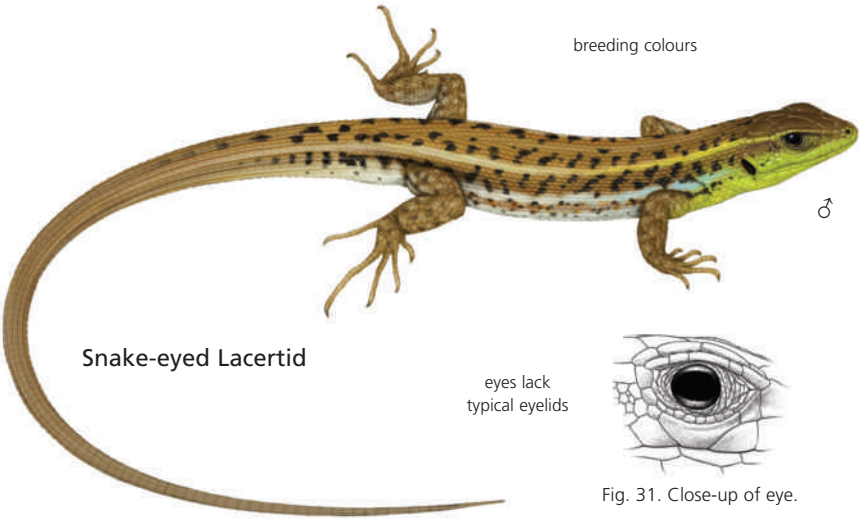


Fig. 31. Close-up of eye.

DESCRIPTION

TL: 19 cm; SVL: 6 cm, but often smaller. Small lacertid lizard. Distinguishable from any other European lacertid by the 'staring' eye which, like snakes, lacks closable (opaque) eyelids. Dorsal scaling coarse and keeled, giving a rough appearance and resembling that of *Psammodromus* species, in contrast to the small, granular scaling of most other lacertid lizards. No collar. Background dorsal colour usually brownish, but may be orange or reddish. Yellowish or whitish dorsolateral stripes along body. Flanks and back with dark spots, especially close to the pale dorsolateral stripes on the back. Breeding males may have yellow underparts and blue and/or green on lower flanks.

DISTRIBUTION

In our area, limited to NE Greece, SE Bulgaria and Turkish Thrace, also a number of E Aegean islands (including Thasos, Lesbos, Ikaria, Samos, Patmos, Kalymnos, Rhodes, Symi and Karpathos). Also Turkey, Cyprus, Middle East, Caucasus, Iran, Pakistan and NW India.

VARIATION

European populations, including those present on the Greek islands, belong to *O. e. macrodactylus*.

HABITAT

A variety of warm, dry habitats, with diverse elements including bare ground, vegetation, rocks, scattered bushes and trees. Especially abundant in more arid habitats on some Greek islands. Usually below 1,000 m in European range.

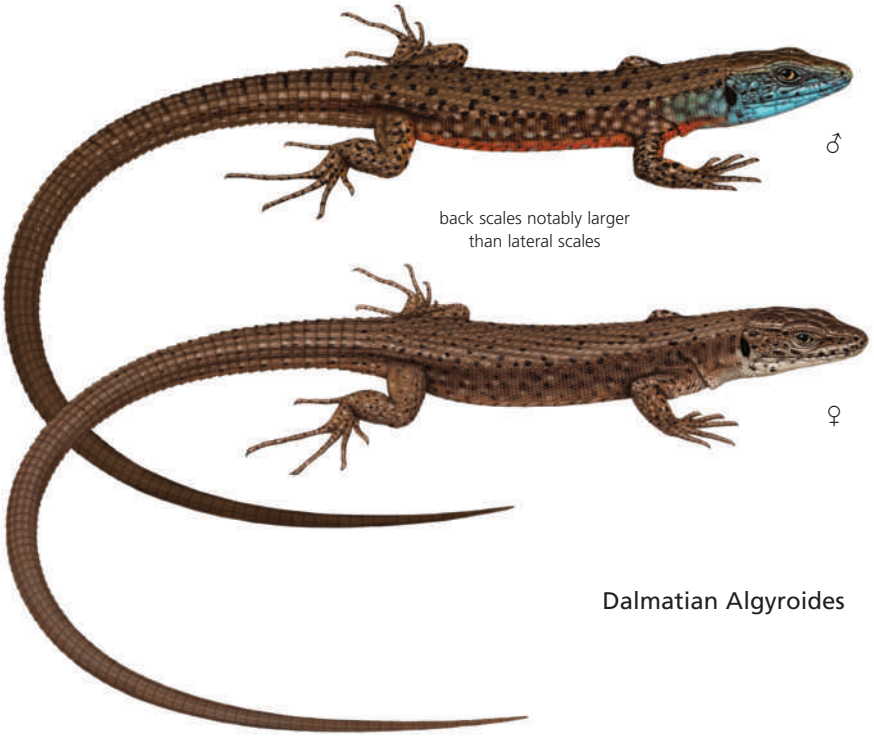
BIOLOGY

Diurnal and essentially ground-dwelling, but often crawls on low walls, rocks and

boulders, as well as open ground. Not extremely swift. May be rather approachable. Thermophilous; may be active even in hot, sunny conditions in high summer. Not readily seen in windy weather. Feeds on a whole range of small invertebrates. Active between March and November but may be seen on sunny days in winter. Males are highly territorial and fight intensely during breeding season. Mating takes place between April and June. Oviparous; females lay 2–6 eggs in May or June and may produce a second clutch. Juveniles emerge from late June onwards.

Dalmatian Algyroides *Algyroides nigropunctatus*

(Duméril & Bibron, 1839)



Dalmatian Algyroides

DESCRIPTION

TL: 21 cm; SVL: 7 cm. Largest *Algyroides* species. Usually brownish above, ranging from very dark brown to reddish, often with small black dots scattered across upperparts. Ventral parts unspotted; in females yellowish or greenish-white, in males red. Males have blue heads which may turn fluorescent blue in mating season, as well as red ventral and lateral parts giving the animal a colourful appearance. Back scales partially overlap, rounded, strongly keeled and notably larger than lateral scales. Larger ventral scales arranged into six longitudinal rows.

DISTRIBUTION

E Adriatic and Ionian coast. From extreme NE Italy (Monfalcone) and W Slovenia through Croatia, W Bosnia and Herzegovina, Montenegro, Albania, extreme W Serbia and Macedonia to W and C Greece, reaching the Gulf of Corinth in the south. Also on many islands.

VARIATION

On Cephalonia, Ithaca, Lefkada and the adjacent mainland, males have green to cyan throats and sometimes yellow flanks, and females have yellow throats. This colour morph has been described as the subspecies *A. n. kephallithacius*, which is mainly found at higher altitudes including Mount Enos on Cephalonia, where it occurs in Greek Fir *Abies cephalonica* forests.

HABITAT

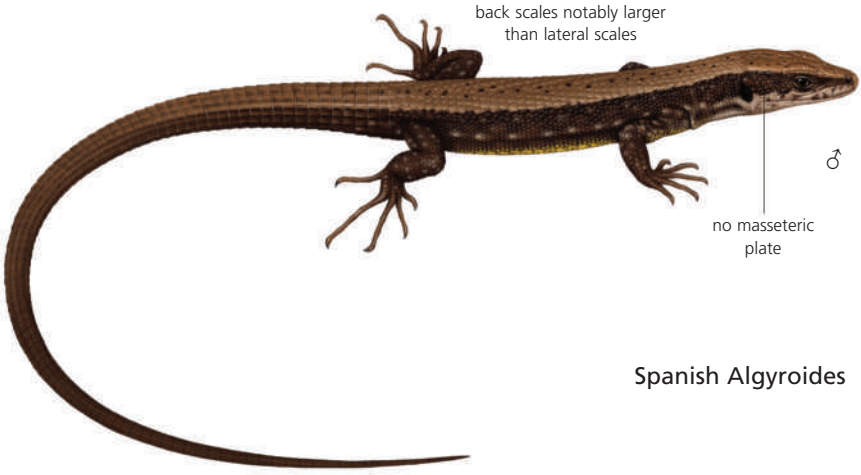
Often in relatively shady habitats such as open woods, old orchards, well-vegetated walls, cliffs and large boulders. Commonly near to water and shows a strong preference for humid places in S of its range. Usually below 700 m but up to 1,600 m on Cephalonia.

BIOLOGY

A diurnal, swift and agile lizard. Not as easy to spot as wall lizard species, but may be very abundant, especially where wall lizards are absent. Basks in the open in relatively poorly exposed spots; secretive, well camouflaged and rather inconspicuous. Usually quite shy and readily takes cover. Feeds on invertebrates, including grasshoppers. Active between February and October but this may vary across its range. In summer not active during the hottest parts of day or only in shade. Mating takes place in March and April. Oviparous; females produce two clutches of 2–8 eggs in May. Juveniles emerge in July or August.

Male Dalmatian Algyroides of the ssp. *kephallithacius* may show green coloration on the lower body. Lefkada, Greece.

Spanish Algyroides *Algyroides marchi* Valverde, 1958



Spanish Algyroides

DESCRIPTION

TL: 15 cm; SVL: 5 cm. A rather small lizard. Brownish above, often with darker lateral bands. Flanks usually darker, brown to black with small greyish dots. Limbs same colour as flanks. Sometimes with small dark spots on back forming a discontinuous vertebral line. Ventral parts white or yellowish, bright yellow in males. Enlarged back scales overlapping, rounded, weakly keeled and notably larger then lateral scales. No masseteric plate.

DISTRIBUTION

Confined to a small area in the Prebaetic mountains of SE Spain. Distribution ranges from the Sierra de Alcaraz southwards through the Sierras de Las Villas, Cazorla and Segura, and adjacent smaller mountain ranges of extreme S Albacete and N Granada. Isolated occurrence in the Sierra de Moratalla, Murcia.

VARIATION

Although considerable genetic variation exists within the small range of this species, morphological variation seems limited and no subspecies are currently recognised. The blue-throated *A. m. niethammeri* from the Sierra de Agua (Jaén) is not valid, as individuals showing this distinctive coloration have not been found since its initial description.

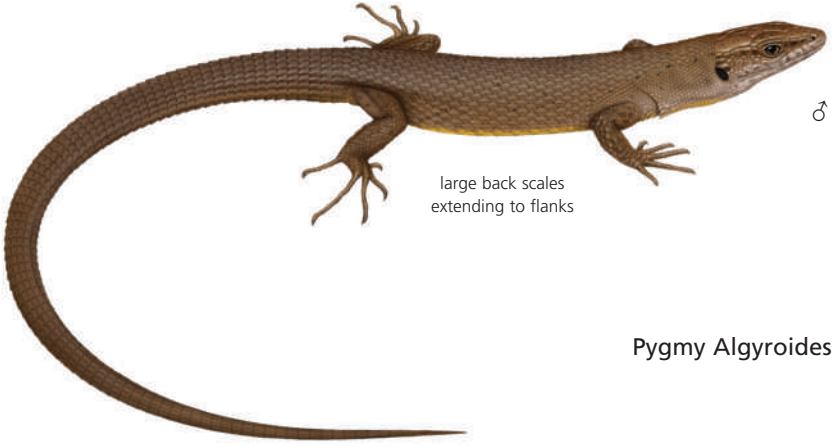
HABITAT

Occurs in relatively humid mountainous habitats, frequently in forests. Often characterised by presence of large rocks or boulders, both the rocks and surrounding forest providing ample shade. Most populations are found close to mountain streams, waterfalls or springs, where high densities can be reached. At higher altitudes, occupies clusters of large boulders on barren or sparsely vegetated erosion slopes. Occurs between 700 and 1,700 m.

BIOLOGY

Diurnal, swift and agile lizard, which actively searches for its invertebrate prey by climbing and jumping between boulders and tree trunks. Generally avoids direct sunlight after the morning hours, especially during summer. More secretive than the coexisting wall lizard species. Often an approachable and inquisitive lizard. Males are territorial, overlooking territories from a high vantage point while bobbing the head up and down. Mating takes place in March and April. Oviparous; females lay up to three clutches, each of 2–3 eggs, between May and July.

Pygmy Algyroides *Algyroides fitzingeri* (Wiegmann, 1834)



Pygmy Algyroides

DESCRIPTION

TL: 13 cm; SVL: 4 cm. The smallest *Algyroides* species and one of the smallest lizards in our area. Usually uniformly brown or buff-grey, sometimes blackish or olive-green. Colour on lower parts variable, whitish, greyish or bluish, or, especially in breeding males, yellowish or orange. Throat usually whitish. Enlarged back scales overlapping, pointed, strongly keeled and extending to flanks.

DISTRIBUTION

Tyrrhenian Islands: Sardinia and several small islands, including Asinara, La Maddalena, Caprera, Tavolara, Sant Antioco and San Pietro; Corsica and the nearby island of Gargalu. Appears more widespread on Sardinia, or is at least more readily observed there than on Corsica.

HABITAT

A wide variety of habitats. Like other *Algyroides* species prefers semi-shaded situations near water, but especially on

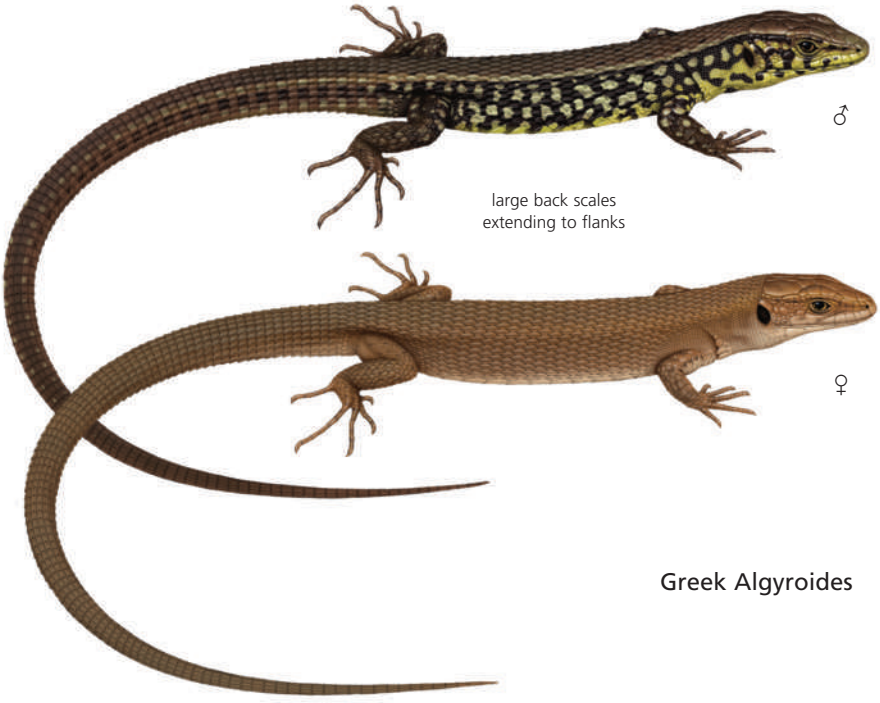
Sardinia and extreme S of Corsica also occurs in maquis, rather arid agricultural land or other places with sparse vegetation on rocky outcrops, especially near the coast and on islets. Found up to 1,400 m on Corsica and up to 1,800 m on Sardinia.

BIOLOGY

An often common, diurnal species but swift and shy. Easily overlooked due to diminutive size and somewhat secretive habits, perhaps as a result of territorial behaviour of coexisting wall lizards, especially Tyrrhenian Wall Lizard *Podarcis tiliguerta* or Italian Wall Lizard *Podarcis siculus*. Usually seen climbing along boulders, dry-stone walls or tree trunks, but also ground-dwelling, moving through herbs and grasses. Feeds on invertebrates, mainly spiders and beetles. Active between March and October, but may be later at higher altitudes. Occasionally seen on warm winter days. Mating takes place in May. Oviparous; females lay 2–4 eggs in May and June. Juveniles emerge between July and September.

Greek Algyroides *Algyroides moreoticus*

Bibron & Bory de Saint-Vincent, 1833



Greek Algyroides

DESCRIPTION

TL: 15.5 cm; SVL: 5 cm. Small and agile lizard. Coloration variable, uniformly brownish or greyish above. Males with darker, blackish sides, often with white, yellow or greenish blotches. Males may also have a white, dorsolateral stripe on either side, running from eye to vent. White or greenish below in both sexes. Juveniles usually darker. Collar consists of 6–9 scales with serrated edges. Enlarged back scales overlapping, pointed, strongly keeled and extending to flanks. Clearly visible masseteric plate.

DISTRIBUTION

Peloponnese and nearby islands of Cephalonia, Ithaca, Zakynthos, Stamphani, Strongili, Sapientza and Psili.

VARIATION

Males from Cephalonia and Ithaca may have blue blotches on the flanks.

HABITAT

Occurs in a wide variety of habitats, such as open woods, riverbanks, olive groves, gardens, ruins, dry-stone walls and pastures. Although relatively humid places are preferred, also sometimes found in drier environments.

BIOLOGY

Diurnal. Seems to climb less frequently than some other *Algyroides* species. Often seen foraging on the ground in pastures, along hedges or searching for invertebrate prey in leaf litter, but also basks on tree trunks. Also found by turning objects. Mating takes place between April and July. Oviparous; females lay 4–8 eggs that hatch in July or August.

Male Greek Algyroides. Cephalonia, Greece.

GREEN LACERTAS (*LACERTA* SPP. AND *TIMON* SPP.)

The green lacertas contain the larger members of the family Lacertidae. They are usually green, especially the males, although juveniles and females may be brownish.

They occupy a large part of the continent. Differences in distribution and habitat generally limit the number of green lacerta species in any given area to three or fewer.

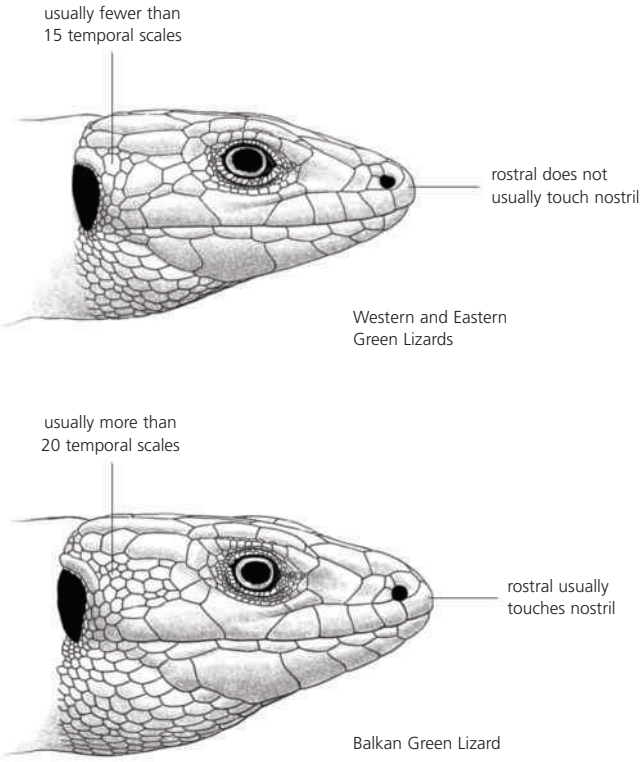


Fig. 32. Heads of green lacertas.

Subadult Ocellated Lizard. S Spain.

Key to Green Lacertas			
1	a	Spain, Portugal, S France (Atlantic and Mediterranean), coastal NW Italy. Grow very large (SVL up to more than 20 cm). Occipital scale large, generally wider than posterior edge of frontal scale. 8 or 10 rows of ventral scales. Adults with 4 or more large blue spots on flanks. Back green with dark speckles and reticulations, but greyish and with less dark pigment and smaller blue spots in SE Spain. Juveniles with back usually covered with dark-edged pale 'eye spots' and occipital scale as wide as posterior edge of frontal scale.	Ocellated Lizard *Timon lepidus* and Sierra Nevada Ocellated Lizard *Timon nevadensis*
	b	Occipital scale narrower than posterior edge of frontal scale. 6 or 8 rows of belly scales. SVL rarely above 16 cm.	2
2	a	SVL usually less than 9 cm, but may reach up to 10 cm. Stout with rather short head, short legs, feet and tail. Ventral scales (almost) rectangular. Breeding males green on flanks, not on back (except parts of Romania and further E). Scales on centre of back typically narrower than adjacent ones (but all small). Rostral scale separated from nostril by supranasal scale. Often only 1 postnasal scale. Usually spotted (eye-shaped spots) and striped (black and white). Dorsolateral bands paler than surrounding areas and usually without spots. Young often with round eye-shaped spots and narrow pale vertebral line. Supratemporal scales usually wider than in small lacerta species. Sometimes back uniform reddish-brown. Widely distributed but absent from most of the Iberian Peninsula and Italy, and mountainous areas in S Balkans.	Sand Lizard *Lacerta agilis*
	b	SVL larger than 9 cm in adults. Tail and toes long and slender. Usually green, and if so, also green on centre of back. Small scales on centre of back not obviously narrower than the adjacent ones. Rostral scale usually touches nostril. Often 2 postnasal scales.	3
3	a	Restricted to more humid parts of NW, W and C Iberian Peninsula. 8 rows of ventral scales. Occipital scale often wider than interparietal scale, especially in adults. Belly often with black spots. Head without pale dappling. Back never with pale stripes. Dark spots on back in both males and females, sometimes also on head. SVL up to 12 cm. Juveniles usually with unspotted back but with pale, dark-edged blotches on sides of trunk and head. Males often with blue head, females brownish and heavily covered in dark blotches.	Schreiber's Green Lizard *Lacerta schreiberi*
	b	Widespread, but on Iberian Peninsula largely restricted to NE. Usually 6 rows of ventral scales. Occipital scale often narrower than interparietal scale. Belly rarely with black spots. Head often with pale dappling. Juveniles do not resemble those of Schreiber's Green Lizard.	4
4	a	May be difficult to distinguish from Eastern Green Lizard – a combination of characters needs to be considered. Restricted to SE Europe: from Croatia in the west and Romania in the east, south to Greece including the Peloponnese and Crete and other islands. Usually 8 rows of belly scales (locally may be 6 or 10). Snout narrow in relation to posterior end of head. Usually continuous row of supraciliary granules. Often more than 20 temporal scales. Rostral scale usually touches nostril. Throat in adult males often yellow, combined with blue at sides of base of head (but may be more blue, e.g. in Peloponnese). Females and young often with 3 or 5 pale lines, one of which runs along centre of back. SVL up to 16 cm or even more.	Balkan Green Lizard *Lacerta trilineata*
	b	Widespread, but in Iberian Peninsula restricted to NE, and absent from N Europe, Peloponnese and Crete. In S Balkans, often restricted to somewhat humid and/or mountainous habitats. Usually 6 rows of belly scales. Snout more blunt, posterior end of head not particularly wide. Usually few or no supraciliary granules. Usually fewer than 20, often fewer than 15 temporal scales. Rostral scale often does not touch nostril. Throat in adult males often blue. Females and young often with 2 or 4 pale lines, none of which runs along centre of back. SVL up to 13 cm or even more.	Western Green Lizard *Lacerta bilineata* and Eastern Green Lizard *Lacerta viridis*

Ocellated Lizard *Timon lepidus* (Daudin, 1802)
Sierra Nevada Ocellated Lizard *Timon nevadensis* (Buchholz, 1963)

DESCRIPTION

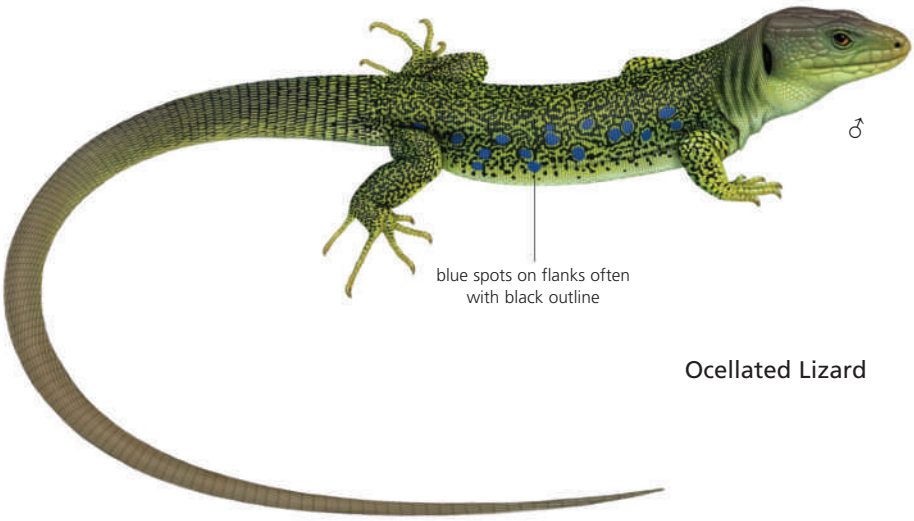
TL: 70 cm; SVL: 24 cm. Together with Glass Lizard, the largest lizards on the continent. Robust with massive head in males, more slender and smaller in females. Snout rounded. Occipital scale much wider than in related species. Scalation homogeneous granular on flanks and upperparts while scalation on tail is keeled. Basal coloration in both sexes is yellowish to emerald green with black dots on back which may form a reticulated pattern extending onto limbs. Large, round blue spots on flanks more prominent in males, often with black outline. Pattern fades towards head and tail. Ventral parts and throat yellowish to white, usually unspotted. Sierra Nevada Ocellated Lizard has limited green coloration and is more commonly uniform brown or grey and without black reticulations on back. Juveniles are often dark in colour with scattered ocellated spots across their upperparts. Back pattern may form cross-bands. Green colour appears with age.

Ocellated Lizard
Sierra Nevada Ocellated Lizard

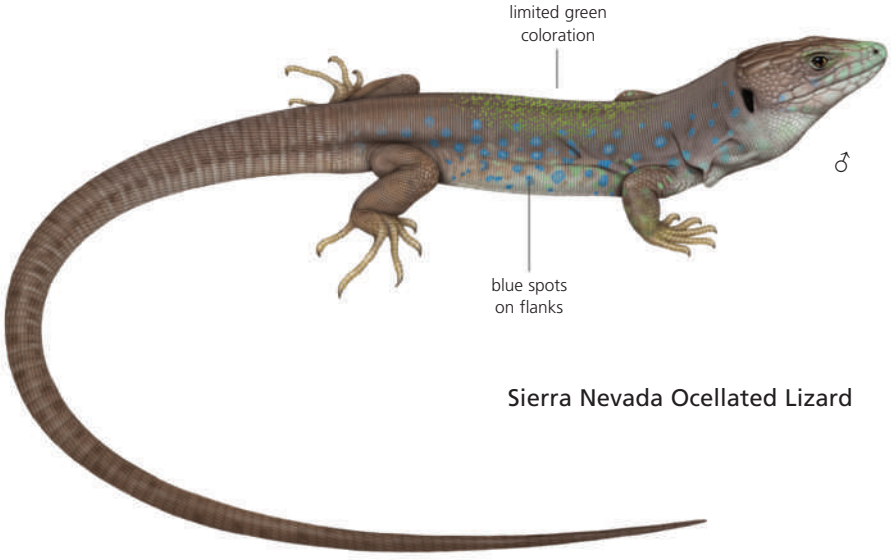
DISTRIBUTION

Ocellated Lizard: Iberian Peninsula (except where Sierra Nevada Ocellated Lizard occurs), S France and extreme NW Italy. Also on the Atlantic coast of France.
Sierra Nevada Ocellated Lizard: SE Spain, in the regions Alicante, Murcia and Almeria.

Female Ocellated Lizard. Galicia, Spain.



Ocellated Lizard



Sierra Nevada Ocellated Lizard

Ocellated Lizard

HABITAT

Mostly confined to relatively dry habitats with large rocks and shrubs, such as maquis, olive groves, open woods, roadsides and older coastal dunes. Individuals hide in self-dug burrows or rodent burrows, large (often spiny) bushes, trees, dry-stone walls or rock crevices. Mostly confined to areas below 1,000 m, but Sierra Nevada Ocellated Lizard occurs up to 2,100 m.

BIOLOGY

Diurnal and largely ground-dwelling, but climbs very well in search of food or when escaping predators. Ocellated lizards are usually shy, and often flee rather clumsily at great distance when approached during warmer weather conditions. They make a lot of noise while fleeing, giving away their presence. If cornered, may even jump up to confront attacker. When handled may bite with great force. Populations living near human habitation may become accustomed to the presence of humans. Prey consists of invertebrates (mainly beetles), lizards, snakes, nestling birds and mice, and also takes some plant matter. Active between March and October. Males hold territories and defend these readily. Mating takes place in April and May. Oviparous; females lay 5–24 eggs between May and July. Sierra Nevada Ocellated Lizard may produce a second clutch.

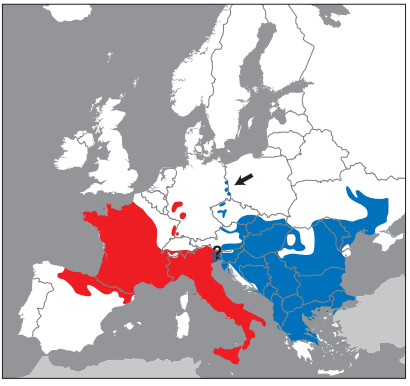
Western Green Lizard *Lacerta bilineata* Daudin, 1802
Eastern Green Lizard *Lacerta viridis* (Laurenti, 1768)

DESCRIPTION

TL: 45 cm; SVL: 13 cm. The two species are highly similar. Typical, medium to large lizards with broad, bulky heads especially in males. Upperparts in males usually emerald green. Yellowish, unspotted belly. White spots on lips and temporal area. Throat in adults, and especially breeding males, usually bright blue, often extending onto much of head. Females smaller, with narrower heads, often with brown temporal area. Usually same basal coloration, but completely brown females also occur. Small black dots on back may form spots or even stripes. Sometimes with pale green or white dorsolateral lines. Throat and belly yellowish or white, or more rarely bluish. Both sexes with six rows of ventral scales and few or no supraciliary granules. Usually fewer than 20, often fewer than 15 temporal scales. Juveniles uniformly grey, brownish or green. Throat often yellowish or greenish. Upperparts sometimes with two or four white, interrupted lines. Never with a vertebral line, which is typical of juvenile Balkan Green Lizard *Lacerta trilineata*.

DISTRIBUTION

Western Green Lizard: France, the Channel Islands, N Spain, Italy (including Sicily and Elba) and W Germany. Until recently believed to extend east to W Slovenia and NW Croatia, but the actual contact zone with Eastern Green Lizard is located in NE Italy. Introduced to the UK and USA (not mapped). Eastern Green Lizard: From E Germany, E and S Austria, S Czech Republic, Hungary and S



Eastern Green Lizard

Ukraine southwards into most of the Balkans. Seems largely absent or scarce along the margins of the lower E Adriatic coast (where replaced by Balkan Green Lizard). Also absent from Peloponnese and most Ionian and Aegean islands, except Corfu, Skiathos, Euboea, Samothrace and Thasos. Presence on Skyros seems doubtful. Outside this area also occurs in N Turkey.

See also Variation, for the unresolved taxonomy of this species complex.

VARIATION

Following recent research results, the *viridis-bilineata* complex comprises four main groups. Several traditionally recognised subspecies are rejected, while the ranges of others are redefined. The status of the main groups (as subspecies or as species, containing in some cases subspecies themselves) is still unclear, rendering the following summary merely tentative.

1. Western Green Lizard. From a number of previously accepted subspecies, only *L. b. chloronota* (Calabria and Sicily) and the nominate subspecies remain recognised.

The remaining three groups comprise what is here considered as the Eastern Green Lizard:

2. 'Adriatic' or 'W Balkan' group: E Adriatic coast from NE Italy to W Greece.
3. *L. v. meridionalis*, but with a much smaller European range than previously considered; now restricted to localities in Greek and Turkish Thrace only. Brown-coloured hind legs and tail, originally treated as typical for the subspecies, also occur in areas that are inhabited by the fourth group (see below) and, as such, do not represent a diagnostic feature. Also occurs along the Anatolian Black Sea coast.
4. The 'true' *L. v. viridis*: within this group, only the nominate subspecies and *L. v. guentherpetersi* (Greece: Dirfis Mountains, Euboea, but also Mt Ossa on the mainland) remain valid, along with the unresolved nature of a distinct subgroup occurring within the range of the 'Adriatic' group in Slovenia and Montenegro.

HABITAT

A wide variety of habitats, with populations further S tending to be more generalistic. Habitats usually contain of a lot of vegetation with warm basking opportunities, often quite near to water. In N of range, south-facing slopes with vineyards and forest edges offer prime habitat. Further south, also inhabits hedgerows along roads and paths, scrubland, open woods, overgrown fields and gardens. In S of range up to about 2,200 m in Greece (Eastern) or 2,100 m in C Apennines and N Spain (Western), but usually below 1,400 m.

BIOLOGY

Rather shy and skittish lizards, often heard fleeing before being seen. Frequently seen foraging close to hiding places, which comprise large bushes or dry-stone walls. Largely ground-dwelling but climbs well, and may be seen in bushes or hedgerows. Food consists of invertebrates (mostly beetles), but also plant matter, smaller lizards, nestling birds and mice. Active between February and September; however, hibernation may be considerably shorter in S of range. Breeding males may display blue throat by raising head and basking from a vantage point. Mating takes place around April. Oviparous; females lay 5–23 eggs in May or June. A second clutch may follow a month later in some populations. The juveniles emerge in August or September.

Dark-coloured female Western Green Lizard. N Spain.

Balkan Green Lizard *Lacerta trilineata* Bedriaga, 1886

DESCRIPTION

TL: 50 cm; SVL: 16 cm. The largest member of the genus *Lacerta*. Upperparts of adults usually uniformly emerald green but this may vary between individuals and subspecies; yellowish, brown or grey individuals may occur. Generally, green colour fades away towards end of tail. Neck region behind ear-opening in breeding males often bright blue, sometimes extending towards throat or flanks. Throat and belly in both sexes bright yellow (or white in some subspecies), often extending towards upper lips. Large head with a relatively narrow snout. Eight rows of ventral scales; continuous lines of supraciliary granules. Often more than 20 temporal scales. Juveniles usually brown or grey, may be uniform but often with three or five white or yellow lines on upperparts, one of these lines forming a vertebral line. Lines on flanks may form an interrupted band of spots. Underside whitish and throat yellowish.

DISTRIBUTION

From N Croatia along E Adriatic coast (including many islands) stretching S to Albania, Macedonia, Greece (including many of the larger Ionian and Aegean islands, Dodecanese and Crete), Bulgaria and SE Romania. Also occurs in W Anatolia.

VARIATION

Several subspecies have been described, while recent genetic data do not seem to confirm all of them. As these data focus on Greek samples, the nature of populations outside Greece may require further investigation. Six groups are distinguished. A first group contains most of the Greek mainland (except the NE and the Peloponnese) as well as the E Aegean islands, as such including *L. t. major*, *L. t. hansschweizeri* (Milos Archipelago) and a part of *L. t. trilineata*. The second group covers the C and W parts of the Peloponnese, thus comprising a part of *L. t. trilineata* as well. The third group contains the E Peloponnese and Crete, and as such the former Cretan subspecies *L. t. polylepidota* and yet another part of *L. t. trilineata*. The fourth group seems to coincide with *L. t. citrovittata* on Tinos, Syros, Andros, Naxos and Ios (individuals whitish or greyish with yellow dorsum, sometimes nearly fully yellow; males with extensive blue coloration during the breeding season), but surprisingly

Subadult Balkan Green Lizard devouring an insect larva. Dadia, Greece.

also contains the species *L. pamphylica* from outside of our area (S coast of Turkey). The fifth group occurs in Thrace and on the Dodecanese Islands (except Lesbos). Finally, the sixth group is known from Lesbos only. The first three and final three groups, in turn, are more closely related to each other than to the other groups. Taxonomic decisions need to be made to correctly attribute these groups to subspecies names.

HABITAT

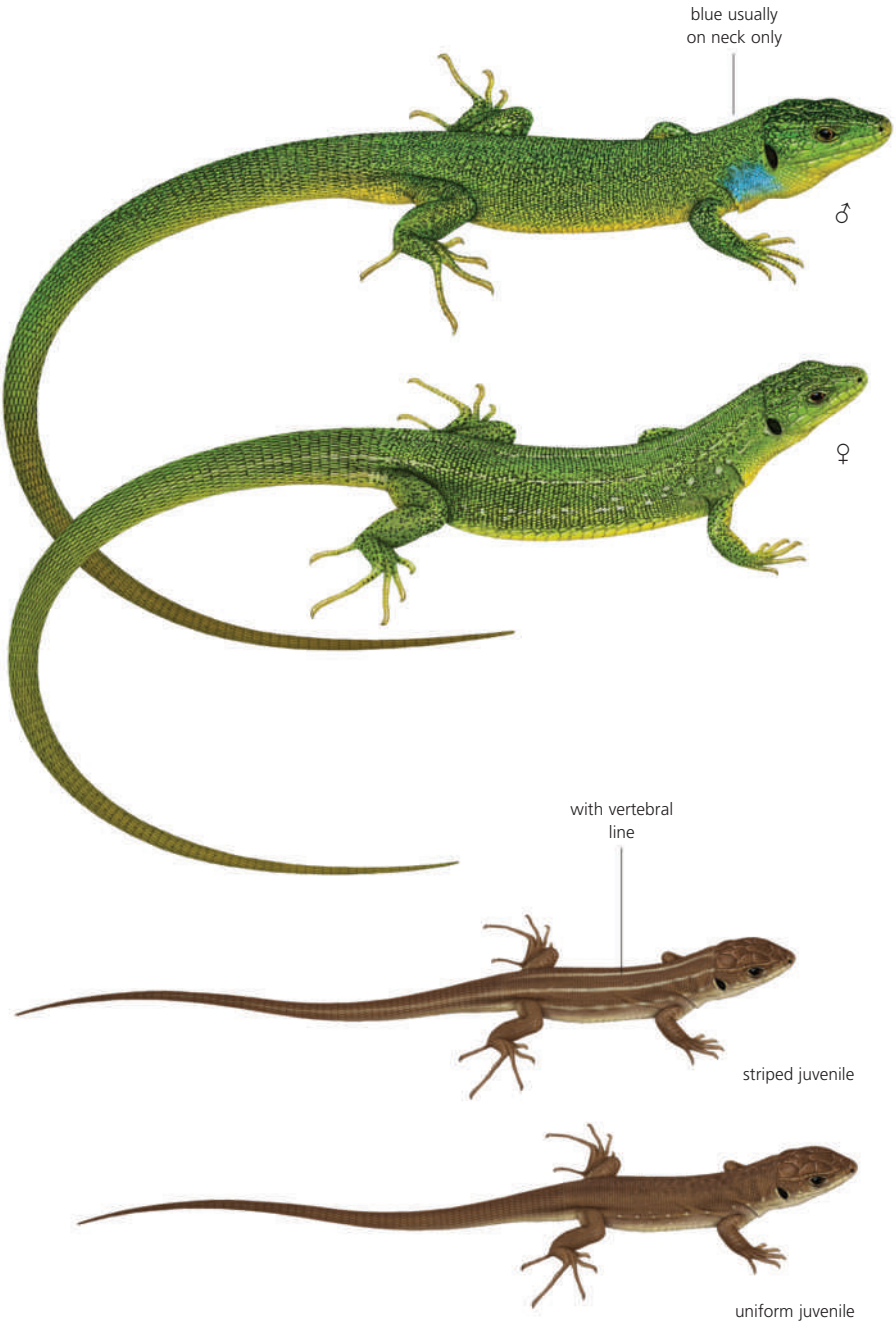
Generally associated with dense vegetation. Inhabits hedgerows, bramble thickets, open woods, older dunes, and overgrown meadows, preferably areas with large rocks to hide in. Also encountered close to human habitation in ruins, roadsides, dry-stone walls, vineyards and gardens. May also be observed close to water in stream-beds and ditches. Occurs up to 1,800 m in Greece.

BIOLOGY

Shy and skittish lizard. Often heard before being seen. Mainly ground-dwelling, but may climb as well. Can be seen basking on asphalt roads. Feeds on large invertebrates such as snails, beetles and grasshoppers but also on small lizards and mammals. During hibernation, individuals stay hidden, even on sunny days, unlike many other lacertids. Males occupy territories and defend them against intruders. Adults display extensive courtship behaviour with males nibbling the female and producing hissing noises. Mating takes place in spring. Oviparous; females lay 5–20 eggs between May and July. Juveniles emerge between July and September.

Balkan Green Lizards from Milos (traditionally, the ssp. *hansschweizeri*) often show a more yellowish coloration. Milos, Greece.

Balkan Green Lizard



Schreiber's Green Lizard *Lacerta schreiberi*

Bedriaga, 1878

DESCRIPTION

TL: 40 cm; SVL: 13 cm. Sturdy, medium to large lacertid lizard. Predominantly green above in males. Head in males bright blue during breeding season. Tail and hind legs brownish. Covered with small black dots above, forming an apparently reticulated pattern. Spots on back usually larger than on flanks. Underside yellowish, often heavily spotted. Females more variable and slightly larger than males, often brown or greenish with larger black blotches or spots; dorsolateral parts often unspotted; head often greyish or dull blue, tail and hind legs as in males. Underside often unspotted. Both sexes have eight rows of belly scales. Juveniles often with dark, unspotted backs and ocellated yellowish spots on the flanks. Underside greenish.

DISTRIBUTION

N and W of the Iberian Peninsula, following the Sistema Central eastwards through C Spain. Isolates further S include Montes de Toledo and Sierra de Guadalupe in S-C Spain, and Serra de Monchique in S Portugal.

VARIATION

Northern females tend to be greener than females from central parts.

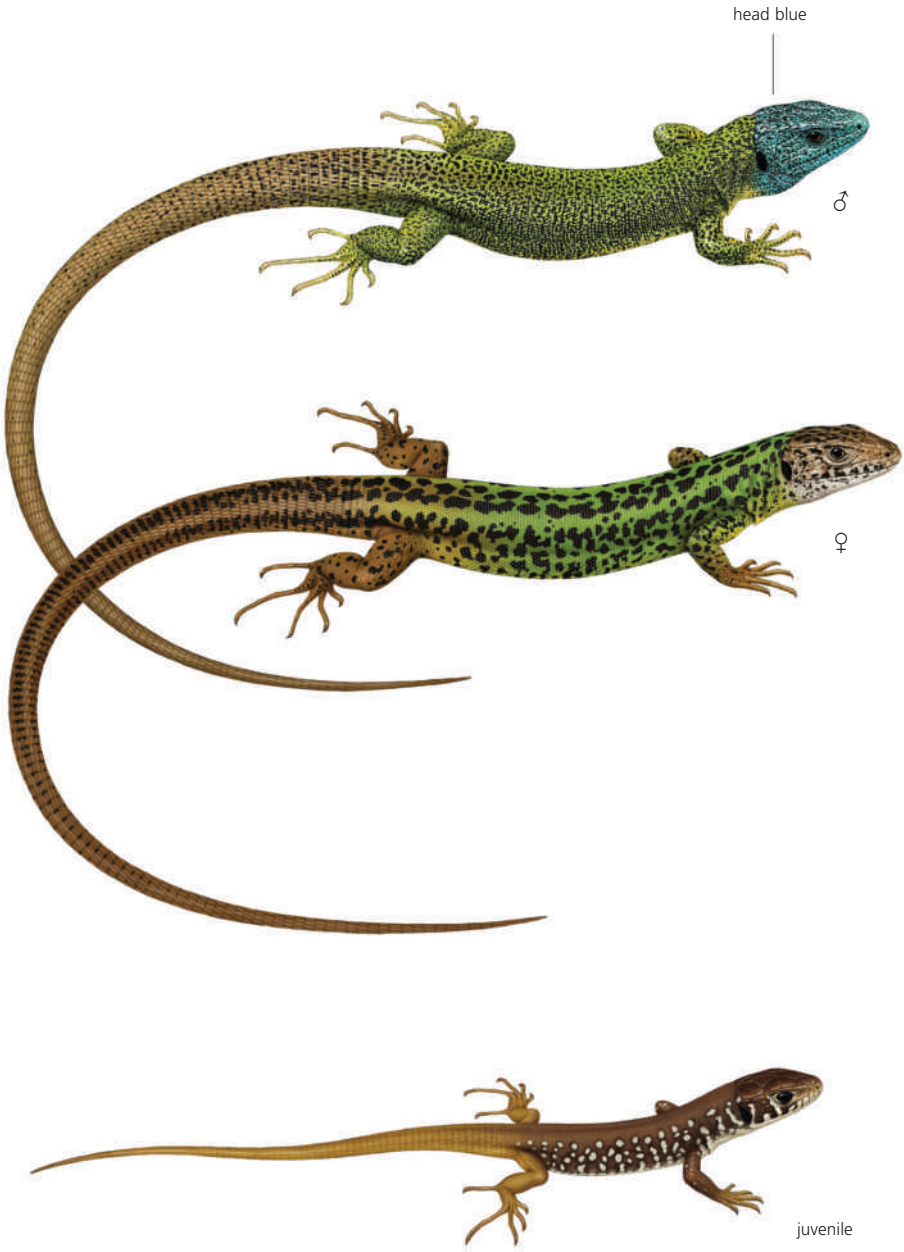
HABITAT

Areas of Atlantic-influenced climate with high annual precipitation. Occurs at the coast in NW of range, while inland generally in mountainous regions. Often associated with lush, green areas near water such as forest clearings, woodland edges, roadsides and overgrown pastures, but also near human settlements. High-altitude populations usually occupy barren, rocky slopes near streams. Occurs up to about 2,100 m in C Spain and up to 1,450 m in N of range (Galicia).

BIOLOGY

Less shy and skittish than most other *Lacerta* species. Can retreat rather slowly and silently when disturbed, remaining unnoticed while doing so. Often seen basking on rocks or logs near streams, into which it may dive when threatened. In hot summer months may also be active at twilight. Feeds on invertebrates, mainly beetles, caterpillars, grasshoppers and flies, but also on small lizards and plant matter. Active between February and November, but hibernation may be considerably longer, depending on altitude. Males and females form close bonds, with males guarding their mate for long periods. Mating takes place between April and June. Oviparous; females lay 11–21 eggs, most often in July. Females may stay close to the nest site for a week or less. Juveniles emerge between August and September.

Schreiber's Green Lizard



Sand Lizard *Lacerta agilis* Linnaeus, 1758

DESCRIPTION

TL: 25 cm; SVL: 11 cm. Stocky lizard with short, blunt snout. Limbs short. Scales on back slightly larger than scales on flanks, but scales on the centre of the back narrower than the adjacent dorsal scales. Males with green or greenish flanks, sides of head and forelimbs. The green colour becomes especially intense in breeding season. Top of head, tail and hindlimbs mostly brown or grey. Two pale, broad, unspotted dorsolateral bands and interrupted dorsal streak along back and tail. Highly variable pattern of ocellated spots and dark blotches, sometimes forming bands or a reticulated pattern between dorsolateral bands on back and on flanks. Ventral parts often green or yellowish with many black markings. Females have less bulky heads than males. The former are largely similar in pattern but may be grey or brown and almost never green on flanks, head or limbs. Ventral parts white, yellow or greenish with fewer markings than males. Juveniles usually greyish with many ocelli on flanks and back, two pale dorsolateral bands (which may not always be obvious) and large heads.

DISTRIBUTION

Throughout most of N, C and SE Europe. Absent from Ireland and much of Great Britain and Scandinavia. In the Spanish/French/Andorra border area (Pyrenees) and Italy (Alps) restricted to small areas. In SE of range (Balkans) mostly in mountainous regions. Also Caucasus, NE Turkey and throughout Russia as far as Siberia.

VARIATION

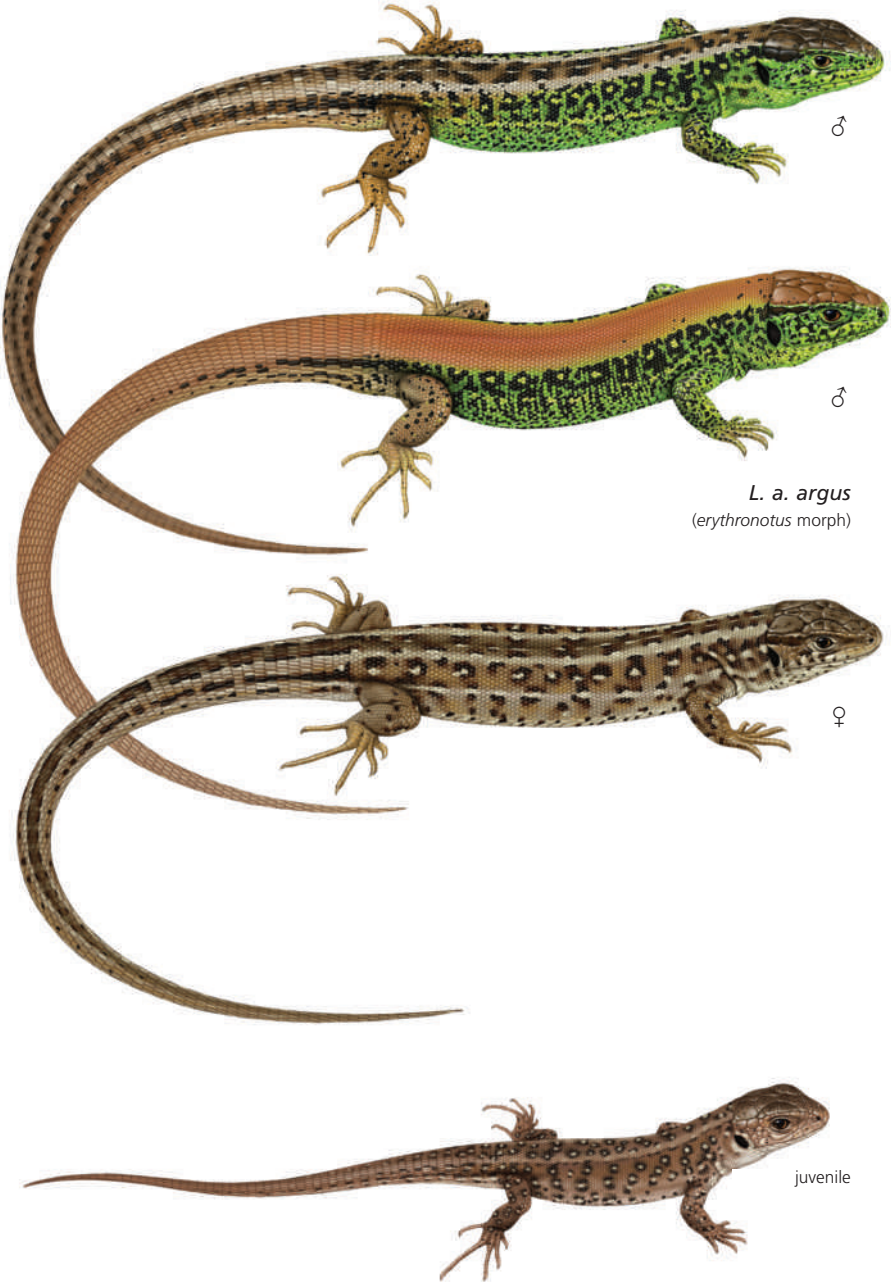
Highly variable species with many subspecies.
L. a. agilis: W and W-C Europe.
L. a. argus: E Europe. Individuals are relatively small and occasionally have unspotted backs, sometimes being red (*erythronotus* morph).
L. a. bosnica: Restricted to mountains on the Balkan Peninsula. Usually with a continuous, white vertebral line.
L. a. chersonensis: E Poland, Romania and Ukraine. Males may be entirely green.
L. a. exigua: N Crimea. May be entirely green and often with three pale lines along back.
L. a. tauridica: Mountains of S Crimea. Similar to *exigua*, but genetically distinct.
L. a. garzoni: Pyrenees. Vertebral band wider and darker than in nominate; legs and snout shorter.

HABITAT

In contrast to its relatives, often found in drier, open situations but always with some vegetation cover such as dense grass or shrubs. Lives in dunes, moorland, (alpine) meadows and forest edges, but also in more human environments such as quarries, roadsides and hedgerows. Often associated with loose soils. Occurs up to 2,100 m in N Greece.

BIOLOGY

Not as fast-moving as many other European lizards and not as shy as other green lizards. Frequently encountered in rather high numbers and during breeding season relatively easy to observe and approach. Feeds on a wide variety of invertebrates, but mainly beetles and grasshoppers. Active between February and November



L. a. argus
(*erythronotus* morph)

in C Europe, but hibernation may be considerably longer in N of range or at high altitudes. Mating takes place from April to June. Males are highly territorial and display extensive courtship behaviour. Male and female may stay together for some time after mating. Oviparous; females lay 5–10 eggs in soft sandy substrates in June or July. In suitable climates a second clutch may be laid. Juveniles emerge in August or September.

Sand Lizard, ssp. *chersonensis*. Dobrudga, Romania.

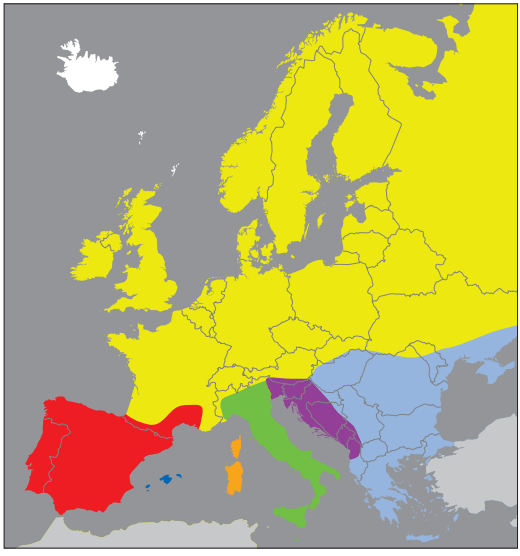
Sand Lizard, ssp. *bosnica*. Bulgaria.

Small Lacertas (*Anatololacerta*, *Archaeolacerta*, *Dalmatolacerta*, *Darevskia*, *Dinarolacerta*, *Hellenolacerta*, *Iberolacerta*, *Podarcis*, *Teira*, *Zootoca*)

The majority of the European members of the family Lacertidae are relatively small to medium-sized lizards, commonly referred to as 'small lacertas'. Previously assigned to only two genera, *Lacerta* and *Podarcis*, growing insights into the relationships between these species have led to a more meaningful arrangement, including the discrimination of multiple genera: while the genus *Podarcis* has remained unaltered, 10 genera of small lacertas are now recognised in our area.

The challenge of identifying individual lizards to species level can be significantly simplified by dividing Europe into seven geographical areas, as proposed by Arnold & Ovenden (1978 – see below). This avoids having to check differences between species which never coexist. Keys are provided for each region.

The limits of these seven areas are not precise – there may always be a species that extends somewhat further outside an area than others. Furthermore, more widespread species obviously occur in multiple areas, and therefore appear in more than one section and key. Where the species account of a more widespread species is in a different section, the page number of the species account is given in the key. Species restricted to a single region are described in the pages following the relevant key.



Geographical areas for the identification of small lacertas.

1. N, W and C Europe (p.264)
2. Iberian Peninsula, Pyrenees and Mediterranean France west of Rhône Valley (p.272)
3. Balearic Islands (p.288)
4. Tyrrhenian Islands (p.293)
5. Italian mainland (except extreme NE), Sicily and Malta (p.298)
6. E Adriatic coast including extreme NE Italy and SE Austria (p.305)
7. SE Europe (p.314)

1. N, W and C Europe

- Green lacertas in this area: Sand Lizard *Lacerta agilis*, Western Green Lizard *Lacerta bilineata*, Eastern Green Lizard *Lacerta viridis*, Ocellated Lizard *Timon lepidus*.
- Other lacertid lizards in this area: Edwards's Psammodromus *Psammodromus edwarsianus* occurs only in Mediterranean France within this area.
- Catalonian Wall Lizard *Podarcis liolepis* occurs in a few localities on the eastern bank of the Rhône River, France, in this area. See key 'Iberian Peninsula, Pyrenees and Mediterranean France east to Rhône Valley' for other localities.
- Italian Wall Lizard *Podarcis siculus* has been introduced to a number of places in S France (Toulon, Ile de Hyères, Ile d'If) but may also occur elsewhere. See key 'Italian mainland (except extreme NE), Sicily and Malta' for other localities.
- Records of Horvath's Rock Lizard *Iberolacerta horvathi* north of extreme S Austria are considered erroneous.

Small Lacertas of N, W and C Europe	
Common Wall Lizard *Podarcis muralis*	**Viviparous Lizard** *Zootoca vivipara*
SVL up to 7.5 cm.	SVL up to 6.5 cm.
Body somewhat flattened.	Body hardly flattened.
Relatively long hind legs with long toes; head rather large and elongated.	Short hind legs; small head.
Collar smoothly edged.	Collar indented or serrated.
Dorsal scales small: 42–75 smooth scales across the mid-body (back and sides).	Dorsal scales larger: 25–37 keeled scales across the mid-body (back and sides).
At least 5 supraciliary granules.	At most 4 supraciliary granules, usually none.
13–27 femoral pores.	5–15 femoral pores.
Pattern highly variable: see species text. Males may be covered in round spots or have a reticulated pattern and may have blue outer belly scales. Females usually with sides darker than back; often with dark vertebral line or row of spots and with pale dorsolateral lines which run onto the head. Belly white, yellow or (especially in males) red, orange or pink. Throat creamy white with variable amount of dark spots.	Pattern highly variable: see species text. Often variable number of eye-shaped spots (pale with dark lining) and pale dorsolateral and lateral lines or rows of stripes with adjacent dark lines or stripes. Dark vertebral stripe often present. Belly yellow to orange-red, usually (especially in males) with numerous small dark spots, especially towards the rear. Young dark-coloured.
Largely a climbing species in sunny habitats in our area.	Much more ground-dwelling, often in habitats with some humidity.

Viviparous Lizard, ssp. *carniolica*, an egg-laying subspecies that may warrant species status. NE Italy.

Common Wall Lizard *Podarcis muralis* (Laurenti, 1768)

DESCRIPTION

TL: 22 cm; SVL: 7.5 cm. Small to medium-sized lizard. Slender-bodied and often predominantly brown above. If present, the dark vertebral stripe is usually more pronounced than the dark stripes separating the flanks from the back. Pale dorsolateral stripes above dark flanks often present in females, whereas males may be more uniformly reticulated all over, but can display a large variety of intermediate patterns. Populations of (lowland) N Italy often with a lot of green on the back of breeding males, with level of dark pigment increasing towards C Italy, where males can often be largely black, with limited greenish spots. Underparts often with more spotting than coexisting relatives, often with somewhat larger, vaguely edged blotches, rather than small specks, on whitish throat in males. Throat may have rusty blotches, more commonly than in many related species. Breeding males usually with some pink, red or orange below. There appear to be three rather discrete belly colours (white, yellow and brick-red including black blotches), which vary in frequency throughout populations. Italian males may have largely black bellies. Masseteric scale often well-pronounced. Collar smooth-edged, in contrast to Viviparous Lizard *Zootoca vivipara* (but slightly notched in small-headed S Italian subspecies *breviceps*). Eye orange, copper-coloured especially in breeding males, in contrast to many coexisting species.

DISTRIBUTION

Widespread through C and S Europe. Naturally absent from large parts of the Iberian Peninsula, the larger Mediterranean islands, the British Isles and most Greek islands (except C Euboea, Corfu (introduced and unmapped) and Samothrace). Commonly introduced outside its native range in many places in Great Britain, the Netherlands, Belgium, Switzerland, Austria and Germany (not mapped).

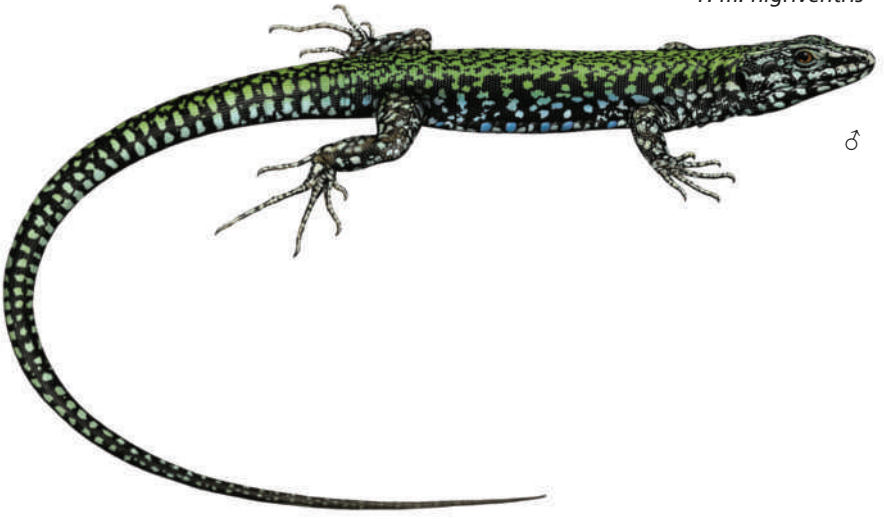
VARIATION

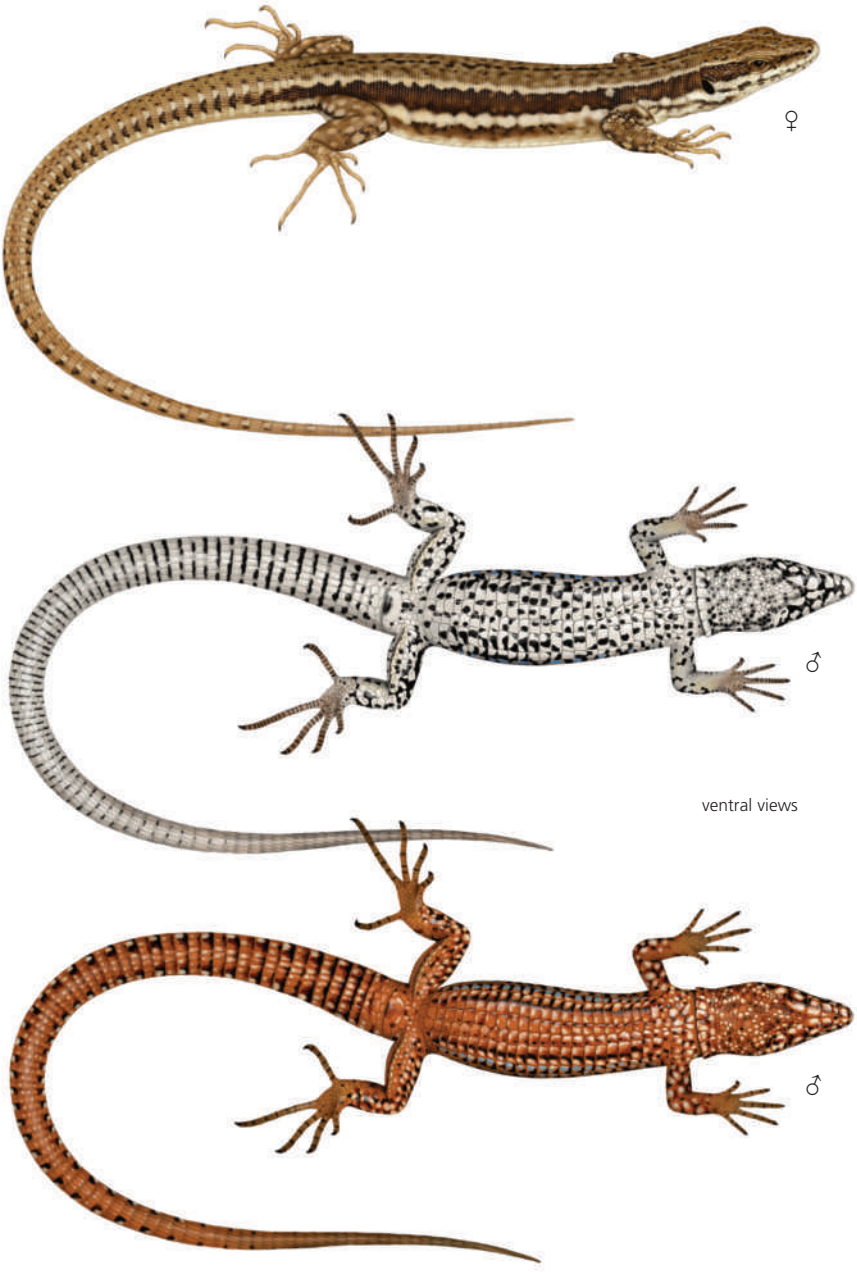
Numerous subspecies have been described and their validity is still a matter of some debate. Variability is huge, but the most strikingly different populations are found in C Italy (see Description and below). A contemporary view of the subspecific taxonomy is presented below.
P. m. muralis (incl. *albanicus*): SE Europe, in the NW as far as E Italian Alps, Slovenia, Austria, Slovakia and Czech Republic.
P. m. breviceps: S Italy; largely restricted to higher elevations, more ground-dwelling and with shorter head and hind legs, reminiscent of Viviparous Lizard.
P. m. brogniardii (incl. *merremius*): W part of range, including France, Belgium, the Netherlands, W Germany and a restricted range in Spain
P. m. colosii: Elba Island, Italy.
P. m. maculiventris: N Italy, north of Apennines, including Po Plain and parts of the mountains in the NE; NW Croatia, E Slovenia, Ticino (Switzerland) and (highly limited) Germany. Introduced to several places in Austria (although native to Tyrol) and Germany, as well as Canada and the

Common Wall Lizard

typical patterns showing
individual variation

P. m. nigriventris




♀
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ventral views
♂

USA. Lower parts may be heavily covered with dark spots.

P. m. nigriventris: Occurs S of *maculiventris* and N of *breviceps*, from Liguria in the N to Naples in the S. The most distinct morph, with males often displaying some degree of green coloration, may cause confusion with Italian Wall Lizard *Podarcis siculus*. In some areas (e.g., Rome) males may be largely dark, being black with green spots. Also on the Tuscan Archipelago (Elba etc.).

HABITAT

Occupies a wide range of sunny habitats. Heat-seeking in the northern parts of its range, in contrast to the more humidity-loving Viviparous Lizard, the only other small lacertid in much of N and C Europe, but becomes restricted to more humid environments at higher elevations towards southern parts of range. Can be very abundant, and is one of our most successful reptile species in man-made habitats. From sea-level to about 2,500 m (in southern areas).

BIOLOGY

One of the most easily seen reptiles in Europe, common and abundant in many areas and in a vast range of habitats. Climbs well, often conspicuous on walls and rocks (although S Italian subspecies *breviceps* largely ground-dwelling). When coexisting with other small lacerta species, often the one most likely to be seen climbing. When coexisting with more specialised climbing species (rock lizards of the genus *Iberolacerta*, for example) usually climbs less high and on less steep slopes. Opportunistic feeder; preys on a wide variety of invertebrates, but may also take small lizards including its own young. Active between February and November in N of range but may be active throughout the year if conditions allow, even after frosty nights and on days with temperatures below 10°C. In S of range, active throughout the year. Males defend territories of up to 25 m² and defend them against intruders. Mating takes place between March and June. Oviparous; females lay 2–11 eggs between April and August. They usually lay 2–3 clutches each year; may lay up to six in warmer regions but only one in colder areas. Eggs are usually deposited in self-dug burrows but may also be laid underneath rocks. Juveniles emerge between July and October.

The shorter head and limbs as well as a more ground-dwelling lifestyle make the S Italian Common Wall Lizard, ssp. *breviceps*, somewhat similar to Viviparous Lizard. Calabria, Italy. The individual depicted is a pregnant female.

Viviparous Lizard *Zootoca vivipara* (Lichtenstein, 1823)

DESCRIPTION

TL: up to 20 cm; SVL: 6.5 cm. Relatively small lacertid lizard with a hardly- or not-flattened body and relatively short legs. Dorsal scaling granular, but coarse (only 22–41 rows across back) and with small keels, in contrast to wall lizards *Podarcis* spp., giving the animal a slightly rough appearance. Collar complete and with serrated edge. Upperparts usually brown. Pattern rather variable, but usually includes some pale dorsolateral streaks, bordered with darker lining. Streaks often interrupted in males into rows of isolated pale spots with darker edges. Females especially often have darker flanks and a dark vertebral line. Throat usually spotted whitish, but belly mostly yellow or orange with black spots, especially in males. Young can be very dark and shiny. Meadow Lizard *Darevskia praticola* is probably most similar (see that species for distinguishing marks), but has a restricted range. Confusion is more likely to occur with the equally widespread Common Wall Lizard *Podarcis muralis*.

DISTRIBUTION

The most cold-resistant lacertid, occurring further north than any other reptile, up to 350 km N of the Arctic Circle. It also has the largest range of any amphibian or reptile species, ranging from Ireland to Japan and north to N Scandinavia, but is absent from much of S Europe including Portugal, Greece and all of the Mediterranean islands.

VARIATION

Z. v. vivipara: Widespread; entire range except as below.
Z. v. carniolica: Slovenia and relatively low regions in NE Italy and S Austria. Egg-laying.
Z. v. louislantzi: Pyrenees and N Spain, N along SW France to the Gironde. Egg-laying.

A study of an Italian contact zone between *carniolica* and *vivipara* suggests that these may in fact be different species, as they seem to be reproductively isolated from each other. The older name *lutea* (attributed to individuals from the surroundings of Bordeaux) may have priority over *louislantzi*.

HABITAT

Occurs in a wide range of habitats with sufficient humidity and rich herbaceous cover, including forest edges and clearings, hedgerows, heaths, along railway tracks, etc. Towards the south of its range, restricted to higher elevations (Pyrenees, Alps, Balkan mountain ranges), where it is even more closely associated with humid conditions and occurs in more open landscapes, including those above the treeline up to about 2,500 m.

BIOLOGY

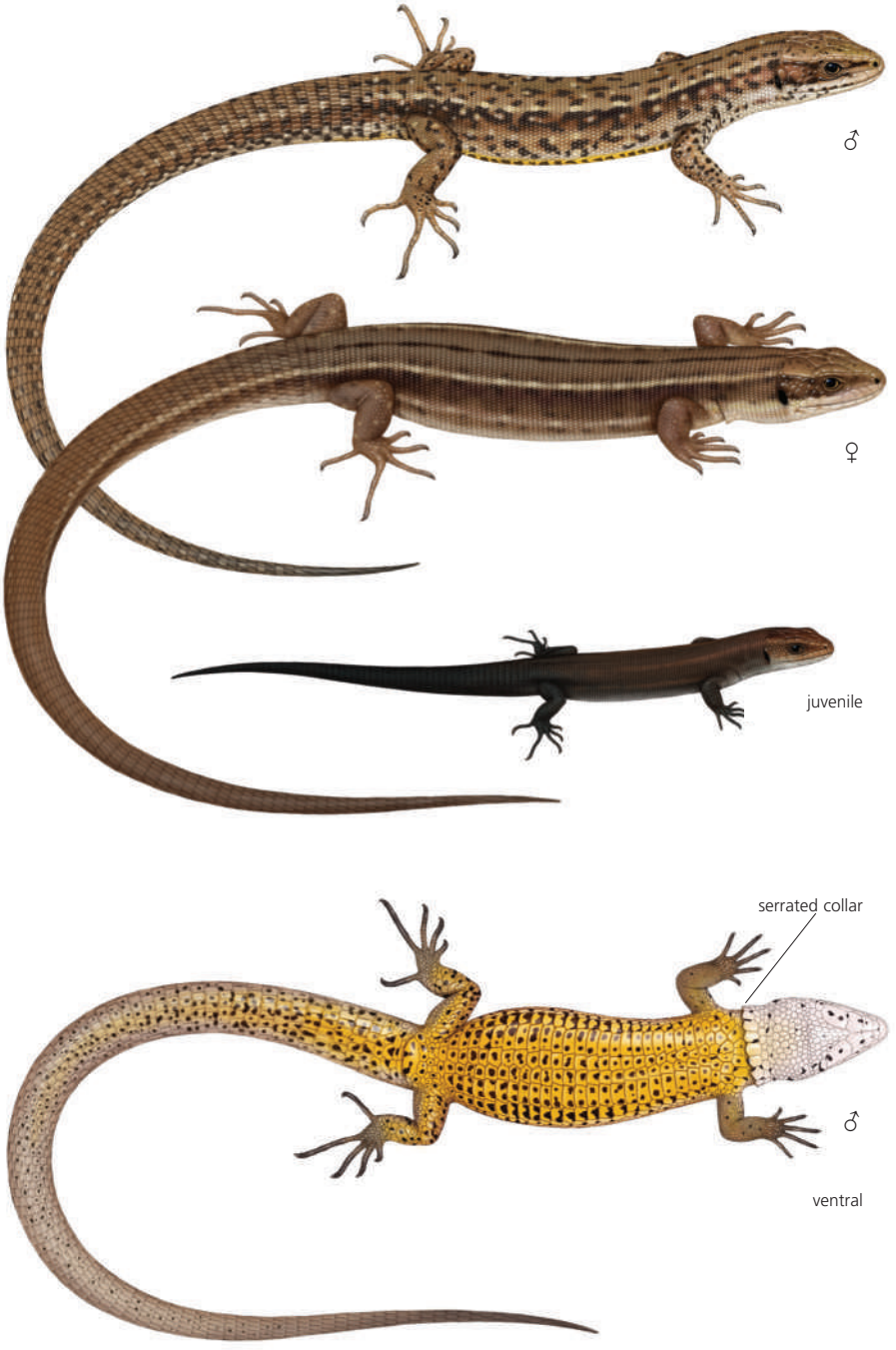
Diurnal and essentially ground-dwelling, but also occasionally climbs in shrubs and trees etc. Not as fast-moving as most other lacertids. Often basks on pieces of wood or dry grass patches. May dive into shallow water when disturbed and swims well. Often quite approachable and may be seen basking in groups. Activity period varies greatly within range. In C Europe often active between February and October, but this may be considerably shorter at high altitudes or in N of range. Mating takes place in April or May in most places but not until June at high

altitudes or in N of range. Bears live young over much of its range, but is egg-laying in certain areas (see Variation). The 3–11 juveniles are usually born in July and August. Juveniles of the same clutch spend one winter together before they disperse. Where oviparous, females produce two clutches of 1–13 eggs per season at lower altitudes, one in June or July and a second in July or August. At higher altitudes usually produces only one clutch in July. Juveniles hatch after several weeks. Feeds on a wide array of invertebrates and may even snatch frog and toad tadpoles or insect larvae from shallow water.

A melanistic Viviparous Lizard. Kent, UK.

Viviparous Lizard with eggs, ssp. *louislantzi*. Huesca, Spain.

Viviparous Lizard



2. Iberian Peninsula, Pyrenees and Mediterranean France west of Rhône Valley

- Green lacertas in this area: Western Green Lizard *Lacerta bilineata*, Schreiber's Green Lizard *Lacerta schreiberi*, Ocellated Lizard *Timon lepidus*, Sierra Nevada Ocellated Lizard *Timon nevadensis*
- Other lacertid lizards in this area: Spiny-footed Lizard *Acanthodactylus erythrurus*, Spanish Algyroides *Algyroides marchi*, Large Psammodromus *Psammodromus algirus* and the smaller psammodromus complex (*Psammodromus edwarsianus, P. hispanicus, P. occidentalis*)
- Ibiza Wall Lizard *Podarcis pityusensis* has been introduced to Barcelona and two places on the northern Atlantic coast of Spain – Gaztelugatxe and Monte Urgull (San Sebastian). Italian Wall Lizard *Podarcis siculus* has been introduced to at least Santander and Noja (Cantabria), Almeria and Barcelona; grows to a SVL of 6 cm and more, usually has an olive-green back, keeled dorsal scales between the hind legs, and an unspotted white or greenish underside.

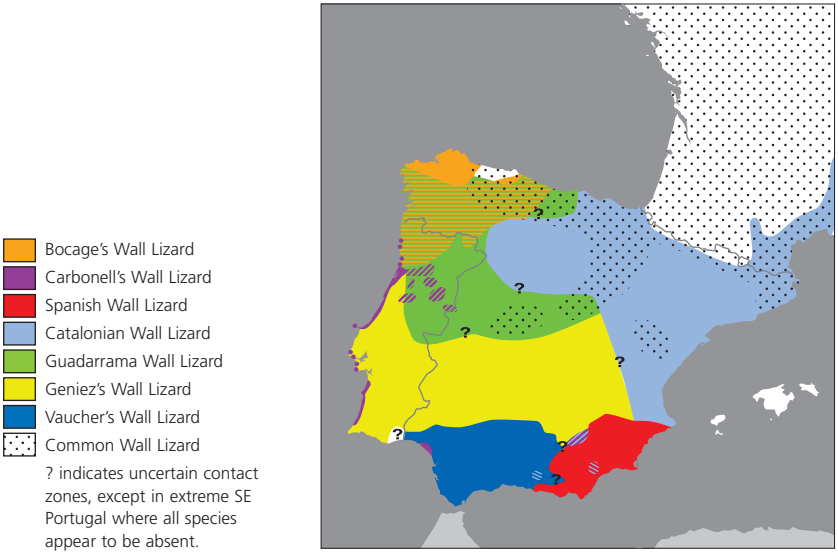
Key to Small Lacertas of the Iberian Peninsula, Pyrenees and Mediterranean France west of Rhône Valley			
1	**a**	N mountain ranges only. Collar indented. 4 supraciliary granules at most, often none. Dorsal scales rather coarse and keeled, with 25–37 rows across the mid-body (back and sides).	Viviparous Lizard *Zootoca vivipara* (p.269)
	b	Collar rather smoothly edged. 5 or more supraciliary granules. More than 40 rows of dorsal scales.	**2**
2	**a**	May be hard to tell apart from 2.b. N and C mountain ranges only, but also at coastal sites in NW Spain. A number of species with isolated ranges. Belly white, bluish or greenish, except for one species which may have orange-yellow belly in breeding males but is restricted to high altitudes in E Pyrenees. Round blue spots starting behind front legs may be present on flanks (not to be confused with blue outer ventral scales) in breeding males, but not in Pyrenees.	Rock lizards – **3**
	b	May be hard to tell apart from 2.a. Widespread throughout the Iberian Peninsula everywhere except the very highest altitudes. Belly white, yellow, orange or red. No round blue spots on flanks (not to be confused with blue outer ventral scales).	Common Wall Lizard *Podarcis muralis* (p.265) Iberian Wall Lizards *Podarcis hispanicus* complex (p.273)
3	**a**	Pyrenees. From 1,700 m to about 3,000 m.	Pyrenean Rock Lizards – **4**
	b	Mountain ranges of NW and C Spain and C Portugal, usually above 1,100 m, but also in coastal sites in Galicia.	Iberian Rock Lizards – **5**
4	**a**	Pyrenees – Vall d'Aran (Spain) and Ariège peaks (France) only. Belly unspotted.	Aran Rock Lizard *Iberolacerta aranica*
	b	E Pyrenees – small range in the area where Andorra, Spain and France meet, occurring in all three states (Macizo de Estats, Montcalm, Coma Pedrosa, Port de Rat, and Tristiana). Breeding males with yellow belly with dark spots.	Aurelio's Rock Lizard *Iberolacerta aurelioi*
	c	Pyrenees, mainly C – more or less from Pic d'Arriel range (W) to Aigüestortes (E) in Spain and Vallée d'Ossau (W) to Vallée d'Aure (E) in France. Belly unspotted.	Pyrenean Rock Lizard *Iberolacerta bonnali*
5	**a**	C Spain – Sierras de Guadarrama, Gredos and Béjar.	Cyren's Rock Lizard *Iberolacerta cyreni*
	b	NW Spain – Small range of Montes de Léon, S of Sil River.	Galan's Rock Lizard *Iberolacerta galani*
	c	C Spain – Sierra de Peña de Francia.	Peña de Francia Rock Lizard *Iberolacerta martinezricai*
	d	NW Spain (from Galicia to Picos de Europa area, but not S of Sil River) and C Portugal (Serra da Estrela).	West Iberian Rock Lizard *Iberolacerta monticola*

Iberian Wall Lizards *Podarcis hispanicus* complex

Previously treated as a single species, molecular and morphological studies have led to the division of the Iberian Wall Lizard *Podarcis hispanicus* complex into several species. Morphological similarity may not align with the evolutionary relations among them. Based on morphology, the first species to be split from the complex was Bocage's Wall Lizard *Podarcis bocagei*, including its subspecies *carbonelli*. Genetic data revealed, however, that Carbonell's Wall Lizard *Podarcis carbonelli* is a species in its own right and that Bocage's Wall Lizard is not its closest relative. Further splits led to five additional species, resulting in a total of seven species. In addition, Common Wall Lizard *Podarcis muralis* can also be found in this region.

Identification of the eight species

Bocage's Wall Lizard and Carbonell's Wall Lizard show range overlap with several of the other species. The eighth species, Common Wall Lizard *Podarcis muralis*, widespread in large parts of Europe, also overlaps with several of the other species in France and parts of N and C Spain. The five remaining species do not generally coexist with each other, but have neighbouring distributions. However, contact zones exist where they meet, rendering identification problematic. Nevertheless, once Bocage's, Carbonell's and Common Wall Lizard have been ruled out, range is an important feature for identification. In a given area, identification of wall lizards is limited to distinguishing from the overlapping species of that area, rather than having to consider all eight species. The major part of the Iberian Peninsula is inhabited by only a single species, i.e. one of the five 'neighbouring species' (see below). Excluding the single area where three species coexist, no more than two species inhabit any one area. Therefore, we largely restrict ourselves here to the relevant distinctions between species, rather than offering comprehensive descriptions of each. As females and juveniles are often hard, if not impossible, to tell apart we focus on adult males. Most individuals show highly contrasting colour patterns during spring and early summer; in autumn and winter both males and females may, however, look pale or even uniformly coloured, so that it can be difficult to distinguish them.



Contact and range overlap zones in Iberian wall lizards								
	hispanicus	*guadarramae*	*liolepis*	*vaucheri*	*virescens*	*muralis*	*carbonelli*	*bocagei*
hispanicus	–		C	C	C			
guadarramae		–	C		C	O	O	O
liolepis	C	C	–		C	O		
vaucheri	C			–	C		O	
virescens	C	C	C	C	–		O	

C = shared contact zone; O = overlapping ranges; empty cells = absence of both contact and overlap zones.

'Overlapping' species

Together with Common Wall Lizard, Bocage's and Carbonell's Wall Lizards form a group showing wide range overlap with the remaining five 'neighbouring species'. Although they are highly variable between and within themselves, the 'neighbouring species' are usually more slender and graceful than the Common Wall Lizard. Also, in contrast to most Common Wall Lizard individuals, many (but not all) lack a vertebral line or have only a rudimentary one, which is then usually most developed anteriorly and in most cases weaker than dark dorsolateral lines or rows of spots. The underparts often show some spots, which are usually smaller and more clearly defined than in Common Wall Lizard. Reddish, pink or orange undersides are also less frequent than in the latter. For additional details on Common Wall Lizard, see its species account (p.265). Most of the 'neighbouring species' (*hispanicus, guadarramae, liolepis, vaucheri* and *virescens*) can be distinguished relatively easily from the 'overlapping' species Bocage's Wall Lizard and Carbonell's Wall Lizard, although distinguishing them from Guadarrama Wall Lizard may be challenging. The two 'overlapping' species are robustly built and have short, deep heads, while the five 'neighbouring' species are rather sharp-snouted and delicately built. In general, Bocage's and Carbonell's Wall Lizards are also much more ground-dwelling than the 'neighbouring species' and Common Wall Lizard.

Bocage's Wall Lizard *Podarcis bocagei* (Seoane, 1884)

Restricted to NW Iberia, from the Douro River valley in N Portugal through most of Galicia, Asturias and NW Castile and León in Spain. Appears to be absent from C Asturias, and is extremely localised in other areas N of the Cantabrian Mountains. Elsewhere it is usually highly abundant, although populations in the dry SE part of its distribution are restricted to humid river valleys or occur in the vicinity of (temporary) streams. Often found on stone walls in villages or rocky hillsides, but many populations are entirely ground-dwelling and occupy shrub vegetation or coastal habitats.

Back usually green, but may appear brownish outside the breeding season. Dorsolateral stripes bright green or whitish with irregular edges bordered by black towards the back; lines usually highly discontinuous in males. Faint second line of small white blotches occasionally present on lower flanks, especially in females. Vertebral line usually lacking. Flanks brown

or black with numerous scattered whitish to brown blotches. Underside usually yellow, occasionally orange. Best distinguished from other wall lizards by the combination of head shape, dark coloration on the flanks and green coloration on the back. Distinguishing individuals which are not green from the Common Wall Lizard may be difficult – Bocage's Wall Lizard usually has fine dark markings above the pale dorsolateral stripe which are usually lacking in Common Wall Lizard. Females are very difficult to distinguish from other wall lizard species.

Carbonell's Wall Lizard *Podarcis carbonelli* Pérez-Mellado, 1981

Highly fragmented distribution, from the Peña de Francia and Gata mountains in Spain (Salamanca) in large isolated fragments through the central-northern Portuguese mountains, down to the Portuguese coast and southwards along the coast as far as Monte Clérigo. Another isolate is located in the Coto de Doñana, Spain.

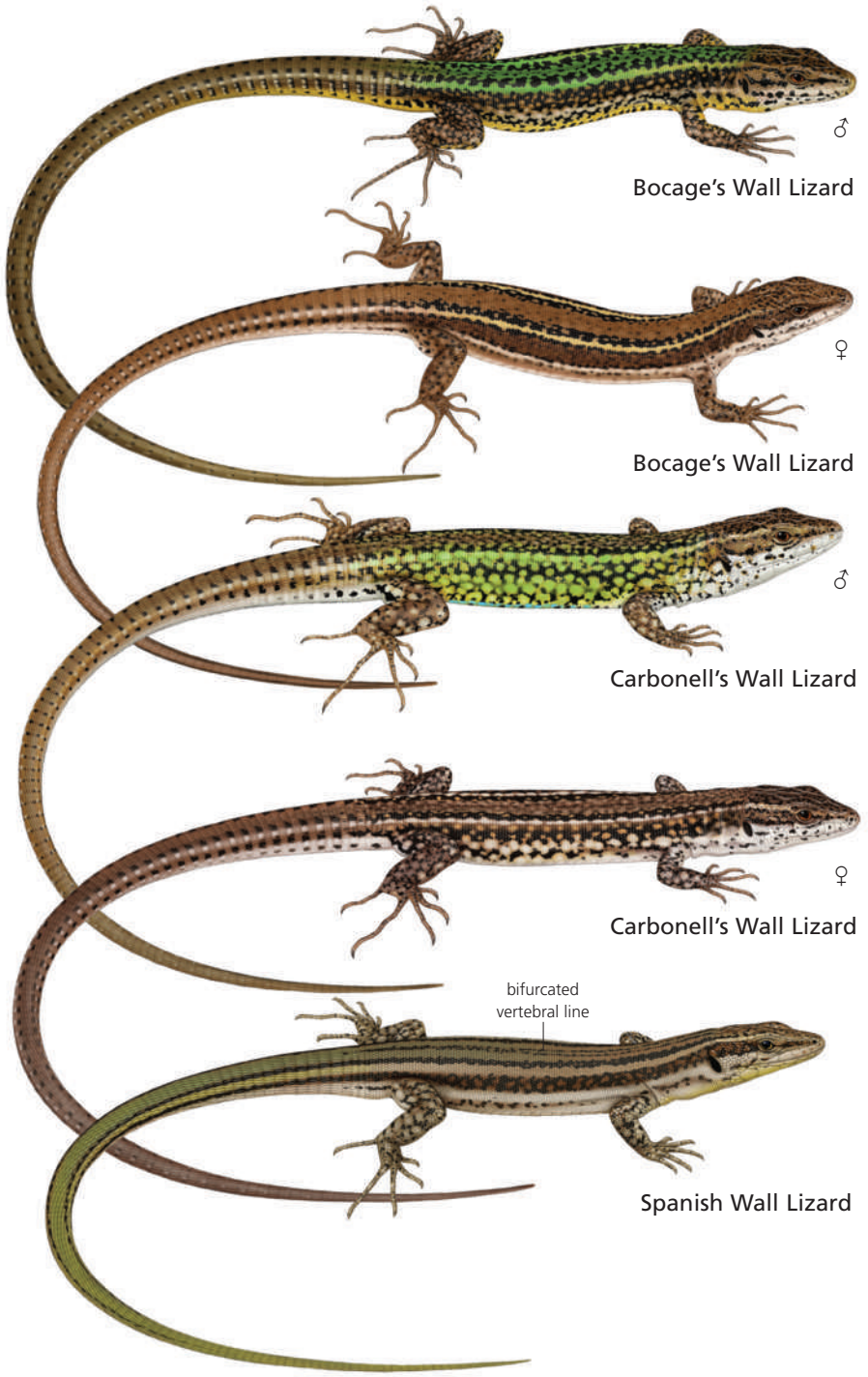
Back generally brown, especially in mountainous populations. May be green in males during the breeding season, although usually less so than flanks. Dorsolateral stripes, if present, bright green (males) or whitish (females) with irregular edges bordered by black towards the back; lines usually highly discontinuous and not very well pronounced in males. Vertebral line usually lacking. Flanks with green or yellow patches and outer ventral scales blue during the breeding season in males; outside of reproductive period the lateral pattern remains lighter than the dorsal colour. Underside usually white, but can be yellowish or orange. Best distinguished from other wall lizards by the combination of head shape and presence of light coloration of the flanks versus darker coloration on the back in males. Females are very difficult to distinguish from other wall lizard species.

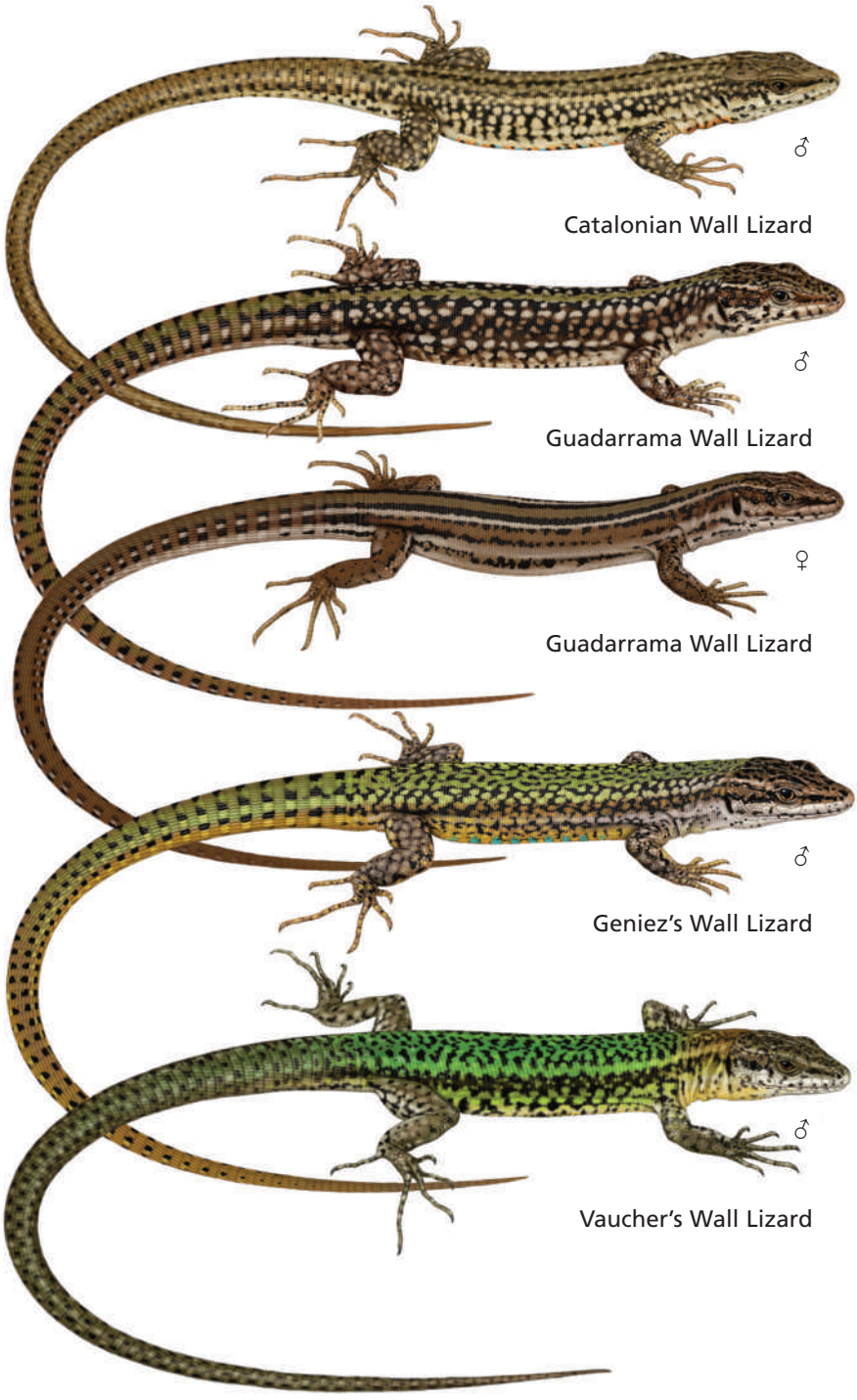
Individuals from the Berlengas Islands and the adjacent Peniche peninsula have been described as *P. c. berlengensis*.

Two highly different types of habitat are used, which are often devoid of rock formations or other habitats characteristic of wall lizards. Mountain populations occur along slightly disturbed areas such as elevated road-banks, trails or small clearings in open deciduous forests consisting mainly of oak trees. These sites are often in the vicinity of streams or waterbodies. Coastal populations inhabit low shrubs in dune ecosystems. In both areas, individuals bask inside tiny shrubs or bushes rather than out in the open. An exception concerns wooden boardwalks in dune areas, which may attract high numbers of individuals using this artificial habitat, both for basking and as cover. The vast majority of populations consist of ground-dwelling individuals, even if no other wall lizard species are present in the vicinity. Abundance of populations in C Spain seems to have dropped significantly over recent decades, with aridification possibly playing a role.

NOTE

Carbonell's Wall Lizard is listed as Endangered in the 2009 IUCN Red List of European Reptiles.


♂
Bocage's Wall Lizard
♀
Bocage's Wall Lizard
♂
Carbonell's Wall Lizard
♀
Carbonell's Wall Lizard
bifurcated
vertebral line
Spanish Wall Lizard


♂
Catalonian Wall Lizard
♂
Guadarrama Wall Lizard
♀
Guadarrama Wall Lizard
♂
Geniez's Wall Lizard
♂
Vaucher's Wall Lizard

'Neighbouring' species

Although exceptions exist, range overlap among the five following species is generally limited. They tend to climb more than Bocage's and Carbonell's Wall Lizards, and have a flatter body and head.

Spanish Wall Lizard *Podarcis hispanicus* (Steindachner, 1870)

This species is restricted to a rather small area in SE Spain. Its contact zone with Catalonian Wall Lizard *Podarcis liolepis* remains somewhat unclear because, for example, the latter seems to be present in several humid, mountainous isolates within the range of Spanish Wall Lizard (see below). An introduced population of Vaucher's Wall Lizard of N African origin occurs within the range of Spanish, in an area west of the city of Murcia. Individuals of Spanish Wall Lizard can be found in typical wall lizard habitats including dry-stone walls, villages and steep rock formations.

Usually rather distinctive in being the smallest of all *Podarcis* species (SVL usually less than 5 cm), often (especially anteriorly) with a bifurcated vertebral line, lack of green coloration on the back, dorsolateral lines which continue onto the head and the usual absence of blue outer belly scales.

Catalonian Wall Lizard *Podarcis liolepis* (Boulenger, 1905)

Occupies NE Spain including the Sistema Ibérico and Columbretes Archipelago, ranging to Zamora in the W and N Valencia in the south. Several isolated populations of this species seem to occur in humid regions of the Baetic mountains, including areas in the Sierra de Segura, Calares de Rio Mundo, Sierra Maria de Nieva and Sierra Nevada. Also occurs in the E Midi-Pyrénées, Languedoc-Roussillon and Rhône-Alpes in France, bordered to the east by the Rhône Valley (not mapped), though a small number of populations have been recorded on the eastern bank of this river.

In contrast to several other species (but not Common Wall Lizard), a dark vertebral stripe is frequently present but is often discontinuous and the belly and underside of the tail are never yellow, but pink, brick-red or white (in contrast at least to Spanish, Geniez's and Vaucher's Wall Lizards). In mountainous areas of N Castile and Leon, where Common Wall Lizard readily coexists with Catalonian Wall Lizard, the former is usually heavily patterned and shows a brick-red underside, while coloration of the latter is much paler including a whitish underside. Masseteric scale usually present. Pale dorsolateral stripes occasionally present, but often less clear than in other species, discontinuous and consisting of blotches in males, but generally continuous in females. In contrast to Spanish Wall Lizard, the dark vertebral stripe never divides anteriorly. In contrast to many Guadarrama Wall Lizards, dorsolateral stripes are pale and less distinct (especially in males), and wider than the dark dorsolateral stripes. Outer ventral scales frequently blue in Catalonian Wall Lizard, while these are supposedly always lacking in Guadarrama Wall Lizard. The back is usually brown or greyish, but may be bright green in males, especially in some southern populations (e.g. Alicante province). Some populations may feature individuals with a broad and distinct dark dorsolateral stripe

(e.g. Cuenca, Baetic mountains). The range of this species overlaps with Common Wall Lizard, which is more robust. The head of the latter is paler on top than on the cheeks, while the head is rather uniformly coloured in Catalonian Wall Lizard. There appears to be no overlap with Bocage's Wall Lizard, as they seem to replace each other rather abruptly – Catalonian Wall Lizard in the north-westernmost area appears to take over Bocage's niche, being more ground-dwelling and robust. Bocage's Wall Lizard does not have blue outer ventral scales.

An abundant species in hilly regions of Castile, Leon, Catalonia and Aragón (up to 1,500 m on the S slopes of the Pyrenees) where it occupies typical wall lizard habitats. Populations located in the flatter and more arid Spanish interior (meseta) are less abundant and generally restricted to small, eroded rock formations or old buildings in villages such as churches.

Several subspecies have been described but some of these are perhaps just colour morphs.

P. l. liolepis: NE Spain.

P. l. atratus: Columbretes Archipelago, E Spain.

P. l. cebennensis: NE of species range, including southern C France (partially mapped only). Transition zone with *P. l. liolepis* in NE Spain has not been documented.

P. l. sebastiani: N Basque Country, N Navarra and coastal NE Cantabria, Spain. This subspecies is also widespread in the adjacent southern Pyrénées-Atlantiques, France. Highly resembles the sympatric Common Wall Lizard due to large size and black to dark brown dorsal colour. However, males often show distinct, largely continuous light dorsolateral stripes (absent in *P. muralis*), occasionally greenish dorsal coloration and a more pointed snout.

An introduced population occurs in Lower Saxony, Germany (not mapped).

Uniformly coloured Catalonian Wall Lizard. Valencia, Spain.

Guadarrama Wall Lizard *Podarcis guadarramae* (Boscá, 1916)

Consists of two subspecies which are morphologically similar but genetically distinct. The nominate subspecies *guadarramae* is restricted to the south-eastern portion of the species range – the Spanish Sistema Central mountains (including Sierras de Guadarrama, Béjar, Gredos, Peña de Francia and Gata, and smaller adjacent ranges). The remaining larger portion of the range in N Portugal and NW Spain is occupied by the subspecies *lusitanicus*. An isolated NE population exists in the Picos de Europa area.

While the pattern may be entirely spotted or dappled, this species often has extensive dark pigmentation on both flanks and back, separated by a clear pale dorsolateral line

or, most often in males, a row of elongated spots, distinguishing it from most other species within or adjacent to its range. Green pigmentation is present on the back, usually in the form of a narrow stripe, especially in some montane and/or western populations. Underside never yellow. Individuals from the Picos de Europa region are often characterised by a very dense pattern of light spots, less conspicuous dorsolateral lines and more extensive green dorsal coloration. The range of this species overlaps with Bocage's Wall Lizard, Carbonell's Wall Lizard and (in the Guadarrama Mountains) Common Wall Lizard. It is considerably smaller and more delicately built than the latter. Where their ranges overlap, Guadarrama Wall Lizard can look similar to Carbonell's and Bocage's Wall Lizards. Carbonell's has blue outer ventral scales. Bocage's has continuous dorsolateral lines. Guadarrama is rarely ground-dwelling and therefore usually observed climbing walls in villages or towns. Populations are often also found among rock formations consisting chiefly of large boulders, which are typically found throughout most areas of its central Spanish range. Individuals from the isolate in the Picos de Europa occur either on old buildings in villages or on very steep rock formations, whereas the coexisting Common Wall Lizard occupies more humid and level areas.

Geniez's Wall Lizard *Podarcis virescens* Geniez, Sá-Sousa, Guillaume, Cluchier & Crochet, 2014

Occupies a large area in the southern, central and western parts of the peninsula. Males are usually less flattened and with fewer dark spots on the snout than Guadarrama Wall Lizard. Dorsolateral spots more rounded and less elongated than in the latter species. Especially in spring, back often greenish and with less dark pigmentation than Guadarrama Wall Lizard. In contrast to Catalonian and Spanish Wall Lizards, a vertebral line is supposedly always absent in Geniez's Wall Lizard, and the belly and underside of the tail commonly have a yellow coloration (pink, white or brick-red in Catalonian, usually whitish in Spanish). Morphological distinction from Vaucher's Wall Lizard is very difficult and often impossible without molecular data. Geniez's Wall Lizard overlaps with Carbonell's Wall Lizard in coastal Portugal. Carbonell's has greenish flanks, while in Geniez's the back may be green but not the flanks.

Although this species is present continuously throughout most of its range, populations are often small or inconspicuous, especially in dry, level landscapes (the meseta plain) – similar to Catalonian Wall Lizard. In contrast, individuals may be commonly observed in towns, especially when old churches or fortifications are present.

Geniez's Wall Lizard. Sierra de Cazorla, Spain.

Despite its occurrence in a relatively arid region, Geniez's Wall Lizard is often found near streams, rivers, water sources or other locations with relatively high humidity. Most individuals display highly restricted activity during the summer period, when they are subject to the particularly high temperatures characteristic of the Spanish interior.

Vaucher's Wall Lizard *Podarcis vaucheri* (Boulenger, 1905)

Confined to Andalucia, S Spain. Ranges from coastal Huelva province through the Guadalquivir Basin, and in most of Càdiz, Málaga and Granada in the south. The eastern limit runs through C Granada province (including the Sierra Nevada) and W Jaén. The northern limit of distribution is unclear; isolated occurrences have been recorded in the Sierra Morena. Also occurs in N Africa.

Can be either bright and contrasting in colour, or very pale, both during and outside the breeding season. Individuals in coastal zones (much) larger and more robust than those in mountainous regions. Males usually have green backs with a brown neck and a greyish head, in contrast to the usually more uniformly coloured Geniez's Wall Lizard (although individuals from the edges of the range may be particularly variable). Lower section of head generally the same colour as the underside. Vague green or yellow irregular, discontinuous dorsolateral lines in males, bordered by a brown, black or grey area on the upper flanks; in females, these lines are lighter (even white) and often continuous. Usually no vertebral line. Dorsolateral lines weakly defined or (especially in males) absent. If dorsolateral lines are present, they are usually broken up into separate rather roundish spots. Blue outer ventral scales normally absent, in contrast to Geniez's Wall Lizard. Underside white, yellow or orange, occasionally with black spots close to the lower flanks and on the throat. Females are very difficult to distinguish from other wall lizard species.

The range of this species overlaps with Carbonell's Wall Lizard in a very small area (the wider Coto de Doñana area, SW Spain). True coexistence seems rare, with Carbonell's occurring as a ground-dweller on sandy soil. However, hybridisation may exceptionally occur (Matalascañas). Carbonell's males have greenish flanks, while in Vaucher's the back may be green as well as the sides, though the sides are never greener than the back. Vaucher's also has a longer, flatter head and is clearly larger than Carbonell's. See table and map (pp.273–274) for range and contact zones with other species. In particular, difficult to distinguish from the more northerly distributed Geniez's Wall Lizard. In addition to typical wall lizard habitats, Vaucher's is also commonly found on the trunks of palm trees along busy tourist beaches.

Vaucher's Wall Lizard. Los Alcornocales, Spain.

Iberian Rock Lizards *Iberolacerta* spp.

West Iberian Rock Lizard *Iberolacerta monticola* (Boulenger, 1905)
Cyren's Rock Lizard *Iberolacerta cyreni* (Müller & Hellmich, 1937)
Galan's Rock Lizard *Iberolacerta galani* Arribas, Carranza & Odierna, 2006
Peña de Francia Rock Lizard *Iberolacerta martinezricai* (Arribas, 1996)

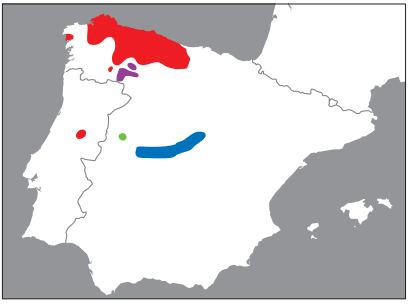
DESCRIPTION

TL: up to about 21 cm; SVL: about 9 cm. Small to medium lacertids. Breeding males can be strongly-built and particularly colourful, sometimes with completely bright green or bluish background colour on both back and belly, with dark, heavy reticulations, round blue spots behind front legs (spots may be particularly numerous in Galan's Rock Lizard but absent in Cyren's Rock Lizard) and blue outer ventral scales. Males from Serra da Estrela (*I. m. monticola*) may show bright cyan colours instead of green. Females less conspicuous, but usually with clearly dark flanks; dorsolateral area often with indistinct paler band. Belly often unspotted (but not in *I. m. monticola*). Juveniles usually with striking bluish tail (but also sometimes seen in wall lizard species). Dorsal scalation shiny but slightly coarser than in wall lizards. In contrast to the latter, shorter head, rostral scale usually touches frontonasal scale (but often not in *I. m. monticola*), supranasal scale usually touches loreal scale, first supratemporal scales large and cut down into parietal scale (see Fig. 34 on p.307 for details of head scales).

The four species do not occur together, so range is an important key to separate between them. Often difficult to distinguish from *Podarcis* wall lizards – use of key and careful reading of distribution and other species account information is advised.

DISTRIBUTION

Endemic to mountain ranges of Spain and Portugal, as well as some restricted lower and even coastal sites in NW Spain.
West Iberian: Serra da Estrela in Portugal (ssp. *monticola*) and in Spain from Galicia to Picos de Europa area including the Sierra del Sueve, but not S of Sil River (ssp. *cantabrica*). The most recently described subspecies of West Iberian is *I. m. astur.* It is known from N Montes de León (Gistredo), Catoute, Tambarón, Nevadín, Villabandín (or Macizo del Alto de la Cañada), Arcos del Agua (or Fernán Pérez), Tiendas and Suspirón, and mainly occurs on quartzite and slate rock substrates.
Cyren's: Only on certain mountains of C W Spain: Sierra de Guadarrama (ssp. *cyreni*), and Sierras de Bejar, Avila (Villafranca, La Serrota, and La Paramera) and Gredos incl. Mijares (ssp. *castiliana*).
Galan's: Small range in Montes de León, S of Sil River (Spain).
Peña de Francia: Two very small, geographically close areas in Salamanca, Spain, comprising mainly Peña de Francia and adjacent mountaintops (Hastiala, Mesa del Francés), but also Puerto El Portillo and its southern slope.



HABITAT

Usually in rocky terrain, often consisting of slopes with large boulders and characterised by sparse vegetation. Also at rocky forest edges or flat, bare mountain plateaus with large, scattered rock outcrops. Often quite close to a source of water (brook, lake, etc.). Most Galician and Asturian populations of West Iberian Rock Lizard (excluding Picos de Europa) occur on dry-stone walls, rock outcrops, bridges and old houses in forested areas at low and mid-altitudes, instead of open mountain regions in which Bocage's Wall Lizard *Podarcis bocagei* is dominant. Southern populations of Peña de Francia Rock Lizard occupy similar habitat in oak forest. Locally, can be highly restricted to a specific habitat. In general, limited to montane altitudes, but there are coastal populations of West Iberian Rock Lizard; usually above 1,100 m, but may reach 2,600 m, especially in the more southern mountains of the combined ranges (Cyren's).

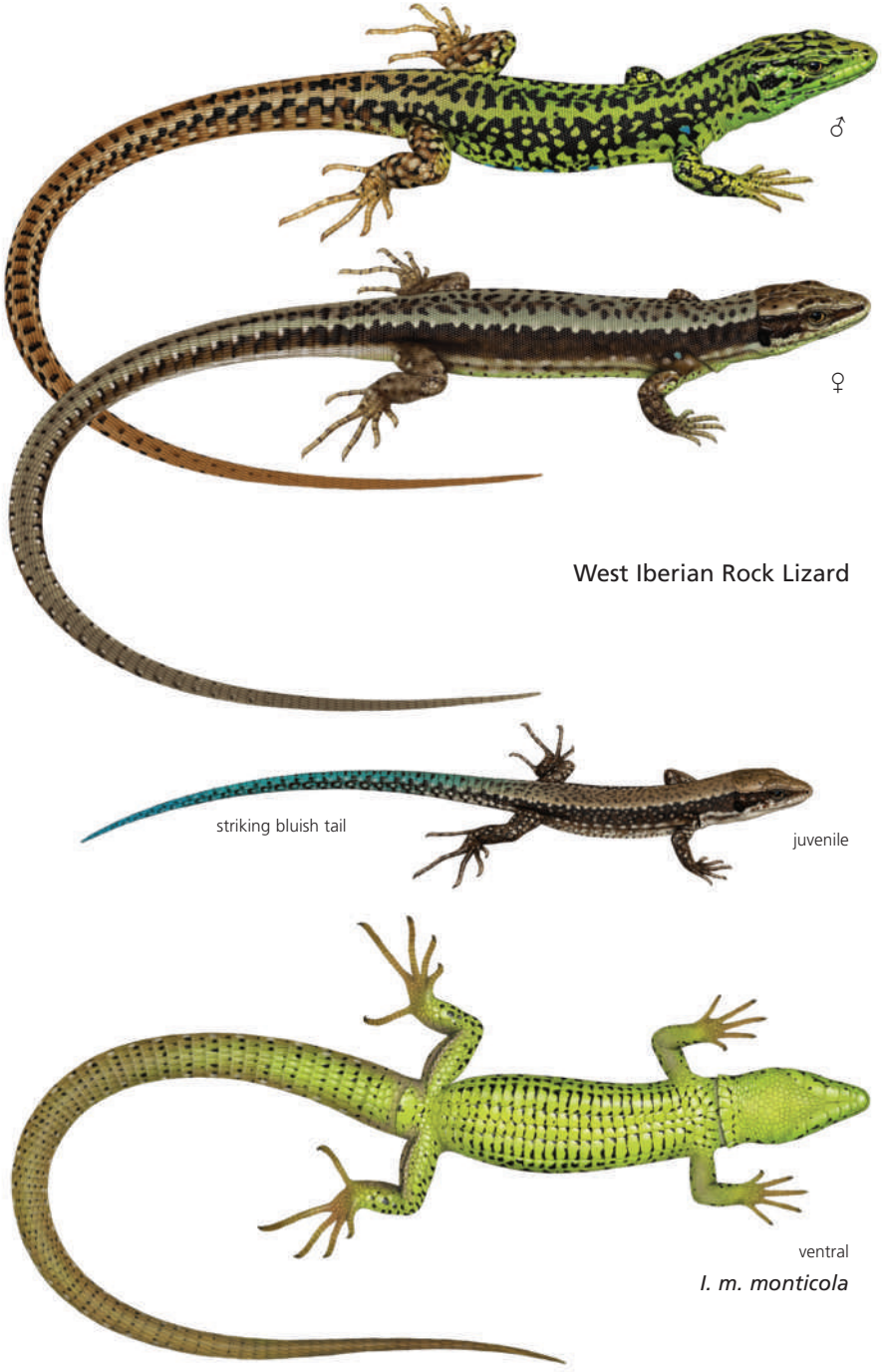
BIOLOGY

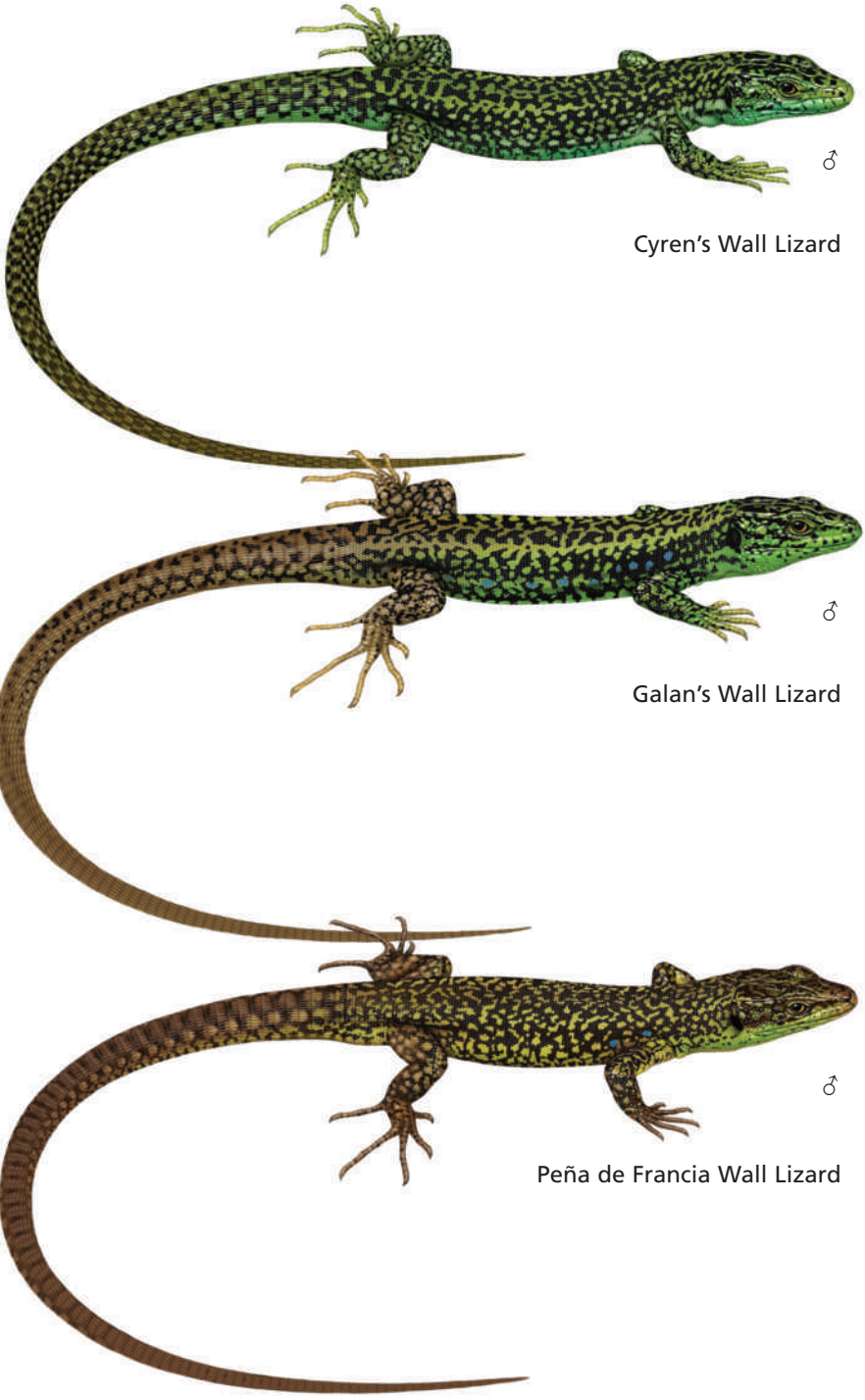
Agile rock-climbing lizards, easily seen basking on large rocks, though avoiding midday heat to some degree. May occur at high densities in suitable habitat. Can be quite approachable with some patience, and feeding and social interactions may be observed. Feeds on all sorts of invertebrates such as ants, flies, beetles and caterpillars. Active between March and October but this is strongly dependent on altitude. Mating takes place between April and June depending on altitude. Females lay 2–10 eggs in July and August. Eggs are usually deposited under rocks, and at higher altitudes occasionally in the vicinity of hiking trails where the loose soil makes it easier for the females to burrow. Juveniles emerge in August or September.

NOTE

West Iberian (Vulnerable), Cyren's (Endangered) and Peña de Francia Rock Lizards (Critically Endangered) are listed in the 2009 IUCN Red List of European Reptiles.

West Iberian Rock Lizard. Serra da Estrela, Portugal.


♂
♀
West Iberian Rock Lizard
striking bluish tail
juvenile
ventral
I. m. monticola


♂
Cyren's Wall Lizard
♂
Galan's Wall Lizard
♂
Peña de Francia Wall Lizard

Pyrenean Rock Lizards *Iberolacerta* spp.

Pyrenean Rock Lizard *Iberolacerta bonnali* (Lantz, 1927)
Aran Rock Lizard *Iberolacerta aranica* (Arribas, 1993)
Aurelio's Rock Lizard *Iberolacerta aurelioi* (Arribas, 1994)

DESCRIPTION

TL: up to about 15 cm; SVL: about 6 cm. Rather small lacertids, grouped in the subgenus *Pyrenesaura*. Dorsal colour usually greyish or brown (may appear iridescent from certain viewing angles). Flanks always darker; dorsolateral area often with indistinct paler band. Back usually unstriped, but may have small dark spots (often at equal distance from centre of back on each side) or reticulations. Flanks with darker pigmentation and pale round spots. No blue spots on outer ventral scales or flanks. Belly unspotted whitish or pale bluish in Pyrenean and Aran Rock Lizards, but yellow with black spots in Aurelio's. Dorsal scalation shiny but coarser than in Common Wall Lizard *Podarcis muralis*. In contrast to the latter, shorter head, rostral scale usually touches frontonasal scale, supranasal scale usually touches loreal scale, first supratemporal scales large and cut down into parietal scale (see Fig.34 on p.307 for details of head scales). Temporal scales convex and shiny, often three larger scales in Aran Rock Lizard, two larger ones with a row of three smaller ones in between (Pyrenean) or all small (Aurelio's).

Pyrenean Rock Lizard
Aran Rock Lizard
Aurelio's Rock Lizard

DISTRIBUTION

Endemic to three small and separate high-altitude sections of the Pyrenees, mainly in Spain.
Pyrenean: More or less from Pic d'Arriel range (W) to Aigüestortes (E) in Spain and Vallée d'Ossau (W) to Vallée d'Aure (E) in France.
Aran: Vall d'Aran (Spain) and the peaks of Ariège (France).
Aurelio's: Small range in the area where Andorra, Spain and France meet, occurring in all three states (Macizo de Estats, Montcalm, Coma Pedrosa, Port de Rat, Tristiana).

HABITAT

Usually on purely rocky terrain, generally consisting of large boulders with little vegetation. Often quite close to some source of water (brook, lake, waterfall, etc.). May be clearly restricted to a specific habitat in any one location. Occurs up to some distance above the treeline: Pyrenean – from 1,700 m to about 3,000 m; Aran – from 1,900 m to about 2,500 m; Aurelio's – from 2,150 m to about 3,000 m.

BIOLOGY

Agile rock-climbing lizards, easily seen basking on large rocks. Tend to avoid midday heat, and then sometimes surprisingly hard to find. Can be quite approachable with some patience and feeding and social interactions may be observed. Occurrence at high elevations may make these lizards hard to find, as they are inactive during rainy weather, which may be frequent even in summer. Feeds on a wide variety of invertebrates. Active from mid-May to late September, although juveniles may be seen until October. Mating takes place between late May and late June. Oviparous; females lay 2–5 eggs between mid-June and mid-July

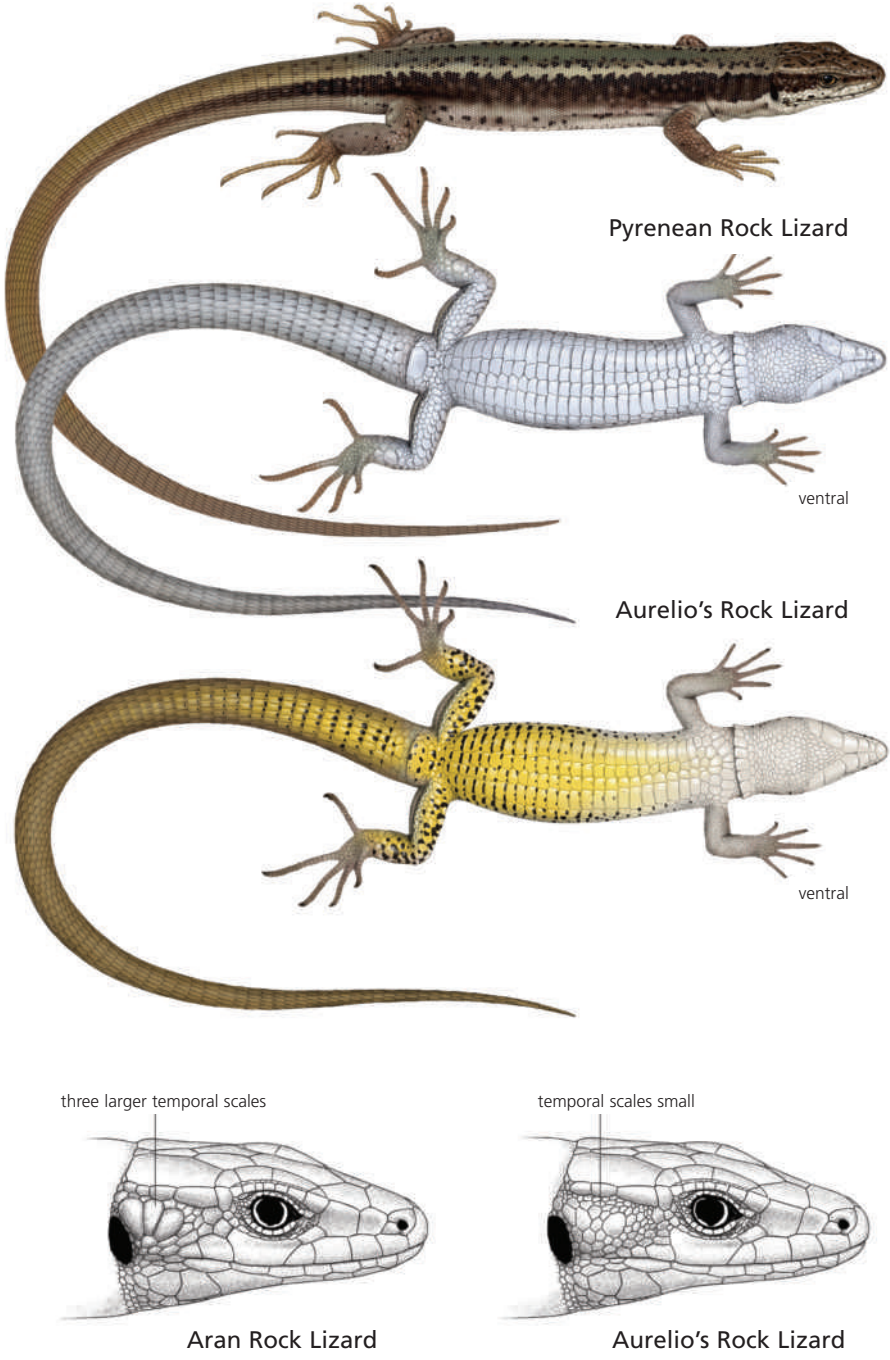


Fig. 33. Heads of rock lizards.

underneath rocks. In at least Aran Rock Lizard and Aurelio's Rock Lizard, several females may deposit their eggs together under the same stone for several years in a row. Juveniles emerge in late August.

NOTE

Aran and Aurelio's Rock Lizards are listed as Endangered in the 2009 IUCN Red List of European Reptiles.

Feeding Aurelio's Rock Lizard. France.

3. Balearic Islands

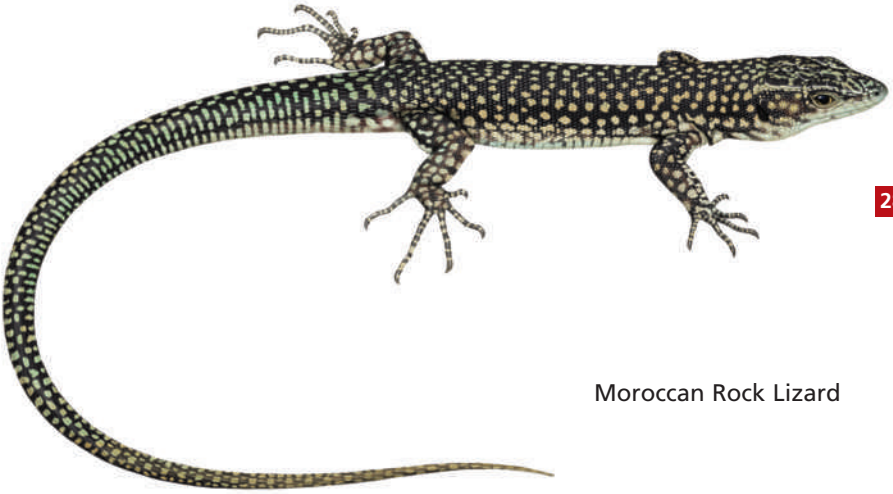
No green lacertas or other lacertid lizards are known to occur in this area.

Key to Small Lacertas of the Balearic Islands			
1	a	Menorca only. 10 rows of belly scales. Lower eyelid with large 'window'. Usually grey or olive with reticulation of dots. SVL up to only 5.5 cm.	Moroccan Rock Lizard *Teira perspicillata*
	b	SVL up to 8 cm or more; 6, rarely 8, rows of belly scales. Eye without 'window'.	2
2	a	Ibiza, Formentera and limited number of introductions on Mallorca. Dorsal scales in between hind leg insertions usually weakly keeled. Pattern highly variable – see species account. May have 2 pale dorsolateral stripes.	Ibiza Wall Lizard *Podarcis pityusensis*
	b	Small islands and islets close to Mallorca and Menorca, as well as a limited number of introductions on Mallorca. Dorsal scales in between hind leg insertions smooth and rather flat. Pattern highly variable – see species account. May have 2 pale dorsolateral stripes.	Lilford's Wall Lizard *Podarcis lilfordi*
	c	Menorca, including only a very limited number of nearby islets. Dorsal scales in between hind leg insertions usually rather clearly keeled. In contrast to several populations of the two species above, underside usually unspotted white or greenish. Pale dorsolateral stripes often unclear or broken up into spots.	Italian Wall Lizard *Podarcis siculus* (p.302)

Moroccan Rock Lizard

Teira perspicillata

(Duméril & Bibron, 1839)



Moroccan Rock Lizard

DESCRIPTION

TL: 16 cm; SVL: 5.5 cm. Small lacertid lizard with flattened body and a rather short but pointed snout. Most individuals with dark reticulated pattern on pale background, forming numerous pale roundish spots. Uniformly pale greyish, olive or bluish individuals can also be found. Tail of juveniles fluorescent blue or green, fading with age. No masseteric plate. 10–12 rows of large belly scales across the mid-body. Most diagnostic feature in comparison to other European lizards is a scaleless transparent lower eye-lid which allows the lizard to see with closed eyes.

DISTRIBUTION

Within Europe only on Menorca, where it was introduced and is rather widespread, but appears to be more abundant in western parts of the island. Natural distribution is NW Africa (Morocco and Algeria).

HABITAT

Dry rocky areas such as cliffs, dry-stone walls, city parks, quarries and rocky outcrops. On Menorca, often around human habitation, up to 100 m, but up to 2,200 m in NW Africa.

BIOLOGY

Diurnal, avoiding hottest parts of the day in summer. Strong climber and rarely leaves vertical surfaces. Often not very shy and easily approachable. Occurs in high densities in suitable habitat. Feeds mainly on insects but may take plant matter (fruits) as well. Active throughout winter under sunny conditions. Mating takes place in spring. Oviparous; females lay 1–4 eggs in June. Juveniles emerge between July and August.

NOTE

After having been assigned to several genera including *Podarcis* and *Lacerta*, some authors argue that this species should be named *Teira perspicillata*, whereas others maintain it within its own genus as *Scelarcis perspicillata*.

Lilford's Wall Lizard *Podarcis lilfordi* (Günther, 1874)

DESCRIPTION

TL: about 20 cm; SVL: 8 cm. Medium-sized wall lizard. Coloration extremely variable within and between populations, including striped, reticulated and uniform individuals. Back quite often somewhat greenish with black speckling, but may also be uniform and less colourful. Flanks may be brown, reddish, blue, etc. Pale dorsolateral lines may be present. Black individuals with blue spots on cheeks, sides and lower parts can constitute entire populations on certain islets. Dorsal scales roundish and smooth (without small keels), apparently distinguishing it from the closely related Ibiza Wall Lizard *Podarcis pityusensis*. Only small lacertid within its natural range.

DISTRIBUTION

Current natural range restricted to a number of islets off the main islands of Mallorca and (especially) Menorca, as well as numerous islets of the Cabrera Archipelago (to S of Mallorca). Absent from the main islands themselves, but locally introduced to at least Mallorca.

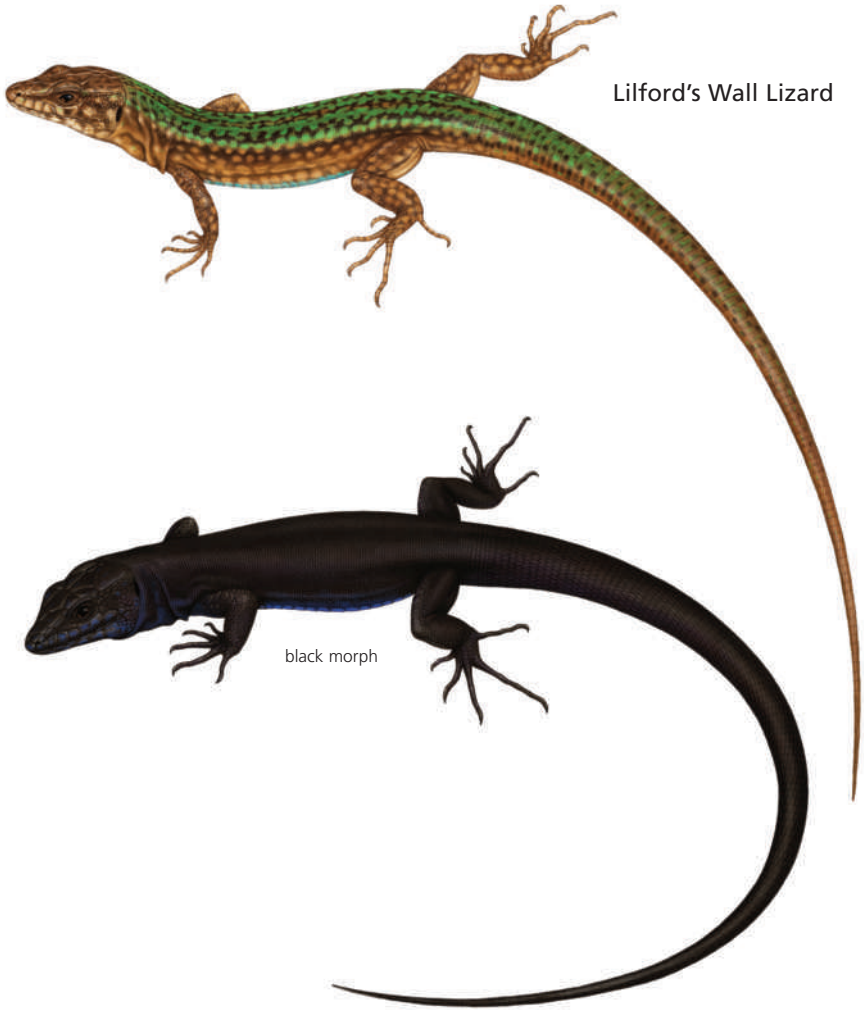
VARIATION

At least 25 subspecies have been described, although their validity requires confirmation.

HABITAT

Occupies nearly all habitat types within its natural range, such as littoral low scrub, rock outcrops, maquis etc.

Local abundance of Lilford's Wall Lizard may be very high. Balearics, Spain.



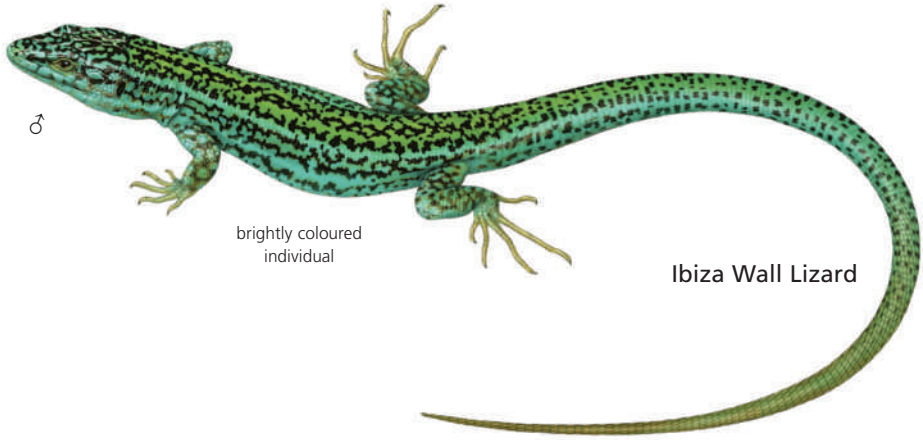
BIOLOGY

Climbs rather well on rocks and in vegetation, but more ground-dwelling than some related species. Usually an inquisitive and rather docile species, but this may vary between islands. Densities may be extremely high on some islands, reaching 44,000 individuals per hectare. In addition to a wide range of invertebrates, also feeds on fruit, flowers and seeds, which is often considered an adaptation to low food availability on small islets. As a side effect, these lizards act as pollinators and seed dispersers for several plant species such as Dead Horse Arum Lily *Helicodiceros muscivorus*. May be cannibalistic. Also forages around the nests of Eleonora's Falcon *Falco eleonorae*, eating discarded prey items, flies attracted by the birds' excrement or even dead birds. May be active throughout the year, though activity is greatly reduced during winter. Oviparous; females lay up to three clutches per year consisting of 1–4 eggs.

NOTE

This species is listed as Endangered in the 2009 IUCN Red List of European Reptiles.

Ibiza Wall Lizard *Podarcis pityusensis* (Boscá, 1883)



DESCRIPTION

TL: about 24 cm; SVL: 9.5 cm. Medium to rather large wall lizard. Coloration extremely variable within and between populations, including striped, reticulated and uniform individuals. Back quite often greenish with black speckling. Flanks may be brown, reddish, blue, etc. Pale dorsolateral lines may be present. Uniformly black individuals with blue spots on cheeks, sides and lower parts can constitute entire populations on certain islets. Dorsal scales rather elongated hexagons, with (obviously small) keels, apparently distinguishing it from the closely related Lilford's Wall Lizard *Podarcis lilfordi*. Only small lacertid within its natural range.

DISTRIBUTION

Natural range restricted to the Pityusic Islands: Ibiza, Formentera and about 40 nearby islets. Introduced to at least Mallorca (Palma de Mallorca, Cala Ratjada, Ses Illetes), Barcelona and two places on the northern Atlantic coast of Spain – Gaztelugatxe and Monte Urgull (San Sebastian).

VARIATION

At least 28 subspecies have been described, although their validity requires confirmation.

HABITAT

Typical widespread and abundant wall lizard, occupying nearly all habitat types within its natural range. Seemingly more abundant in more lush environments and somewhat less so in more closed wooded areas.

BIOLOGY

Climbs rather well on rocks and in vegetation, but more ground-dwelling than some related species. Densities may be extremely high, reaching 30,000 individuals per hectare in some places. In addition to a wide range of invertebrates, also feeds

on fruit, flowers and seeds, which is often considered an adaptation to low food availability on small islets. As a side effect, these lizards may act as pollinators and seed dispersers for certain plant species. Active throughout the year, though activity is greatly reduced during winter. Oviparous; females lay 1–4 eggs.

Ibiza Wall Lizard from an introduced population on Mallorca, Spain.

4. Tyrrhenian Islands

Here, we restrict this area to Corsica, Sardinia and nearby islets, while excluding islands closer to the Italian mainland, such as the Tuscan Archipelago.

- No green lacertas are known to occur in this area.
- Other lacertid lizard in this area: Pygmy Algyroides *Algyroides fitzingeri* (p.245).

Key to Small Lacertas of the Tyrrhenian Islands			
1	a	Usually obviously flattened body. Large head. Supratemporal scales do not extend clearly onto sides of head. Usually 6th supralabial scale touches the eye. Usually brown or olive with dark reticulations or with round spots, but without dorsolateral or vertebral stripes. Scales between hind legs tiny and flat. Underside and especially throat often with dark pigmentation.	Bedriaga's Rock Lizard *Archaeolacerta bedriagae*
	b	Not very flattened. Head relatively short and/or stout. Supratemporal scales in adults extending from the upper surface of the head onto the sides of the head. Usually 5th supralabial scale touches the eye. With or without dorsal stripes.	2
2	a	Scales between hind legs not keeled (but not flattened). Pattern highly variable but frequently with dorsolateral and/or vertebral stripes. Belly white, yellow, orange or reddish, and usually with dark spots, especially on throat. If present, dark dorsolateral stripes or rows of spots usually narrower than vertebral stripe.	Tyrrhenian Wall Lizard *Podarcis tiliguerta*
	b	Scales between hind legs keeled. Back often predominantly green, striped (most of Corsica) or reticulated (S Corsica and Sardinia). Belly unspotted, usually white or greenish. If present, dark dorsolateral stripes or rows of spots usually wider than vertebral stripe.	Italian Wall Lizard *Podarcis siculus* (p.302)

Bedriaga's Rock Lizard *Archaeolacerta bedriagae*

(Camerano, 1885)

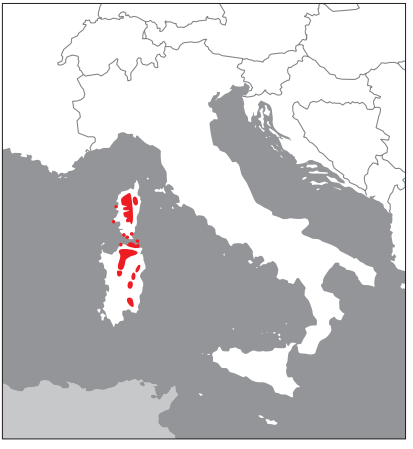
Bedriaga's Rock Lizard

DESCRIPTION

TL: 28 cm; SVL: 8 cm. Medium to quite large lizard with strongly flattened body. Almost always without stripes above. Two main trends in coloration exist: 1) Corsican inland mountains – dominant background colour is greyish-green or pale brown with dark reticulations of variable extent and; 2) most of Sardinian and Corsican coastal populations – dark brown to black with sometimes a dominant greenish tinge, covered with pale, often whitish or yellowish spots of variable size and number. Intermediate morphs exist. Individuals with blue dots on flanks and tail and blue outer belly scales occur. Underside whitish, grey, cream or sometimes orange. Juveniles usually darker above with distinctive light spots. Can be distinguished from Tyrrhenian Wall Lizard *Podarcis tiliguerta* by size, large head and flattened body.

DISTRIBUTION

Endemic to the Tyrrhenian Islands: Corsica, Sardinia, and a number of smaller islets, especially off the NE coast of Sardinia (La



Maddalena islets). While rather widespread in the mountainous part of Corsica especially, much more restricted in Sardinia. Sardinian localities include isolated populations along the NE coast and in the mountain ranges of the Monte Albo, Gennargentu, Sette Fratelli, Sopramonte di Oliena and Monte Limbara.

VARIATION

The previously accepted subspecies are now questionable in the light of recent genetic evidence. Corsican mountain populations seem to form at least one lineage, while the Corsican coastal populations and Sardinian populations form another group.

HABITAT

Usually found in habitat with a lot of large, bare rock surfaces. May be at sea-level (coastal rock outcrops, sometimes very close to the sea) or at high elevation (mountains). Clearly less frequent in more lush and human-influenced situations. In the mountains, quite often near water and especially abundant above the treeline. Reaches about 2,550 m (Corsica) but mostly between 1,000 and 1,500 m.

BIOLOGY

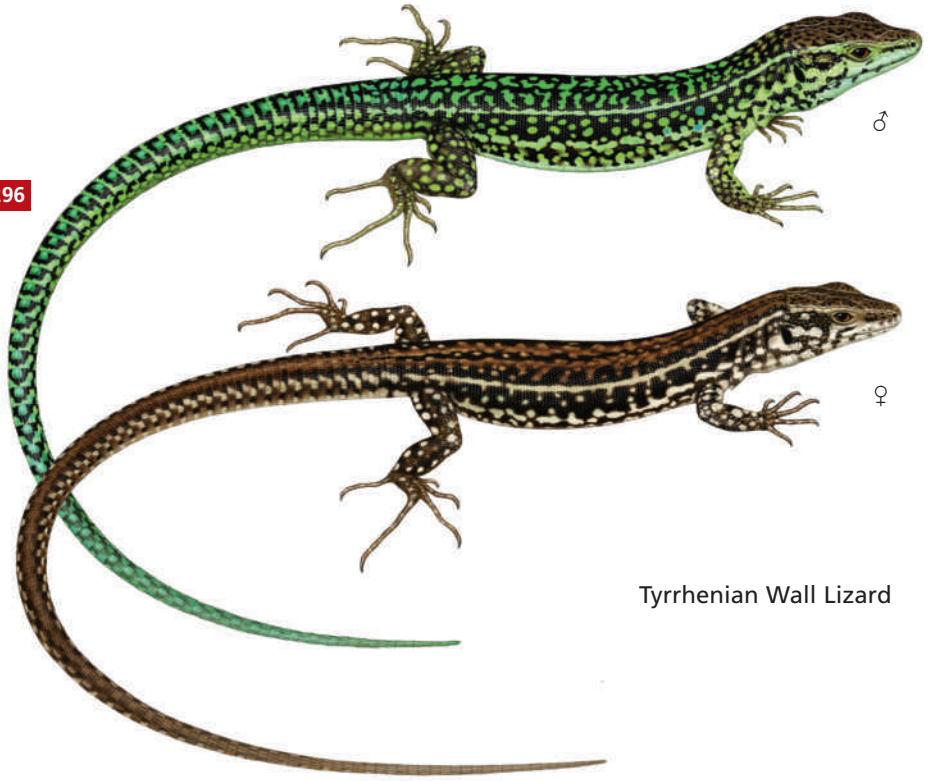
An agile rock-climbing lizard, which can flatten its body considerably when basking. Can be locally rather abundant. Usually skittish, but with patience easily approachable. Feeds on invertebrates such as spiders, beetles and wasps, but may also take some plant matter. Active between March and October but this may vary widely, depending on elevation. Mating takes place between April and June. Oviparous; females lay 3–6 eggs in summer. Juveniles emerge between July and September.

Bedriaga's Rock Lizard. Note the wide head. Col de Verghio, Corsica, France.

Tyrrhenian Wall Lizard

Podarcis tiliguerta

(Gmelin, 1789)



Tyrrhenian Wall Lizard

DESCRIPTION

TL: 25 cm; SVL: 6.5 cm. Medium-sized lacertid. Coloration highly variable, but usually with pale dorsolateral lines. Breeding males often with greenish back and bluish tail, but usually covered with extensive dark pigmentation. Females brownish, usually with less dark pigmentation, but flanks especially may be largely black and a vertebral stripe or row of blotches may be present. Underparts usually spotted, can be white, yellow, reddish or even bluish. Scales smoother than those of Italian Wall Lizard *Podarcis siculus*.

DISTRIBUTION

Endemic to the Tyrrhenian Islands: Corsica, Sardinia, and numerous smaller islets.

Widespread throughout both islands, but seems to have been displaced by Italian Wall Lizard in S Corsica.

VARIATION

Numerous subspecies have been described, but they need re-evaluation. Recent molecular research suggests this species in fact comprises at least three distinct species. Sardinian males tend to be more colourful, but exceptions are numerous.

HABITAT

Occupies a wide range of sunny habitats, from sea-level to mountain peaks, but tends to be somewhat less common near human habitation and in lusher habitats than Italian Wall Lizard. Reaches the highest peaks of both main islands, extending to above 2,500 m.

BIOLOGY

A typical, abundant and widespread wall lizard. Climbs rather well, but less often than Bedriaga's Rock Lizard *Archaeolacerta bedriagae*. Feeds on a wide variety of invertebrates. On certain islets, inhabits the vicinity of Eleonora's Falcon *Falco eleonorae* nests, feeding on the minerals in bird faeces and the insects attracted to them. Active between February and November, but individuals may be seen basking on sunny winter days. Mating takes place in April or May. Oviparous; females lay 6–12 eggs.

Male Tyrrhenian Wall Lizard. Monte Limbara, Sardinia, Italy.

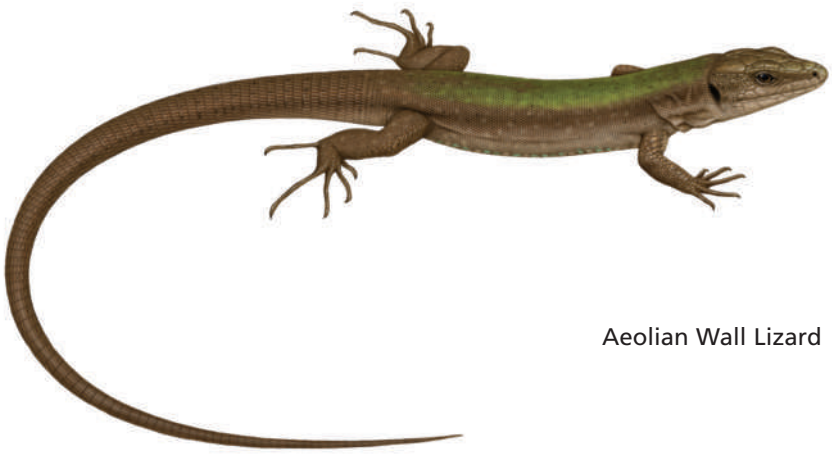
Female Tyrrhenian Wall Lizard. Corsica, France.

5. Italian mainland (except extreme NE), Sicily and Malta

- Green lacertas in this area: Western Green Lizard *Lacerta bilineata* (widespread) and Ocellated Lizard *Timon lepidus* (extreme NW only).
- Other lacertid lizards in this area: Dalmatian Algyroides *Algyroides nigropunctatus* (only in extreme NE Italy).
- Dalmatian Wall Lizard *Podarcis melisellensis* and Horvath's Rock Lizard *Iberolacerta horvathi* are restricted to the extreme NE. See key for E Adriatic area (p.306).

Key to Small Lacertas of the Italian mainland, Sicily and Malta			
1	a	Maltese Archipelago only. Highly variable.	Maltese Wall Lizard *Podarcis filfolensis*
	b	Sicily and nearby islets, including Aeolian Islands	2
	c	Italian mainland except extreme NE.	3
2	a	Green colour on back extends onto tail-base. Pale dorsolateral stripes usually present. Belly in breeding males may be orange or red.	Sicilian Wall Lizard *Podarcis waglerianus*
	b	Only on Aeolian Islands, NE Sicily. Only larger island still inhabited is Vulcano, where seemingly heading for extinction and total replacement by introduced Italian Wall Lizard. Other populations on tiny islets, where it is the only lacertid. Scoglio Faraglione (W of Salina), Strombolicchio (NE of Stromboli) and La Canna (W of Filicudi). Pattern differs considerably between islands, being sometimes green-backed or uniformly blackish. Vulcano population supposedly brown above and with at least some dark pigmentation below, especially on throat.	Aeolian Wall Lizard *Podarcis raffoneae*
	c	Green colour ends before tail-base. In this area, usually without pale dorsolateral lines and pattern reticulated rather than striped. Belly and throat usually white or greenish and unspotted.	Italian Wall Lizard *Podarcis siculus*
3	a	N Italy only (Alps). Tail, legs and toes relatively short. Collar serrated. Coarse dorsal scales: 25–37 rows of keeled scales across the mid-body. No or at most 4 supraciliary granules. 5–15 femoral pores. Pattern highly variable; often variable amount of eye-shaped spots (pale with dark lining) and pale dorsolateral and lateral lines or rows of stripes with adjacent dark lines or stripes. Dark vertebral stripe often present. Belly yellow to orange-red, usually (especially in males) with numerous small dark spots, especially towards the rear. Young dark-coloured.	Viviparous Lizard *Zootoca vivipara* (p.269)
	b	Tail, legs and toes relatively long and slender. Collar smoothly edged. Smaller dorsal scales: 42–75 rows of unkeeled scales across the mid-body. Usually numerous supraciliary granules (at least 3). 13–27 femoral pores.	4
4	a	Underside usually with dark spots, which may be dominant. Belly may be reddish. Back usually predominantly brownish but may be green with black reticulations. If striped, usually with narrow vertebral stripe (not much more than a dotted line). In S Italy, localised, relatively short-legged, never with green back and more ground-dwelling.	Common Wall Lizard *Podarcis muralis* (p.265)
	b	Underside usually unspotted, white or greenish but rarely reddish. Back usually predominantly green. If striped, usually with relatively wide vertebral stripe. May also be reticulated, especially in S Italy.	Italian Wall Lizard *Podarcis siculus*

Aeolian Wall Lizard *Podarcis raffoneae* (Mertens, 1952)



Aeolian Wall Lizard

DESCRIPTION

TL: 26 cm, SVL: 8.5 cm; size differs between populations. Medium-sized lacertid with variable coloration. On the smaller islets, often relatively dark, but may have a green back in spring. Vulcano population brown with pale dorsolateral lines and (in contrast to Italian Wall Lizard *Podarcis siculus*) dark spots on throat.

DISTRIBUTION

Aeolian Islands, N of E Sicily. Previously on all main islands, now largely replaced by Italian Wall Lizard. Vulcano is the only larger island still inhabited, where the species is said to mainly occupy the Vulcanello Peninsula, although it seems to be rapidly heading towards extinction. Other populations are on Scoglio Faraglione (W of Salina), Strombolicchio (NE of Stromboli), and La Canna (W of Filicudi).

VARIATION

P. r. raffoneae: Strombolicchio. Males often large and dark coloured.
P. r. alvearioi: La Canna, Scoglio Faraglione, Vulcano.

HABITAT

Small, relatively flat areas which support scarce, open maquis vegetation on otherwise steep and barren islands. As the islands on which the species occurs are very small, habitats are often fragmented, restricted, and support only low numbers of individuals.

BIOLOGY

Generally ground-dwelling. Easily observed around large bushes and basking at their bases. Feeds mainly on insects such as ants and beetles. Can sometimes be attracted by offering fruit. As food availability is low across their distribution, individuals have been observed hunting in intertidal zones, and are known to consume prey remains found near nests of Eleonora's Falcon *Falco eleonorae* or various gull species. Active throughout the year. Mating takes place

between March and May. Oviparous; females lay one or two clutches, consisting of 4–8 eggs. Juveniles emerge two months later.

NOTE

Previously regarded as a subspecies of Italian and (the more closely related) Sicilian Wall Lizard *Podarcis waglerianus*. Originally referred to by a species name with masculine gender, *Podarcis raffonei*. This species is listed as Critically Endangered in the 2009 IUCN Red List of European Reptiles.

Sicilian Wall Lizard *Podarcis waglerianus* Gistel, 1868

DESCRIPTION

TL: 25 cm; SVL: 7.5 cm. Medium-sized lacertid. Back usually green, with variable degree of dark spots and blotches – often with a vertebral row of blotches, especially on posterior part of back and in between hind legs. Presence of pale dorsolateral stripes sets it apart from the sympatric morph of Italian Wall Lizard *Podarcis siculus*. These stripes may be bordered on the dorsal side by dark blotches. Dark pigmentation usually more extensive on flanks. Males larger, with more dark pigmentation and more vibrant bright green on the back; belly and lower tail may be salmon or red, while throat is green, bluish and often with some small darker spots; outer ventral scales may be blue. Uniformly green individuals are not rare, but usually the paler dorsolateral stripes and/or some limited spots on posterior vertebral area, although faint, remain distinguishable. In contrast to Italian Wall Lizard, the green on the back of Sicilian Wall Lizard does not usually end in front of the hind leg bases.

DISTRIBUTION

Endemic to Sicily and the nearby Aegadian Islands. Appears to be largely absent from the NE of Sicily.

VARIATION

P. w. waglerianus inhabits the entire distribution apart from Marettimo Island off of the W Sicilian coast, from which *P. w. marettimensis* has been described.

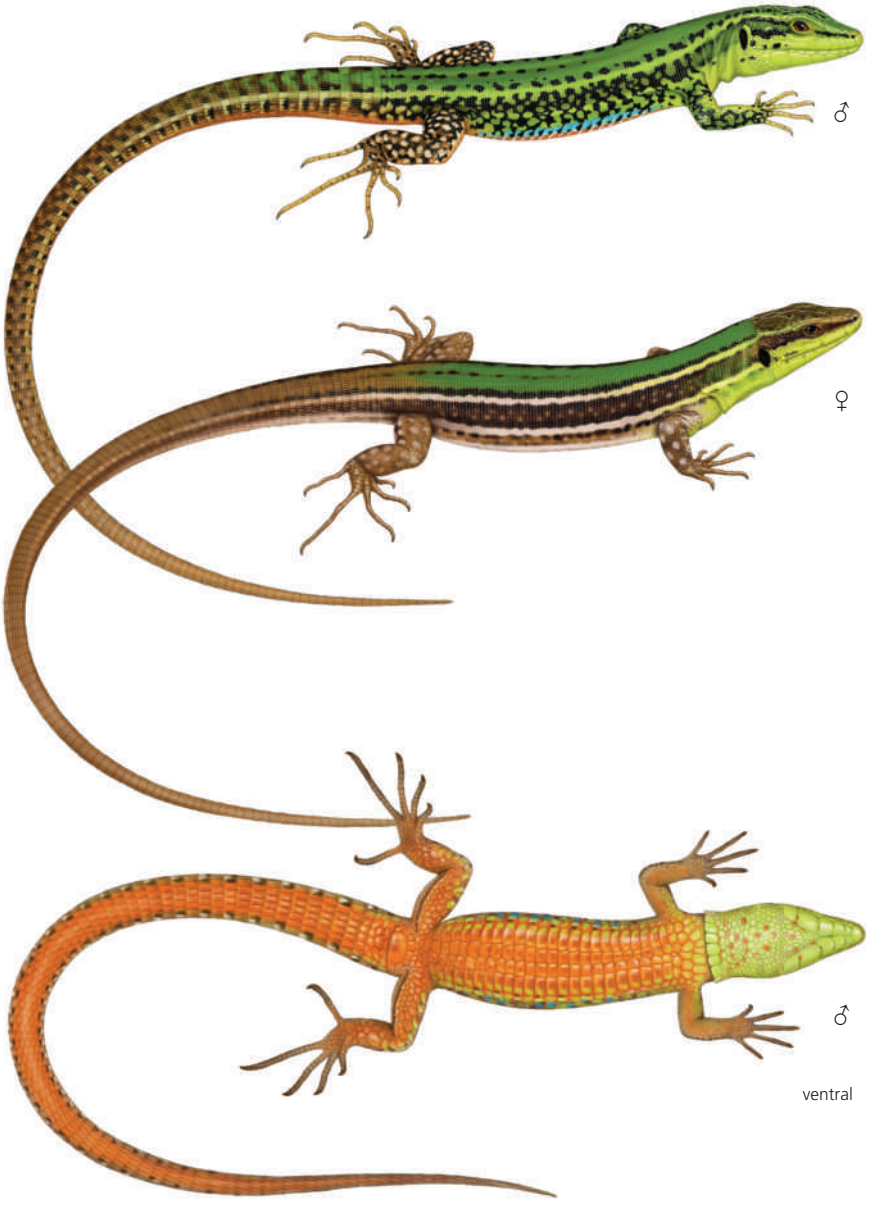
HABITAT

Typical wall lizard, usually occurring in a variety of not too dry habitats with some rocks and vegetation cover, including clearings and meadows in woods in mountainous areas. Prefers grassy and richly-vegetated herbaceous areas. Less often encountered near human habitation than Italian Wall Lizard.

BIOLOGY

A mostly ground-dwelling species in contrast to Italian Wall Lizard, and also more shy. Often seen basking on flat stones or foraging amongst shrubs or on the borders of dense grassy vegetation. Feeds on various invertebrates. Active throughout the year, though individuals at higher altitudes may hibernate. Mating takes place in April and May. Oviparous; females lay one or two clutches of 2–6 eggs. Juveniles emerge in late summer.

Sicilian Wall Lizard



Italian Wall Lizard — *Podarcis siculus*

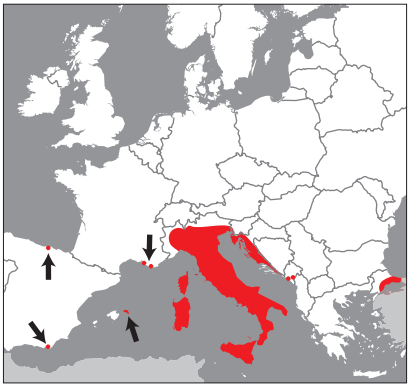
(Rafinesque-Schmaltz, 1810)

DESCRIPTION

TL: 26 cm; SVL: 9 cm; significant size variation between populations, especially on islands. Medium-sized to larger lacertid. Highly variable in pattern, including insular populations consisting of black individuals with blue bellies. Generally, however, green above, either with vertebral and dorsolateral stripes and lines (subspecies *campestris*) or rather reticulated (subspecies *siculus*). In males, at most half of the outer ventral scales blue. Underside usually unspotted whitish or greenish and not orange or red, although red or orange bellies may occur in the N Adriatic area. Eye usually not copper-coloured (as in Common Wall Lizard *Podarcis muralis*). See Dalmatian Wall Lizard *Podarcis melisellensis* for distinction.

DISTRIBUTION

Includes many introductions of variable duration. Occurs throughout Italian mainland except northern montane parts, and range includes Sicily, Sardinia, Corsica, Menorca, and E Adriatic coast from Italy to Croatia; also on countless smaller islands and islets. Other established introduction sites include Kotor (Montenegro), Istanbul, Spain (Santander, Almeria) and S France (Toulon, Château d'If – where known since 1883, Hyères). Numerous more recent (unmapped) exogenous populations include those in Portugal (Lisbon), additional localities in Spain (Barcelona, Noja (Cantabria), S Mallorca) and even in a greenhouse complex in Belgium. Outside our area, also introduced to Cyprus, Tunisia, Libya and USA (California, Kansas, New York, New Jersey, etc.).



VARIATION

Numerous subspecies have been described, most of which are invalid in view of genetic data.

P. s. siculus: S Italy, Sicily and Sardinia; introduced to several other localities.

P. s. campestris: N and C Italy, Corsica, E Adriatic coast.

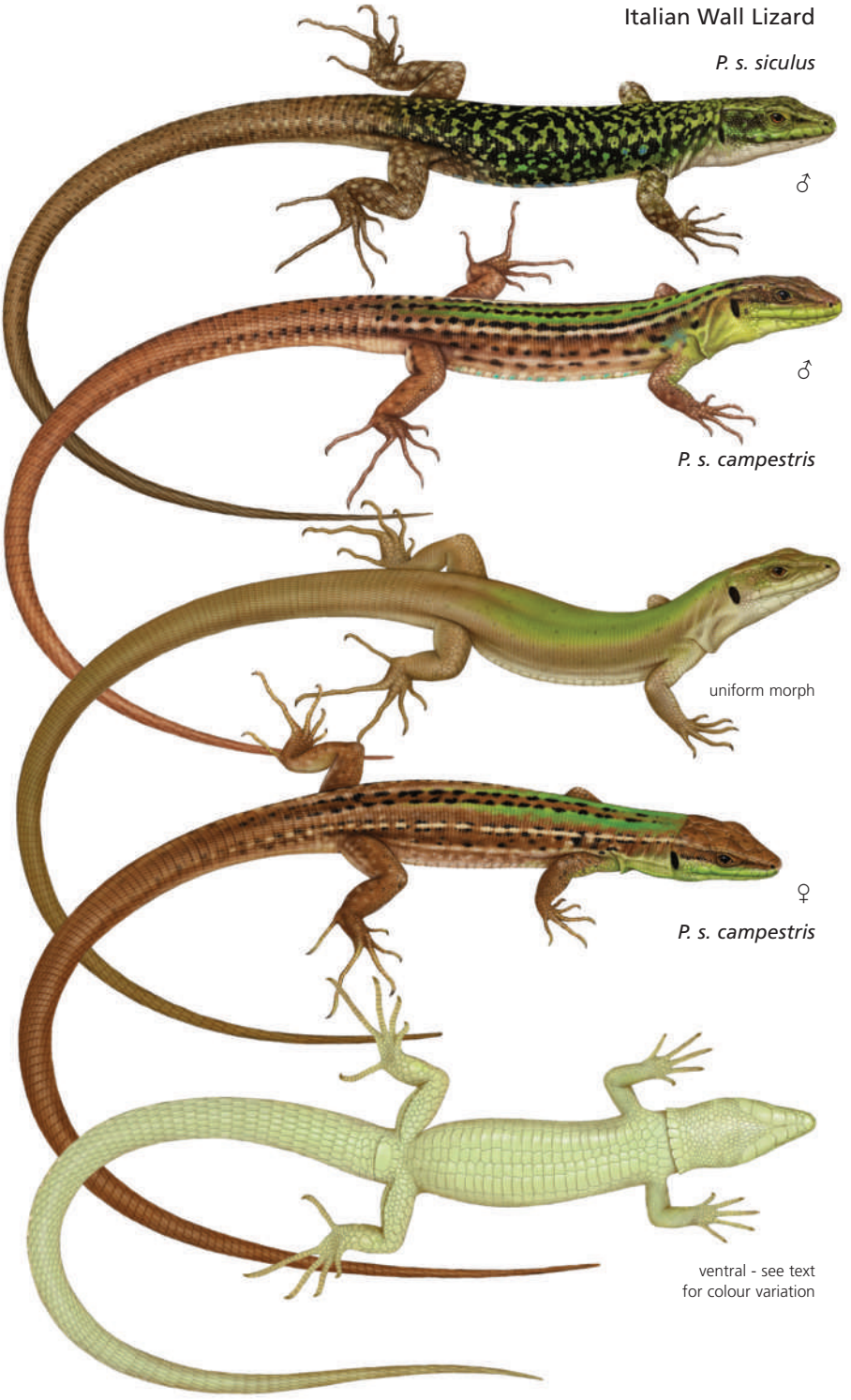
The Sardinian subspecies *cettii*, which also has been introduced to S Corsica and the Balearic island of Menorca, has been placed in synonymy with *siculus*.

HABITAT

Occupies a wide range of sunny habitats, from sea-level to medium altitude; also common near human habitation and in lusher environments (such as gardens, orchards, agricultural land). Replaced by Common Wall Lizard or Dalmatian Wall Lizard (where the latter overlaps its range) in harsher environments. Usually from sea-level up to 1,000 m, but in the south found up to 2,200 m (Etna, Sicily).

BIOLOGY

An abundant, conspicuous and widespread wall lizard. Climbs rather well, but less often than other wall lizard species within its range. Known to outcompete related species, including Tyrrhenian Wall Lizard *Podarcis tiliguerta* and Dalmatian Wall Lizard, in particular where it has been introduced (e.g. Corsica). On the Aeolian Islands, NE of Sicily, believed to be related to the disappearance of Aeolian Wall Lizard *Podarcis raffoneae* from the larger islands of the archipelago. Like most


Italian Wall Lizard
P. s. siculus
♂
♂
P. s. campestris
uniform morph
♀
P. s. campestris
ventral - see text
for colour variation

wall lizards, an opportunistic feeder, taking a variety of invertebrates and plant matter. Active between February and November in N of range but active throughout the year further south. Males court females extensively. Mating takes place between April and June. Oviparous; females lay up to four clutches per year, each consisting of 2–8 eggs.

Maltese Wall Lizard *Podarcis filfolensis* (Bedriaga, 1876)

Maltese Wall Lizard

DESCRIPTION

TL: 25 cm; SVL: 8.5 cm. Medium-sized lacertid with extremely variable coloration, including striped and reticulated individuals. Dorsal colours include brown, yellow, grey, green, and black and blue, while belly can be white, orange and black, and blue. Individuals from Filfola, Linosa and Lampione are rather dark with pale whitish but also bluish spots.

DISTRIBUTION

Endemic to the Maltese Archipelago (Malta, Gozo, Comino, and a number of smaller islets), Linosa and Lampione. Outside our area, introduced to Lampedusa.

VARIATION

Four subspecies recognised, of which *P. f. maltensis* occurs on Malta, Gozo and Comino. Those from Linosa and Lampione are the darker *P. f. laurentiimuelleri*, while *P. f. generalensis* occurs on the Fungus Rock. The nominate subspecies is restricted to Filfola.

HABITAT

Typical wall lizard, although rare or even absent in some parts of Malta itself. Occurs frequently on walls and rock surfaces, even in cities, as well as amongst low coastal vegetation.

BIOLOGY

An agile rock-climbing lizard, which can flatten its body significantly when basking.

However, seems more ground-dwelling than other wall lizards. Can be locally rather abundant, and with patience may be easily approachable. Feeds on various invertebrates but may also eat fruits, flowers and smaller vertebrates, including its own young. Active throughout the year. Mating takes place in April or May. Oviparous; females lay one or two clutches of 1–4 eggs each. Juveniles emerge in late summer.

Maltese Wall Lizard, ssp. *maltensis*. Gozo, Malta.

6. E Adriatic coast including extreme NE Italy and SE Austria

- Green lacertas in this area: Sand Lizard *Lacerta agilis* (mountains only), Western Green Lizard *Lacerta bilineata* (extreme northeast), Eastern Green Lizard *Lacerta viridis*, Balkan Green Lizard *Lacerta trilineata*.
- Other lacertid lizards in this area: Dalmatian Algyroides *Algyroides nigropunctatus*.
- The endemic species of this area (Sharp-snouted Rock Lizard *Dalmatolacerta oxycephala*, Prokletije Rock Lizard *Dinarolacerta montenegrina*, Mosor Rock Lizard *Dinarolacerta mosorensis*, and Horvath's Rock Lizard *Iberolacerta horvathi*) tend to occur no further than 130 km inland.
- Italian Wall Lizard *Podarcis siculus* is largely restricted to lowland coastal and island locations, Common Wall Lizard *Podarcis muralis* is largely restricted to cooler habitats and (except in N of area and several islands in the Skadar Lake and the Bojana River mouth area) is absent from the vicinity of the coast. Viviparous Lizard's *Zootoca vivipara* occurrence is very restricted and usually only in humid montane environments.
- Erhard's Wall Lizard *Podarcis erhardii* supposedly occurs in NE Albania.

Key to Small Lacertas of the E Adriatic coast including extreme NE Italy and SE Austria			
1	a	Collar indented. Largely restricted to rather humid mountain areas. Dorsal scales somewhat rough (keeled) and arranged into 37 rows across the mid-body or fewer. 4 supraciliary granules or fewer, often none. 5–15 femoral pores.	Viviparous *Lizard Zootoca vivipara* (p.269)
	b	Collar indented. Restricted to N Albania within this key's area. Dorsal scales small, in 45 or more rows. 14–25 femoral pores. Back usually green and without dark pigmentation in the central part (compare with Dalmatian and Italian Wall Lizards, which both have a smooth-edged collar).	Balkan Wall *Lizard Podarcis tauricus* (p.322)
	c	Collar with smooth edge. Dorsal scales small, in 40 or more rows.	2
2	a	Underside of tail with 2 rows of wide enlarged scales. Restricted range from S Croatia to N Albania, more or less from around Šibenik in the N to the Skadar Lake in the S, but also on several islands. Body very flat. Underside usually bluish. Dorsal scales flat and shiny. Back may be dappled with pale round spots, in which case the tail usually has alternating rings of blue (or green) and black. Alternatively, upperside may be entirely black. SVL to 6.5 cm.	Sharp-snouted Rock Lizard *Dalmatolacerta oxycephala*
	b	Underside of tail with normal scales, appearing similar all round. Underside not bluish. Dorsal scales shiny or rough. Pattern different.	3
3	a	Largely restricted to (limestone) mountain areas. Able climbers. 1st supratemporal scale large, cutting into parietal scale. Rostral scale usually touches frontonasal scale. Dorsal scales flat and not keeled, may be shiny. Scales encircling the tail may be arranged into alternating smaller and larger rings. Belly yellow.	4
	b	Not restricted to mountain areas, being common in coastal areas as well. 1st supratemporal scale not much larger than the other supratemporal scales, nor cutting into parietal scale. Rostral scale usually does not touch frontonasal scale. Dorsal scales more convex, may be (if only slightly) keeled. Scales encircling the tail usually equally sized. Belly not often yellow but rather white, green, pink or reddish.	5
4	a	N part of this key's area, restricted to limited range from NE Italy and S Austria, through Slovenia and N Croatia to the vicinity of Šibenik. Usually 1 postnasal scale, separated from frontonasal scale by supranasal scale. Supranasal touches 1st loreal scale (in contrast to Common Wall Lizard). Chin with 5 pairs of larger scales. Dorsal scales on lower hind leg smaller than dorsal scales. Back pale brown, flanks darker. Throat white, belly white with yellow centre (and unspotted). Head narrow, blunt and short.	Horvath's Rock Lizard *Iberolacerta horvathi*
	b	S part of this key's area, restricted to limited range from S Croatia (practically S of Split), S Bosnia and Herzegovina, Montenegro and N Albania. Usually 2 postnasal scales, separated from frontonasal scale by supranasal scale. Chin with 6 pairs of larger scales. Dorsal scales on lower hind leg not particularly smaller than dorsal scales. Sides not obviously darker than central part of back. Underside entirely yellow (and without spots). Body (very) flattened. Head rather short.	Mosor Rock Lizard *Dinarolacerta mosorensis* and Prokletije Rock Lizard *Dinarolacerta montenegrina*
5	a	Not on islands except Cres, where it is most likely introduced. Generally uncommon or absent from coastal area. Iris copper-coloured, especially in breeding males. Belly usually white, pink or reddish and with some darker pigmentation.	Common Wall Lizard *Podarcis muralis* (p.265)
	b	Iris not copper-coloured, often yellow. Belly unspotted.	6

Key to Small Lacertas of the E Adriatic coast including extreme NE Italy and SE Austria (*continued*)			
6	a	Dark dorsolateral row of spots narrow, sometimes fused to a single dark line, bordered by a pale (usually and especially in females uninterrupted) dorsolateral line. In males, 2/3 or more of the outer ventral scales blue. Masseteric scale often large and in contact with 1 or more supratemporal scales. Underside frequently orange or red in breeding males. Snout somewhat shorter and blunter than in Italian Wall Lizard.	Dalmatian Wall Lizard *Podarcis melisellensis*
	b	Highly variable but in this area usually with vertebral and dorsolateral stripes and lines (subspecies *campestris*). Dark dorsolateral row of spots or line often broader, often bordered by interrupted narrower row of spots. In males, at most half of the outer ventral scales blue. Masseteric scale often small and not touching the supratemporal scales. Underside usually whitish or greenish, although some populations with orange-bellied individuals exist.	Italian Wall Lizard *Podarcis siculus* (p.302)

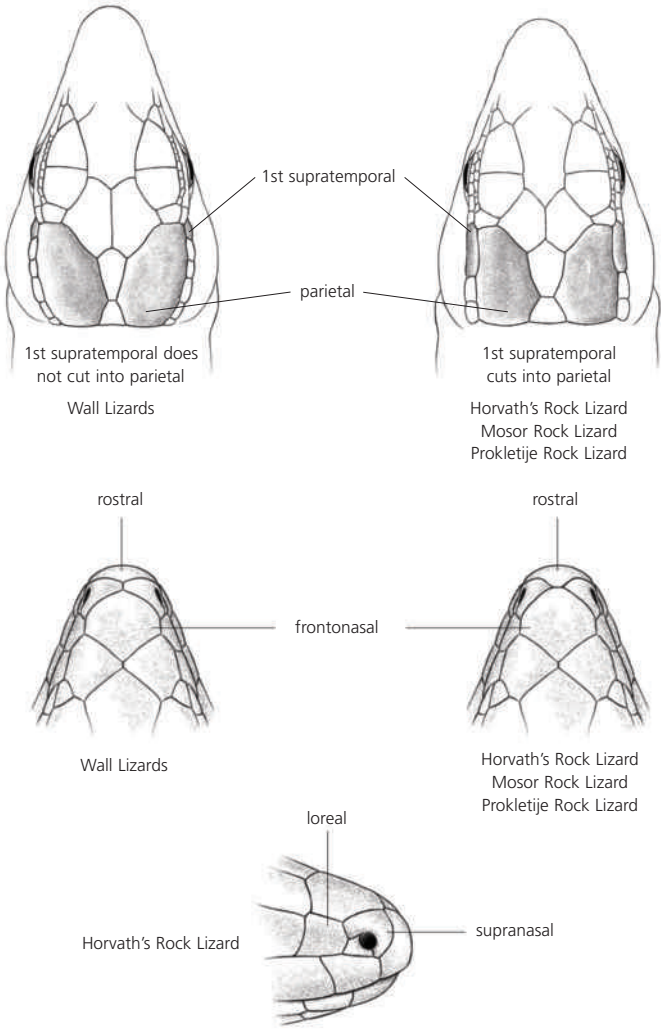
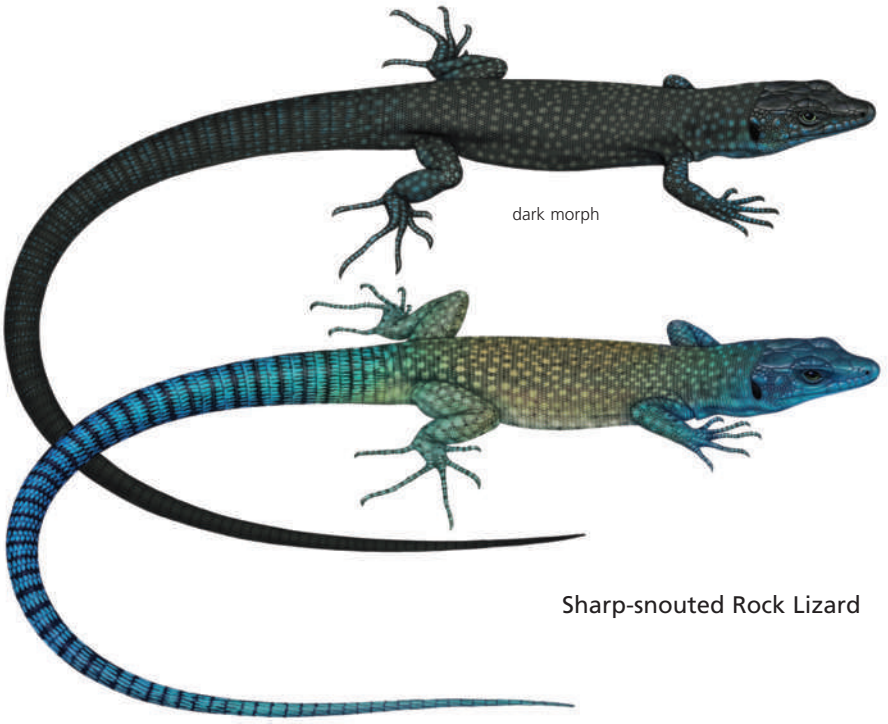


Fig. 34. Head scales of small lacertas.
[The rock lizard features shown here also partially apply to the species on p.282 and p.286.]

Sharp-snouted Rock Lizard
Dalmatolacerta oxycephala (Duméril & Bibron, 1839)



Sharp-snouted Rock Lizard

DESCRIPTION

TL: 20 cm; SVL: 6.5 cm. Small to medium-sized lacertid with strongly flattened body and rather long head. Never striped. Two main trends in coloration: 1) light-grey body covered with pale, round spots and tail with alternating rings of black and blue or greenish; and 2) predominantly dark above (especially common at higher altitude and some islands). Males may develop extensive blue coloration across the head, limbs and tail during the breeding season. Underside bluish or whitish. Ventral side of tail characterised by two rows of wide scales, unlike other lacertid lizards.

DISTRIBUTION

Endemic to E Adriatic coast from S Croatia through S Bosnia and Herzegovina, and Montenegro to N Albania, more or less from the vicinity of Šibenik in the N to the Skadar Lake in the S. Also on several islands. A small introduced population exists further north, on Cres Island (not mapped).

VARIATION

Dark-coloured individuals from mainland S Bosnia and Herzegovina, Montenegro and Albania (but also Korčula) have been attributed to *D. o. tomasinii*, which also differs from the nominate subspecies

in scalation characteristics. Populations consisting of light-coloured individuals, however, also occur in this region. Separation from the nominate subspecies, which has been confirmed from at least the Hvar, Vis and Lastovo Archipelagos, as well as from the lowlands around Dubrovnik, took place about five million years ago, suggesting the necessity for future taxonomic revision.

HABITAT

Usually found in habitats with many large, bare rock surfaces, at sea-level (coastal rocks) as well as at higher elevation (mountains). Also found on rock walls in human environments (e.g. Dubrovnik). Can coexist with Mosor Rock Lizard *Dinarolacerta mosorensis*, but often occupies more exposed, warmer and drier habitats. From sea-level to over 1,500 m.

BIOLOGY

A very agile, rock-climbing lizard, occasionally leaping and performing other acrobatics. Flattens its body considerably when basking. Avoids summer heat and then only active in early morning, late afternoon or in shade. Colourful tail can be wiggled as a distraction manoeuvre when facing a potential predator. Feeds on invertebrates, mainly flying insects that land on rocky surfaces. Hibernation short, may be active between February and December if conditions at lower altitudes are favourable, but may be seen basking next to snow as well. Mating takes place in March and April. Oviparous; females lay 2–4 eggs in June. Recently hatched juveniles measure only about 40–50 mm.

Mosor Rock Lizard *Dinarolacerta mosorensis*

(Kolombatović, 1886)

Prokletije Rock Lizard *Dinarolacerta montenegrina*

Ljubisavljević, Arribas, Džukić & Carranza, 2007

Mosor Rock Lizard

DESCRIPTION

TL: 22 cm; SVL: 7 cm. On average, Prokletije Rock Lizard is slightly smaller. Small to medium-sized lacertids with flattened body, especially while basking. Head as well as tail rather long. Dorsal colour varies from pale grey to chocolate brown; can be uniform or with small dark spots. Never striped. Back may appear shiny. Underside essentially unspotted, often yellow (like egg yolk) in Mosor Rock Lizard, and usually more greyish in Prokletije Rock Lizard. Both species are very similar and best distinguished by range.

Mosor Rock Lizard
Prokletije Rock Lizard

DISTRIBUTION

Mosor Rock Lizard: Endemic to a small area in S Croatia (barely reaching Split), S Bosnia and Herzegovina, and W Montenegro. Prokletije Rock Lizard: Known from the Prokletije Mountains, in E Montenegro and N Albania.

HABITAT

Typically on rocky outcrops in wooded areas at medium elevation or on realtively bare karst areas at higher elevation, often in the vicinity of water. Mosor Rock Lizard occurs between 450 and 1,900 m, while Prokletije Rock Lizard occurs roughly between 1,500 and 1,700 m.

BIOLOGY

Agile, diurnal lizards, climbing well on limestone rock outcrops. They avoid midday heat in summer at lower altitude, but may be seen by day higher in the mountains. Rather timid but approachable with patience. Appear to be less shy at higher altitude, where they may locally reach high densities. They feed on a wide variety of invertebrates but can often be seen hunting for spiders in rock cracks, which they can catch using their flattened snout. Activity starts around April at lower altitude but may start at end of May higher in the mountains. Mating takes place shortly after hibernation. Females lay 3–5 eggs that hatch after 17–19 days. This rapid development may represent an adaption to harsh mountain climates.

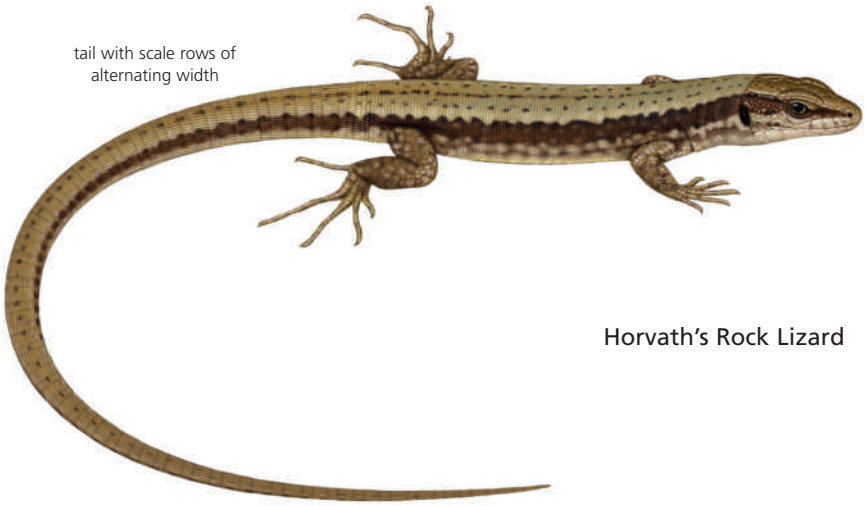
NOTE

Remarkably, genetic studies have shown the *Dinarolacerta* species to be the closest relatives of the two *Algyroides* species from SE Europe. No formal name changes have been proposed to date. Mosor Rock Lizard is listed as Vulnerable in the 2009 IUCN Red List of European Reptiles.

Prokletije Rock Lizard. Prokletije Massif, Montenegro.

Horvath's Rock Lizard *Iberolacerta horvathi*

(Méhely, 1904)



Horvath's Rock Lizard

DESCRIPTION

TL: up to about 18 cm; SVL: about 6.5 cm. A rather small lacertid whose closest relatives live on the Iberian Peninsula. Dorsal colour usually greyish or brown (may appear iridescent from certain viewing angles). Flanks always darker, with slightly wavy dorsolateral edge. Back usually unstriped, but usually with at least some small dark spots (often at equal distance from centre of back on each side) or reticulations. Narrow vertebral line may be present. No blue spots. Belly unspotted yellow and throat whitish. Dorsal scalation shiny but coarser than in Common Wall Lizard *Podarcis muralis*. In contrast to the latter, shorter head, rostral scale usually touches frontonasal scale, supranasal scale usually touches loreal scale, first supratemporal scales large and cut into parietal scale, and tail with scale rows of alternating width (each wider ring being bordered by two narrower rings).

DISTRIBUTION

Endemic to limited range along E Adriatic coast, stretching from NE Italy and S Austria, through W Slovenia, Istria and N Croatia to the vicinity of Šibenik. Has erroneously been recorded from S Germany.

HABITAT

Usually in rocky terrain, often in forested areas. Often quite close to a source of water (brook, lake, waterfall, etc.). Can be locally quite clearly restricted to a specific habitat. Mainly found in mountainous limestone regions, from 250 m to about 2,000 m. May occur with Common Wall Lizard in some places, in which cases it prefers the steeper rock faces or cliffs.

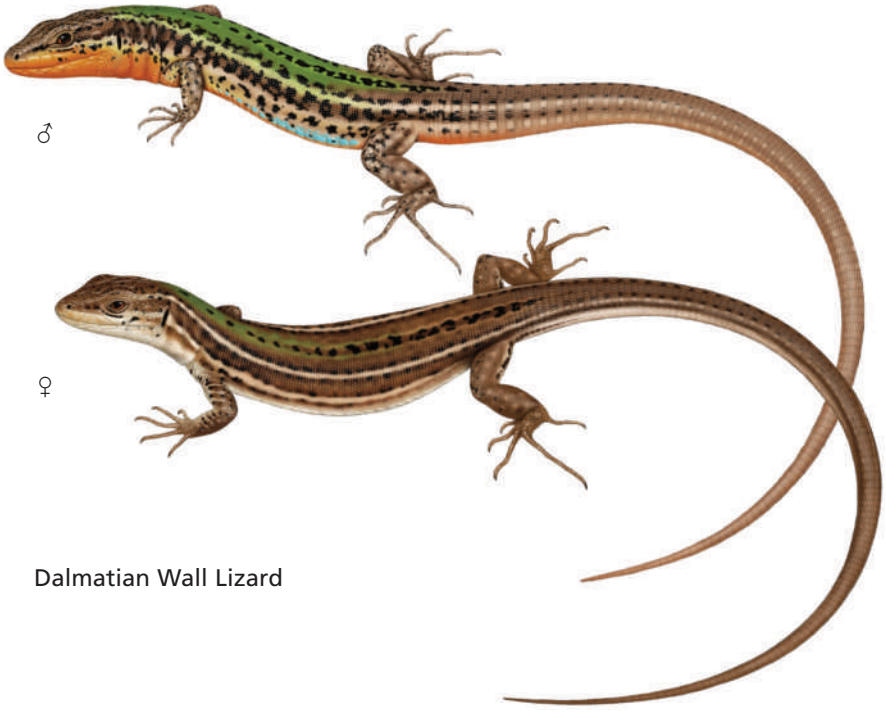
BIOLOGY

Agile rock-climbing lizard, easily seen basking on large rocks, yet avoiding midday heat to

a certain degree. Can be quite approachable with some patience, allowing observation of feeding and social interactions. Local abundance can be (very) high. Feeds on a wide variety of invertebrates such as beetles, flies, spiders and snails. Activity depends on altitude. May be active between March and November but at high altitude activity may be reduced, e.g. only active between May and October. Mating takes place in May or June. Oviparous; females lay 2–5 eggs in July in rock cracks or underneath rocks. Juveniles emerge in early August.

Dalmatian Wall Lizard *Podarcis melisellensis*

(Braun, 1877)



Dalmatian Wall Lizard

DESCRIPTION

TL: 22 cm; SVL: 6.5 cm. Rather moderate-sized lacertid. Apart from (not uncommon) uniformly coloured individuals, always with a(n often double) vertebral row of spots which runs from between the hind legs onto the first half of the body, but is usually broken up and often does not reach the neck. Dark dorsolateral row of spots narrow (in comparison with Italian Wall Lizard *Podarcis siculus*), sometimes fused into a single dark line, bordered by a pale (usually and especially in females uninterrupted) dorsolateral line. In males, 60% or more of the outer ventral scales blue (whereas Italian Wall Lizard has at most 50% blue outer ventral scales). In contrast to most Italian Wall Lizards, masseteric scale often large and in contact with one or more supratemporal scales, and dorsal scales smaller, smooth and shinier. Underside usually unspotted; frequently orange or red in breeding males,

which is rare in Italian Wall Lizard, but may also be white or even bluish. Snout somewhat shorter and blunter than in Italian Wall Lizard. Eye usually not copper-coloured (as in Common Wall Lizard *Podarcis muralis*).

DISTRIBUTION

Endemic to E Adriatic coast, stretching from the limestone region near Monfalcone (NE Italy) through SW Slovenia, coastal areas of Croatia, Bosnia and Herzegovina, Montenegro and NW Albania. Numerous large and small islands are inhabited, where Italian Wall Lizard does not usually coexist with this species, except on a few islands such as Cres, Lošinj, Krk, and Pag.

VARIATION

Numerous subspecies have been described, many of which are invalid in the light of genetic data. The mainland populations are *P. m. fiumanus*, while the nominate subspecies occupies the Vis Archipelago (Croatia). Individuals from the Lastovo Archipelago comprise a third genetically divergent group for which subspecies status has been suggested.

HABITAT

Occupies a wide range of sunny habitats, but tends to be somewhat less common near human habitation and in lusher environments (such as gardens, agricultural land) than Italian Wall Lizard. On the other hand, at higher elevation and in more humid conditions, tends to be replaced by Common Wall Lizard. The latter is largely absent from the islands within the range of Dalmatian Wall Lizard. Occurs from sea-level up to about 1,400 m.

BIOLOGY

A typical, abundant and widespread wall lizard. Climbs rather well, but does so far less than Common Wall Lizard. Fairly skittish, often not readily allowing close approach. Feeds on invertebrates, but may also take a small portion of plant matter. Active between February and November but this differs between populations. On some islands, active throughout the year. Males start defending their territories shortly after hibernation and show extensive courtship behaviour. Mating takes place in April or May. Oviparous; females lay 2–8 eggs in May or June and may lay several clutches per year. Juveniles emerge in July.

A male of the unstriped morph of Dalmatian Wall Lizard. Cres, Croatia.

7. SE Europe

- Green lacertas in this area: Sand Lizard *Lacerta agilis*, Eastern Green Lizard *Lacerta viridis*, Balkan Green Lizard *Lacerta trilineata*.
- Other lacertid lizards in this area: Greek Algyroides *Algyroides moreoticus*, Dalmatian Algyroides *Algyroides nigropunctatus*, Steppe Runner *Eremias arguta*, Snake-eyed Lacertid *Ophisops elegans*.
- Armenian Rock Lizard *Darevskia armeniaca* (Méhely, 1909) occurs naturally in NW Armenia, W Azerbaijan, S Georgia and NE Turkey, and has been introduced to the Zhytomyr area (Ukraine), supposedly in 1963. More recently, Dahl's Rock Lizard *Darevskia dahli* (Darevsky, 1957), known only from eight isolated populations in N Armenia and S Georgia, was discovered within this introduced population. Both are parthenogenetic species – only females exist and reproduction is clonal. The former has two rows of nearly equally-sized scales between the masseteric and the central temporal scales.

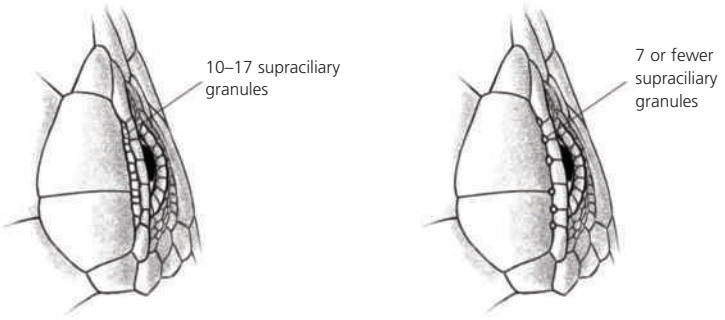


Fig. 35. Supraciliary granules in wall lizards of SE Europe.

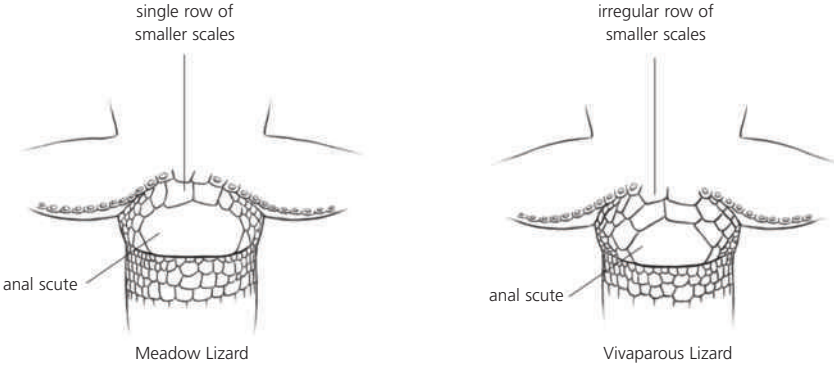


Fig. 36. Detail of cloaca region in small lacertas.

Key to Small Lacertas of SE Europe			
1	a	Milos Archipelago only.	Milos Wall Lizard *Podarcis milensis*
	b	Skyros Archipelago only.	Skyros Wall Lizard *Podarcis gaigeae*
	c	Islets Pori (or Prasonisi) and Lagouvardos, in between Kythira and Antikythira.	Pori Wall Lizard *Podarcis levendis*
	d	Crete (only W half of main island) and nearby islets only.	Cretan Wall Lizard *Podarcis cretensis*
	e	Peloponnese.	2
	f	Mountains of SE Crimean Peninsula only. In contrast to Balkan Wall Lizard *Podarcis tauricus* (the only other small lacerta in Crimea) collar smoothly edged. Sides often with scattered small round blue spots and without heavy pattern of dark spots.	Crimean Rock Lizard *Darevskia lindholmi*
	g	Samos and Ikaria islands only.	Anatolian Rock Lizard *Anatololacerta anatolica*
	h	Rhodes, Symi, Nissiros and Pentanissos only.	Pelasgian Rock Lizard *Anatololacerta pelasgiana*
	i	Other areas and/or with different pattern.	6
2	a	Back often clearly green, centre usually without darker spots. Collar indented.	Balkan Wall Lizard *Podarcis tauricus*
	b	Collar with smooth edge.	3
3	a	Body flattened. Never striped, usually olive-green or greyish with small dark pigmentation, sides often dappled with pale round spots. Males especially may have round blue spots near front leg base. Belly yellow or orange, with dark spots at least on throat. Cheeks with small scales only. 1st supratemporal scales clearly larger than the others, cutting into the parietal scale. 2 postnasal scales. Often in not too dry habitats.	Greek Rock Lizard *Hellenolacerta graeca*
	b	Different. May be striped. Usually with single postnasal scale and often one or a few somewhat larger scales on cheeks.	4
4	a	Body somewhat flattened. Largely restricted to mountainous areas. Brown above, usually without obvious broad pale dorsolateral stripes. If present, dark dorsolateral stripes less well developed than vertebral stripe. Underside usually with at least some spots on throat. Throat often white.	Common Wall Lizard *Podarcis muralis* (p.265)
	b	Not particularly flattened. Often with rather wide pale dorsolateral stripes. If present, dark dorsolateral stripes usually better developed than vertebral stripe. Throat may be spotted, but belly usually unspotted. Both throat and belly orange or red in males.	5
5	a	Most commonly seen small lacerta on Peloponnese. 7 or fewer supraciliary granules. Inner surface of upper front leg usually with particularly large rectangular scales. Back often brown with olive (especially in males) or yellowish dorsolateral stripes. Males often with blue spots on flanks, which may vary in extent. Underside usually without dark spots. SVL up to 8.5 cm.	Peloponnese Wall Lizard *Podarcis peloponnesiacus*
	b	Rarely at highest elevations, but also not particularly widespread in coastal Peloponnese. 10–17 supraciliary granules. Few really large scales on inner surface of upper front leg. Pattern variable but may be more reticulated than Peloponnese Wall Lizard, especially in males. Spots either restricted to chin and sides of throat, or absent altogether. SVL up to 7 cm.	Erhard's Wall Lizard *Podarcis erhardii*
6	a	Collar indented. Small dorsal scales often keeled.	7
	b	Collar smoothly edged. Small dorsal scales often smooth or only weakly keeled.	9
7	a	Back usually green, unspotted in central area. Often in rather dry habitats. 14–25 femoral pores. 45–62 dorsal scale rows across the mid-body.	Balkan Wall Lizard *Podarcis tauricus*
	b	Back usually brown. Often in rather lush habitats. 5–15 femoral pores. Dorsal scales somewhat larger, arranged in fewer than 44 rows.	8

continued overleaf

Key to small lacertas of SE Europe (*continued*)			
8	**a**	N Balkans, especially in mountainous terrain. Not in Greece. Pattern highly variable: see species text. Often variable amount of eye-shaped spots (pale with dark lining) and pale dorsolateral and lateral lines or rows of stripes with adjacent dark lines or stripes. Dark vertebral stripe often present. Belly yellow to orange-red but usually not greenish, usually (especially in males) with numerous small dark spots, especially towards the rear. Young dark-coloured. Anal scute irregularly bordered by smaller scales. Small scales on sides and back of more or less equal size. At most 4 supraciliary granules, usually none.	Viviparous Lizard *Zootoca vivipara* (p.269)
	b	Fragmented range in parts of Serbia, Romania, Bulgaria and extreme NE Greece. Pattern rather stable, with dark flanks, a white line running along the lower flanks, and a darker band running along the centre of the back (the latter also setting it apart from Balkan and Common Wall Lizards). Throat white, belly with at least a central band of greenish to lemon-yellow, unspotted. Anal scute bordered by a single row of smaller scales. Small scales on sides slightly smaller than those on back. 3–11 supraciliary granules.	Meadow Lizard *Darevskia praticola*
9	**a**	Coastal areas around the Marmara Sea, Istanbul area (Turkish Thrace) only, introduced in ancient times. Large, SVL to 9 cm. Back usually greenish with reticulated pattern or rather broad dark vertebral stripe. Usually without pale dorsolateral stripes. Belly usually unspotted, white or greenish.	Italian Wall Lizard *Podarcis siculus* (p.302)
	b	Elsewhere and/or different.	**10**
10	**a**	Body somewhat flattened. Largely restricted to mountainous areas. Brown above, usually without obvious broad pale dorsolateral stripes. If present, dark dorsolateral stripes less well developed than vertebral stripe. Underside usually with at least some spots on throat. Throat often white. Largely absent from the islands, except C Euboea, Corfu (introduced and localised) and Samothrace.	Common Wall Lizard *Podarcis muralis* (p.265)
	b	Not particularly flattened. Often with rather wide pale dorsolateral stripes. If present, dark dorsolateral stripes usually better developed than vertebral stripe, the latter more often than not lacking. Throat may be spotted, but belly usually unspotted. Both throat and belly orange or red in males. Occurs on many islands (also on Samothrace, but not on Corfu), excluding those mentioned in the first steps of this key which are inhabited by related species. On these islands, pattern may be rather different, including individuals with largely green backs.	Erhard's Wall Lizard *Podarcis erhardii*

Mating behaviour of Erhard's Wall Lizard, showing male biting female's tail. Prespes, Greece.

Crimean Rock Lizard

Darevskia lindholmi

(Lantz & Cyrén, 1936)

Crimean Rock Lizard

DESCRIPTION

TL: up to about 18 cm; SVL: about 6.5 cm. Small to medium-sized lacertid with rather flattened body. Body usually not striped, but with small dark spots or reticulations on back. Flanks with darker pigmentation and pale round spots. Back often green, especially in males, with at least some blue spots on flanks behind front legs, and lower flanks often bordered blue. Females often more brownish. Belly yellowish. Young may have greenish or bluish tail. Large first supratemporal scale.

DISTRIBUTION

SE mountain ridge of Crimean Peninsula.

HABITAT

Typically in rocky terrain, but also on tree trunks and ruins, sometimes near water. Abundant within its distribution. Occurs from sea-level to over 1,000 m.

BIOLOGY

A typical climbing lizard, easily seen basking, yet avoiding midday heat. Active between March and December on south-facing slopes and between April and September on north-facing slopes. Males occupy territories of up to 70 m² and regularly mate with up to three resident females. Mating takes place in May or June. Oviparous; females lay two clutches of 2–5 eggs in June or July. Juveniles emerge in August or September.

Balkan Wall Lizard *Podarcis tauricus* (Pallas, 1811)

DESCRIPTION

TL: 25 cm; SVL: 8 cm. Rather large small lacerta. Apart from some uniformly coloured individuals, usually with pale dorsolateral lines and neighbouring parietal rows of dark spots. Vertebral row of spots, if present, usually restricted to posterior half of the body. In males, outer ventral scales may have blue spots, which are usually quite pale. Unspotted belly whitish or – in breeding males – orange with green or yellow throat. Collar slightly serrated, in contrast to most other small lacertas..

DISTRIBUTION

SE Europe, throughout most of the Greek mainland, Albania, Macedonia, Bulgaria, parts of Serbia, W Romania, S Ukraine and an isolated range in Hungary. Also on Ionian Islands (including Corfu, Cephalonia, Ithaca, Zakynthos) and Thassopoula in N Aegean Sea. Presence in Montenegro unconfirmed – individuals recorded there mostly relate to misidentified Dalmatian Wall Lizards *Podarcis melisellensis*. Outside our region also in a small area in Anatolia, across the Bosphorus from Turkish Thrace.

VARIATION

P. t. tauricus (most of range): Rows of wide parietal spots (with or within brown pigmentation bands), leaving a narrow central unspotted green zone, which turns brownish in summer; vertebral row of spots never reaches anterior half of back.
P. t. ionicus (Albania, NW Greece, Peloponnese, Ionian Islands): Sometimes complete row of (singular) vertebral spots, but usually incomplete or missing (as in *tauricus*); parietal spots narrower (without brown pigmentation), so central zone wider. Intermediate patterns occur on the Peloponnese.

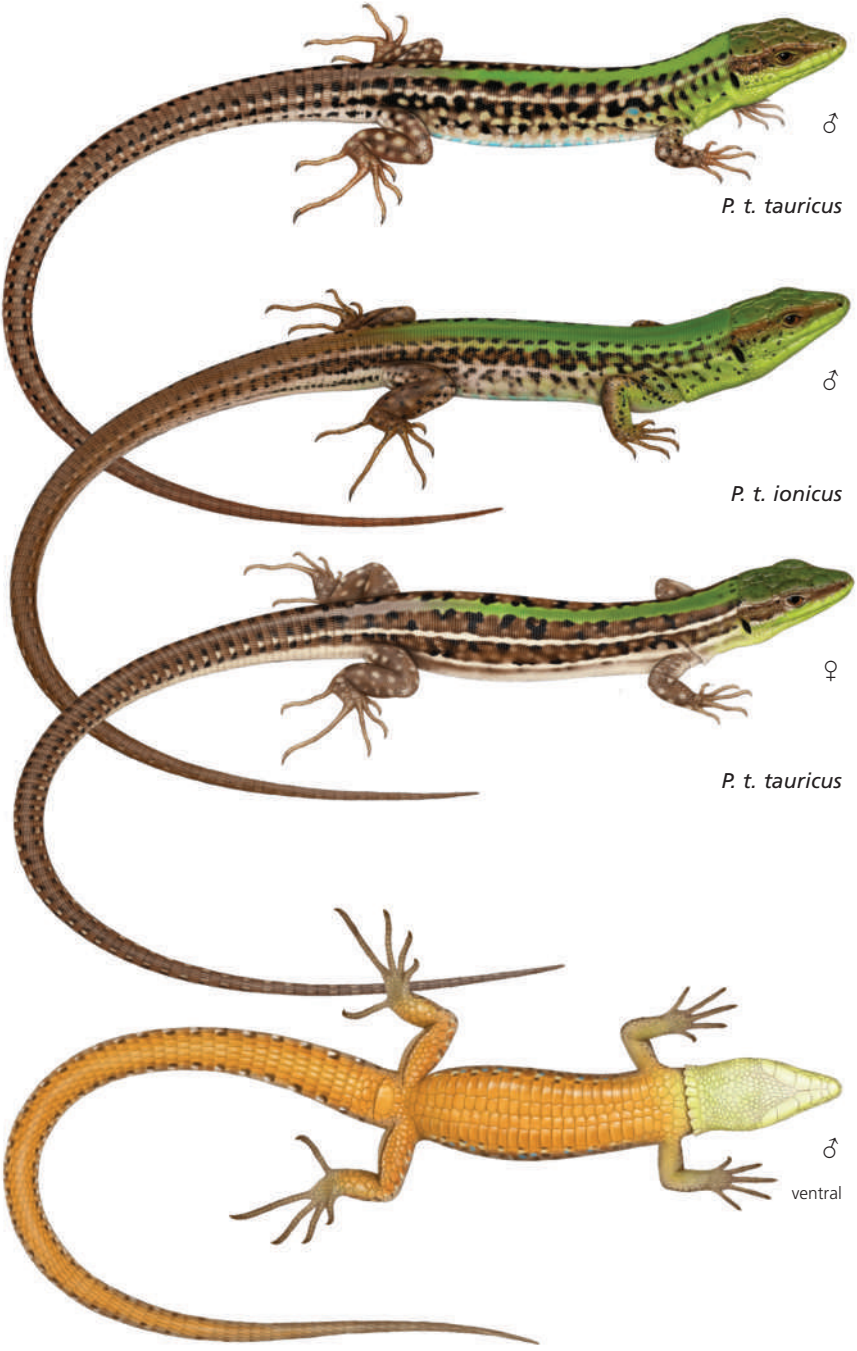
HABITAT

Occupies a wide range of sunny habitats, from sea-level to medium altitudes, often with low vegetation and sandy soil. Can be markedly abundant in grassy environments. Mainly a lowland species, but on Peloponnese found above 2,300 m.

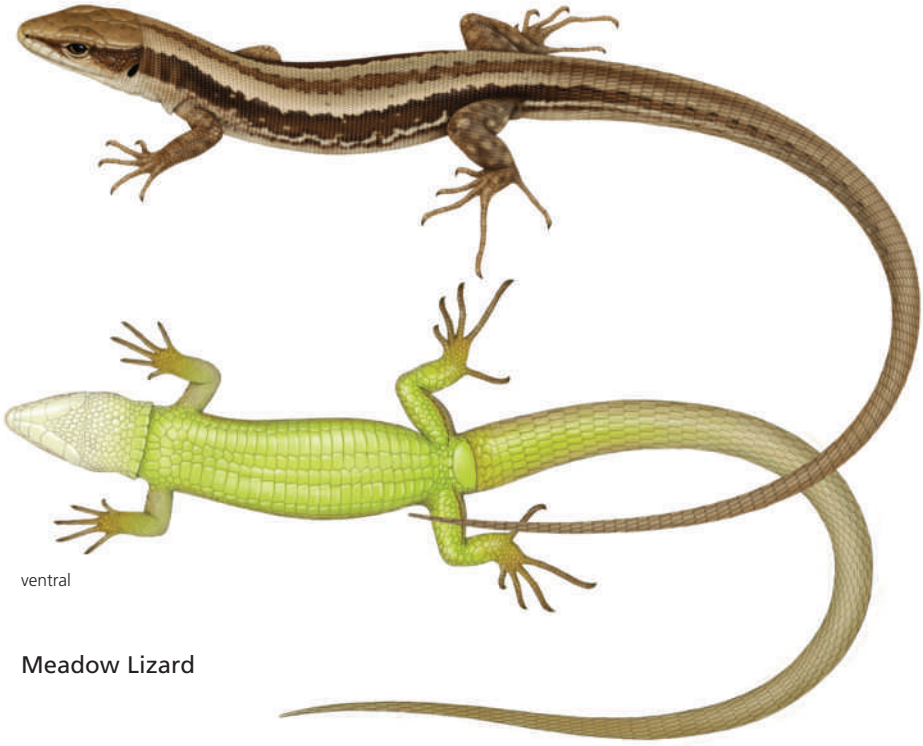
BIOLOGY

Almost exclusively ground-dwelling. Often basks on isolated rocks, logs or tree trunks. Active between February and October; however, this may vary widely throughout its range, depending on local weather conditions and altitude. Mating takes place between March and June. Oviparous; females lay one or two clutches consisting of 2–10 eggs in southern populations or 2–6 in N of range. Juveniles emerge in July.

Balkan Wall Lizard



Meadow Lizard *Darevskia praticola* (Eversmann, 1834)



ventral

Meadow Lizard

DESCRIPTION

TL: 16 cm; SVL: 6.5 cm. Relatively small lacertid lizard with non-flattened body and relatively short legs. Reminiscent of Viviparous Lizard *Zootoca vivipara*, with rather coarse, slightly keeled dorsal scales (only 29–49 rows across back), which differentiate it from wall lizards *Podarcis* spp. Collar usually with somewhat serrated edge. Upperparts usually brown. Pattern rather constant, usually lacking clear spots, but with obvious colour bands. Upper flanks darker than back, lower flanks paler than back. Vertebral stripe quite wide, slightly darker than neighbouring parts of back. This band may be bordered with narrow paler or darker lines. Lower parts usually unspotted yellow or greenish, with paler throat. Only a single semicircle of scales around the preanal scute (in contrast to irregular scaling as found in Viviparous Lizard). Flank scales somewhat smaller than back scales.

DISTRIBUTION

Discontinuous isolates in E and S Serbia, Bulgaria, Romania, extreme NE Greece and Turkish Thrace, as well as less clearly defined range N of the Caucasus.

VARIATION

Recent research has demonstrated that the populations in our area are best named *D. p. hungarica*. The species is absent from Hungary, but the name was first given to animals from a place in Romania which was formerly part of Hungary.

HABITAT

Typically in broad-leaf woods in hilly terrain. In such areas prefers roadsides, open spots within woods or forest edges with sufficient oak and beech leaf litter or grassy vegetation. Usually found around 600 m but may occur higher, up to 2,000 m in Armenia.

BIOLOGY

Not very fast-moving, well camouflaged and rather inconspicuous, somewhat resembling Viviparous Lizard. Predominantly ground-dwelling and forages amongst leaf litter and grassy vegetation. Often seen basking on fallen tree trunks or on dry leaves. Feeds on a wide variety of invertebrates. Active between March and October. Mating takes place between May and July. Oviparous; females lay 3–6 eggs in humus-rich soil in June or July. Juveniles emerge in August or September.

Peloponnese Wall Lizard *Podarcis peloponnesiacus*

(Bibron & Bory de Saint-Vincent, 1833)

Peloponnese Wall Lizard

DESCRIPTION

TL: 26 cm; SVL: 8.5 cm. One of the largest wall lizard species. Usually easily distinguished by size and coloration. Nearly always striped, with rather broad pale dorsolateral bands and wide dark parietal rows of spots, or stripes, most pronounced in females. Dark vertebral stripe may be

present which, together with parietal stripes, creates two pale dorsal bands. Pale stripes may be particularly bright in juveniles, persisting more strongly in females with ageing. In contrast to Balkan Wall Lizard *Podarcis tauricus*, back usually not bright grass green, although a greenish tinge may often be present. Breeding males often with extensive blue or greenish spots on flanks (at least near front leg) and vivid orange (or even red) underparts. Underparts usually lack dark spots. Number of supraciliary granules useful in distinguishing it from Erhard's Wall Lizard *Podarcis erhardii* (usually 7 or fewer, versus 10 or more in the latter). Females may resemble juvenile Balkan Green Lizard *Lacerta trilineata* but the latter has a serrated collar, a more rounded snout and a larger head.

DISTRIBUTION

Endemic to Peloponnese Peninsula (S Greece), where it is widespread and abundant.

VARIATION

Populations from eastern part of range are attributed to *P. p. thais*, which has a whitish underside.

HABITAT

Occupies a wide variety of sunny habitats at all altitudes. More abundant than Greek Rock Lizard in drier environments, but both species often coexist. May also coexist with Balkan Wall Lizard, Erhard's Wall Lizard and Common Wall Lizard *Podarcis muralis*, the latter two, however, being less widespread on the Peloponnese. Reaches from sea-level up to 1,600 m.

BIOLOGY

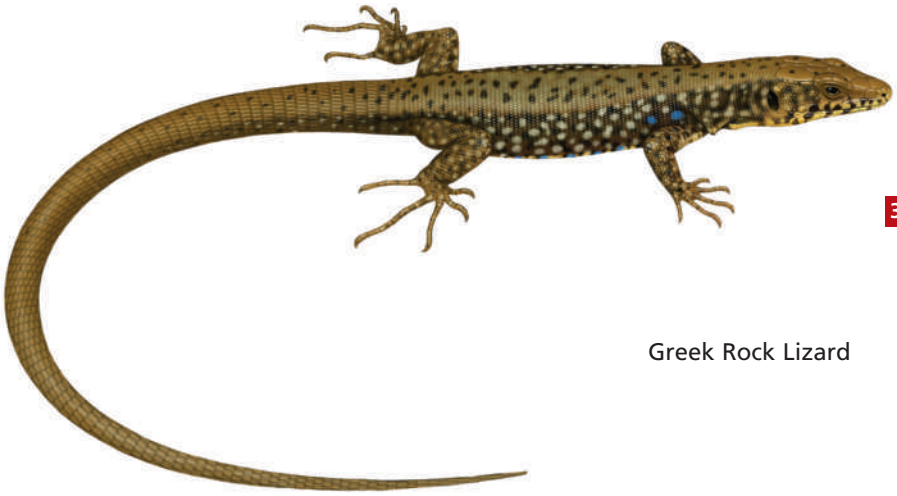
Climbs rather well, but when coexisting with other more ably climbing lacertids, is often the more ground-dwelling species. Easily seen while basking on a vantage point or foraging on the ground. Feeds on invertebrates and small vertebrates (including its own young) and makes great leaps to catch flying insects. Active between February and November but this may depend on altitude. May also be seen basking on sunny days in winter. Males occupy territories and defend their mates vigorously. Mating takes place in spring. Oviparous; females may lay two clutches in lowland areas (one at higher altitudes), each consisting of 1–6 eggs. Juveniles emerge around July.

Male Peloponnese Wall Lizard. Peloponnese, Greece.

Greek Rock Lizard

Hellenolacerta graeca

(Bedriaga, 1886)



Greek Rock Lizard

DESCRIPTION

TL: 22 cm; SVL: 8 cm. Medium-sized lacertid with strongly flattened body and rather long head. Never striped. Main colour usually greyish, olive or brownish. Usually a few small dark spots on the back and darker flanks with pale round spots. Males usually with variable number of blue spots on flanks behind front legs, sometimes continuing towards base of hind legs. Young with bright blue tail. Belly yellow or orange with black spots. Combination of two (instead of one) postnasal scales, large first supratemporal scale and the lack of large cheek scales set it apart from other lacertas within its range.

DISTRIBUTION

Endemic to the Peloponnese, S Greece.

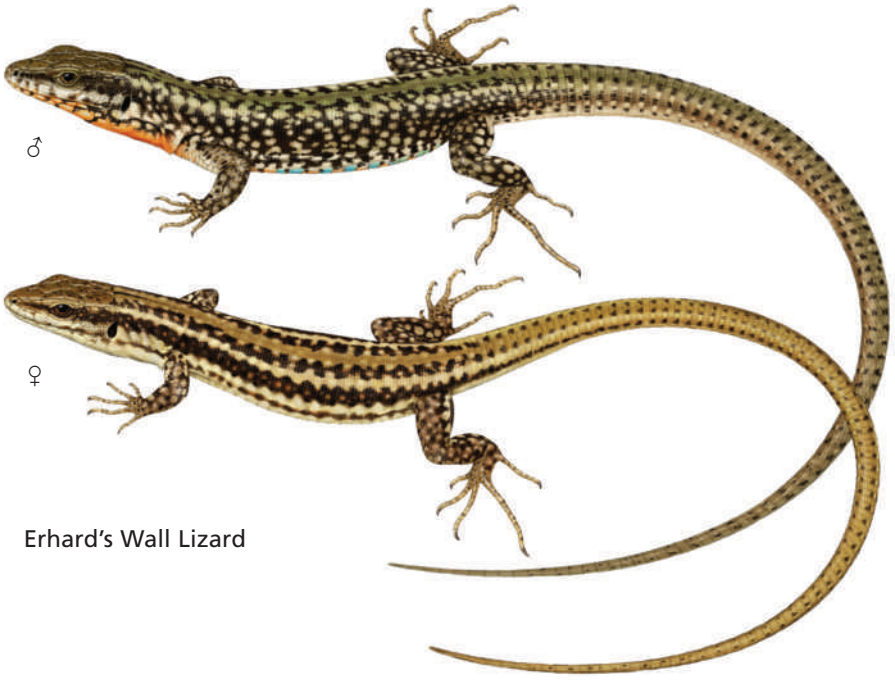
HABITAT

Predominantly in rocky terrain, quite often near to water with sufficient shady stretches, where it may reach high numbers. From sea-level up to over 1,600 m, but most abundant at intermediate altitudes.

BIOLOGY

An agile rock-climbing lizard. Flattens its body significantly when basking. Like numerous other rock lizard species, timid when first disturbed, but quite approachable if one proceeds calmly. While fleeing may also enter the water and swim to avoid predators. Feeds on various invertebrates. Avoids summer heat but is active in shady areas, e.g. in open woods. Active between April and November. Mating takes place in spring. Oviparous; females lay 1–6 eggs. Juveniles emerge between August and October.

Erhard's Wall Lizard *Podarcis erhardii* (Bedriaga, 1876)



Erhard's Wall Lizard

DESCRIPTION

TL: 22 cm; SVL: 7 cm; may be larger on islands. Small to medium-sized lacertid. Highly variable. Mainland populations usually brownish with pale dorsolateral stripes (which may sometimes be less obvious), bordered by often broad dark stripes or rows of spots. In contrast to Common Wall Lizard *Podarcis muralis*, these dark stripes or rows are usually more pronounced than any vertebral stripe or spots, the latter being often absent in Erhard's Wall Lizard. Some males may be less clearly striped and display (heavy) reticulated pattern, but central part of back usually less spotted. Belly from white to red, with spots (if any) usually limited to chin and sides of throat. Island populations highly variable, with dorsal and lateral coloration sometimes including fair amounts of green or blue. Number of supraciliary granules useful in distinguishing it from Peloponnese Wall Lizard *Podarcis peloponnesiacus* (usually 10 or more, versus 7 or fewer in the latter).

DISTRIBUTION

Greek mainland (but lacking from some SW parts) and numerous Aegean islands (mainly C but also Samothrace), S Bulgaria, Macedonia, W Albania, S Serbia.

VARIATION

Numerous subspecies have been described from the islands, while currently two subspecies are accepted from the mainland – *P. e. livadiacus* in the south: Attica, E Peloponnese (Feneos, Parnon), Euboea; and *P. e. riveti* in the rest of its mainland range. The nominate subspecies *P. e. erhardii* supposedly occupies Siphnos and Seriphos, but available research suggests that populations from these islands might be better treated as two different subspecies. The island subspecies require future research, many of them possibly being invalid. A split of this species into three species (*P. erhardii* for the islands and *P. livadiacus* and *P. riveti* on the mainland) cannot be ruled out, and other closely related species have already been split off in the past (Milos Wall Lizard *P. milensis,* Skyros Wall Lizard *P. gaigeae,* Cretan Wall Lizard *P. cretensis* and Pori Wall Lizard *P. levendis*).

HABITAT

Occupies a wide variety of sunny habitats, from sea-level to medium altitudes, often with at least some low vegetation. On the mainland, usually not in the driest habitats, but often replaced by Common Wall Lizard in more humid environments, at higher elevation and around human habitation, while both may occur together (e.g. near the Prespes Lakes). On islands, often associated with the typical low, thorny *Pistacea* shrubs, seeking cover underneath them and basking along their edges. Occurs up to about 1,400 m.

BIOLOGY

Less of a climber than many other wall lizard species, but climbs more than some others such as Balkan Wall Lizard *Podarcis tauricus*. On islands, in coastal habitat often seen running between low shrubs. Usually an inquisitive species and less shy than some of its congeners. Feeds on a wide variety of invertebrates. On some islands in the Aegean, it lives alongside Eleonora's Falcon *Falco eleonorae*. Lizards on these islands gravitate towards falcon nests when they breed in late summer, feeding on discarded prey, flies attracted to the birds' excrement and possibly also on external parasites of the chicks. Active throughout the year in S of range. In N of range active between February and November. Males occupy territories and survey them from a high vantage point. Mating takes place in March and males fight vigorously over females. Oviparous; females lay 1–5 eggs in July in mainland populations. Insular populations may have smaller clutch sizes. Juveniles emerge in September.

A colourful Erhard's Wall Lizard, ssp. *mykonensis*. Tinos, Greece.

Milos Wall Lizard *Podarcis milensis* (Bedriaga, 1882)

Milos Wall Lizard

DESCRIPTION

TL: about 21 cm; SVL: up to 7.5 cm. Medium-sized wall lizard with distinct coloration, especially in males, featuring highly contrasting reticulations of blue and/or yellow, with a high percentage of dark pigmentation. Back usually brownish with some dark spots, including a frequently interrupted vertebral line. Males may have blue spots behind front leg base, as well as blue pigmentation on the more lateral ventral scales, although the colour of the scales may not be very conspicuous as the surrounding scales may be blue as well. Females less strikingly coloured. Only small lacertid within its range.

DISTRIBUTION

Endemic to Milos Archipelago, Greece.

VARIATION

Four subspecies are recognised.
P. m. milensis: Milos, Kimolos, Polyaegos.
P. m. adolfjordansi: Ananes Archipelago.
P. m. gerakuniae: Falkonera and Velopoula.
P. m. schweizeri: Antimilos.

HABITAT

Typical widespread wall lizard, seemingly most abundant in more lush environments, including near human habitation, but also throughout areas with rock cover, shrubs, bushes and trees, as well as in low, thorny, coastal vegetation and saltmarshes.

BIOLOGY

Typical wall lizard, quite easily observable basking on vantage points. Climbs rather well, but more ground-dwelling than most related species. Mostly a shy and skittish lizard that appears to have no fixed basking sites, like many other wall lizard species; instead it wanders around and if disturbed runs off to bask somewhere else. Populations near human settlements may be more approachable. Feeds on a variety of invertebrates, but mostly ants in summer. Active throughout the year if conditions are suitable. Breeding season is long and females lay several small clutches of 1–3 eggs over a longer period.

NOTE

This species is listed as Vulnerable in the 2009 IUCN Red List of European Reptiles.

Skyros Wall Lizard *Podarcis gaigeae* (Werner, 1930)

Skyros Wall Lizard

DESCRIPTION

TL: about 23 cm; SVL: 8.5 cm, but only about 6 cm on Skyros (see Variation). Medium-sized to rather large wall lizard with extremely variable coloration, including striped, reticulated and uniform individuals. Dorsal colours often with at least some green, especially in males, but may include brown, yellow, grey, black and blue. Belly can be white, orange, and black and blue. Flanks often darker and dark vertebral and dorsolateral stripes quite often present, as well as pale dorsolateral stripes. Males may have blue spots behind front leg base, as well as blue pigmentation on the more lateral ventral scales. Only small lacerta within its range. Collar slightly serrated.

DISTRIBUTION

Endemic to Skyros and many nearby islets in the N Sporades (Aegean Sea, Greece), but also on Piperi islet, roughly 40 km N of Skyros.

VARIATION

Population on Piperi islet usually unstriped and assigned to subspecies *P. g. weigandi*. On some islets (Lakonisi, Exo Diavatis) with low numbers of predators, individuals are large-bodied and may be about twice as large as those on Skyros. They may also behave in a less skittish manner.

HABITAT

Typical widespread wall lizard, seemingly most abundant in more lush environments, including moist valleys and gardens, but also widespread throughout the more barren southern half of Skyros, as well as on seemingly inhospitable islets, seeking refuge among *Pistacea* and other thorny shrubs.

BIOLOGY

Climbs rather well, but more ground-dwelling than some related species. Feeds on a wide variety of invertebrates, but in summer mostly on ants. May also take plant matter or exhibit cannibalism. On certain islets including Piperi, lives around nests of Eleonora's Falcon *Falco eleonorae* feeding on the minerals in bird faeces and the insects attracted to them. Active throughout the year but activity may be reduced during winter. In summer avoids midday heat. Oviparous; females lay several clutches of 1–3 eggs.

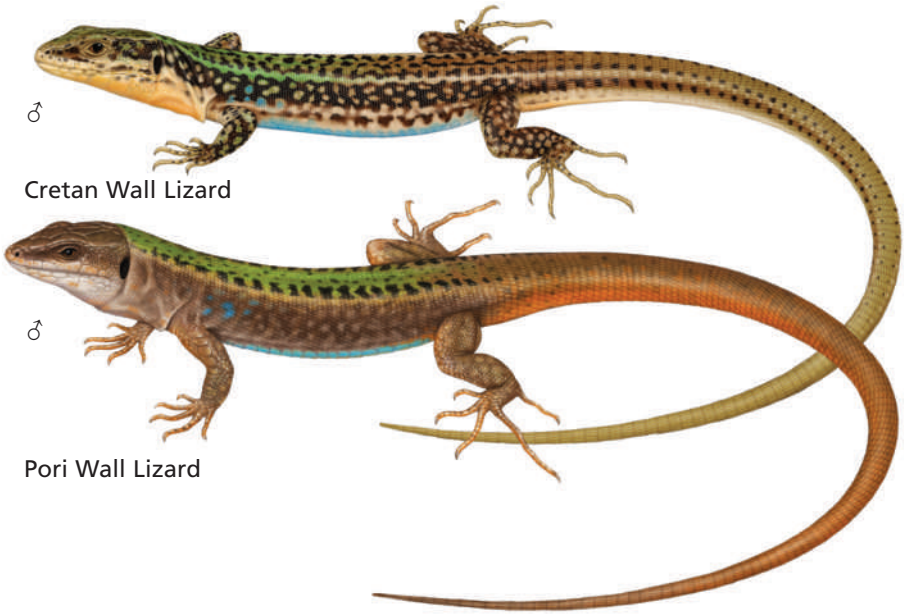
NOTE

Formerly considered as a subspecies of Milos Wall Lizard *Podarcis milensis,* Balkan Wall Lizard *P. tauricus,* or Erhard's Wall Lizard *P. erhardii*. The species is listed as Vulnerable in the 2009 IUCN Red List of European Reptiles.

Skyros Wall Lizard. Lakonisi islet, close to Skyros, Greece.

Cretan Wall Lizard *Podarcis cretensis* (Wettstein, 1952)
Pori Wall Lizard *Podarcis levendis*

Lymberakis, Poulakakis, Kaliontzopoulou, Valakos & Mylonas, 2008



DESCRIPTION

TL: about 23 cm; SVL: up to 6.5 cm in Cretan Wall Lizard and about 7.5 cm in Pori Wall Lizard, which is considered one of the larger species in the wall lizard genus. Medium-sized to large wall lizards. Breeding males of both species frequently with green backs and blue spots behind front legs and along edge of the belly. Females less colourful, often brownish. Flanks often darker than back. Pale dorsolateral lines may be present, bordered with bands of dark blotches. Dark vertebral line may occur in Cretan Wall Lizard, but seems rare(r) in Pori Wall Lizard. Belly may be white, yellow or orange, usually with few or no dark spots. Tail of Pori Wall Lizard often with orange tinge, especially in adult males. Both are the only small lacerta within their range.

Cretan Wall Lizard
Pori Wall Lizard

DISTRIBUTION

Restricted to islands of the S Aegean Sea.
Cretan Wall Lizard: Inhabits (only) W half of Crete, as well as numerous islets around the entire island.
Pori Wall Lizard: Only occurs on Pori (or Prasonisi, a name commonly given to many Greek islets) and Lagouvardos – two small islets located between Kythira

and Antikythira in the SW Aegean Sea. Surprisingly, no wall lizard species inhabit either of the two latter, larger islands.

VARIATION

Several subspecies of uncertain validity have been described for Cretan Wall Lizard.

HABITAT

Cretan Wall Lizard: Common within its range, reaching the highest numbers in more lush, humid situations (e.g. near waterbodies), but also reaches (occasionally very) high numbers in the low scrub vegetation on the islets surrounding Crete. Occurs up to 2,000 m.
Pori Wall Lizard: Found throughout the phrygana habitat characterising the Pori islet, and appears to be abundant.

BIOLOGY

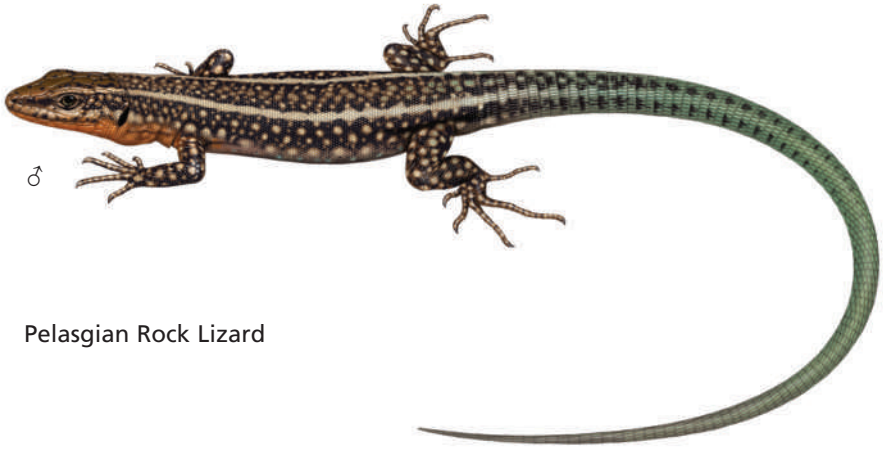
Both species climb well on rocks, walls, tree trunks and in shrubs, but are more ground-dwelling than some related species. Pori Wall Lizard, like many other islet wall lizard species, can be observed basking and foraging in the top layer of medium-height bushes, avoiding the hot rocky ground surface. Like many small lacertas, however, they tend to be more secretive when temperatures are high (for example, at midday from June to September).

NOTE

Both formerly treated as part of Erhard's Wall Lizard *Podarcis erhardii*. Given their geographical location in relation to each other and their morphological similarity, somewhat surprisingly Cretan Wall Lizard is more closely related to the Peloponnese Wall Lizard *Podarcis peloponnesiacus* than to Pori Wall Lizard, the latter representing an old relictual lineage in relation to the two former species. Cretan Wall Lizard (Endangered) and Pori Wall Lizard (Vulnerable) are listed in the 2009 IUCN Red List of European Reptiles.

Cretan Wall Lizard - male (above) and female (below). Crete, Greece.

Anatolian Rock Lizard
Anatololacerta anatolica (Werner, 1902)
Pelasgian Rock Lizard
Anatololacerta pelasgiana (Mertens, 1959)



Pelasgian Rock Lizard

DESCRIPTION

TL: 24 cm; SVL: 7 cm. Medium-sized lacertids with rather flattened bodies, especially while basking, and pointed snouts. Colour above from pale grey to brown, with wide variation in markings. Often two pale, rather wide dorsolateral stripes, bordered by darker reticulated back and sides. These stripes are virtually always continuous in Pelasgian but are often interrupted in Anatolian. May also be heavily spotted or blotched. Throat red, orange or whitish in adults, but in juveniles white (Anatolian) or reddish (Pelasgian). Underside with dark spots on outer ventral lining (Anatolian) or small dots (Pelasgian). Juveniles often with bright blue tails. Two postnasal scales. Both species very similar, best distinguished by range.

Anatolian Rock Lizard
Pelasgian Rock Lizard

DISTRIBUTION

Anatolian: The Greek islands of Samos and Ikaria. Also W Anatolia.
Pelasgian: The Greek islands of Rhodes, Alimia, Symi, Nissiros, Strongili and Pentanissos. Also SW Anatolia.

The origin of recently discovered individuals on (unmapped) Kastellorizo (Greece) remains unclear. If native, these probably belong to Budak's Rock Lizard *Anatololacerta budaki* which commonly occurs on the adjacent Turkish mainland.

HABITAT

Typically on rocky outcrops in woods at medium elevation but both occur in a wide variety of habitats from sea-level up

to 1,700 m (Anatolian) or even 1,950 m (Pelasgian) in Turkey. Abundance may differ between islands, being clearly higher on several islands inhabited by Pelasgian and on Ikaria (Anatolian) than, for example, in Samos' Anatolian Rock Lizard populations. Often near human settlements and even inside towns and villages.

BIOLOGY

Diurnal, able climbers with behaviour similar to typical wall lizard species. They feed on invertebrates, mainly beetles, grasshoppers and spiders. Primarily active between February and November, but may be active throughout winter. Both species may avoid the hottest parts of the day in summer and are relatively hard to find at that time. Mating takes place around April. Oviparous; females lay 3–8 eggs in summer. Juveniles emerge around July in our area.

ABOVE: A fairly dull-coloured Pelasgian Rock Lizard. Symi, Greece.

LEFT: Anatolian Rock Lizard. Samos, Greece.

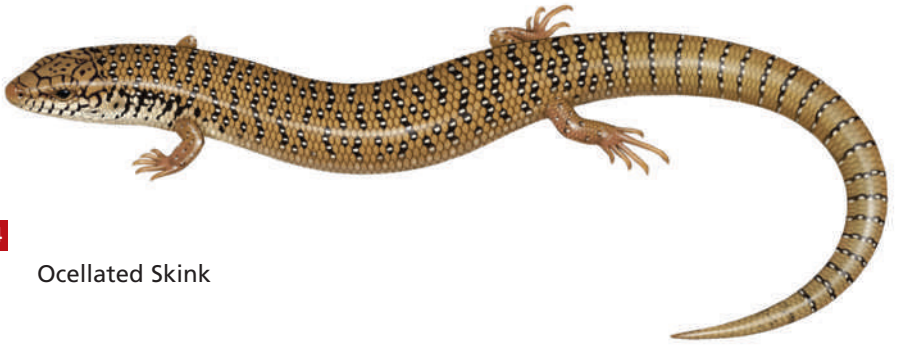
Skinks (Scincidae)

With over 1,500 species, the skinks are one of the larger lizard families in the world, but only seven (maybe eight) species occur in our area. These, however, demonstrate the diverse stages of development of legs in this family, going from normal-legged (e.g. Levant Skink *Trachylepis aurata*), through tiny-legged (Three-toed Skinks *Chalcides* spp.) to legless species (Limbless Skink *Ophiomorus punctatissimus*). Their ventral scales are identical to the dorsal, semi-circular ones, all of which are flatter and shinier than in the Lacertidae family. They are largely restricted to southern parts of Europe.

Key to Skinks			
1	**a**	S Greece (Peloponnese), Kythira and Kastellorizo only. No legs. Body covered in small spots which are arranged in numerous rows, merging to form more obvious lines towards the tail. Up to 18 cm.	Limbless Skink *Ophiomorus punctatissimus*
	b	Limbs may be tiny, but never entirely absent.	**2**
2	**a**	Legs vestigial, with only 3 small toes.	**3**
	b	Legs more developed, with 5 toes each.	**4**
3	**a**	Spain, Portugal, Mediterranean and S Atlantic France, W Liguria (NW Italy). Large number of narrow dark lines (> 9).	Iberian Three-toed Skink *Chalcides striatus*
	b	Italy only, excluding extreme NW, including Sicily and Sardinia. Only 4–6 dark lines. Pale dorsolateral stripes may be present (nearly always in Sardinian individuals).	Italian Three-toed Skink *Chalcides chalcides*
4	**a**	SE Europe, ranging north to Hungary and Slovakia. Small: only up to 12 cm. Snake-like eye, with staring gaze, lacking closable eyelids.	Snake-eyed Skink *Ablepharus kitaibelii*
	b	With closable, normal lizard eye.	**5**
5	**a**	Samos, Kos, Symi, Rhodes and Kastellorizo. Rostral scale does not touch nostril. Often 2 rows of dark bars on back and 1 or 2 pale stripes on sides.	Levant Skink *Trachylepis aurata*
	b	Elsewhere but also on Rhodes. Rostral scale touches nostril. Pattern different.	**6**
6	**a**	Spain and Portugal only.	Bedriaga's Skink *Chalcides bedriagai*
	b	Not Spain and Portugal: Sardinia, Sicily, Malta and nearby islets; Greece: on mainland, mainly Attica and NE Peloponnese, but also on a number of islands, including Crete, Kea, Euboea, Chios, Karpathos and Rhodes.	Ocellated Skink *Chalcides ocellatus*

The skink *Ablepharus (budaki) anatolicus* might just reach our region on the Greek islet of Kastellorizo.

Ocellated Skink *Chalcides ocellatus* (Forskål, 1775)



Ocellated Skink

DESCRIPTION

TL: up to 30 cm. A quite robust, sturdy, large and shiny skink, with relatively strong, yet short legs. Body and tail rather 'fat' compared with pointed, neckless head. Usually pale yellowish, brownish or greyish, with numerous small spots with a pale centre and dark edge (ocelli), as well as entirely dark spots.

DISTRIBUTION

Much of its range is the result of historical introductions, resulting in a discontinuous European range. Sardinia, Sicily, Malta and nearby islets; Greece: on mainland, mainly Attica and NE Peloponnese, but also on a number of islands, including Crete, Kea, Euboea, Chios, Karpathos and Rhodes. Outside our area, also on the Italian islands of Conigli, Linosa, Lampione and Lampedusa; widespread in N Africa, Arabia, S Turkey and the Middle East to Pakistan.

VARIATION

Nominate subspecies *C. o. ocellatus* (Greece) fits general description, while *C. o. tiligugu* (Sardinia, Sicily, Malta) tends to grow larger, with somewhat paler, wide dorsolateral lines and dark streaks below them.

HABITAT

Rather variable, both dry and humid. Can be common in (coastal) sandy areas, but also inhabits dry-stone walls in extensive agricultural environments, limestone hillsides, maquis, etc. From sea-level up to 1,500 m. Sometimes abundant, especially in lowland areas where it may be found under nearly half of the available loose rocks.

BIOLOGY

Diurnal but may be more crepuscular during summer. Can move quite swiftly despite its stocky appearance. Feeds on invertebrates, but may take a small portion of plant matter as well. Active between April and October; however, hibernation may be considerably shorter in S of range. Mating takes place in April and May. Females give birth to 2–20 live young in summer. Often found when turning objects but may also be seen basking on dry-stone walls or dry vegetation, especially during the first or last hours of sunlight or during overcast weather.

Ocellated Skinks of the ssp. *tiligugu* usually display darker flank colours. Sardinia, Italy.

Bedriaga's Skink *Chalcides bedriagai* (Boscá, 1880)

Bedriaga's Skink

DESCRIPTION

TL: 16 cm. Small or medium, elongated skink. Coastal individuals much smaller than those of southern mountain populations. Like a smaller, less clearly marked version of Ocellated Skink *Chalcides ocellatus*, with which it does not coexist. Colour varies from light to dark brown or greyish, with lighter individuals being common in dune areas.

Tiny white spots bordered with black present on body and tail, forming discontinuous rows. Two light, largely unspotted, wide dorsolateral lines run from base of head to start of tail, which can be inconspicuous in darker individuals or lacking overall. Uniformly coloured individuals without spots or stripes are encountered quite frequently (*concolor* morph).

DISTRIBUTION

Most of the Iberian Peninsula, yet largely lacking from the north.

VARIATION

Three subspecies are recognised.
C. b. bedriagai: N and C Spain. Individuals living in coastal dunes may have a somewhat longer and flatter head, and a more elongated body shape, enabling them to dig more freely in loose sandy soil.
C. b. cobosi: S Portugal and S Spain.
C. b. pistaciae: *M*ountains of Portugal and NW Spain.

HABITAT

Somewhat similar to that of Ocellated Skink, but perhaps more typical of relatively humid environments. Occurs from sandy lowland areas such as dunes in the N and S of its range to agricultural areas, places with rich herbaceous plant growth (as for three-toed skinks), rocky, sunny hillsides and humid, partially forested brook valleys. A common feature of these varied habitats is the large number of potential hiding places such as rocks, logs or even human garbage.

BIOLOGY

Diurnal and ground-dwelling. Feeds on small invertebrates. Active between April and September in N of range but hibernation may be shorter in S of range. Can be seen on sunny days in winter. Mating takes place between March and June, depending on latitude and elevation. Females give birth to 1–6 live young between May and August. Rather secretive; may be abundant, but not readily seen outside of the breeding season.

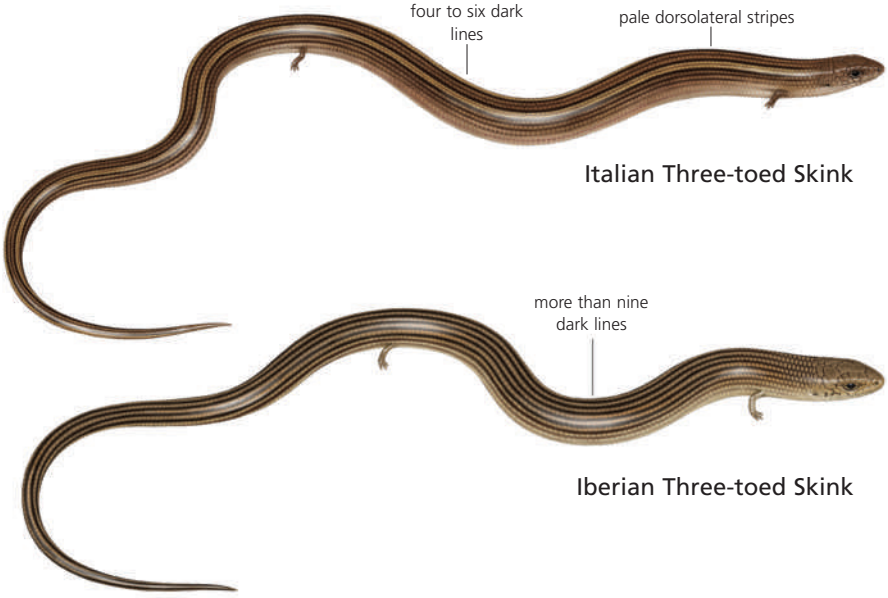
Bedriaga's Skink, ssp. *pistaciae*. Galicia, Spain.

Italian Three-toed Skink *Chalcides chalcides*

(Linnaeus, 1758)

Iberian Three-toed Skink *Chalcides striatus*

(Cuvier, 1829)



DESCRIPTION

TL: up to 48 cm. Two similar species of elongated, snake-like skinks with tiny residual legs, each with only three toes. Middle hind toe about equal in length to outer toe in the Iberian Three-toed Skink, and longer in the Italian, but due to small size often hard to tell. Range and coloration are, however, the best means of distinguishing between them. In the Iberian species, the body is marked with a large number of narrow dark lines (> 9), whereas usually only four to six are present in the Italian species. Pale dorsolateral stripes may be present in Italian Three-toed Skink (and are nearly always present in those on Sardinia).

DISTRIBUTION

The two species have largely separate ranges, with only a small contact zone in NW Italy. Italian Three-toed Skink: Mainland Italy S of Po floodplain, but absent from W Liguria. Present on Elba, Sicily and Sardinia. Also in NE Algeria, Tunisia and W Libya. Iberian Three-toed Skink: Iberian

Peninsula and Mediterranean France, stretching into Italy only in W Liguria. Isolated occurrence on French Atlantic coast. Apparently largely absent from E Spain.

VARIATION

Both species, but especially Italian Three-toed Skink, may be uniformly coloured and unmarked (*concolor* morph). Sardinian populations are attributed to subspecies *C. c. vittatus*, and are believed to have been introduced from N Africa; those on Sicily also belong to the latter subspecies.

HABITAT

Wide variety of grassy or similar habitats such as sunny hillsides, overgrown dunes and humid, partially forested brook valleys. Other dense herbaceous undergrowth will also suit, including typical saltmarsh vegetation. Reaches 1,800 m (Iberian) and 1,300 m (Italian).

BIOLOGY

Diurnal and agile. Moves very quickly through grassy vegetation, into which it can virtually disappear in a split second. While seemingly useless, the tiny legs are used to position itself in grassy surroundings. Feeds on small invertebrates. Active between February and October but much more secretive in summer and autumn, when activity is restricted to early morning hours or cooler weather conditions. Mating takes place between March and May depending on latitude. Females give birth to around 15 live young in summer.

A fairly uniformly coloured Iberian Three-toed Skink. Los Barrios, Andalucia, Spain.

Snake-eyed Skink *Ablepharus kitaibelii*

Bibron & Bory de Saint-Vincent, 1833

Snake-eyed Skink

DESCRIPTION

TL: 12 cm; SVL: 8 cm. A very small and slender skink. Shiny, round scales over entire body. Snake-like eye with staring gaze, lacking (opaque) closable eyelids. Legs and toes small and quite widely spaced. Background dorsal colour usually metallic dark brownish. Flanks usually darker than back, from nostril to tail. Often two or four fine, inconspicuous lines on back. Juveniles may have brightly coloured orange or reddish tails.

DISTRIBUTION

SE Europe, from NE Croatia, Serbia, E Montenegro and S Romania south to Greece (including many islands). Also isolated occurrences in Hungary and S Slovakia. Outside our area, also in W Turkey.

VARIATION

Four subspecies occur within our area.
A. k. kitaibelii: Aegean Islands, also W and SW Turkey.
A. k. fabichi: Islets near the coast of Crete, Karpathos, Kasos, and Armathia (SE Aegean).
A. k. fitzingeri: Slovakia, N Serbia, Hungary, Croatia, Greece including the Ionian Islands, Kythira and the Cyclades.
A. k. stepaneki: Bulgaria, Romania, Serbia, Croatia, Bosnia and Herzegovina, Montenegro, Macedonia, Albania.

Individuals from unmapped Kastellorizo (Greece) have visible eardrums and probably belong to a different species – *Ablepharus (budaki) anatolicus* Schmidtler, 1997.

HABITAT

Wide variety of rather dry habitats, but typically found in places with sufficient cover of low vegetation or leaf litter, offering hiding places for this small, rather secretive lizard. Found in meadows, grassy slopes, and along forest edges. Most common in lowlands, but reaches 1,800 m.

BIOLOGY

Diurnal, often preferring the cooler times of day and may be crepuscular in summer. Due to its small size, often overlooked, but not very rare throughout most of its range. Feeds on small invertebrates. Moves off swiftly through the grass or fallen leaves when disturbed, moving rather like a tiny, but short snake. Often found hiding under logs and stones. Activity may vary throughout range, in S sometimes active throughout winter. Mating usually takes place in April and May. Oviparous; females lay 2–4 eggs between June and August, in loose soil, underneath logs, rocks, etc.

Limbless Skink

Ophiomorus punctatissimus

(Bibron & Bory de Saint-Vincent, 1833)

Limbless Skink

DESCRIPTION

TL: 18 cm, but usually less. A small, shiny, legless skink. Usually metallic brownish, yellowish or greyish. Flanks usually somewhat darker. Numerous rows of small dark spots running along entire body, merging to become more obvious stripes on tail. Juveniles seem to show more contrast, with darker flanks.

DISTRIBUTION

Limited range, only in S Greece within our area. Most of Peloponnese (yet supposedly lacking from the NW). Presence in adjacent E part of S Greece (Thessalia, Attica) seems questionable, as recent records are lacking. Also on Kythira Island. Outside Europe, a small range in SW Turkey, and on the adjacent Greek island of Kastellorizo (not mapped).

VARIATION

None noted, but Turkish populations and those on Kastellorizo have been separated from Greek populations for millions of years.

HABITAT

Usually found under stones in loose soil, in which it digs with ease. Typically in olive groves with grassy undergrowth and scattered stones.

BIOLOGY

Hardly ever found out of hiding. Seeks cover beneath buried stones and similar objects in order to absorb indirect heat. Feeds on small invertebrates. When disturbed, able to bury itself swiftly in loose soil. Usually active between February and November but may be active throughout the year under suitable conditions and at low elevations. May be locally highly abundant, especially in spring. Hard to find in the warmer parts of the year, when it is believed to be less active and may burrow deeper into the ground. Mating takes place in April and May. Oviparous; females lay 2–4 eggs in loose soil underneath rocks.

Limbless Skink. Peloponnese, Greece.

Levant Skink *Trachylepis aurata* (Linnaeus, 1758)

Levant Skink

DESCRIPTION

TL: over 20 cm. Quite robust, large and shiny, with relatively strong, yet short legs. Legs somewhat larger and head more pronounced and elongated than in Ocellated Skink *Chalcides ocellatus*, with which it may coexist. Usually pale yellowish, brownish or greyish, with two rows of dark bars on back and spotless central area. Flanks darker with white speckling, often arranged in vague cross-lines.

DISTRIBUTION

Mainly an Anatolian species, occurring in our area only on Kos, Rhodes, Symi, Samos and Kastellorizo (not mapped).

HABITAT

Rocky and often well-vegetated areas such as erosion slopes, ruins or dry-stone walls which are often close to (temporary) streams or other waterbodies. Also occurs in gardens.

BIOLOGY

Diurnal and even active during high summer, but then in more shaded places. Found by turning objects; can also be seen basking on dry-stone walls, especially in the morning or at other times when temperatures are moderate. Feeds on a wide variety of invertebrates. Shy and skittish. Ovoviviparous, but little is known about its reproduction.

Levant Skink. Turkey.

Slow Worms (Anguidae)

This family occurs across the Northern Hemisphere, with most of its 120 species being found in America. The European species have lost their legs completely, although in one, tiny rudiments are visible near the vent (Glass Lizard *Pseudopus apodus*). Their body covering of non-overlapping scales gives them a stiff appearance. The slow worms *Anguis* spp. are usually slow-moving and secretive and can only rarely be found active or basking; they are more often active underneath vegetation, rocks or logs. In contrast, the Glass Lizard may be quite easily seen basking when conditions are not too hot. They frequently inhabit heavily-vegetated areas. Food consists of a wide range of invertebrates, but primarily worms, slugs and small insects. The Glass Lizard seems to prefer snails, which it crushes with its powerful jaws. They only rarely bite when handled but will often wriggle heavily while excreting faeces. May either be ovoviviparous (slow worms) or oviparous (Glass Lizard).

The highly similar slow worms are best identified by range.

Key to Slow Worms	
Balkans including some islands. Lateral groove running from ear-opening to vent. Coarse, smooth scales. Remnants of limbs visible at vent.	Glass Lizard *Pseudopus apodus*
Peloponnese, Zakynthos, Cephalonia. 34–36 scale rows across the mid-body, forming clearly defined dorsolateral lines with wavy edges on neck. Slender appearance. Elongated snout.	Peloponnese Slow Worm *Anguis cephallonica*
E Europe (see species account). 26–30 scale rows across the mid-body. Males often with high proportion of blue spots. Ear opening often visible.	Eastern Slow Worm *Anguis colchica*
Much of Europe (see species account). 24–26 scale rows across the mid-body. Ear opening rarely visible.	Slow Worm *Anguis fragilis*
SW Balkans, including W Greece and Corfu.	Greek Slow Worm *Anguis graeca*
Italy, SE France, possibly S Switzerland.	Italian Slow Worm *Anguis veronensis*

Glass Lizard — *Pseudopus apodus* (Pallas, 1775)

DESCRIPTION

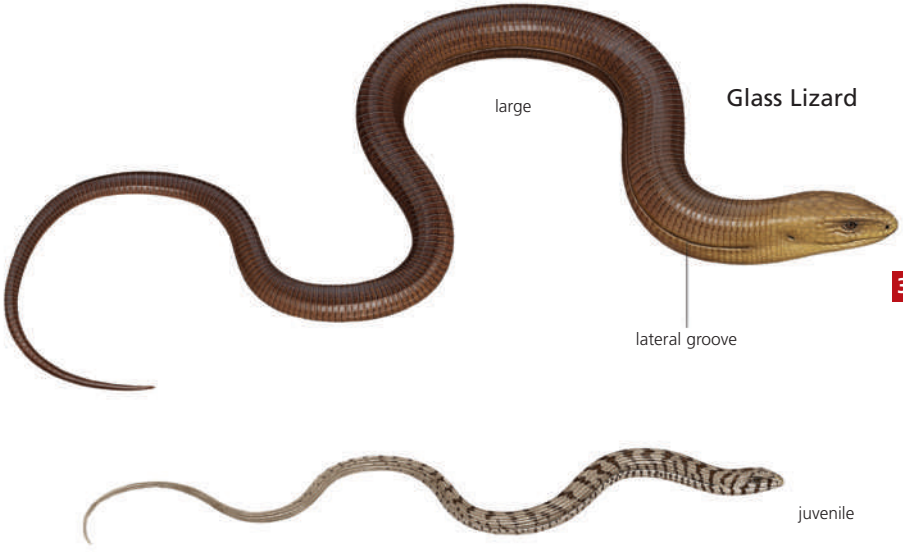
TL: 140 cm; SVL: 47 cm. In terms of total length, the largest European lizard. Adult individuals practically unmistakable, resembling a giant slow worm *Anguis* spp. but with an obvious lateral groove running from the ear-opening down to the cloaca. Coloration varies from tan to dark brown. Strong, bulky head, often with paler coloration. Sometimes with reddish or orange spots across upperparts. Juveniles with remarkable contrasting pattern of dark bars on head and body on pale grey background, pattern fading with age. Lower parts paler. Scales armoured and coarse but generally smooth, some scales slightly keeled forming longitudinal lines, especially on tail. Tiny remnants of hindlimbs visible on both sides of the vent.

DISTRIBUTION

From Istria, N Croatia along the E Adriatic coast to Greece, including Peloponnese and some Ionian and Aegean islands. Also SE Macedonia and SE and E Bulgaria, and the Crimean Peninsula. Also Turkey, the wider Caucasus area and the Middle East.

VARIATION

European populations have been attributed to *P. a. thracius*, while the nominate subspecies is assumed to occur further eastwards in C Asia. Crimean populations could belong to *P.*



a. apodus as occurrence of the species from C Asia to this region is probably continuous.

HABITAT

Often in fairly dry, stony habitats with plenty of vegetation cover such as maquis, rocky pastures, olive groves, open woods, roadsides and dry-stone walls. Mostly below 400 m but occurs up to 800 m in Bulgaria.

BIOLOGY

Diurnal species, avoids hottest parts of day. Feeds mainly on slugs and snails, cracking the shells with its powerful jaws. May also feed on insects (mainly beetles), mice and small reptiles. When disturbed, often escapes noisily and swiftly but halts after some metres. When handled often excretes faeces; males also may show hemipenes. Tail does not break off as readily as in slow worms; the regenerated tail is stubby. Active between March and November, varying with elevation. Mating takes place mostly in April and May. Oviparous; females lay 6–12 eggs that hatch between July and September. May be abundant, often found when looking for snakes but usually less easily startled.

Glass Lizard. Primorsko, Bulgaria.

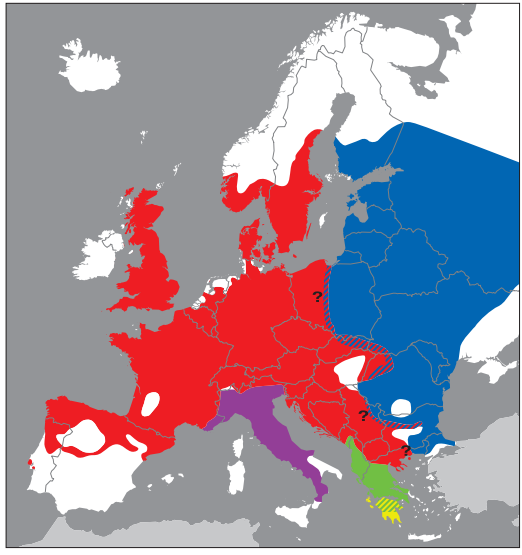
Slow Worms *Anguis* spp.

Slow Worm *Anguis fragilis* Linnaeus, 1758
Eastern Slow Worm *Anguis colchica* (Nordmann, 1840)
Peloponnese Slow Worm *Anguis cephallonica* Werner, 1894
Greek Slow Worm *Anguis graeca* Bedriaga, 1881
Italian Slow Worm *Anguis veronensis* Pollini, 1818

DESCRIPTION

TL: up to 50 cm; SVL: 22 cm. Cylindrical, snake-like lizards with fairly uniform coloration in males (sometimes with small bright blue spots, especially in Eastern Slow Worm) while females usually have darker flanks. Predominantly brown or greyish but may vary throughout the year. Juveniles with black flanks and metallic golden or silvery back, with a dark dorsal line running from a roundish spot on top of the head and fading towards the tail. Adults may also have dorsal lines, especially females. Head usually with pale spots around mouth and eye region. Lower parts dark in both sexes. Scales smooth and round. Eyes are closable. Must open the mouth when tasting the air with its tongue (in contrast to snakes). All species very similar and best distinguished by range. Eastern Slow Worm is relatively more robust, with more blue spots and broad head in males (and sometimes females) and has 26–30 scales across the mid-body while Slow Worm supposedly has 24–26. Presence of ear-opening, previously used to distinguish Eastern Slow Worm from Slow Worm, (present in Eastern, not present in Slow Worm) does not seem to coincide with the genetic definitions of the species.

Peloponnese Slow Worm looks much like other slow worm species but is often more slender in appearance, with a longer tail and a slightly more elongated snout. Flanks dark brown to black, upperparts pale brown. Often with clearly defined dorsolateral lines with wavy edges on the neck. Juveniles have strongly contrasting pattern of black sides and golden backs. Single dorsal stripe often discontinuous and fading towards the tail. Number of scale rows across the mid-body:



Slow Worm
Eastern Slow Worm
Peloponnese Slow Worm
Greek Slow Worm
Italian Slow Worm


♀
Slow Worm
♂
Eastern Slow Worm
Peloponnese Slow Worm
wavy edge
juvenile
Slow Worm
juvenile
Peloponnese Slow Worm

34–36. May be confused with Greek Slow Worm which also occurs in N Peloponnese (where it is largely restricted to higher elevations) or Limbless Skink *Ophiomorus punctatissimus* which is smaller, has no well-defined dorsolateral line and has many rows or lines of small dots running along its body.

DISTRIBUTION

The distribution limits and contact zones of the different species are currently poorly known.

Slow Worm: Almost all of Europe but not Ireland, N Scandinavia, S Peloponnese, S Iberian Peninsula, Italy, most Mediterranean islands and areas where the other species occur.

Eastern Slow Worm: Finland, Lithuania, NE Poland, E Czech Republic, Slovakia, E Hungary and Romania. Outside our area ranges further into Russia, N Turkey, the Caucasus and N Iran.

Peloponnese Slow Worm: Peloponnese, Zakynthos and Cephalonia.

Greek Slow Worm: At least Albania, Montenegro, Serbia, W and C Greece including N and NW Peloponnese, Corfu and Euboea.

Italian Slow Worm: Italy, parts of SE France, maybe S Switzerland.

HABITAT

Occurs in a wide variety of habitats but usually in well-vegetated and relatively moist places such as meadows, open woods, scrubland, heathland and also near human habitation on railway embankments and in parks and gardens. Slow Worm occurs up to 2,400 m in the Alps, and Peloponnese Slow Worm up to 1,100 m in the Taygetos Mountains.

BIOLOGY

Diurnal but secretive, rarely basking in the open and more often found basking underneath thickets of vegetation, stones, wood, rubbish, etc. Sometimes found in large groups underneath suitable objects of natural or man-made origin. They feed mainly on slugs and worms but take insects, spiders and even juvenile lizards as well. When caught they often wriggle intensely while defecating; sometimes bite and may drop tail. Active between March and October in most of range, but this may be considerably shorter in N of range and longer in S. Mating takes place between March and July in S of range and usually April or May in the N. Males fight over females and may inflict damage on each other. Males bite females in the neck region during copulation, often leaving visible scars. Mating may last up to 10 hours. Ovoviviparous; females give birth to 3–26 juveniles in late summer.

Italian Slow Worm. Liguria, Italy.

WORM LIZARDS (AMPHISBAENIA)

Like snakes (Serpentes) and lizards (Sauria), the worm lizards are often treated as a distinct suborder of the order Squamata. Genetic studies show, however, that they are the closest living relatives of the Lacertidae family (p. 232), and as such are not particularly distinct from lizards. For presentation purposes only, we follow the more traditional treatment here. The group contains six families and some 130 species, found in the Mediterranean area, Africa, the Arabian Peninsula and Latin America. Three highly similar species of the family Blanidae are native to our area. They are limbless reptiles with tiny skin-covered eyes. Their pale pink to dark purple colour and their annularly arranged body scales give them a superficial resemblance to earthworms, but unlike the latter, they have a rigid body structure, an obvious mouth with teeth and a dry skin.

In contrast to all other elongated reptiles, which have their left lung reduced to fit their narrow body (e.g. snakes), the right lung is reduced in worm lizards.

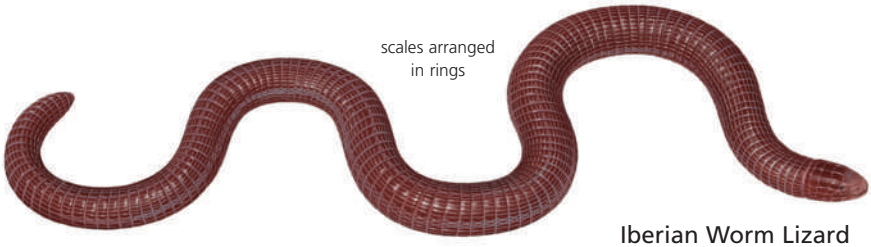
The European species spend the majority of their time underground, often burrowing in or around ant and termite nests to feed on the adult insects and their eggs and larvae. The head is supported by a solid bony structure as an adaption to their burrowing lifestyle. They are oviparous, laying only one or two eggs per clutch.

Key to Worm Lizards			
1	a	Snout overhangs lower jaw. In our area, only on Asian Greek islands.	Anatolian Worm Lizard *Blanus strauchi*
	b	Snout does not overhang lower jaw. Iberian Peninsula.	2
2	a	Not in the SW corner of the Iberian Peninsula.	Iberian Worm Lizard *Blanus cinereus*
	b	Only in the SW corner of the Iberian Peninsula: southern third of Portugal, S of a line between Lisbon and Elvas; SW Spain, bordered by but not including Cáceres, Córdoba and Málaga provinces	Maria's Worm Lizard *Blanus mariae*

Maria's Worm Lizard. Portugal.

Worm Lizards *Blanus* spp.

Iberian Worm Lizard *Blanus cinereus* (Vandelli, 1797)
Maria's Worm Lizard *Blanus mariae* Albert & Fernández, 2009
Anatolian Worm Lizard *Blanus strauchi* (Bedriaga, 1884)



Iberian Worm Lizard

DESCRIPTION

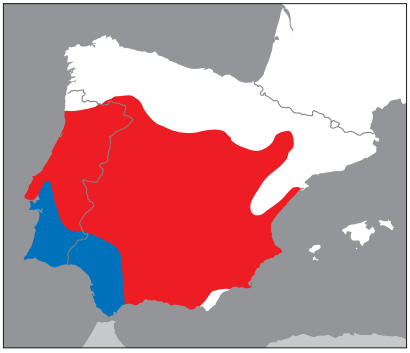
TL: Iberian and Maria's up to 25 cm or even 30 cm; Anatolian up to 20 cm. Distinctive worm-like animals. Head small, triangular with rounded snout and a clear collar groove separating the head from the body (see Fig. 37). Eyes small and rather indistinct. Body covered with rectangular scales arranged in rings. Also a lateral groove with smaller scales. Tail very short (1/10 of TL). Colour pinkish to violet. The two Iberian species are very similar: Maria's Worm Lizard is on average slightly larger, with more body annuli but fewer dorsal and ventral scales (segments in rings), but virtually impossible to differentiate other than by location. In Anatolian Worm Lizard, the snout clearly overhangs the lower jaw and the collar groove is less obvious (see Fig. 37). Within its range, it might be superficially confused with Worm Snake *Xerotyphlops vermicularis*, but Worm Snake lacks rings around its body and has a distinct spike on its tail-tip.

DISTRIBUTION

Iberian Worm Lizard: Iberian Peninsula south of the rivers Minho and Ebro, except in SW Spain and S and C Portugal, where it is replaced by Maria's Worm Lizard.
Anatolian Worm Lizard: in our area, only on the Dodecanese Islands and Kastellorizo (unmapped). Also S Turkey, Syria and Lebanon.

HABITAT

Mediterranean scrubland, forests, arable and grassland up to 1,800 m. Soil should be loose enough to burrow in, e.g. sand or humus-rich soils.



Iberian Worm Lizard
Maria's Worm Lizard

Anatolian Worm Lizard

BIOLOGY

Inconspicuous animals, spending almost their entire lives underground. Usually found under stones and other objects. Relatively easy to find in spring and during winter in the southernmost parts of its range, but they seek refuge deeper underground during summer where they may even aestivate, making them more difficult to find. Can be observed migrating above ground during the night, especially during rainfall, when they may cross roads. Feed mainly on ants, termites and insect larvae. Mating takes place between February and June. Oviparous; females lay 1–3 eggs in the soil or in decaying wood. When disturbed, often anchor themselves by the tail on roots or plant stems. When handled they wriggle vigorously, and may bite.

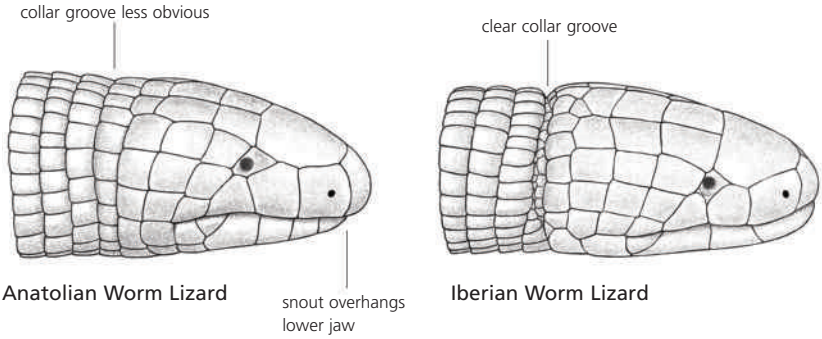


Fig. 37. Heads of worm lizards.

An Iberian Worm Lizard anchoring itself as a defensive measure. Extremadura, Spain.

LEFT: Short-toed Eagle *Circaetus gallicus*, while not exclusively feeding on snakes, is a well-known serpent predator. The bird shown here has caught a Western Montpellier Snake. Spain.

BELOW LEFT: While several species may release a foul musk from their anal glands, the water snakes, like this Grass Snake, may also play dead, showing their underparts and opening their mouth.

BELOW: Ritual combat between two male Adders. London, United Kingdom.

LEFT: Drab colours and an opaque eye indicate that a snake is about to shed its skin, like this Horseshoe Whip Snake. Valencia, Spain.

RIGHT: Balkan Whip Snake feeding on a Dalmatian Wall Lizard. Croatia.

SNAKES (SERPENTES)

There are about 3,400 species of snakes worldwide. They are well-known, legless reptiles with eyes that cannot be closed – or rather, eyes that are always closed, being covered with a transparent horny layer which is part of the periodically shed skin. The snake body is a unique construction. The skull has more joints than other reptiles and the jawbones are only connected by elastic ligaments. This allows these bones to move away from each other, enabling the mouth to have a wider gape. Behind the skull, the skeleton mainly consists of vertebrae and floating ribs. Together, these features enable snakes to swallow large prey. Snakes also have a unique set of senses. They are practically deaf, and their eyesight is average at best, being most responsive to movement. They are very sensitive to vibration, and can detect approaching prey or an attacker by sensing even the weakest vibration of the ground. Their main sense, however, is smell, in which the Jacobson's organ is more important than the nose. Odour particles are sampled by the forked tongue and then brought into this organ, giving the snake a directional sense of smell and taste.

Of the 41 species in our area, only 15 are (more or less) venomous. There are three types of snake fangs that can deliver venom, of which two are represented in our area.

1. Opisthoglyphous (= backward grooved) whereby snakes administer their venom though a pair of enlarged teeth at the back of the upper jaw. Because of this, the prey has to be moved into the rear of the mouth before the venom can be 'chewed in'. The fangs are grooved to channel venom into the bite wound. European opisthoglyphous or rear-fanged snakes generally have the weakest venom and are harmless to humans.
2. Solenoglyphous (= pipe grooved) snakes have the most sophisticated venom mechanism of all snakes. The hollow fangs, which can be as long as half the length of the head, are like curved syringes fixed on a hinged part of the upper jaw. They can be folded back horizontally in a resting position and unfolded vertically if the snake wants to strike. Vipers are typical solenoglyphous snakes.

Non-venomous snakes are aglyphous (lacking grooves). They have no specialised teeth; each tooth is similar in shape and often in size. Although they are called non-venomous, some species can have mildly venomous saliva.

The number and arrangement of scales are often diagnostic in identifying snake species. While somewhat variable within each species, they may be used to establish the presence of a species from a shed snake skin.

Key to Snakes			
1	a	Body scales identical all around the body – no enlarged belly scales.Vestigial eyes, visible as small dark subcutaneous spots. Spiny scale at the tail-tip. Body scales arranged smoothly around the body, no annular structure.	Worm Snake *Xerotyphlops vermicularis*
	b	Belly scales enlarged. Eyes well developed and visible.	2
2	a	Thick-bodied snakes with a short tail, Slit-shaped, vertical pupil.	3
	b	None of the combinations of features above.	4
3	a	Belly scales only enlarged to about 1/3 of the body width. Head not very distinct from the body. Tail with blunt tip. Dorsal scales smooth.	Sand Boa *Eryx jaculus*
	b	Belly scales enlarged to more than half of the width of the body. Head clearly distinct from the body. Tail with pointed tip. Dorsal scales keeled.	Vipers – Viperidae (p.404)
4	a	Dorsal scales not smooth nor keeled but grooved. Characteristic head with a distinct brow ridge over the eyes.	African Sand Snakes – Psammophiidae (p.400)
	b	Not the combination of features above.	5
5	a	Often found close to or in water. One large temporal scale. Anal scale divided. Dorsal scales keeled.	Water Snakes – Natricidae (p.393)
	b	Not the combination of features above.	Colubrids – Colubridae (p.358)

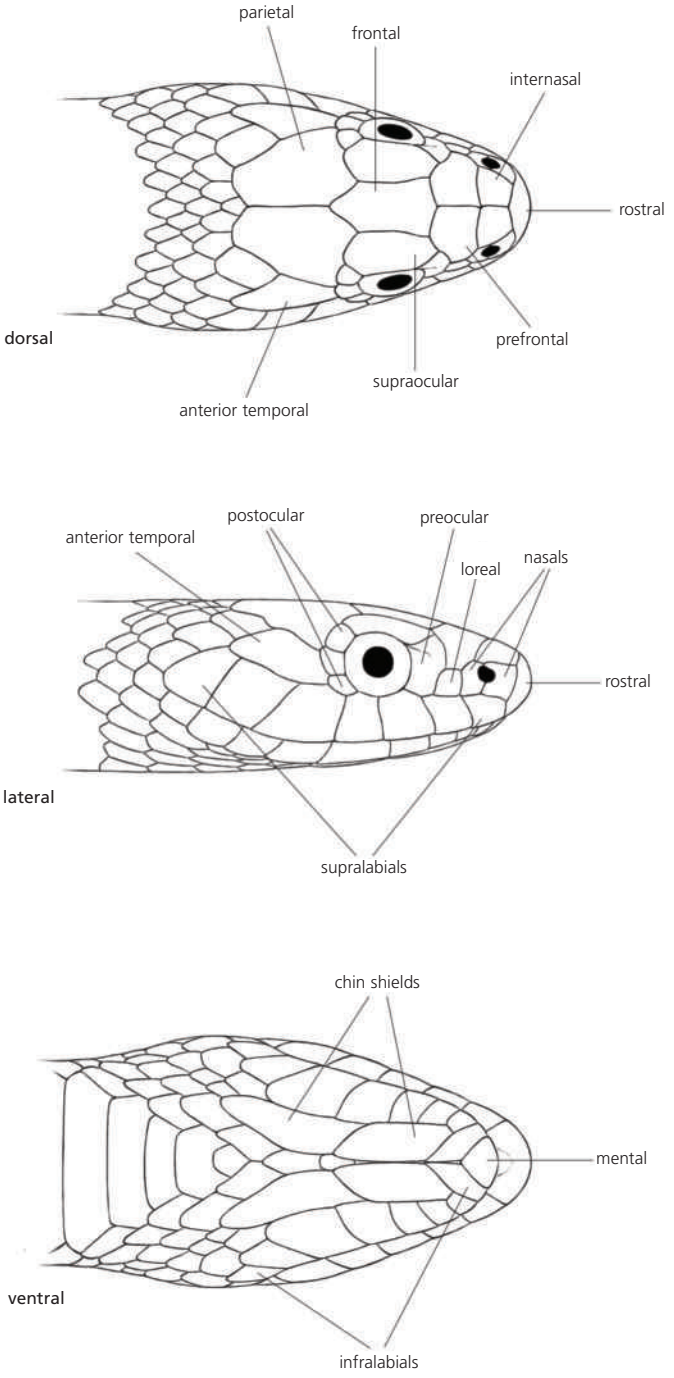


Fig. 38. Heads of colubrid snakes.

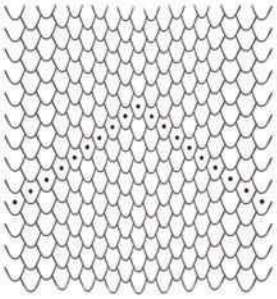


Fig. 39. Counting dorsal scales of snakes.

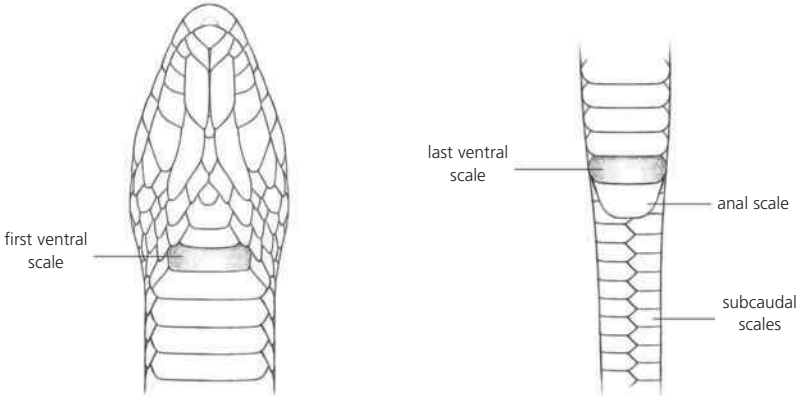


Fig. 40. Counting ventral scales of snakes.

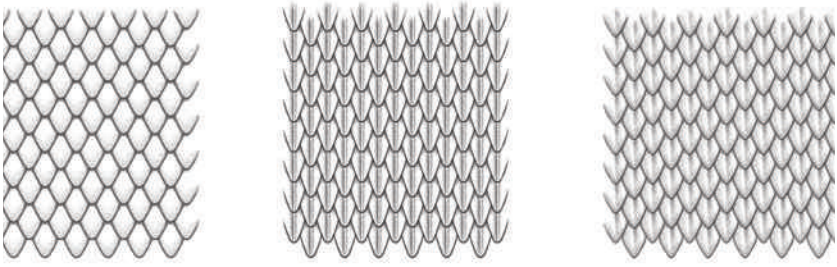


Fig. 41. Types of dorsal scales in snakes.

Blind Snakes (Typhlopidae)

The blind snake family (Typhlopidae) consists to date of 16 genera and over 200 species found in the tropical and subtropical regions of the world. Only one species occurs naturally in our area. Blind snakes spend practically their entire lives underground, burrowing in or around ant and termite nests to feed on the adult insects and their eggs and larvae. Their rudimentary eyes are reduced to merely light-sensitive dark spots. The head is flattened like a shovel as an adaptation to the burrowing lifestyle.

Worm Snake *Xerotyphlops vermicularis* (Merrem, 1820)

Worm Snake

DESCRIPTION

TL: 30 cm or even 40 cm. A distinctive snake species. Earthworm-like appearance, but without segmented rings around the body. Head rounded and flattened, not distinct from the body, with small black eyes. Cylindrical body with thicker tail. Scales smooth and arranged like slates around the body, without enlarged belly scales. Tail extremely short with a spiny scale at the end. Pinkish-yellow to purple. 22–24 rows of scales around mid-body.

DISTRIBUTION

S Balkans including Turkish Thrace. Distribution runs north along the Adriatic coast to Montenegro in the west. NE limit in S Bulgaria. Also on several Greek islands (Euboea, Thasos, Lesbos, Samos, Kos, Rhodes, Corfu, Lefkada, Nydri, Andros, Dilos, Paros, Naxos, Patmos, Kythira, Symi, Salamina, Kastellorizo and maybe Skyros – latter two islands unmapped). Outside our area, widespread in Turkey, Middle East, Caucasus and eastwards to Iran and Afghanistan.

HABITAT

Fairly dry open areas with loose soil, sometimes with herbaceous cover but usually without tall vegetation, such as grassy fields or even sandy, beach-like areas with scattered stones. Up to 1,200 m.

BIOLOGY

Worm Snakes spend almost their entire lives underground. In spring they often occur closer to the surface, when they can be found under stones, but in other seasons individuals hide deeper underground and are hard or even impossible to find. Surface activity is rarely observed and usually takes place after heavy rain and/or at twilight. Feeds mainly on ants and their pupae, but may also feed on other small invertebrates such as spiders, beetles, caterpillars and ant-lions. Usually calm when found but becomes nervous when exposed to direct sunlight or when handled. Mating takes place in May and June. By August females lay 4–8 elongated eggs. Juveniles hatch around September. Usually a common species and may be present underneath almost every suitable rock in some areas in spring.

NOTE

Formerly called *Typhlops vermicularis* until a revision of the blind snake family in 2014. On Samos feared by locals who claim the bite of this species will cause death before sunset.

■ Sand Boas (Erycidae)

Sand Boas (Erycidae) are a primitive family of snakes, with three genera and some 15 species found in N America, SE Europe, Africa and parts of Asia. A single species occurs in our area. Like their relatives, the boas (Boidae), sand boas have a rudimentary pelvic girdle and hindlimbs that are partially visible as tiny spurs. Most species are ovoviviparous, with young hatching from translucent egg membranes after leaving the mother's body.

Sand Boa — *Eryx jaculus* (Linnaeus, 1758)

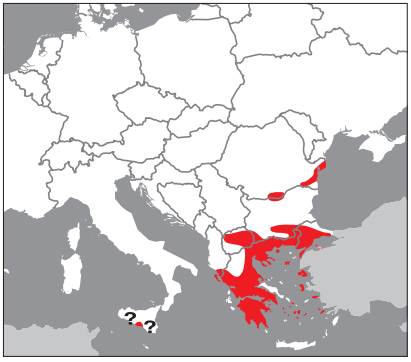
Sand Boa

DESCRIPTION

TL: usually less than 80 cm. Medium-sized, sturdy snake. Head not distinct from the body, trapezoidal and flattened, making the snout chisel-like. Eyes small with vertical pupil. Scales smooth, enlarged ventral scales rather narrow. Tail blunt and short. Background coloration cream, beige, and yellow to bright orange. Often irregular dark bars on back and smaller spots on flanks. Dark stripe on the side of the head, going from the eye to the neck. 41–57 rows of scales around the mid-body.

DISTRIBUTION

S Balkans: S Albania, Macedonia, Bulgaria, Turkish Thrace, Greek mainland and several Greek islands (Amorgos, Chios, Corfu, Eraklia,



Epano Koufonissi, Folegandros, Ios, Kalymnos, Keros, Antikeros, Kimolos, Kos, Lemnos, Leros, Lesbos, Naxos, Paros, Antiparos, Polyaegos, Samos, Schinoussa, Sikinos, and Tinos). Recently rediscovered in S Romania after 20 years without (recorded) sightings. Confirmed from S Sicily in 2015, possibly resulting from an ancient introduction. Outside our area, widespread in N Africa, Middle East, Caucasus and eastwards to Iran.

VARIATION

European populations belong to the subspecies *E. j. turcicus*. If native, Sicilian populations could belong to *E. j. jaculus*.

HABITAT

Typically in steppes or savanna-like habitats with loam soil and, in contrast to its common name, somewhat less often in sandy areas such as beaches. Also on arable land and even rocky slopes, provided there is enough loose soil.

BIOLOGY

Nocturnal but may be active by day in spring or autumn. Spends most of its life underground, either in self-dug burrows or in rodent galleries. Likes to take warmth by basking just under the surface of loose soil or fallen leaves, or indirectly underneath (not too) warm stones. Sometimes can be found above the surface after dark. Feeds mainly on small mammals which are actively pursued in their burrows, but may also feed on birds, lizards, invertebrates and even slugs. Sometimes ambushes prey from a hiding place under loose soil. Usually sluggish when handled and rarely bites. Active between March and November. Females give birth to 6–20 live young between July and September.

Large and well-fed adult Sand Boa. Limnos, Greece.

■ Colubrids (Colubridae)

Colubrid snakes (Colubridae) are the largest family of snakes. The taxonomic division of this family is still under debate. Recently, subfamilies of the Colubridae such as Natricinae and Psammophiinae have been upgraded to family level, currently known as Natricidae and Psammophiidae. Even under its revised definition the Colubridae still contains some 700 species, belonging to nearly 100 genera. These species are widely distributed throughout the world, apart from much of Australia and some islands such as Ireland and New Zealand. Our area contains 10 genera including some 22 species.

All European colubrids are characterised by large scales on the top of their heads, and by the presence of one large loreal scale (see Fig. 38). Most species are non-venomous and have aglyphous teeth, although some genera (false smooth snakes *Macroprotodon* spp. and Cat Snake *Telescopus fallax*) are opisthoglyphous. They are, however, not considered harmful to man.

Most species are mainly diurnal and have round pupils, but especially Southern Smooth Snake *Coronella girondica*, Dwarf Snake *Eirenis modestus*, the false smooth snakes and Cat Snake are crepuscular, while several others (e.g. Ladder Snake *Rhinechis scalaris*, Aesculapian Snake *Zamenis longissimus*) may be encountered at night. The Cat Snake is characterised by a vertical, slit-shaped pupil, while the false smooth snakes show a slightly vertically oval pupil in clear daylight.

Almost all European colubrids deposit eggs, apart from the Smooth Snake *Coronella austriaca* which gives birth to fully developed young.

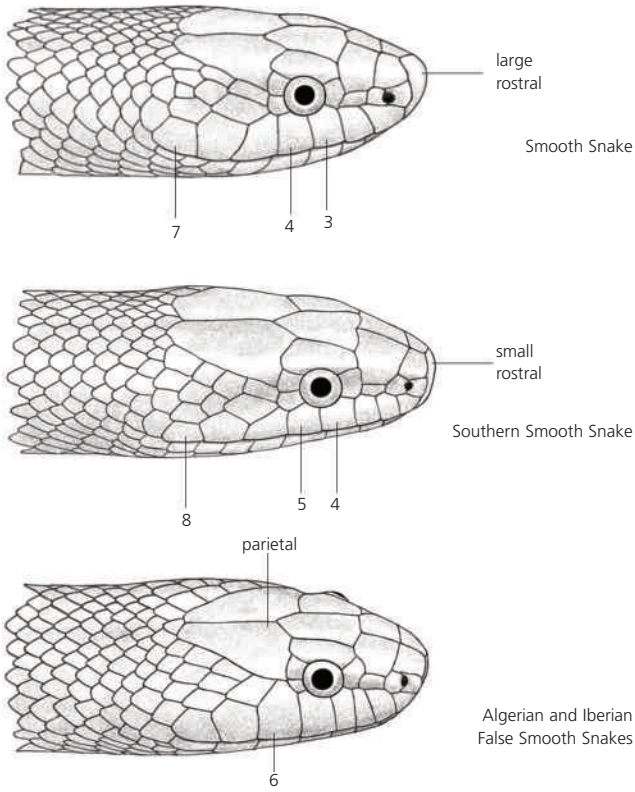


Fig. 42. Heads of smooth snakes *Coronella* spp. and false smooth snakes *Macroprotodon* spp., showing numbered supralabial scales (see pp.386–390).

Key to Colubrids			
1	a	17 rows of dorsal scale rows across the mid-body. Dark collar (which may be faint in adults). Only the European part of Turkey and some Greek islands in front of the the W Turkish coast.	Masked Dwarf Snake *Eirenis modestus*
	b	Not the above combination of features.	**2**
2	a	Pupil vertically slit-shaped in bright light. SE Europe and Malta. Head horizontally flattened. Body vertically flattened.	Cat Snake *Telescopus fallax*
	b	Not the above combination of the features.	**3**
3	a	One supralabial scale (usually 6th) large, touching or nearly touching parietal scale. Only Mallorca and Menorca. Pupil vertically oval-shaped in bright light.	Algerian False Smooth Snake *Macroprotodon cucullatus*
	b	One supralabial scale (usually 6th) large, touching or nearly touching parietal scale. Iberian Peninsula. Pupil vertically oval-shaped in bright light.	Iberian False Smooth Snake *Macroprotodon brevis*
	c	Not as above. 6th supralabial scale not particularly large.	**4**
4	a	Iberian Peninsula and Sardinia. Supralabial scales never touch the eye (complete row of subocular scales). 23–29 rows of dorsal scales on mid-body.	Horseshoe Whip Snake *Hemorrhois hippocrepis*
	b	Only Malta. 25–27 rows of dorsal scales on mid-body.	Algerian Whip Snake *Hemorrhois algirus*
	c	Only Greek islands close to Turkey. A row of dark round spots on the back, merging on the 2nd half of the back into a zigzag stripe. The tail has longitudinal light and dark stripes.	Coin-marked Snake *Hemorrhois nummifer*
	d	Not the above combination of features.	**5**
5	a	Balkans only. Extremely slender. Black ocelli on the sides of the neck or on the back.	**6**
	b	Not the above combination of features.	**7**
6	a	Balkans, from C coastal Croatia southwards. Black ocelli on the sides of the neck, reducing in size, along the first 1/3 of the body.	Dahl's Whip Snake *Platyceps najadum*
	b	Black Sea coast in S Bulgaria and Turkish Thrace. Dark band on neck and dark ocelli on the back, reducing in size, along the whole of the back.	Reddish Whip Snake *Platyceps collaris*
7	a	Balkans, S Italy, Sicily, Malta and Crimea. Unique pattern of red or reddish-brown, dark-edged spots or stripes.	Leopard Snake *Zamenis situla*
	b	Not the above combination of features.	**8**
8	a	Not in W Europe. Usually more than 2 dark stripes or rows of dark blotches along the body. 2 preocular scales.	**9**
	b	Not the above combination of features.	**10**
9	a	Italy, E Adriatic coast, Albania, Macedonia, most parts of Greece, except the NE. Dorsal scales slightly keeled. Adults with 4 longitudinal dark lines along the body, juveniles have 4 rows of dark, black bordered irregular patches.	Four-lined Snake *Elaphe quatuorlineata*
	b	NE Greece, Turkish Thrace, E Bulgaria, Black Sea coast of Romania and Ukraine. Dorsal scales slightly keeled. Body pattern with 4 rows of dark irregular patches. Adult ground colour often yellow.	Blotched Snake *Elaphe sauromates*

Key to Colubrids (*continued*)			
	c	SE Ukraine. Dorsal scales unkeeled. Rows of dark transverse bars and/or light or dark longitudinal lines on the back. U-shaped marking on the neck, opening to the back.	Steppe Snake *Elaphe dione*
10	a	Usually 23 or more rows of dorsal scales across the mid-body. If only 21 dorsal scales then without dark streak from eye to side of the neck (however, from eye to corner of the mouth is possible).	**11**
	b	19 or 21 rows of dorsal scales across the mid-body.	**12**
11	a	Usually 23 (21) rows of dorsal scales across the mid-body. Widespread in C and S Europe, only NE Iberian Peninsula, not S Italy. Rostral scale not clearly pointed behind. Iris golden-beige.	Aesculapian Snake *Zamenis longissimus*
	b	Usually 23 (21) rows of dorsal scales across the mid-body. Only S Italy and Sicily. Rostral scale not clearly pointed behind. Iris copper red.	Italian Aesculapian Snake *Zamenis lineatus*
	c	Usually 27 rows of dorsal scales across the mid-body, Only Iberian Peninsula and SE France. Rostral scale pointed behind, wedged between internasal scales.	Ladder Snake *Rhinechis scalaris*
12	a	Dark streak from eye to side of the neck.	**13**
	b	No dark streak from eye to side of the neck.	**14**
13	a	Dark eye-stripe from the nostril to the side of the neck. Belly dark marbled. 7 supralabial scales, 3rd and 4th touching the eye.	Smooth Snake *Coronella austriaca*
	b	Dark stripe from the eye to the side of the neck and a dark 'bridle' over the snout. Belly whitish or pinkish with black dice markings arranged in 2 (intermittent) stripes. 8 supralabial scales; 4th and 5th touching the eye.	Southern Smooth Snake *Coronella girondica*
14	a	Broad area along E Adriatic and Ionian coast, including many islands; in the south, also to E part of C Greece and north up to Macedonia; from Istria to Peloponnese, also Crete. 160–185 ventral scales, 80–110 pairs of scales beneath tail. Adult grey-brown with narrow lighter longitudinal stripes, dark patches and white bars on the back, belly uniform cream-coloured, with a row of small black dots on the sides, at least on the first part of the belly.	Balkan Whip Snake *Hierophis gemonensis*
	b	France, Italy and neighbouring areas, also Corsica, Sardinia and Malta. 187–227 ventral scales, 95–124 pairs of scales beneath tail. Ground coloration yellow, with a variable amount of black pigmentation, but in a significant area virtually entirely black.	Western Whip Snake *Hierophis viridiflavus*
	c	S and E Balkans, but not Peloponnese and Crete; 189–207 ventral scales, 80–110 pairs of scales beneath tail. Adults grey-brown with narrow longitudinal stripes along the body, head orange or copper, belly unspotted.	Caspian Whip Snake *Dolichophis caspius*
	d	In our area only on some Greek islands along the Turkish coast: Chalki, Kastellorizo, Kos, Leros, Rhodes, Symi and Tilos. 200-211 ventral scales, 90-120 pairs of scales beneath tail. Adults black with lower part of the head and throat orange to copper. Juvenile sandy with dark markings on the back, and red and black dots on the ventral scales.	Black Whip Snake *Dolichophis jugularis*

Western Whip Snake *Hierophis viridiflavus*

(Lacépède, 1789)

DESCRIPTION

TL: 150 cm or even 180 cm. Fairly slender but strong snake. Ground colour cream to bright yellow with a variable amount of black pigmentation, the light colour often arranged in irregular transverse bars on the first part of the back, and in yellow and black longitudinal lines on the rear part of the body. Individuals from the NE part of the range are often entirely black (see Variation), while those in NE Italy, SW Slovenia and adjacent Croatia occasionally display (light) brown dorsal coloration, highly resembling the Balkan Whip Snake *Hierophis gemonensis*. Underside uniform cream or yellow. Juveniles olive or brownish, sometimes with a faint pattern of light brown transverse bars which become more distinct through time; head dark, with light streaks at the base, between the eyes and on the sides. While juveniles strongly resemble those of Balkan Whip Snake, those of the latter have a more brownish colour, always show distinct spots or blotches on the upper half of the body, and may show small white spots on the lower and upper edges of the dorsal scales, which are absent in Western Whip Snake. Dorsal scales unkeeled and in 19 rows across the mid-body.

DISTRIBUTION

Most of France (except the NW), the extreme N of Spain (S flanks of the Pyrenees), S Switzerland, SW Slovenia, N Croatia (south to Karlobag) including the island of Krk, and the whole of the Italian mainland. Also the islands of Corsica, Sardinia, Sicily and Elba.

VARIATION

H. (v.) carbonarius from the NE of the range (Croatia and Slovenia) and also S Italy and Sicily is almost completely black. In the rest of the range the nominate subspecies is found. Research, however, shows that the two colour morphs do not entirely coincide with genetic data. Some authors treat *carbonarius* as a separate species.

Individuals from the Greek Aegean island of Gyaros were previously considered to be an endemic species (*Coluber gyarosensis*), but molecular evidence hints that *H. (viridiflavus) carbonarius* was introduced to the island in the past.

HABITAT

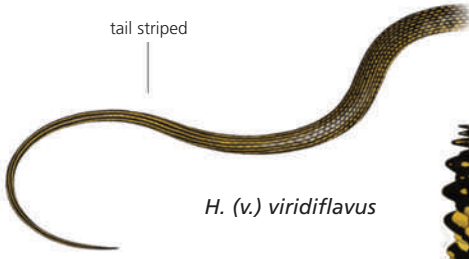
A wide variety of dry, warm, open biotopes, e.g. maquis, heathland, forest edges but also man-made habitats such as gardens and orchards. In the mountains up to 2,000 m.

BIOLOGY

Diurnal, strong, fast snake that actively hunts for a wide range of prey: lizards, small mammals, birds and eggs. May also feed on other snakes including vipers and may even exhibit cannibalism. Usually terrestrial but may climb bushes to bask or to hunt for its prey, Will bite persistently when caught or handled, a defensive strategy shared by most whip snakes. Active between March and November, but may be seen on relatively warm winter days as well. Mating takes place between April and May. Oviparous; females lay 5–15 eggs in June or July and juveniles emerge in late summer.

typical
H. (v.) viridiflavus

typical
H. (v.) carbonarius



H. (v.) viridiflavus

juvenile

Subadult Western Whip Snake. La Brenne region, France.

Balkan Whip Snake *Hierophis gemonensis*

(Laurenti, 1768)

DESCRIPTION

TL: less than 130 cm. A fairly large and slender snake. Ground coloration silver-grey to beige-brown. Centre of dorsal scales lighter than the upper and lower parts. Dark patches, sometimes merged into transverse bars, and narrow white scale edges on the first part of the body. Hind part of the body with narrow beige and brown longitudinal lines. Head with dark patches, often a light streak connecting the eyes and more irregular lines on the back of the head and the side of the neck; post- and preocular scales white. Belly white or cream, unspotted with the exception of a row of small black dots on the sides at least on the first part of the belly. Juveniles show a similar but often lighter colour than adults and a more contrasting pattern on the head, due to which they closely resemble those of Western Whip Snake *Hierophis viridiflavus*, with which the species coexists in the N part of its range. See the description of the latter species for specific differences. Dorsal scales unkeeled and in 19 rows across the mid-body.

DISTRIBUTION

W Balkans. Records from NE Italy and SW Slovenia have been attributed to light-coloured Western Whip Snakes. Ranges

Balkan Whip Snake

from N Croatia further south along the Adriatic coast, including most of the Croatian Adriatic Islands, south to the Peloponnese, NE to Thessaloniki and N along the Vardar Valley into Macedonia. Present on several islands (Aspro, Euboea, Aegina, Psili, Tolon, Stavronissos, Tsougriá, Corfu, Ithaca, Zakynthos, islets of Argolikos Bay, Kythira, Crete and satellite islets).

HABITAT

Dry, stony habitats in lowland and hilly regions, up to 1,400 m. Mediterranean-type shrubby vegetation, pastureland and rural gardens usually characterise these habitats.

BIOLOGY

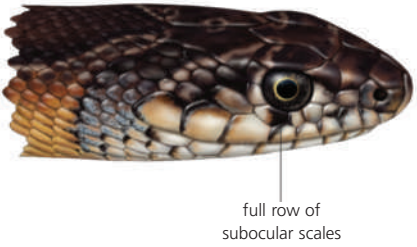
Diurnal, fast-moving snake. Mainly preys on lizards and small mammals but also on other snakes or invertebrates. Will bite persistently when handled. Active between February and November, but this may vary by region. Mating takes place in April and May. Oviparous; females lay 3–10 eggs. Juveniles emerge in late summer. A common snake within its range.

Balkan Whip Snake juvenile. Pylos, Peloponnese, Greece.

Horseshoe Whip Snake *Hemorrhois hippocrepis*

(Linnaeus, 1758)

Horseshoe Whip Snake



DESCRIPTION

TL: usually up to 160 cm or even 185 cm. Large, robust snake. Tail relatively short. Ground coloration yellow, beige, olive or grey with a row of round dark brown spots on the back and a row of smaller dark patches on each side. Dark markings expand with age and old individuals are completely dark with a row of light X-shaped markings on the back. Dark horseshoe-shaped marking on neck and a dark band between the eyes. Markings on the tail merge into alternating light and dark longitudinal lines. Belly yellow or orange, sometimes with black dots on the sides of the belly. Full row of subocular scales present. Dorsal scales unkeeled and in 23–29 rows across the mid-body.

DISTRIBUTION

Iberian Peninsula, except NW corner and E part of C Spain. Occurs along the eastern coast of Spain, however, up to Gerona. Also SW Sardinia and the nearby islet San Pietro. Introduced to Mallorca and Ibiza (latter not mapped). Outside our area, also N Africa and the Italian island of Pantelleria.

HABITAT

Dry, rocky, sunny areas with open vegetation: maquis, often man-made habitats such as pastures and rural gardens with dry-stone walls, sometimes also urban areas. In the south of Europe up to 1,700 m.

BIOLOGY

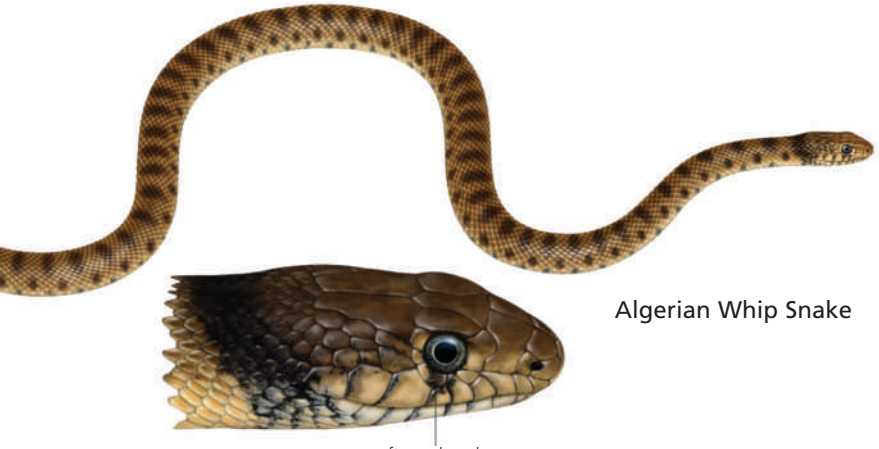
Diurnal but may become crepuscular in the warmest months of the year. An agile, fast moving snake that actively hunts its prey. Feeds on a wide variety of prey items such as small mammals, birds, lizards and invertebrates. Mainly terrestrial, but may also

climb to reach birds and their nests. A shy snake which flees at a great distance. When cornered, will flatten head, extend the jaw bones (making the head triangular) and hiss loudly. Will bite readily and may defecate when handled. Active between March and October but hibernation may be shorter or absent in S of range. Mating takes place in April and May. Oviparous; females deposit 4–11 eggs in June or July, and juveniles emerge in August or September. Except on Sardinia, usually a common snake within its range.

ABOVE: Horseshoe Whip Snake. Monfragüe, Extremadura, Spain.

RIGHT: Horseshoe Whip Snake. Ceuta, Spain.

Algerian Whip Snake *Hemorrhois algirus* (Jan, 1863)



Algerian Whip Snake

DESCRIPTION

TL: up to 130 cm. A strong, agile snake. Head dark brown or grey with a black collar around the neck. Body grey, yellowish to beige-brown with black cross-bars on the back, alternating with a row of black blotches on each side. Belly cream or yellow to orange with a row of more or less square black dots on each side. Subocular scales often present, sometimes a complete row.

Dorsal scales unkeeled and in 25 rows across the mid-body.

DISTRIBUTION

In Europe, only present as an introduced species on Malta (supposedly during WWI), where it seems quite rare and localised, possibly restricted to the capital, Valletta. Occurs naturally in N Africa.

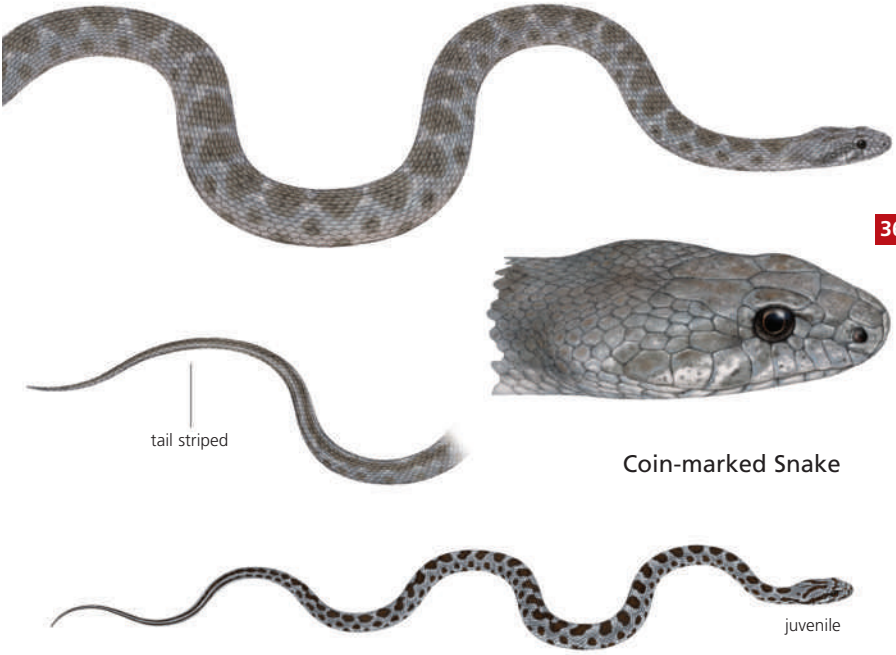
HABITAT

Stony, sunny habitats with open, structured vegetation, such as scrubland. In Malta, old gardens with dry-stone walls and ruins, and in overgrown, unattended parks in the capital.

BIOLOGY

Similar to other whip snakes. Diurnal but may become crepuscular in hot summer months. Hibernation may be short and interrupted in warm weather. Feeds on a wide variety of small prey items such as mammals, birds, lizards and even grasshoppers. Oviparous but otherwise little is known about its reproduction.

Coin-marked Snake *Hemorrhois nummifer* (Reuss, 1834)



DESCRIPTION

TL: up to 160 cm, sometimes larger. Strong, agile snake. Ground coloration light to dark grey. Colour pattern slightly variable; usually comprising a row of either light or dark brown or grey blotches often bordered by a black line on the back, and a row of similar coloured but often slightly darker spots on each side. Some individuals show cross-bars instead of blotches. Dorsal blotches or cross-bars merge into a zigzag stripe on the second half of the back, while the tail has longitudinal light and dark stripes. Pattern may fade during growth, being most distinct in juveniles; however, adults with highly contrasting patterns occur throughout the range, resembling the Ottoman Viper *Montivipera xanthina*. Underside creamy with dark blotches or bars. Dorsal scales (rather lightly) keeled and in 25 rows across the mid-body.

DISTRIBUTION

In our area, only on Greek islands close to Turkey (Lesbos, Chios, Samos, Leros, Kalymnos, Kos, Symi, Rhodes, Leipsi, Samothrace and Kastellorizo – the latter unmapped). Presence in Turkish Thrace requires confirmation. Also in Anatolia, Cyprus, the Middle East and Egypt.

HABITAT

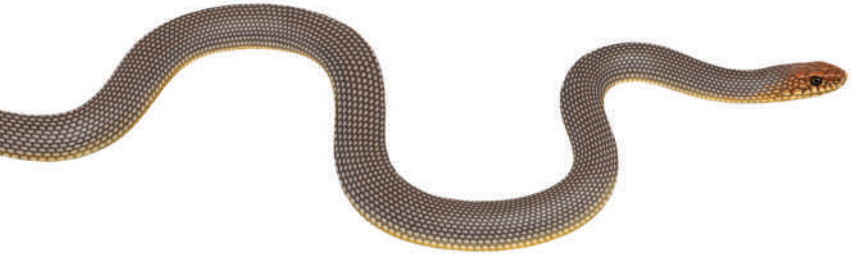
Stony habitats with semi-open vegetation, such as rocky slopes with maquis and scrub,

but also rural gardens or olive groves with dry-stone walls. Up to 1,800 m but usually below 1,000 m in our area.

BIOLOGY

Individuals are active both during the day and night; nocturnal activity occurs especially during summer. Generally quite slow moving, and may readily bite when handled. May hiss loudly and flatten its head when disturbed. Both in morphology and defensive behaviour may resemble two viper species: Ottoman Viper in W part of range and Blunt-nosed Viper *Macrovipera lebetina* with which it often coexists in E part of range. An opportunistic feeder, prey items include large lizards including Starred Agama *Laudakia stellio*, but also various small mammals and birds. Little is known about its biology. Activity starts in February if weather conditions are suitable.

Caspian Whip Snake *Dolichophis caspius* (Gmelin, 1789)



Caspian Whip Snake

belly

juvenile

DESCRIPTION

TL: up to 200 cm, occasionally 250 cm. Large, strong snake. Ground colour silver-grey to beige-brown with the central part of the dorsal scales a lighter shade than the upper and lower part, forming narrow, sometimes poorly defined, longitudinal lines along the body. Head in older adults sometimes orange or copper. Belly cream or yellow, completely unmarked. Juveniles have dark cross-bars at least over the first part of the back and a dark longitudinal stripe in the middle of the neck, often forming a cross with the first lateral bar. Juvenile head markings resemble those of juvenile Balkan Whip Snake. Dorsal scales unkeeled and in 19 rows across the mid-body.

DISTRIBUTION

Isolated populations in Hungary, thinly dispersed in Serbia, more common from coastal Montenegro south through Albania, Macedonia, Bulgaria, S Ukraine (including Crimea), Moldova, Turkish Thrace and Greece (mainland but not on the Peloponnese, and also present on the islands of Andros, Agathonisi, Alonissos, Chios, Corfu, Euboea, Fourni, Ikaria, Kalymnos, Karpathos, Kea, Cephalonia, Kos, Kythnos, Lemnos, Lesbos, Nysiros, Patmos, Samos, Samothrace, Serifos, Sifnos, Spetses, Syros, Thasos and Tinos). Outside our area also in N and W Turkey.

VARIATION

Individuals from many island populations tend to remain small (TL up to 100 cm) and sometimes retain the juvenile pattern.

HABITAT

A wide variety of rather warm and sunny habitats, ranging from open steppe through scrubland to stony mountain slopes with arboreal vegetation up to 1,600 m. In Montenegro even in fairly humid woods.

BIOLOGY

Diurnal. A swift snake that actively hunts its prey: a wide variety of small mammals, birds and reptiles. If threatened, it will raise its body while hissing loudly. Readily bites when handled. May even jump up to 1 m towards its attacker. Usually a terrestrial species but may climb as high as 7 m or more in search of prey. Active between March and November but may be found outside this period if weather conditions are suitable. Mating takes place in April and May. Oviparous; females lay 5–18 eggs in June or July. Juveniles emerge in September. Usually a common species in S of range; partly because of its active foraging strategy often seen as road kill.

Subadult Caspian Whip Snake with remnants of the juvenile pattern. Montenegro.

Black Whip Snake *Dolichophis jugularis* (Linnaeus, 1758)

belly of adult

belly of juvenile

Black Whip Snake

DESCRIPTION

TL: up to 200 cm or even 250 cm. Large, robust snake. Adults characterised by deep black dorsal coloration, with dark orange to red discoloration on the lower part of the head and throat. Parts of the snout, upper and especially lower jaw white, with black-edged scales. Underside variable; in our area usually faint red or yellow with irregular black marks, sometimes completely black or with cream head and white underside. Both sexes may show lighter, occasionally brownish, dorsal coloration and yellowish ventral colours, similar to that of juveniles (see also Variation). Juveniles and subadults below roughly 80 cm show light brown or occasionally olive dorsal colours, with the upper body showing dark brown spots bordered and/or partially interspersed with white streaks; the underside is yellow, sometimes with dark blotches and/or red spots or discolorations. White streaks on the head are especially apparent in juveniles. This colour pattern darkens with age and increasing size. Dorsal scales unkeeled and in 19 rows across the mid-body.

DISTRIBUTION

In our area, only on S Greek islands along the Turkish Coast: Halki, Kastellorizo (not mapped), Kos, Leros, Rhodes, Symi and Tilos. Also Cyprus, Turkey and the Middle East.

VARIATION

The often somewhat lighter-coloured individuals from Rhodes, Symi, Tilos and Chalki have been described as *D. j. zinneri*. In addition they have fewer than 200 ventral scales, in contrast to more than 200 in *D. j. jugularis*.

HABITAT

Dry, open areas such as banks of (temporary) rivers and streams, rocky slopes and fields; can often be found close to human habitation in gardens, olive groves or vineyards.

BIOLOGY

Diurnal but may become crepuscular or even nocturnal in the hot summer months. Feeds mainly on small mammals, birds and lizards which it actively chases. Cannibalism has been reported several times in this species. Usually bites when handled. Active between February and November but may also be active in winter as well, when weather conditions are optimal. Not much is known about its reproduction, but presumably it is similar to that of Caspian Whip Snake *Dolichophis caspius*.

A subadult Black Whip Snake, ssp. *zinneri*. Symi, Greece.

Black Whip Snake inhabits fairly inhospitable habitats. Symi, Greece.

Reddish Whip Snake *Platyceps collaris* (Müller, 1878)

Reddish Whip Snake

DESCRIPTION

TL: up to 70 cm or even 100 cm. A very slender snake, similar in appearance to Dahl's Whip Snake *Platyceps najadum*, but pre- and postocular scales black, the first black ocelli usually connected across the neck (rare in Dahl's Whip Snake) and often extend into a black streak that reaches the nostrils. Ocelli not necessarily gradually arranged by size and may continue onto the posterior part of the body as small dots. Dorsal scales unkeeled and in 19 rows across the mid-body.

DISTRIBUTION

In our area only the Black Sea coast of Turkish Thrace and SE Bulgaria. Also Turkey and the Middle East.

VARIATION

Populations in our area have been assigned to the subspecies *P. c. thracius*, which is smaller than the Middle Eastern nominate subspecies, and has fewer ventral scales.

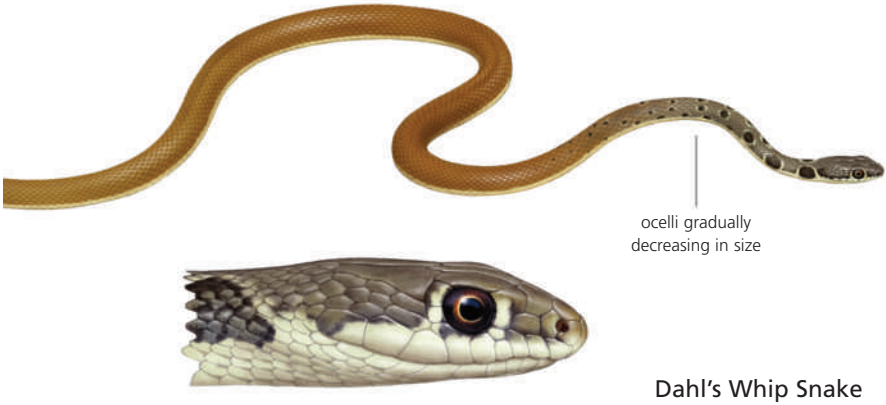
HABITAT

A lowland species in Europe (always below 200 m), which occupies stony habitats such as eroded hillsides, rocky outcrops and boulder formations, usually surrounded by forests or well-vegetated habitats. Outside of Europe in drier habitats, up to 2,200 m.

BIOLOGY

Diurnal but may become crepuscular in summer. Hunts on the ground for lizards which form the bulk of its diet, but may also take insects. A swift, agile, shy snake that flees readily when approached. Usually does not bite when handled, but often empties anal glands. Active between March and October. Mating takes place in April and May. Oviparous; females lay 2–6 eggs in June or July, which hatch in August or September.

Dahl's Whip Snake *Platyceps najadum* (Eichwald, 1831)



Dahl's Whip Snake

DESCRIPTION

TL: up to 120 cm or even 140 cm. A very slender snake. Head clearly distinct from the body with large eyes and round pupils. Head and first quarter of the body usually grey with round, black, white-rimmed ocelli on the sides, shrinking in size further along the body. Rest of the body uniform beige-brown. Belly, throat and pre- and postocular scales white, cream or light yellow. Dorsal scales unkeeled and in 19 rows across the mid-body.

DISTRIBUTION

E Adriatic coast, S from Starigrad (Croatia), through Montenegro, Albania, S Serbia, Macedonia, most parts of Greece, including some Aegean and Ionian islands (Aegina, Agkistri, Chios, Corfu, Euboea, Kalamos, Kalymnos, Karlonissos, Kastos, Kea, Kos, Kythnos, Lemnos, Leros, Lesbos, Oxia, Patmos, Poros, Provati, Rhodes, Salamina, Samos, Samothrace, Spetses and Thasos) and a few Croatian islands (e.g. Pag). Outside our area, also Turkey and the Middle East.

VARIATION

The individuals in our area are assigned to the subspecies *P. n. dahlii*, though some authors include those from Rhodes with the nominate subspecies while the dark-coloured population from Kalymnos has been assigned to *P. n. kalymnensis*.

HABITAT

Occurs in dry, stony habitats with low vegetation, stone steppes but also cultivated biotopes such as vineyards and olive groves with dry-stone walls or old ruins. Predominantly a lowland species, but can be found up to 2,000 m.

BIOLOGY

Diurnal but may become crepuscular in hot weather. An extremely fast snake which actively hunts lizards on the ground and on dry-stone walls. Readily bites when handled.

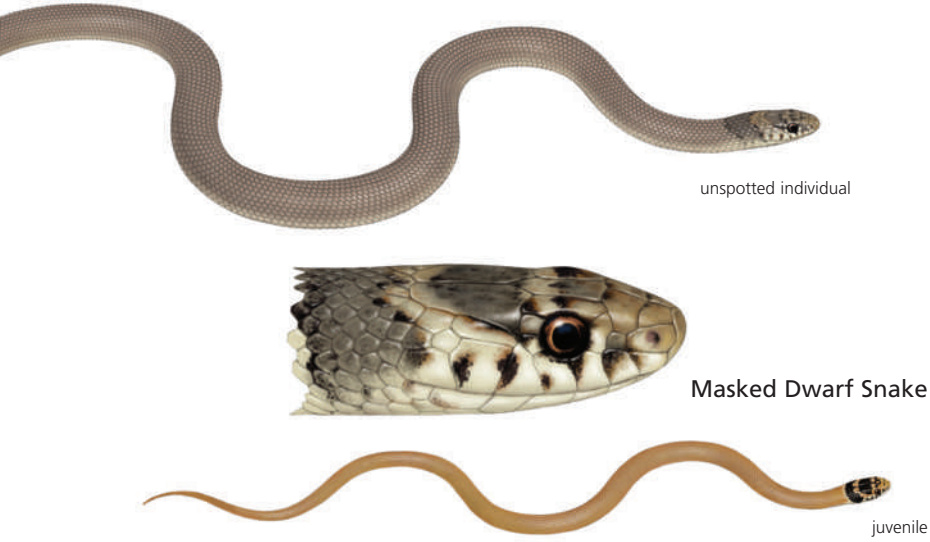
Dahl's Whip Snake, ssp. *kalymnensis*. Kalymnos, Greece.

Active between March and October. Mating takes place in April or May. Oviparous; females lay 3–16 eggs in June or July and juveniles hatch in September. May be abundant in suitable habitat.

NOTE

Although not a venomous snake in the strict sense because it has no fangs, the bite can cause poisoning symptoms if blood is drawn and the saliva has the time to work its way into the wound. This will quickly cause the death of prey, although in humans symptoms are restricted to swelling of the wound or even the lymph nodes. This phenomenon has also been observed in other whip snakes (e.g. Algerian Whip Snake *Hemorrhois algirus*).

Masked Dwarf Snake *Eirenis modestus* (Martin, 1838)



DESCRIPTION

TL: 60 cm. Small, fairly slender snake. Head not very distinct from the body, but broader. Top of the head dark, bordered by a light U-shaped (open to the front) collar, often a light M-shaped blotch between

the eyes and a dark crossbar on the neck. Juveniles especially vivid, with adults often being rather dull. Body uniform grey, beige or sand-coloured. Belly uniform cream or yellow. Dorsal scales unkeeled and in 17 rows across the mid-body.

DISTRIBUTION

In our area only on Greek islands along the Turkish coast: Chios, Fourni, Kalymnos, Kastellorizo, Leros, Lesbos, Samiopoula, Samos and Symi, Presence in Turkish Thrace requires confirmation. Also in Turkey and the Caucasus.

VARIATION

Individuals with rows of dark blotches on the (first half of the) body exist in many populations. Because of this, populations in our area have been named *E. m. semimaculatus*, which has been used both to denote a subspecies as well as a morph.

HABITAT

Typical inhabitant of dry, rocky areas with sparse vegetation. It can be also be found in woodland, fallow agricultural land and cultivated areas.

BIOLOGY

Crepuscular, spending most of its time under stones and in rock crevices, hunting for invertebrates (most commonly grasshoppers, crickets and beetles but also centipedes and scorpions) and small lizards. Infrequently found above ground in sunny weather, avoiding direct sunlight. When disturbed, does not tend to flee immediately but may bite when handled. Active between March and October. Mating takes place until June. Oviparous; females lay 3–8 eggs in July and juveniles emerge in September. Usually not an uncommon species, with sightings being more frequent in spring.

Masked Dwarf Snake, ssp. *semimaculatus*. Symi, Greece.

Four-lined Snake *Elaphe quatuorlineata* (Bonnaterre, 1790)

DESCRIPTION

TL: up to 200 cm or even 250 cm. Large, robust snake. Head clearly distinct from the body. Adults with grey, olive or beige ground colour, often in a darker shade on the back. Black lines run along each side of the back as well as below them on each flank. Black streak from the eye to the corner of the mouth. Juvenile pattern is markedly different, with dark, black bordered irregular patches on the back and a row of black blotches on each flank, usually more greyish than adult ground colour. New-borns with completely dark markings. Subadults have intermediate pattern and colours. Dorsal scales somewhat keeled and in 25 (23–27) rows across the mid-body.

DISTRIBUTION

Mainland Italy, from Tuscany southwards and along the entire E Adriatic coast. In the south becoming more widespread inland and to the east, covering much of Albania, S Serbia, Macedonia, most parts of Greece (except the NE) and extreme SW Bulgaria. Also on many Aegean and Ionian islands (Amorgos, Andros, Corfu, Euboea, Heraklia, Ios, Kalamos, Karlonissi, Kea, Cephalonia, Mykonos, Naxos, Paros, Provati, Schinoussa, Skiathos, Skyros, Spetses, Tinos, and Zakynthos). Records from Sicily and some Greek islands (including Milos) are of doubtful validity or incorrect.

VARIATION

While the nominate subspecies *E. q. quatuorlineata* inhabits the mainland, several subspecies characterised by smaller adult size (TL: usually 120 cm) and the development of adult markings at 60 cm length have been described from island populations in the Aegean. Those additionally supported by genetic evidence are *E. q. scyrensis* from Skyros and *E. q. muenteri* from the Cyclades (confirmed from Andros, Naxos, Amorgos, Ios, but populations from nearby islands including Paros, from which *E. q. parensis* was described, probably also belong to this subspecies).

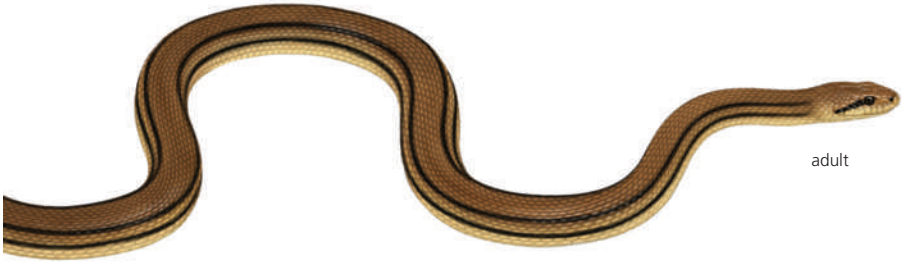
HABITAT

Inhabits (often relatively humid) Mediterranean biotopes, usually with ample vegetation such as meadows with broad hedgerows, edges of open deciduous forests and scrubby areas around swamps and lakes. Habitats on Greek islands may be much drier and characterised by maquis vegetation and dry-stone walls. Normally below 900 m, but up to 1,400 m in the S of its area.

BIOLOGY

Diurnal and crepuscular. Usually calm and relatively slow-moving. Rarely bites when handled. Hunts on the ground or, being an able climber, in vegetation searching for warm-blooded animals and their nests. Also swims rather well and even occasionally feeds on fish. May show increased activity during twilight hours. Active between March and October with mating taking place in April or May. Oviparous; females lay 3–18 eggs in July or August and juveniles emerge two months later.

Four-lined Snake



adult

subadult

juvenile

NOTE

This species and the Aesculapian Snake *Zamenis longissimus* are renowned for their part in a religious snake feast in the Italian Abruzzi town of Cocullo, in which the patron saint's statue (Domenico di Sora) is carried in procession covered with live snakes. After the ceremony, the snakes are released in the surrounding woods.

Blotched Snake *Elaphe sauromates* (Pallas, 1811)

Blotched Snake

DESCRIPTION

TL: 200 cm (or even 250 cm), but usually smaller. Similar in build to Four-lined Snake *Elaphe quatuorlineata*, but dorsal scales slightly less keeled. Top of head and line running diagonally downwards from behind the eye, dark brown or black. Body light grey in juveniles, interspersed with distinct dark brown or black blotches which fade during growth. Adults show whitish or yellow body, rarely reddish; the faded pattern of dark blotches and presence of black spots on top of the dorsal scales gives them a 'dirty' appearance which contrasts sharply with the bright white or yellow scales around the mouth. Underside uniform white or yellow. Dorsal scales in 25 (23–27) rows across the mid-body.

DISTRIBUTION

NE Greece (provinces of East Macedonia and Thrace, including the islands of Thasos and Samothrace), Turkish Thrace, Bulgaria (mainly in SE, but throughout most of the C and E parts of the country, except the SW), SE and E Romania, Moldova and S, C and E Ukraine (including Crimea). Outside our area also Turkey, the Middle East and SW Russia.

VARIATION

Monotypic species. Previously considered a subspecies of Four-lined Snake.

HABITAT

In Europe, typically a lowland species of open, humid steppes with scattered bushes, river valleys and open deciduous forest, but may also be found in drier habitats.

BIOLOGY

Diurnal. In contrast to its Four-lined congener, will usually strike readily and bite when caught. Being an able climber, it feeds generally on birds and raids their nests. Also takes rodents and reptiles. Active between February and November depending on local weather conditions. Mating takes place in April and May. Oviparous; females lay 4–16 eggs in June, July or August and juveniles emerge in August or September.

Steppe Snake *Elaphe dione* (Pallas, 1773)

Steppe Snake

DESCRIPTION

TL: 100 cm or even 120 cm. Medium-sized snake. Ground colour grey or beige with rows of dark transverse bars and/or light or dark longitudinal lines on the back. Head marked with a bold dark streak from the corner of the mouth to the eye, extending into a dark bridle over the snout. U-shaped mark on the neck, opening posteriorly. Dorsal scales somewhat keeled on centre of back but smooth on flanks, and in 25 (21–28) rows across the mid-body.

DISTRIBUTION

In our area only present in SE Ukraine, but occupies a large range across Russia, the Caucasus area, NE Turkey, Azerbaijan, Turkmenistan, Uzbekistan, Kazakhstan, Tajikistan, Kyrgyzstan, Mongolia, N China and North Korea.

HABITAT

In our area a lowland species from steppes with loamy or rocky soil, especially around small brooks or temporary ponds. Also arable land, gardens or open forest.

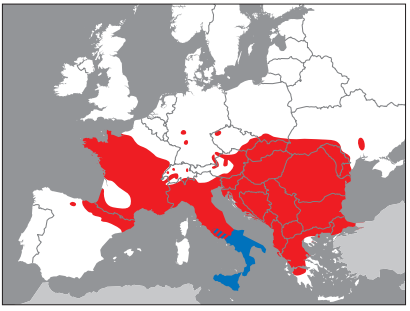
BIOLOGY

Diurnal but may be nocturnal during hotter parts of the year. Hunts on the ground for small mammals, mostly mice and hamsters, and birds and their nests. Prey is killed by constriction. Often lives in rodent burrows, such as holes of Bobak Marmots *Marmota bobak* and sousliks *Spermophilus* spp. A calm snake that rarely bites but may rapidly shake tail against vegetation to create a rattling sound if disturbed. Active between February and November; however, this may be considerably shorter at higher elevations. In our area mating takes place in April. Oviparous; females lay up to 24 eggs by the end of June.

Aesculapian Snake *Zamenis longissimus* (Laurenti, 1768)
Italian Aesculapian Snake *Zamenis lineatus* (Camerano, 1891)

DESCRIPTION

TL: up to 200 cm or more; Italian only up to 160 cm. Large, fairly slender snakes. Head relatively long and narrow. Eye with round pupil. Iris yellowish or greyish in Aesculapian Snake, while copper to deep red in Italian. Four dark dorsolateral lines especially common in Italian (but usually narrower than in Four-lined Snake *Elaphe quatuorlineata*). Adults often shiny grey, olive, beige or brown with numerous small bright white dorsal scale edges (all over body in Aesculapian, but rather restricted to area of stripes in Italian). Belly and lower part of the head (from the eye down) yellow or cream. Juveniles with black streak from eye to corner of mouth, yellow or cream crescent-shaped blotch on sides of head with a black streak behind it, and black blotch under eye; these fade with age, head markings persisting somewhat. Dorsal scales smooth, sometimes slightly keeled in posterior body sections; 23 (rarely 21) rows across mid-body. Outer edges of ventral scales keeled to facilitate climbing.



Aesculapian Snake
Italian Aesculapian Snake

DISTRIBUTION

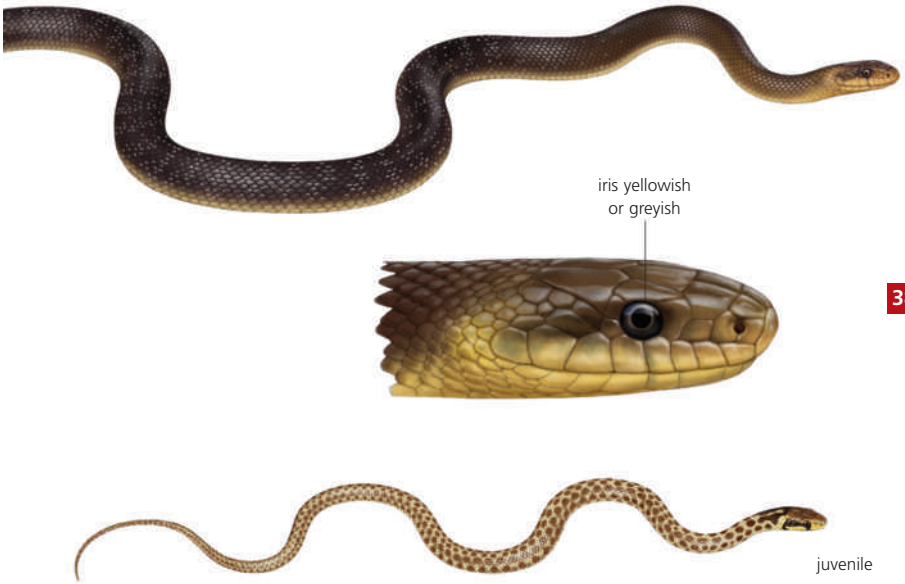
Aesculapian: France (not N of Paris), NE Spain (from Santander to Barcelona), N and C Italy (approximately N of Rome), isolated populations in W Germany and N Czech Republic, large parts of C and E Europe, from Switzerland to S Poland south to Greece, but absent from most Greek islands (except Corfu, Paxos and Samothrace). Sardinian records doubtful. Introduced to two sites in the UK (not mapped). Outside our area, also E Black Sea coast and N Turkey.
Italian Aesculapian: S Italy and Sicily; NW to Monti Lepini (S Latium), NE to C Molise. Overlap with Aesculapian in Campania and Molise, maybe also in N Apulia.

HABITAT

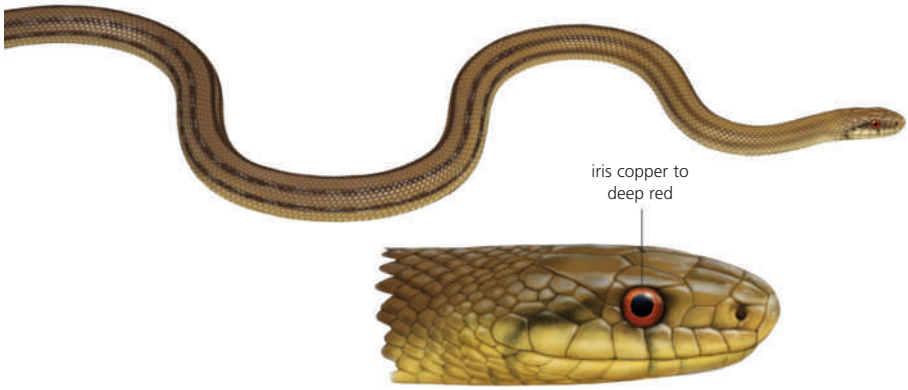
Typical of forested, moderately warm and humid, hilly or rocky habitats, often with lush vegetation alternating with sunny basking spots, but Italian Aesculapian also in drier Mediterranean scrubland. Frequently found near overgrown ruins, dry-stone walls, abandoned railway tracks, etc. In northern

Uniformly coloured Italian Aesculapian Snake. Calabria, Italy.

Dark-coloured Aesculapian Snakes are a fairly regular sight in the Balkan Peninsula. Primorsko, Bulgaria.



Aesculapian Snake



Italian Aesculapian Snake

areas, restricted to warm, south-facing microhabitats.

BIOLOGY

Diurnal. In summer, often most active in cloudy weather or in between rain showers; may even become crepuscular. They actively hunt small mammals and birds, climbing shrubs and even high up in trees or buildings. In spring, birds, nestlings and eggs may form a considerable part of their diet. May bite and excrete faeces when handled. Active from March to October, although varies with latitude and elevation. Males fight over females; mating takes place in May or June. Oviparous; female lays 2–12 eggs (rarely up to 18) in June or July. Suitable egg deposition sites may be used by several females. Juveniles emerge in August or September.

NOTE

Italian Aesculapian Snake was previously regarded as a subspecies of Aesculapian Snake, as *Elaphe longissima romana*.

Leopard Snake *Zamenis situla* (Linnaeus, 1758)

leopardinus morph

situla morph

Leopard Snake

DESCRIPTION

TL: up to 100 cm or even 120 cm. Medium-sized snake. Head long and not very distinct from the body. Ground coloration grey, yellowish or beige with either black-bordered reddish transverse blotches or longitudinal lines. Usually Y-shaped marking on the back of the head, often extending between the eyes. Row of black and (sometimes) red blotches on each flank. Black streak from the corner of the mouth extends towards upper posterior edge of the eye. Black bridle from eye to eye. Black blotch under the eye. Pupil round, iris copper-red. Dorsal scales unkeeled, arranged in 27 (rarely 25) rows across the mid-body.

DISTRIBUTION

SE of Italian mainland (mostly S Apulia), SE Sicily, Malta, E Adriatic coast from Istria southwards, Albania, S Bulgaria, Greece, including many Aegean and Ionian islands (Alonissos, Andros, Chios, Corfu, Crete, Euboea, Ithaca, Kea, Cephalonia, Kos, Kythira, Kythnos, Lesbos, Milos, Paros, Rhodes, Salamina, Samos, Santorini, Serifos, Sifnos, Skopelos, Skyros, Spetses, Syros, Tinos and Zakynthos), Turkish Thrace and the Crimea. Also W Turkey.

VARIATION

No subspecies have been described, but individuals can be roughly divided into

two morphs: *leopardinus* with transverse blotches, and *situla* with longitudinal lines. While either morph may be more dominant within a particular population, both may coexist and transitional morphs occur.

HABITAT

Typical inhabitant of fairly dry, stony habitats such as Mediterranean maquis, also cultivated biotopes like vineyards and olive groves with dry-stone walls or old ruins.

BIOLOGY

Diurnal, often active during or after rain showers. In warmer parts of the year may be nocturnal and can be found at twilight or at night. Mostly ground-dwelling where it hunts for mice which form the major part of the diet. Will also climb dry-stone walls, bushes and trees, hunting for birds and lizards. Secures prey by means of constriction. Rather cryptic, thus often found only by uncovering them from under all sorts of natural and man-made objects. May bite when disturbed and rattle the tail, but usually calm. Active between February and November but inactivity may be interrupted during periods of warm weather. Mating takes place between March and May with a single copulation which is known to last for up to three hours. Oviparous; eggs are mostly laid in July. Eggs are relatively large and clutches consist of up to 8 eggs. Juveniles emerge in August or September.

ABOVE: Juvenile Leopard Snakes often display more reddish spots. Peloponnese, Greece.

RIGHT: Leopard Snake. SW Bulgaria.

Ladder Snake *Rhinechis scalaris* (Schinz, 1822)

Ladder Snake

DESCRIPTION

TL: 120 cm or even 150 cm. A fairly large, robust snake. Head distinct from the body, and with pointed snout. Marked differences between adult and juvenile pattern. Adults have grey or beige ground colour with a black line on each side of the back. Juveniles have a row of black H-shaped markings on the back, often connected into a ladder pattern, irregular black blotches or bars on the sides, a black streak from the eye to the corner of the mouth, a black blotch under the eye and sometimes an X-shaped black marking connecting eyes and nostrils. Head markings gradually fade with age. Rostral scale large and wedged between the internasal scales. Dorsal scales unkeeled, arranged in 27 (rarely 25 or 29) rows across the mid-body.

DISTRIBUTION

Iberian Peninsula (except the NW coast and wider Pyrenean area) and the Mediterranean area of S France. Records from NW Italy require confirmation. Also introduced and widespread on the Balearics where it breeds on Menorca and (more recently) Ibiza and even on the islet of Illa d'en Colom. More recently also recorded from Mallorca and Formentera (not mapped).

HABITAT

Confined to typical warm Mediterranean habitats, especially maquis or other scrubby areas such as wild gardens or vineyards with dry-stone walls. Also in dune areas and open forests. Generally a lowland species which occurs up to 700 m, but can be found in C and S Spain up to 2,000 m, e.g. in open pine forest interspersed with rocky areas.

BIOLOGY

Most active during the day in cloudy weather or in between rain showers; during hot summer months sometimes nocturnal. Actively hunts small mammals on the ground. Also found climbing in shrubs, trees or dry-stone walls, looking for lizards or birds and their nests. Highly mobile, with considerable daily movements and a relatively large home range. Often hisses loudly with gaping mouth when disturbed and may bite when handled, lunging towards the attacker. However, when found at night, e.g. on roads, it is clearly more placid. Active between February and November but hibernation may be interrupted during sunny weather conditions. Mates between April and June. Oviparous; up to 22 eggs are laid in June or July and juveniles emerge in September or October. Females are known to check on the eggs days after they are laid.

Juvenile Ladder Snake. Andalucia, Spain.

Ladder Snake with remnants of juvenile pattern. Menorca, Spain.

Smooth Snake *Coronella austriaca* Laurenti, 1768

belly of adult

belly of juvenile

Smooth Snake

DESCRIPTION

TL: 70 cm or even 90 cm. A fairly slender snake, often with a shiny appearance. Head not very distinct from the body. Grey, beige or brown above with rows of dark grey, brown or reddish blotches along the back, sometimes merging into transverse bars or even longitudinal lines. Dark blotch on the back of the head, often with two extensions to the back, sometimes continuing in rows of dorsal blotches. Dark eye-stripe from the nostril to the side of the head, often continuing in a row of dots on the flanks. Belly usually rather uniformly coloured; often dark and lightly dappled, but especially in juveniles may also be brighter (e.g. orange). Rostral scale triangular and large, wedged between the internasal scales. Usually 7 supralabial scales, third and fourth touching the eye (see Fig. 42). Dorsal scales unkeeled, arranged in 19 (rarely 17 or 21) rows across the mid-body.

DISTRIBUTION

Widespread over European mainland, from S Scandinavia southwards. In S Europe confined to mountain areas. Also S England, Elba and on Sicily, but absent from most of the other Mediterranean islands. In Spain reaches S to mountains of Andalucia, including an occurrence in the Sierra de Aljibe which seems to require confirmation. Outside our area also N Turkey, Caucasus and Russia.

VARIATION

C. a. acutirostris: from the N and NW Iberian Peninsula (excluding Pyrenees, S to the Serra da Estrela) remains relatively small and has a narrow head and a pointed snout with very notable rostral wedge between the internasal scales.

The subspecies *C. a. fitzingeri*, from Italy including Sicily, is no longer considered valid.

HABITAT

Sunny rocky or sandy areas including quarries, heathlands, partially-vegetated road banks and dry-stone walls, often quite close to forests and generally in hilly terrain. Populations in the S of the distribution occur in largely rocky habitats in mountain ranges, usually close to streams or other waterbodies at higher altitudes. Occurs up to 2,700 m in the Sierra Nevada, Spain.

BIOLOGY

Diurnal and rather cryptic, most often encountered in cloudy weather conditions or in between rain showers when individuals are tempted to leave their cover and bask more openly. May show increased activity at twilight. Feeds mainly on lizards but may even feed on other snakes including vipers. Secures prey by means of constriction. When handled, often strikes and bites but may also coil up into a ball and hide its head. May be active between February and November depending on latitude and elevation; however, this can be considerably longer in N of range. Usually mates in April or May. Ovoviviparous; females are often seen basking in August and may gather communally in suitable basking spots. Up to nine juveniles are born in late August or September.

ABOVE: Dark-coloured Smooth Snake. S Germany.

RIGHT: Smooth Snake. Moncayo, Spain.

Southern Smooth Snake *Coronella girondica*

(Daudin, 1803)

Southern Smooth Snake

belly

DESCRIPTION

TL: up to 70 cm. Very similar to Smooth Snake *Coronella austriaca*, but dark stripe runs from eye to the side of the head, more frequently with dark 'bridle' over the snout, belly contrasting with black blotches arranged in two (intermittent) stripes, rostral scale small and not wedged between the internasal scales. Usually eight supralabial scales, of which the fourth and fifth touch the eye (see Fig. 42). Also, back tends to be slightly more often tinged with orange or pink. Dorsal scales unkeeled, usually 21 rows across the mid-body.

DISTRIBUTION

Iberian Peninsula, S France (north up to Ile d'Oléron), N Italy (south more or less to Rome. Outside our area also in N Africa.

VARIATION

Individuals from Murcia and the Baetic mountains (e.g. Sierras de Espuña, Nevada, Baza) and associated lowlands in the SE Iberian Peninsula show 19 instead of the usual 21 dorsal scale rows, and often display transverse bars; they probably represent an undescribed subspecies.

HABITAT

A lowland species of relatively dry sandy and rocky areas in temperate forests and Mediterranean scrubland. Often found in or near abandoned human constructions such as ruins, quarries, and dry-stone walls in agricultural areas. Usually occurs below 900 m, but in Spain as high as 1,600 m, where it may even (rarely) coexist with Smooth Snake.

BIOLOGY

Crepuscular or nocturnal; also active during the day during spring rains. Hunts on the ground or under stones for lizards. Secures prey by constriction. Unlike Smooth Snake, does not bite readily, but excretes faeces and the contents of anal glands. Mainly active between March and November, with mating taking place in May. In contrast to Smooth Snake, this species is oviparous and lays up to 16 eggs that emerge in August.

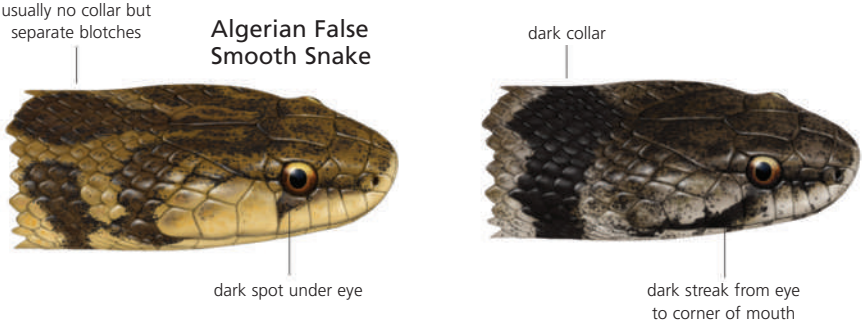
Iberian False Smooth Snake *Macroprotodon brevis*

(Günther, 1862)

Algerian False Smooth Snake

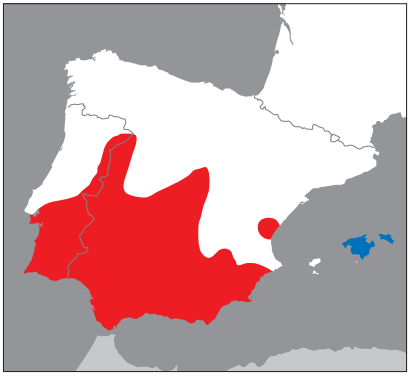
Macroprotodon cucullatus (Geoffroy Saint-Hilaire, 1827)

Iberian False Smooth Snake



DESCRIPTION

TL: 65 cm. Fairly slender but short-bodied. Head long and flattened with a short snout. Pupils vertically oval-shaped in clear light (but may appear round otherwise). Pale grey or brown above with a row of dark blotches along mid-back, flanked by rows of smaller dots. One supralabial scale (usually sixth) large, touching or nearly touching parietal scale (see Fig. 42). Iberian False Smooth Snake has a dark grey or brown collar over the neck with a central (usually anteriorly pointing) bulge. Dark streak under the eye, running towards the corner of the mouth. In some cases, head may be almost completely black. Belly whitish, yellow or pinkish with black more or less square blotches, often arranged in one or two (intermittent) stripes. Dorsal scales unkeeled. 19–23 rows of dorsal scales on the mid-body. Algerian False Smooth Snake differs in neck markings: large dark brown or grey blotch on top of the head connected by a thin line to a smaller one on the neck and to a crescent-shaped blotch on the side of the head, a second oval blotch on the side of the neck and a dark spot under the eye. Generally more yellowish. No, or reduced, markings on belly and 19, more rarely 21, rows of dorsal scales on the mid-body.



Iberian False Smooth Snake

Algerian False Smooth Snake

DISTRIBUTION

Iberian False Smooth Snake: The Iberian Peninsula, mainly S of the Sistema Central, with few populations recorded north of these mountains. Outside our area also in Morocco.
Algerian False Smooth Snake: Only present within Europe as introduced species on Mallorca and Menorca. Native to N Africa and the Italian island of Lampedusa.

VARIATION

Iberian False Smooth Snake: The Iberian individuals are attributed to the subspecies *M. b. ibericus*; the nominate subspecies is found in Morocco.
Algerian False Smooth Snake: Balearic individuals have been assigned to the subspecies *M. c. mauritanicus* (or, erroneously by several authors, even as a separate species *M. mauritanicus*).

HABITAT

Thermophile, normally a lowland species typically found in areas with loam or sandy soil and large boulders or loose rocks and stones. However, also occurs in a wide variety of habitats including coastal maquis, dunes, pine forests or orchards. Can be found up to 1,500 m in S Spain.

BIOLOGY

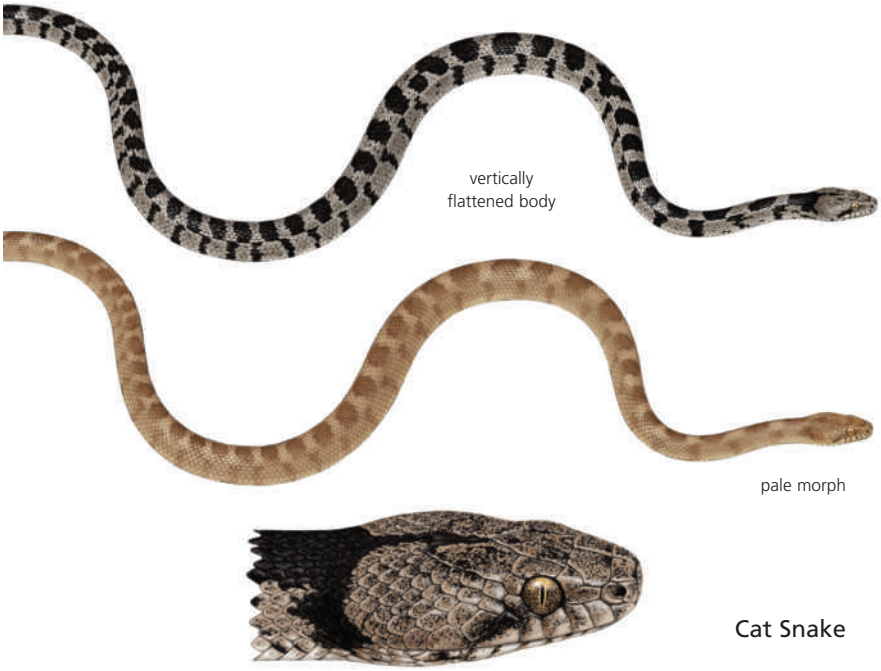
Iberian False Smooth Snake is almost completely crepuscular or nocturnal, hunting on the ground or under stones for lizards, geckos and worm lizards, the latter constituting up to half of its menu. Algerian False Smooth Snake appears more diurnal than its congener on the mainland. On the Balearics, preys on mammals and nestling birds. When disturbed, may roll to form a ball and pretend to strike, while emitting faeces. Sometimes bites. Active between February and November, but commonly seen on warm winter days and may be active throughout the year in S of range. Mating takes place between March and May. Females lay up to seven eggs in June or July and juveniles emerge in August or September.

VENOM

Opisthoglyphous. Venomous but no cases of envenomation of humans are known. The rear fangs reduce the possibility of venom injection, the mouth is too small and the toxicity of the venom is too low to cause obvious symptoms.

Algerian False Smooth Snake. Menorca, Spain.

Cat Snake *Telescopus fallax* (Fleischmann, 1831)



DESCRIPTION

TL: usually less than 100 cm but sometimes up to 120 cm. Fairly slender and elegant, yet strong snake. Head rather small, but somewhat broad and flat, clearly distinct from the slightly vertically flattened body. Eyes with vertical pupils (in clear light; may be round at night). Body grey or beige with large irregular dark transverse bars or blotches on the back and a row of interspersed smaller ones on each side. Usually with a dark collar, often extending to the middle of the head. Belly pale white, yellow or pinkish with dark speckled blotches. Dorsal scales unkeeled, usually arranged in 19 (rarely 17 or 21 – see Variation) rows across the mid-body.

DISTRIBUTION

From the Italian Adriatic coast (near Duino) south through Croatia, W Bosnia and Herzegovina, Montenegro, Albania, S Serbia, Macedonia and S Bulgaria. Inhabits most of Greece, including many Aegean and Ionian islands (Agkistri, Amorgos, Andros, Cephalonia, Chios, Christiani, Corfu, Crete, Dilos, Aegina, Euboea, Ikaria, Kalymnos, Karpathos, Kasos, Kea, Kimolos, Kythira, Antikythira, Koufonissi, Lesbos, Milos, Mykonos, Paros, Antiparos, Polyaegos, Rhodes, Samos, Santorini, Serifos, Symi, Syros, Tinos, Tourlo, and Zakynthos). Also Turkish Thrace and Malta. Outside our area occurs in Turkey, Caucasus and the Middle East.

VARIATION

The nominate subspecies has 19 rows of dorsal scales at the mid-body, while some island populations in the Aegean have 21–22. Individuals in these populations often show less contrasting markings, and several subspecies have been described:
T. f. intermedius: Antikythira.
T. f. multisquamatus: Koufonissi islet off Crete.
T. f. pallidus: Crete, Gavdos, Elassa, Christiani, Santorini, Kasos.
T. f. rhodicus: Rhodes.

Dark transverse bars on back appear to be lighter in colour and more brownish in southern subspecies and more blackish in the nominate subspecies.

HABITAT

All sorts of warm rocky or stony areas such as stone steppes, rocky slopes with maquis or garrigue, or even open deciduous forest, orchards and gardens with dry-stone walls, old ruins, sometimes close to human settlements. Usually a lowland species, but can be found up to 1,300 m in Greece.

BIOLOGY

Almost completely crepuscular or nocturnal. Most readily found while turning stones in spring or autumn. On warm summer nights often found climbing slowly inside or along dry-stone walls or rocky outcrops. Hunts especially for lizards, with geckos being its main prey, but sleeping wall lizards, skinks and even chameleons may also be taken. Usually calm, not readily fleeing when discovered. When handled, also usually placid but some individuals may hiss or bite. Usually active between March and October but hibernation may be short or facultative in south of range. Usually mates in May. Females lay up to nine eggs in July and juveniles emerge in August and September.

VENOM

Opisthoglyphous. Venomous but no cases of envenomation of humans are known. The rear fangs reduce the possibility of venom injection, and the venom is of too low toxicity to cause obvious symptoms.

NOTE

In the town of Markopoulo on Cephalonia this snake is used in religious processions in early August.

Cat Snake inhabits many Aegean Islands. Skyros, Greece.

Water Snakes (Natricidae)

The Natricidae family contains 32 genera and some 210 species found worldwide. They are often among the most abundant and most easily found snake species within their range, e.g. European Grass Snake *Natrix natrix* in Europe and Garter Snake *Thamnophis* spp. in North America. They are usually closely associated with water. Four species from the Eurasian genus *Natrix* can be found within our area, and all are egg-laying. They are medium to large snakes with keeled body scales, large scales on top of the head, round pupils and a contrasting belly pattern.

Key to Water Snakes	
Nostrils on the side of the snout, not clearly pointing upwards. Usually 19 dorsal scale rows across the mid-body. Usually 7 upper labial scales with 3rd and 4th touching the eye. 1 preocular scale. 2–4 postocular scales. Very widespread.	Grass Snake *Natrix natrix* and Iberian Grass Snake *Natrix astreptophora*
Nostrils pointing upwards. Usually 19 dorsal scale rows across the mid-body. Usually 8 upper labial scales with 4th (sometimes also 5th) touching the eye. Usually 2 or 3 preocular scales. 3–4 postocular scales. C and E Europe.	Dice Snake *Natrix tessellata*
Nostrils pointing upwards. Usually 21 dorsal scale rows across the mid-body. Usually 7 upper labial scales with 3rd and 4th touching the eye. 1–2 (3) preocular scales. 2 (3) postocular scales. SW Europe.	Viperine Snake *Natrix maura*

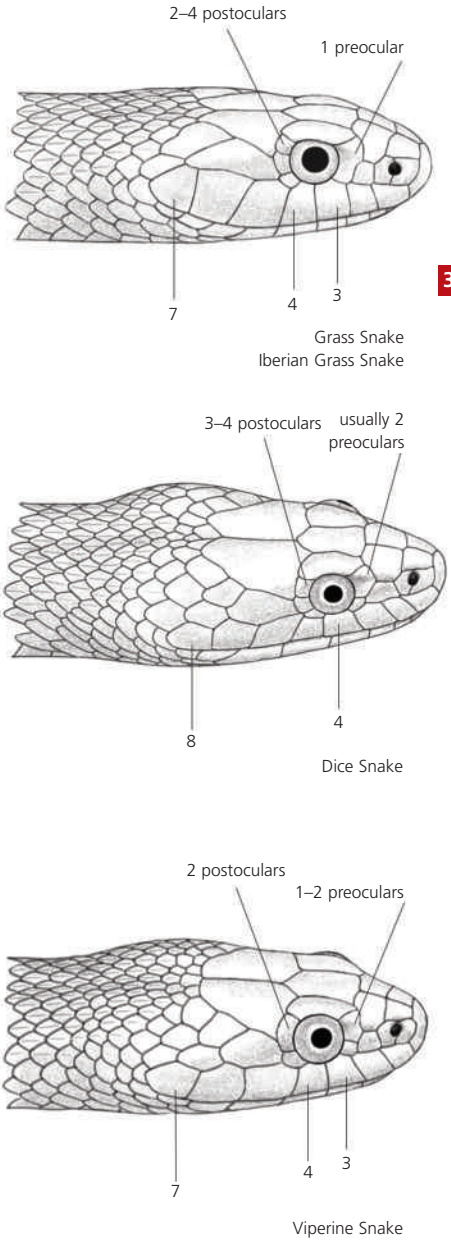


Fig. 43. Heads of water snakes, showing numbered supralabial scales.

Grass Snake — *Natrix natrix* (Linnaeus, 1758)
Iberian Grass Snake — *Natrix astreptophora* (Seoane, 1884)

DESCRIPTION

TL: up to 150 cm or even 200 cm. Medium-sized to large snakes. Head clearly distinct from the body. Grass Snake is typically olive-green, brown or greyish above with rows of black spots on the back and a row of black bars or spots along the sides. Underside usually white or yellowish with bold dark rectangular markings. Characteristic black-bordered yellow collar behind the head. Supralabial scales light and black-rimmed. Many populations contain dark or even melanistic individuals. 6–8 supralabial scales, third and fourth touching the eye. One preocular and 3–4 postocular scales (see Fig. 43). Dorsal scales keeled, arranged in 19 rows across the mid-body. In Iberian Grass Snake, only juveniles have a white and black collar and body markings, while adults lack the collar and are often uniformly brown, grey or olive-green. Iris of the latter species usually vivid orange.

DISTRIBUTION

Grass Snake: Widely distributed on the European mainland, from C Scandinavia to S Greece, S Italy and S France; also present on most Mediterranean islands, but not on Crete or the Balearics. Absent from Ireland and most of Scotland. Reaches E far into Russia. Iberian Grass Snake: Replaces Grass Snake on the Iberian Peninsula and in limited adjacent parts of Mediterranean SW France. Also occurs in NW Africa.

Grass Snake
Iberian Grass Snake

VARIATION

Pattern and colours may vary enormously between and within populations. Traditionally, the following subspecies of Grass Snake are recognised.
N. n. natrix (C Europe, between Rhine and Dnepr, and Scandinavia): yellow, cream or white collar always present; body markings absent or reduced to 4–6 rows of small dots.
N. n. cetti (Sardinia): yellow collar absent; broad vertical bars on the side, reaching almost to the mid-back.
N. n. corsa (Corsica): yellow collar absent; narrow vertical bars on the side; one or two rows of dots on the back.
N. n. fusca (W Cyclades: Kea): ground colour very dark; four rows of large black blotches on the body.
N. n. gotlandica (Gotland island in Sweden): collar deep yellow or orange; often melanistic.
N. n. helvetica (W Europe N of Pyrenees and W of the Rhine, S flanks of the Alps to Istria; also England and Wales): collar cream or yellow; a row of vertical bars on the flanks; small or no dots on the back.
N. n. lanzai (Italian mainland except S): collar cream or light yellow, distinctly black-bordered; vertical bars on the side; three rows of small black dots on the back, sometimes merged into transverse bars.
N. n. persa (Balkans, many Aegean islands): yellow collar not always present; often a row of vertical bars on the flanks; often two light dorsolateral lines.

Grass Snake

N. n. natrix

N. n. persa

N. n. schweizeri

belly

Iberian Grass Snake

N. n. schweizeri (Milos, Kimolos and Polyaegos): yellow collar absent; four rows of large black blotches on the body; often melanistic.
N. n. sicula (Calabria and Sicily): yellow collar mostly absent; snout-tip orange.

Recent molecular data question the validity of a large number of these variations in Grass Snake. Among others, Corsican and Sardinian populations belong to the same lineage (in consequence, all named *cetti*) and the striped *persa* morph occurs in more than one lineage. Four lineages occur in Greece, yet individuals from the Milos Archipelago appear to belong to the same clade as those from mainland Greece, which continues as far north as Scandinavia. Gotland seems to be inhabited by a mix of clades, suggesting multiple waves of colonisation.

Individuals showing a deep orange collar behind the head occur throughout the range; this characteristic has been related to a higher incubation temperature.

Iberian Grass Snake is monotypic.

HABITAT

Both species inhabit all kinds of wetlands – ponds, lakes, streams, marshes and ditches – but not as aquatic as the other two European members of the family. Also found in gardens, open woodland, rough grassland, mostly in the lowlands, but in the south of its area up to 2,300 m.

BIOLOGY

Both diurnal and nocturnal. Often feed largely on frogs and toads, but also take other prey such as fish. In the absence of amphibians, Grass Snakes on the Cyclades feed mostly on small mammals and reptiles. When caught, may hiss and often spray foul-smelling contents of anal glands. Rarely bite, though may flatten and enlarge head and strike with closed mouth. If this does not deter the aggressor, they often feign death, turning belly up with open mouth and tongue hanging out. When threatened, may also flatten head and push the jaws outwards, giving the head a typical triangular viper-look. All European water snakes may display this behaviour. Active between February and November but hibernation may be shorter or facultative in the south. Mating takes place in April and May, often in sizeable mating colonies with dominant males courting the less numerous females. Eggs are laid between May and August, preferably in rotting plant material, also in rotten wood or in burrows. Clutches consist of up to 100 eggs or more, but usually fewer, with larger females laying more eggs. Females may travel great distances, up to several kilometres, to find suitable egg deposition sites.

Sicilian Grass Snakes (ssp. *sicula*) and other Italian subspecies may have an orange snout. Piana delgi Albanesi, Sicily, Italy.

Viperine Snake *Natrix maura* (Linnaeus, 1758)

belly

Viperine Snake

DESCRIPTION

TL: up to 85 cm or even 100 cm. Medium-sized snake. Head clearly distinct from the body. Juveniles are quite slender, while adults become more robust. Typically olive-green, brown or greyish above with two rows of staggered black dots along the mid-back, often merging into a zigzag, viper-like pattern which may fade with age. Often with row of 'ocelli' on flanks. Sometimes two lighter dorsolateral lines (*bilineata* morph). Melanistic individuals also exist. Supralabial scales light and black-rimmed. Underside white, yellow or reddish with bold dark rectangular markings. 6–8 supralabial scales, third and fourth touching the eye. 1–2 (3) preocular and 2 (3) postocular scales (see Fig. 43). Dorsal scales keeled, arranged in 21 rows across the mid-body.

DISTRIBUTION

SW Europe. Iberian Peninsula, France from just north of the Loire Valley southwards, NW Italy and extreme SW Switzerland. Introduced to Sardinia, Menorca and Mallorca.
More recently, also introduced to Corsica (unmapped), but sightings are rare. Outside our area, also in N Africa.

VARIATION

Populations from Sardinia are closely related to those from Tunisia. Individuals from these populations often have a more flattened appearance in comparison to other European ones.

HABITAT

Highly aquatic species, nearly always found in or near ponds, canals, rivers and lakes; also known to inhabit brackish water, coastal marshes, salinas, etc. Tends to occupy larger waterbodies in areas where it coexists with Grass Snake *Natrix natrix*.

BIOLOGY

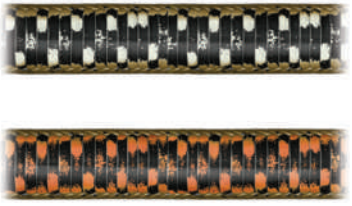
Diurnal and nocturnal, with some populations in the south of its range becoming almost entirely nocturnal during

the hottest months of the year. Preys mainly on fish and amphibians and searches actively for prey using scent, vision and touch. May also hunt by ambush, hanging silently in the water anchored by its tail around a rock or root, waiting for fish to pass. When threatened, may flatten head and push the jaws outwards, giving the head a typical triangular viper look. Active between March and November; however, hibernation may be shorter or facultative in S of range. Mating takes place in April and May and may occur communally like other *Natrix* spp. with several males courting a single female. Females lay about seven eggs (but maybe up to 24) in July. Juveniles emerge two months later. A common snake; may occur in high densities in suitable habitat.

Viperine Snake. La Brenne region, France.

Dice Snake *Natrix tessellata* (Laurenti, 1768)

Dice Snake



belly

DESCRIPTION

TL: up to 100 cm or even 130 cm. Medium-sized snake. Head clearly distinct from the body. Typically olive-green, beige or brown above, often with four rows of sometimes obscure, more or less square black blotches along the body which may merge into transverse bars. May also be completely uniformly coloured or melanistic. Underside usually white, yellow or reddish with bold

dark rectangular markings. 8 supralabial scales, fourth (sometimes also fifth) touching the eye. 2–3 preocular and 3–5 postocular scales (see Fig. 43). Dorsal scales keeled, arranged in 19 rows across the mid-body.

DISTRIBUTION

Much of C and SE Europe. Most of mainland Italy, E Austria, Czech Republic, Slovakia, Hungary, Balkan peninsula, Romania, Moldova and S Ukraine. Relict populations in Germany (Lahn and Nahe River valleys) and Switzerland (Ticino), but also introduced, for example, to several lakes in Switzerland (even displacing Viperine Snake *Natrix maura* in Lac Leman). Absent from most Mediterranean islands, but present on Crete, Corfu, Euboea, Lefkas, Lesbos, Seriphos and Tinos in Greece. Sightings from Krk and Cres in Croatia have been debated, although recent records exist. Outside our area also occurs throughout Turkey, the Caucasus, S Russia, W China, the Middle East and the Nile delta.

HABITAT

Similar to Viperine Snake, but may show an even greater preference for larger waterbodies. In addition, observed at sea in Trieste harbour, the Black Sea and off Crete, hunting for prey on the shoreline.

BIOLOGY

Diurnal and nocturnal, with some populations in the south of the area becoming almost entirely nocturnal during the hottest months of the year. Possibly the most aquatic snake in our area, feeding largely on fish. Active between March and October. Mating takes place from April to July and may occur communally like other *Natrix* species. Females lay 5–37 eggs in July. Juveniles emerge in August or September. A common snake; may occur at very high densities in suitable areas.

Dice Snake. Sveti Naum, Macedonia.

African Sand Snakes (Psammophiidae)

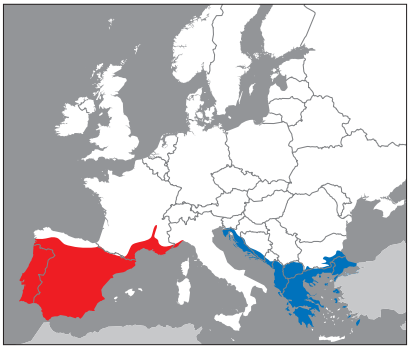
The African sand snake family contains 8 genera and some 50 species found in Africa, the Middle East, Madagascar, S Europe and S C Asia. Distinctive features include the vestigial nature of the male genitalia (hemipenes), which are short, thin and without the ornamentation characteristic of those in other snake families. Two species from the genus *Malpolon* can be found in our area.

Western Montpellier Snake *Malpolon monspessulanus* (Hermann, 1804)

Eastern Montpellier Snake *Malpolon insignitus* (Geoffroy Saint-Hilaire, 1827)

DESCRIPTION

TL: usually less than 200 cm but occasionally up to 250 cm. Strong, formidable snake with characteristic head: large prominent eyes with a distinct 'eyebrow' (a ridge formed by the top of the preocular scale and the supraocular) giving it a stern expression, and top of the head concave. 19 (Western) or 17 (Eastern) dorsal scale rows across the mid-body. Dorsal scales not keeled but grooved. Juveniles greyish or reddish-brown with dorsal pigmentation of lighter, narrow and irregularly shaped transverse bars, rows of dark spots and white dashes on the flanks. Throat in juveniles sometimes uniform yellow, sometimes with bold red or brown markings. Females may retain the juvenile appearance, but become more uniform. Adult males of Western Montpellier Snake with front part of the body uniform yellowish, grey or olive, often followed by a dark grey or bluish 'saddle' on the back, and the posterior part of the body uniform brown, grey or olive; belly uniform yellow. Males of Eastern Montpellier Snake always lack the dark 'saddle' and adults often have narrow dark longitudinal stripes or rows of white dashes and spots.



Western Montpellier Snake
Eastern Montpellier Snake

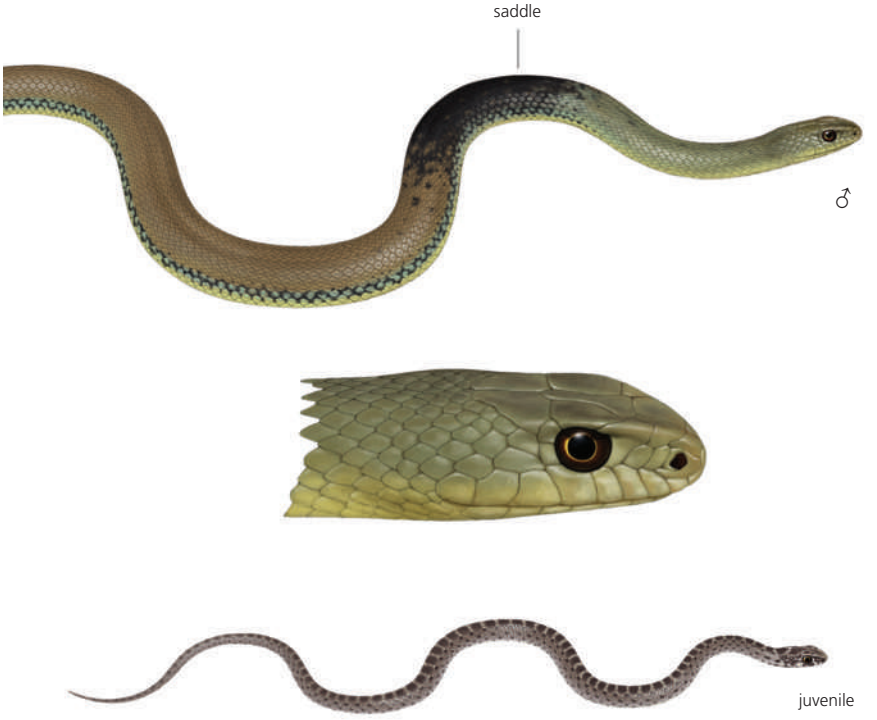
DISTRIBUTION

Western: SW Europe. Spain, Portugal, SE France and the extreme NW of Italy. Introduced to Ibiza and may be breeding on Mallorca and Formentera as well (all unmapped). Outside our area occurs in Morocco and Algeria, east to Algiers. Eastern: E Mediterranean Basin, from E Morocco through SW Asia to the Balkans. In our area, along the E Adriatic coast (presence in NE Italy and Slovenia requires confirmation), through Albania, Macedonia, the Greek mainland, S Bulgaria and Turkish Thrace. Also on the Greek islands of Chios, Corfu, Euboea, Hydra, Kastellorizo, Cephalonia, Kos, Lefkada, Lemnos, Lesbos, Oxia, Poros, Psili, Rhodes, Salamina, Samothrace, Samos, Skiathos, Skopelos, Thasos and Zakynthos. Also on the Italian island of Lampedusa.

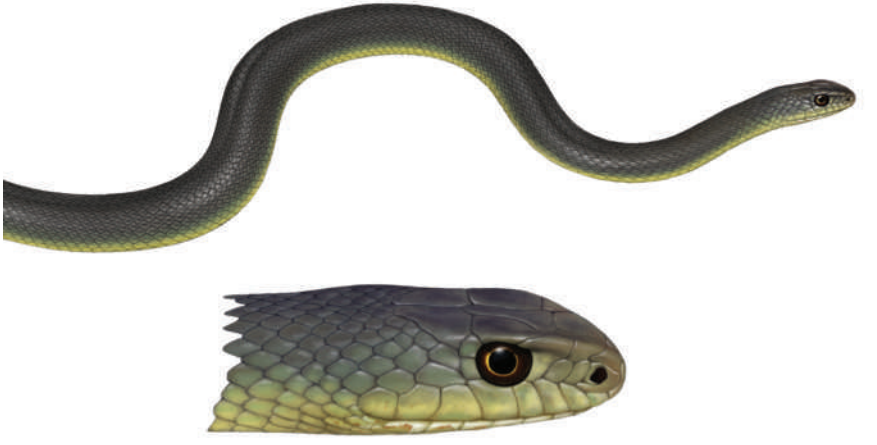
VARIATION

E European individuals, assigned to the subspecies *M. i. fuscus*, have 17 dorsal scale

Western Montpellier Snake



Eastern Montpellier Snake



rows on the mid-body, while the nominate subspecies (not found in our area) has 19 dorsal scale rows.

HABITAT

Typical inhabitant of Mediterranean habitats with a combination of sunny areas and more humid spots: garrigue and maquis, sand dunes, saltmarshes, but also on rocky slopes in hilly terrain. Also in anthropogenic habitats such as quarries, agricultural land and even gardens well into urban areas. At higher altitudes on the Iberian Peninsula often around rocky outcrops in open pine/oak forests. Usually between sea-level and 600 m, but has been found up to 2,200 m in S Spain.

BIOLOGY

Mostly diurnal and thermophilous. Active in the afternoon, even in hot summer months, but may be crepuscular as well. A fast, visual predator which actively hunts its prey on the surface, typically with the head and forepart of the body raised and readily climbing onto rocks or into bushes. May swim across small waterbodies. Feeds on a wide array of prey such as other reptiles, birds and mammals. Will flee swiftly when disturbed. May hiss when cornered, sometimes for minutes, and may raise the forepart of the body and expand the neck, making a cobra-like threat display. The raised ridges between eye and nostril contain glands which produce a liquid that the snake rubs over its body, especially after shedding its skin. This may waterproof the skin as well as spread pheromones. Active between February and November, depending on local weather conditions. Males mark territories with scent, courting females by presenting a prey item as a gift. Mating takes place in May and June. Females lay up to 20 eggs and juveniles hatch between August and October. This snake is often seen as roadkill due to its active foraging strategies.

VENOM

Opisthoglyphous. Venomous but few cases of envenomation of humans are known. The rear fangs reduce the possibility of venom injection, and the venom is of low toxicity. Symptomatic treatment suffices to treat envenomation.

Female Western Montpellier Snake. Coto Doñana, Spain.

Young Western Montpellier Snake. Cádiz, Spain.

Vipers (Viperidae)

The viper family is composed of four subfamilies. The Viperinae (true vipers) from Europe, Asia and Africa, and the Crotalinae (pit vipers, including rattlesnakes) from Asia and America are the largest groups. Currently, ten species are believed to occur within our area, all but two (Ottoman Viper *Montivipera xanthina* and Blunt-nosed Viper *Macrovipera lebetina*) belonging to the genus *Vipera*. Vipers are stocky snakes with short tails (about 10% of total length), keeled dorsal scales, a triangular head with multiple small or divided scales on top, and a vertical pupil. Frequent pattern features include a dark dorsal zigzag stripe, one or two rows of lateral spots, two dark streaks in a V-shape on top of the head, and a dark stripe on the side of the head running from the eye to the neck.

All vipers are venomous, solenoglyphous snakes. The venom is primarily used to kill or immobilise the prey, but also has a digestive function. Defensive bites (e.g. against humans) are often 'dry bites', not injecting any venom. The venom is predominantly cytotoxic, causing cardiovascular damage resulting in local swelling, necrosis and in some cases, disruption of the blood coagulation system. However, in some species it also contains neurotoxic elements (e.g. Ottoman Viper), causing damage to the nervous system. Venom composition may even differ between subspecies (e.g. in Asp Viper *Vipera aspis* and Seoane's Viper *Vipera seoanei*).

Within Europe, vipers are found throughout the European mainland, even N of the Arctic Circle, but are absent from many, even large, islands such as Ireland, the Balearics, Corsica, Sardinia, Malta and Crete.

They are ground-dwelling, slow-moving snakes, but may strike rapidly. They are typical ambush predators. After administering a bite, they track their prey by scent once the venom has killed it. Adults feed mainly on small mammals, but juveniles will take large insects and lizards, especially lizard tails.

During the mating season, males pursue females and on entering the territory of another male may engage the resident in a ritual fight. They raise the front part of their body vertically and try to push each other down until one of them, often the one that cannot raise its body the highest, becomes exhausted and leaves the territory. This behaviour can also occur in competition for an already struck dead prey item. All but one species (Blunt-nosed Viper *Macrovipera lebetina*) in our area give birth to live young (ovoviviparous). In fact, the name *Vipera* is derived from Latin: *vivere* = 'to live' and *pario* = 'to give birth'.

Vipers are often very easy to observe, as they trust strongly in their camouflage and venom. Once spotted, they can easily be watched with binoculars for long periods.

Adder swallowing a rodent. Overijssel, the Netherlands.

Key to Vipers			
1	a	Snout rounded, not sharp or horned. Only small scales on top of the head, except perhaps the supraocular scale. Only Milos Archipelago and coastal extreme NE Greece, Turkish Thrace and E Greek islands.	2
	b	Not the combination of features above.	genus *Vipera* - **3**
2	a	Large supraocular scale. Only European part of Turkey, Greek Thrace and some Greek islands off the Turkish W coast.	Ottoman Viper *Montivipera xanthina*
	b	Supraocular scale divided at least in 2, usually more, smaller scales. Only W Cyclades: Milos, Kimolos, Polyaegos and Siphnos.	Blunt-nosed Viper *Macrovipera lebetina*
3	a	Snout horned or pointed upwards. Usually no large scales on the centre of the head.	subgenus *Vipera* - **4**
	b	Snout not clearly pointed upwards or horned. Central head scales (frontal and parietal) large.	subgenus *Pelias* - **5**
4	a	Horn on snout nearly always very distinct. Rostral scale does not extend onto front of horn. Horn covered with more than 8, sometimes up to 20 small scales. E Europe.	Nose-horned Viper *Vipera ammodytes*
	b	Horn on snout quite distinct. Rostral scale extends onto the front of the horn. Horn covered with 4–8 small scales. Iberian Peninsula.	Lataste's Viper *Vipera latastei*
	c	Snout tip upturned because of high rostral scale. 2–4 small scales covering the raised part of the snout. C Europe and Italy, in the SE not further than W Slovenia and in Spain only in Pyrenees and parts of north.	Asp Viper *Vipera aspis*
5	a	Nostril large and in the middle of the nasal scale. Usually two apical scales touching the rostral scale.	**6**
	b	Nostril small and in the lower half of the nasal scale. Usually only one apical scale touching the rostral scale.	**7**
6	a	Only NW Iberia and extreme SW France.	Seoane's Viper *Vipera seoanei*
	b	The whole of N Europe and Great Britain (but not in Ireland), more patchy distribution in W and C Europe and the Balkans. Absent from Iberian Peninsula, including Pyrenees.	Adder *Vipera berus* and Walser Viper *Vipera walser*
7	a	6–7 supralabial scales, 2nd, 3rd and 4th under the eye enlarged. Only Pindos Mountains, Greece and adjacent parts of S Albania.	Greek Meadow Viper *Vipera graeca*
	b	21 rows of dorsal scales on the first part of the body, reduced to 19 rows before reaching the mid-body section. 113–135 ventral scales (but Romanian subspecies *V. u. moldavica* up to 145). Fragmented range of small areas across Europe, from the Danube Delta westwards.	Meadow Viper *Vipera ursinii*
	c	21 rows of dorsal scales across the mid-body, reduced to 19 rows only on the second part of the body. 135–150 ventral scales. In Europe only from Ukraine eastwards.	Steppe Viper *Vipera renardi*

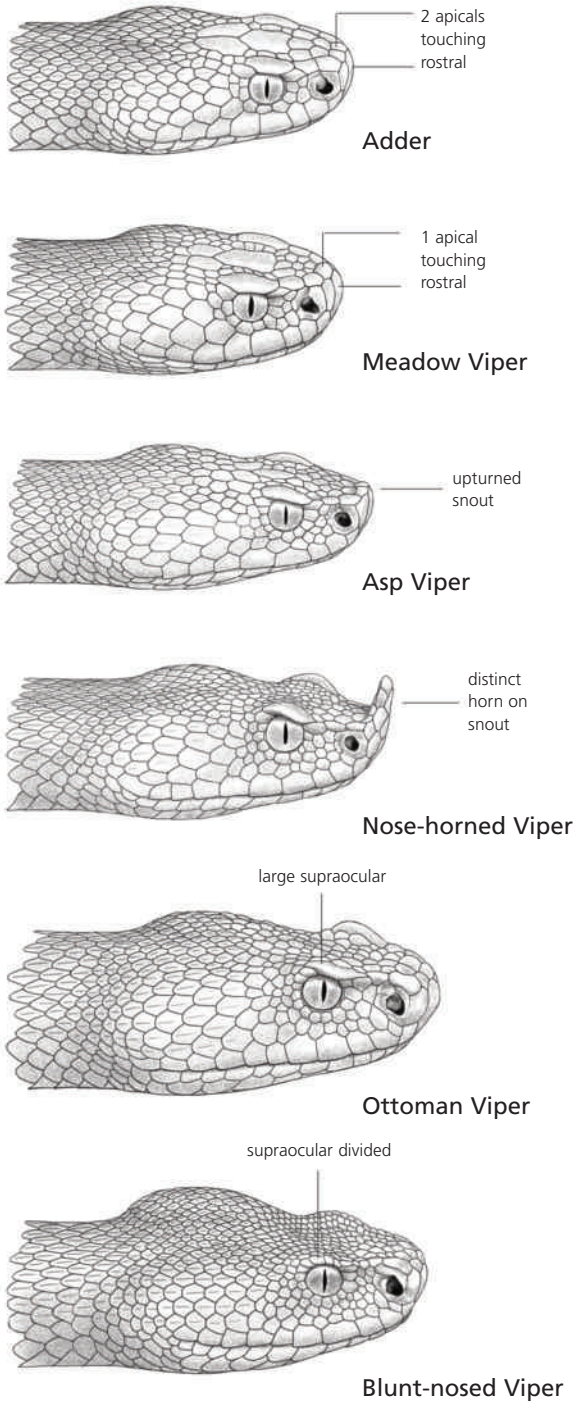


Fig. 44. Heads of vipers, showing details of scalation.

Adder — *Vipera berus* (Linnaeus, 1758)

Walser Viper — *Vipera walser* Ghielmi, Menegon, Marsden, Laddaga & Ursenbacher, 2016

DESCRIPTION

TL: usually up to 65 cm, rarely up to 90 cm. Medium-sized viper. Back brown, red, or light grey with a dark zigzag stripe on the back. Typically, two dark streaks in a V-shape on top of the head and a dark stripe on the side of the head, running from the eye to the neck and continuing as a row of dots along the flanks. Supralabial scales white. Males have more contrasting colours than females. Sometimes entirely black (melanistic), especially in colder areas. Sturdily-built, with a flat snout and more than 12 (including several large) scales on top of the head. Generally one row of suboculars. Nostril large and in the centre of nasal scale. 21 rows of keeled dorsal scales across the mid-body. Walser Viper is very similar, but ranges do not overlap, and the latter has finer scalation on the head. Similar to some *V. b. bosniensis* (see Variation) and Asp Viper *Vipera aspis*, it often has transverse bars on the back rather than a continuous zigzag.

DISTRIBUTION

Adder: Widest distribution of all terrestrial snakes. Most of N Europe and Great Britain but not in Ireland. More patchy distribution in W and C Europe and the Balkans, where populations are often (but not exclusively) restricted to higher elevations. Absent from S France and the Iberian Peninsula, including Pyrenees. Outside our area, ranges far into Russia through N Kazakhstan, N Mongolia to Sakhalin.

Walser Viper: Small range in NE Piedmont, NW Italy, where Adder is absent.

Adder

Walser Viper

VARIATION

A number of Adder subspecies have been described.

V. b. berus: Most of the range.

V. b. bosniensis: Balkans (N to parts of S Slovenia). May resemble Asp Viper, having dark transverse bars on the back. Often two rows of suboculars.

V. (b.) nikolskii: TL up to 90 cm. Forest meadows in Ukraine and Moldova and recently established for E Romania based on morphology. Sometimes regarded as a separate species. Juveniles similar to *V. b. berus*; most adults black, only the supralabial scales sometimes white.

A fourth subspecies, *V. b. sachalinensis*, generally assumed to be restricted to Russia, might occur in the Baltic Region.

During their evolution, Adder populations from the Italian Alps, the Swiss-Italian border area, N Slovenia and most of Austria were the first to differentiate from other populations, and show significant differences in a number of scalation features compared to *V. b. berus*. These populations were shown to deserve subspecies status at most.

HABITAT

Can be found in a wide variety of habitats, which share a certain level of humidity: heathland, forest clearings, marshland,

Adder

♂

♀

♂

V. b. bosniensis

pastures with hedgerows, etc. In the south, confined to higher altitudes, including alpine meadows up to 2,600 m in the Alps.

BIOLOGY

Diurnal. Can be seen basking in groups in suitable spots. They feed mainly on small mammals but birds, lizards and frogs may also be taken. Individuals may emerge from hibernation as early as February in C Europe, sometimes crawling over patches of melting snow. Hibernation may last as long as six months in N of range or at higher altitude. Between 15% (adults) and 40% (juveniles) may perish during hibernation. Mating usually takes place a few weeks after hibernation. Females give live birth to up to 21 juveniles between August and October.

VENOM

Cytotoxic and quite potent causing local swelling, internal haemorrhaging and necrosis. Envenomation of humans is potentially lethal in cases involving anaphylactic shock. Some populations in Germany and the Carpathian Basin have proved to be neurotoxic. Medical aid should be sought if bitten.

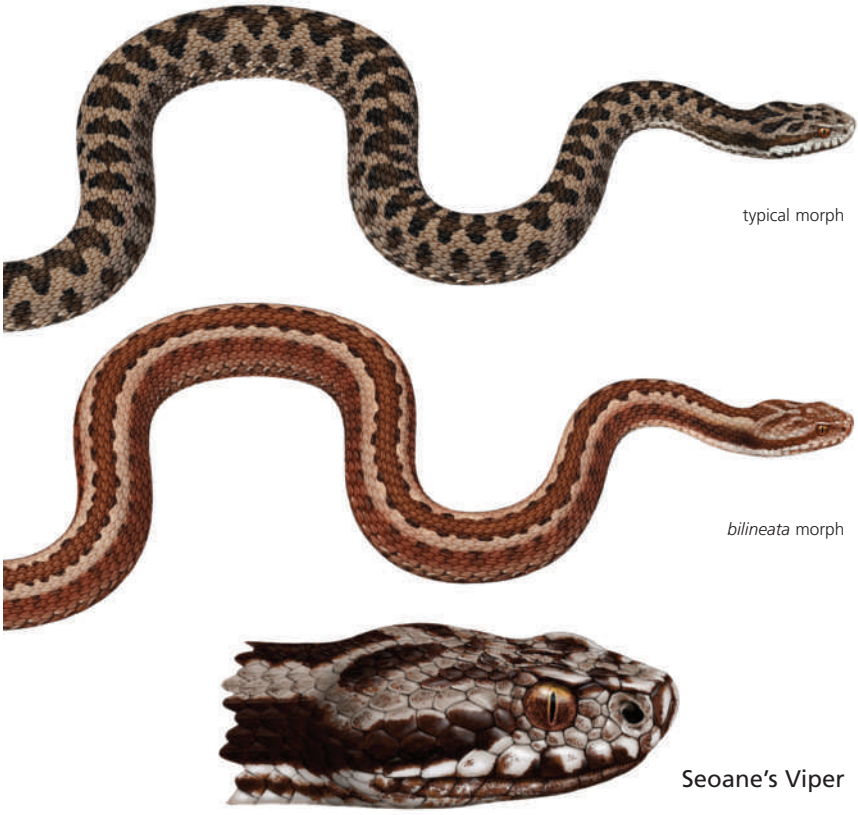
NOTE

While long believed to represent an isolated population of Adder and morphologically highly similar to that species, molecular data indicate that Walser Viper is part of the Meadow Viper *Vipera ursinii* complex. The species description was not published at the time of finalising this book's text, leaving the possibility for some changes to what has been written here.

ABOVE: Walser Viper. Piedmont, Italy.

LEFT: Adder, ssp. *bosniensis*. Montenegro.

Seoane's Viper *Vipera seoanei* Lataste, 1879



DESCRIPTION

TL: normally up to 50 cm, occasionally 70 cm. Highly variable in appearance. The typical morph has a beige, grey or even reddish background colour. Dorsal area lighter with a contrasting darker brown zigzag or even straight stripe, bordered with black longitudinal bars on both sides. Other morphs have two lighter dorsolateral lines (*bilineata* morph), or a narrow, pale vertebral stripe bordered with dark transverse bars (*cantabrica* morph) or are melanistic, uniform red or brown. Within its range, can only be confused with Asp Viper *Vipera aspis* and Lataste's Viper *Vipera latastei*, but lacks the (strongly) upturned snout of these two species. In the zone where there is an overlap with Asp Viper, Seoane's Viper usually has only one row of subocular scales. 21 rows of keeled dorsal scales across the mid-body.

DISTRIBUTION

Restricted to humid N Spain, northernmost Portugal and a small area in extreme SW France.

VARIATION

V. s. seoanei: Has one row of subocular scales, displays a greater number of different colour morphs and is found in the Atlantic-influenced part of the distribution, including N Burgos.

V. s. cantabrica: Occurs on the relatively drier slopes of Castile and León which face the Spanish interior, and is characterised by 1½

or two rows of subocular scales. Only the melanistic and the *cantabrica* morphs (see Description) occur in this subspecies.

HABITAT

Warmer microclimates in relatively moist habitats typical of the mild southern European Atlantic climate: clearings in deciduous (often oak) forests and forest edge meadows with luscious undergrowth (*Pteridium* spp., *Erica* spp. etc.), also dry-stone walls and blackberry-bordered (*Rubus* spp.) pastures, up to 1,500 m. Local population densities can be quite high.

BIOLOGY

Diurnal, but may be nocturnal during the hottest part of the year. Can be found basking in groups in suitable places. Mainly feeds on small mammals that are caught by ambush but also actively pursued into their burrows. Individuals emerge from hibernation between March and May, depending on altitude. Females give live birth to up to 10 young between August and October.

VENOM

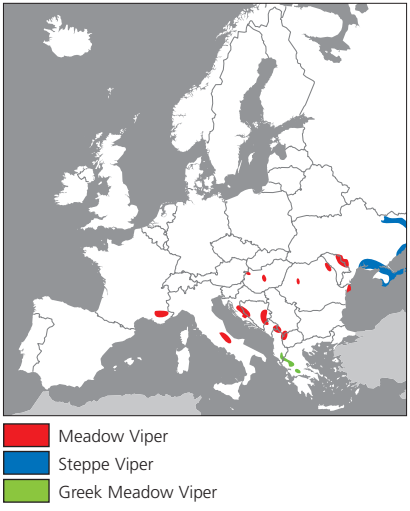
Intermediate between that of Adder *Vipera berus* and Asp Viper *Vipera aspis*. However, the potency of the venom varies within its range, the *V. s. cantabrica* venom being at least twice as toxic as that of *V. s. seoanei*. Medical aid should be sought if bitten.

Seoane's Viper. Melanistic individuals are a common sight throughout their range. SW France.

Meadow Viper *Vipera ursinii* (Bonaparte, 1835)
Steppe Viper *Vipera renardi* (Christoph, 1861)
Greek Meadow Viper *Vipera graeca* Nilson & Andrén, 1988

DESCRIPTION

TL: Meadow Viper: usually up to 50 cm, occasionally up to 60 cm; Steppe Viper: up to 65 cm; Greek Meadow Viper: up to 35 cm, females rarely up to 45 cm. The smallest European vipers. Background coloration dull, brown or grey with a dark, broad, often black-edged, wavy stripe on the back and dark spots on the flanks. Back colour (along wavy stripe) often slightly paler than flanks. General appearance rough due to high keels on dorsal scales. Snout shorter than Adder *Vipera berus* and never upturned like Asp Viper *Vipera aspis*, with only one apical scale touching the rostral. Nostril small and in the lower half of nasal scale. Normally, the top preocular scale touches the nasal scale, while it does not in the Adder, but exceptions are too numerous to rely on this feature alone. Scales on top of the head relatively large (12 or fewer). In Steppe Viper, the 21 rows of dorsal scales across the mid-body are reduced to only 19 rows on the second part of the body, whereas in Meadow Viper this reduction generally occurs before the mid-body section is reached. Greek Meadow Viper can show just 17 mid-body scale rows. Best identified by range.



DISTRIBUTION

Meadow Viper: Restricted to relictual 'islets' of suitable habitat left after the last Ice Age, although much of its former lowland range has been lost due to habitat destruction. SE France, C Italy, Hungary, Croatia, Bosnia and Herzegovina, Montenegro, Serbia, Macedonia, Albania, Romania, and Greece. Extinct in SE Austria. Contemporary presence in Bulgaria is debatable.
Steppe Viper: In our area only known from the lowland steppes of E part of the Ukraine and Crimean Peninsula. Outside our area, in Azerbaijan, Russia, N Kazakhstan, Kyrgyzstan and W China.
Greek Meadow Viper: Endemic to the Pindos Mountains of C and N Greece, as well as S Albania.

VARIATION

Several Meadow Viper subspecies have been proposed.

Montane subspecies (TL up to 45 cm) are *V. u. ursinii* from SE France and C Italy, *V. u. macrops* from Bosnia and Herzegovina (except N) south to N Albania and Macedonia, and a yet undescribed subspecies from the Dinaric Alps of N Croatia and N Bosnia and Herzegovina, which is closely related to the Italian and French populations.

Lowland forms (TL up to 60 cm) include *V. u. rakosiensis* from Hungary and W Romania, and *V. u. moldavica* from NE Romania and Moldova. The latter also includes the Danube Delta populations which have been assigned to Steppe Viper by some authors.

In Steppe Viper, *V. r. puzanovi* has been described from the S Crimean Peninsula, but is of unclear taxonomic validity.

HABITAT

Mountain morphs of Meadow Viper live on grassy karstic slopes with patches of *Juniperus* and *Vaccinium* spp. from 1,000 m to 2,500 m. Lowland morphs occur on usually treeless, grass steppes with sandy soil, dune areas and even moist meadows. The Greek Meadow Viper occupies similar habitat to the mountain morphs of Meadow Viper, between 1,300 and 2,100 m.

BIOLOGY

Diurnal. Despite their small size, all species may be quite feisty when disturbed, hissing and striking at the supposed attacker (e.g. grazing cattle or goats), but then quickly calm down and become docile when handled. Food consists mainly of insects (predominantly grasshoppers) and snails, but sometimes lizards and small mammals are also taken, depending on their seasonal and local availability. Hibernation may last up to six months in high altitude populations, with individuals emerging from hibernation as late as May. Lowland populations may emerge in March or April. Mating takes place a few weeks after emerging. Females can give birth to up to 18 live young in late summer.

VENOM

The least venomous of the European vipers. However, the bite can still be painful to humans and cause local internal haemorrhaging.

NOTE

These species are listed as Vulnerable in the 2009 IUCN Red List of European Reptiles.

LEFT: Meadow Viper, ssp. *moldavica*. Danube Delta, Romania.

BELOW: Greek Meadow Viper. Pindos Mountains, Greece.

V. u. ursinii

V. u. moldavica

Meadow Viper

Steppe Viper

Greek Meadow Viper

Meadow Viper

Steppe Viper

Asp Viper — *Vipera aspis* (Linnaeus, 1758)

DESCRIPTION

TL: normally up to 60 cm, occasionally up to 90 cm. Medium-sized viper. Sturdy build, but on average slightly more slender than other vipers in our area. Snout-tip upturned in profile because of high rostral scale. In general, two rows of subocular scales. Typical morph is beige, grey or even reddish above with two rows of dark transverse bars on the back, often merging on centre of back. Sometimes a row of dots on each flank. Very variable in coloration and markings show regional tendencies (see Variation). Uniform specimens occur, and melanistic individuals are common in highland areas. 21 (more rarely 23) rows of keeled dorsal scales across the mid-body.

DISTRIBUTION

France (except NW), Pyrenees, NE Spain (reaching the province of Burgos in the W, where it hybridises with Lataste's Viper *Vipera latastei*), Italy (including the islands of Sicily, Elba and Montecristo, but not Sardinia), S and W Switzerland and just entering the extreme SW of Germany (Black Forest) and the extreme W of Slovenia, where occasional hybrids with Nose-horned Viper *Vipera ammodytes* occur.

VARIATION

V. a. aspis (France except SW and Pyrenees, N Spain except Pyrenees, W Switzerland).

V. a. 'atra' (French Alps, Switzerland and NW Italy): High proportion of black as well as heavily marked individuals. The validity of this subspecies is debatable.
V. a. francisciredi (S Switzerland, N, NE and C Italy, including Elba): Very similar to the nominate subspecies but with swollen head (supralabial scales visible from above) and white spots on the ventral scales.
V. a. hugyi (S Italy including Montecristo and Sicily): Broad, wavy, dark stripe on the back, somewhat reminiscent of Nose-horned Viper *V. ammodytes*, sometimes broken up into a series of blotches and with the central part of the stripe in a lighter shade.
V. a. zinnikeri (SW France and Pyrenees E of Andorra): Often has a pale, sometimes vague vertebral stripe bordered with dark transverse bars on each side.

HABITAT

Wide range of usually drier habitats, especially open rocky hillsides, usually with some vegetation cover, but also extends into high, wet mountainous terrain. Also open forest, scrublands, stone quarries and mountains up to about 3,000 m.

BIOLOGY

Diurnal throughout most of the year. Often with a mild disposition, somewhat sluggish and relatively timid, but will strike quickly and repeatedly if cornered or provoked. Feeds mainly on small mammals but birds, lizards and frogs are also taken. Mating takes place between March and May, depending on the climate. Females give live birth to up to 20 juveniles between August and October.

VENOM

Similar to that of Adder *Vipera berus*, but a little more toxic on average. Systemic neurotoxicity has been described in patients envenomated by certain populations of some subspecies (*V. a. zinnikeri* in particular). Medical aid should be sought if bitten.

Asp Viper

V. a. aspis

V. a. 'atra'

melanistic individual

V. a. hugyi

V. a. zinnikeri

slightly upturned snout

Nose-horned Viper *Vipera ammodytes* (Linnaeus, 1758)

DESCRIPTION

TL: usually up to 65 cm, occasionally up to 95 cm. One of the somewhat larger European vipers. Whitish silver-grey over beige, yellow, orange, red, brown to dark grey above, nearly always with a darker zigzag on the back (often with a dark edge, sometimes a lighter fringe). Often a row of round dots on the flanks. Females usually have more brownish or reddish shades, males more greyish. In some populations, particularly in *V. a. ammodytes*, head without any markings. Unmistakable in its range due to the almost invariable presence of a (rather soft) horn on the snout, covered with 9–22 small scales. Top of the head covered with small scales, except for a large scale over each eye. 21 (more rarely 19 or 23) rows of keeled dorsal scales across the mid-body.

DISTRIBUTION

From parts of E, W and S Romania, NE Italy and S Austria down the entire Balkan Peninsula, Ionian Islands (but not known from Zakynthos), N Sporades, Thasos, Samothrace and many Cyclades (Andros, Dilos, Ios, Iraklia, Ano Koufonissi, Mykonos, Naxos, Paros, Antiparos, Sikinos, Stroggylo, Syros, Tinos – but absent from the Milos Archipelago).

VARIATION

Three subspecies are recognised in Europe, with *V. a. ruffoi* from the Adige Valley in Italy and *V. a. gregorwallneri* from S Austria placed in synonymy with the nominate subspecies.

V. a. ammodytes (N Albania, most of former Yugoslavia except Macedonia, SW Romania, NE Italy and S Austria): Red tail-tip; the largest subspecies (149–156 ventral scales); rostral scale broader than high.

V. a. meridionalis (from Thessalia through the Greek mainland and islands): Yellow or greenish tail-tip; the smallest subspecies (135–143 ventral scales), on the Cyclades often shorter than 35 cm.

V. a. montandoni (N Greece in Thrace and Macedonia, most of Turkish Thrace, Macedonia, S Albania, Bulgaria and Romanian Dobruja): Greenish tail-tip, 145–152 ventral scales; rostral scale as high as it is broad.

However, recent phylogenetic studies show a huge genetic variability in the Balkans, with newly found clades in the phylogenetic tree that do not accord with the traditional taxonomic subdivisions based on morphological characters. Additional research on this matter may shed a completely new light on the species' taxonomy. Finally, the small-sized vipers of the Cyclades may warrant distinct taxonomic status.

HABITAT

Contrary to its species name ('*ammos*' meaning 'sand'), the common feature of its biotopes is not sand, but rocks and stones, usually with some vegetation cover (herbs, shrubs, small trees, etc.). Shows no preferences regarding the origin of the habitat: man-made stone walls and natural rock formations are equally favoured. Prefers open, sunny slopes in the north of its range, but occupies a variety of biotopes further south, even inhabiting more humid and cooler environments. Occurs from sea-level to 2,500 m.

BIOLOGY

Diurnal and crepuscular. Hibernation may be short or interrupted during periods of warm

Nose-horned Viper

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♀

colour variation

distinct horn on snout

weather in south of range. At high altitude may hibernate for up to six months. Mating takes place in April and May. Ovoviviparous; females may give birth to up to 20 live young in summer. Not very irascible; when disturbed, it will produce a hissing sound, but normally only bites when handled or stepped on. Feeds mainly on mammals and reptiles (mostly lizards), while juveniles also prey on arthropods such as centipedes.

VENOM

Highly venomous, potentially lethal, with neurotoxic and cytotoxic components. Bites produce local swelling and severe pain in 90% of cases and additional symptoms such as palpitations and nausea in 4% of cases. Medical aid should be sought if bitten.

Nose-Horned Viper, ssp. *montandoni*. N Greece.

Male Nose-horned Viper; the horn angle may vary quite a bit. Romania.

Lataste's Viper *Vipera latastei* Boscá, 1878

V. l. latastei

V. l. gaditana

distinct horn on snout

Lataste's Viper

DESCRIPTION

TL: normally up to 60 cm, occasionally 75 cm. Medium-sized viper. Light to dark brown, beige or light (silver) to dark grey above with a darker broad stripe, sometimes sharply zigzagging, sometimes wavy or even broken up into a series of blotches. This stripe often has a dark edge, sometimes a lighter fringe. Often a row of round dots on the flanks. Tail-tip can be green, orange, yellow or black. Unmistakable in its range due to the distinct horn on the snout, covered with 3–7 smaller scales. Asp Viper *Vipera aspis* only has an upturned snout because the rostral scale is much higher than it is wide. 21 (more rarely 23) rows of keeled dorsal scales across the mid-body.

DISTRIBUTION

Iberian Peninsula, except extreme N. Also in NW Africa.

VARIATION

Two subspecies have traditionally been recognised: *V. l. latastei* was thought to occupy most of the range apart from the SW of the Iberian Peninsula, which is inhabited

by *V. l. gaditana*. Although differences in size and scalation have been described between these two subspecies, recent research has revealed a much greater extent of morphological and deep genetic variation throughout the range of Lataste's Viper. As such, its intraspecific taxonomy is in urgent need of revision.

HABITAT

Occupies a wide variety of habitats along a very broad altitudinal range. Often in typical Mediterranean biotopes with mild wet winters and hot dry summers, such as coastal dunes with Umbrella Pines (*Pinus pinea*) in some southern areas, and open deciduous forest, rocky outcrops and dry-stone walls in the mid-range sierras, but also on sunny rock slopes in the Sierra Nevada up to 3,000 m. Less widespread than its SE European counterpart, Nose-horned Viper *Vipera ammodytes*, which might be related to differences in topography and land use having led to reduction of its natural range.

BIOLOGY

Diurnal, however tends to be nocturnal during warmer months. Feeds on a wide variety of prey but generally takes small mammals and lizards. Hibernation short in south of range and may be active as early as February. At higher altitudes and in north of range becomes active later. Ovoviviparous; females give birth to up to 10 live young in late summer. Generally seems to be more secretive than other viper species.

VENOM

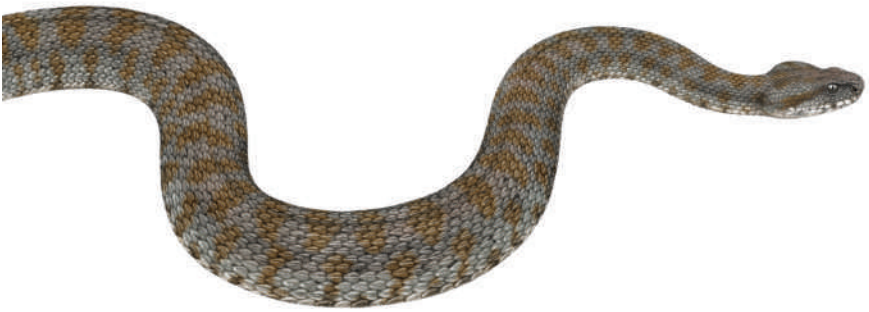
Cytotoxic and quite potent, causing local swelling, internal haemorrhaging and sometimes necrosis. Nevertheless, probably less potent than that of Adder *Vipera berus* and Asp Viper *Vipera aspis*, containing enzymes that are relatively more effective in mice than in humans. Envenomation of humans rarely lethal, but medical aid should be sought if bitten.

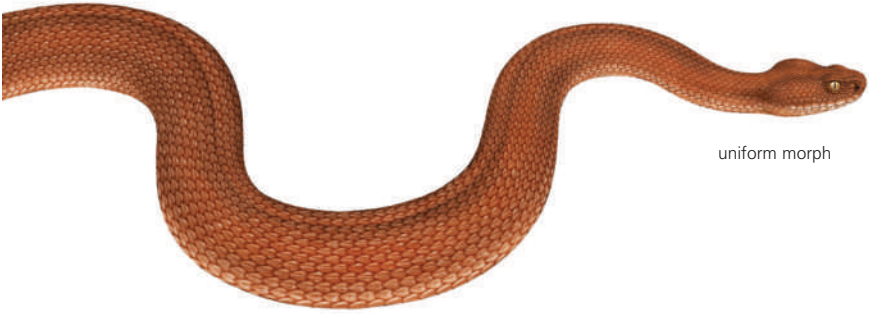
NOTE

Spelling of the species name is subject to debate, with certain authors advocating *Vipera latasti*. This species is listed as Vulnerable in the 2009 IUCN Red List of European Reptiles.

Lataste's Viper. Burgos, Spain.

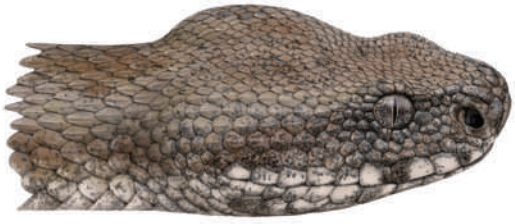
Blunt-nosed Viper *Macrovipera lebetina* (Linnaeus, 1758)





uniform morph

Blunt-nosed Viper



DESCRIPTION

TL: up to 70 cm, occasionally to 100 cm. Large, robust viper with rounded snout. Grey, whitish, beige, yellow, orange or red above, often with two rows of broad transverse bars in a darker tone (often merging in centre of back) and one on each flank. Markings more prominent in young individuals, fading with age. In some individuals, markings less visible because scales are covered with small dark pigmented specks, giving the snake a smudgy look. Uniform brick red individuals also occur. No large scales on top of the head, including the multiple scales lining the upper edge of each eye. In our area, the only viper in its range and unlikely to be confused with any other snake species. 23 (more rarely 19, 21 or 25) rows of keeled dorsal scales across the mid-body.

DISTRIBUTION

In our area, only W Cyclades: Milos, Kimolos, Polyaegos and Sifnos. Outside our area widespread in the Middle East and E Turkey. Also on Cyprus.

VARIATION

Until recently, the European subspecies *M. l. schweizeri* (Werner, 1935) was treated as a full species, *M. schweizeri*, including a debated subspecies from Sifnos (*M. s. siphnensis*). Recent studies, however, show that subspecies rank is more appropriate.

HABITAT

A range of habitats on the islands, typically hillside phrygana with large and small bushes on gravel or rocky soil, with a preference for large bushes (> 10 m²), but also cultivated land and gardens up to 400 m. The species also seems to favour habitats where water is available such as pools or (ephemeral) creeks.

BIOLOGY

Generally diurnal, but partially nocturnal during the hottest part of the year. In spring, they gather along water courses to ambush birds that come to drink, while during autumn migration, they climb into the scrub to prey on birds that come to roost in the evening. Unlike other European vipers, they tend to hold the bird in their mouth until it dies from the venom, probably because birds would leave no scent trail on the ground while the venom is taking effect. Feeds mainly on migratory birds, but may also take small mammals and lizards. Mating takes place in April and May. The only European viper to lay (up to 10) eggs.

VENOM

Highly venomous, potentially lethal if untreated. Venom with cytotoxic components causing pain, severe swelling, bruising, blistering and moderate to severe necrosis, as well as various non-specific effects such as headache, nausea, vomiting, abdominal pain, diarrhoea, dizziness, collapse or convulsions. Medical aid should be sought if bitten.

NOTE

Though the endemic subspecies is not rare in its area, it is listed (as a separate species) as Endangered in the 2009 IUCN Red List of European Reptiles because of its limited geographic range. Main threats are illegal collection of animals for the pet trade, accidental mortality on roads and habitat loss through tourist development, bush fires (often caused by humans) and, especially, intensive mining on Milos.

Blunt-nosed Vipers tend to frequent the vicinity of perennial streams, among other things to prey on migrating songbirds coming down for a drink. Milos, Greece.

Ottoman Viper *Montivipera xanthina* (Gray, 1849)

Ottoman Viper

DESCRIPTION

TL normally up to 100 cm, occasionally 120 cm. The largest viper in our area. with a large, robust body and blunt snout. Beige, brown or grey above with a broad, wavy, dark stripe, sometimes broken up into a series of blotches. Central part of the stripe sometimes a lighter shade. Dark, vertical bars on each flank. Head markings contrasting: often two dark dots on top of the head, two dark streaks in a V-shape on the neck, a dark stripe on the side of the head from the eye to the neck, and a dark vertical streak below the eye. No larger scales on top of the head, except one over each eye. 23 (more rarely 25) rows of keeled dorsal scales across the mid-body.

DISTRIBUTION

Turkish and Greek Thrace on the mainland and several Greek islands off the Turkish Coast: Symi, Kos, Kalymnos, Leros, Lipsi, Patmos, Samos, Chios, Inousses (islet E of Chios), Lesbos and Samothrace. Outside our area also in W Turkey.

VARIATION

Within our area two subspecies have been described based on morphology. Populations from Chios have been described as *M. x. nilsoni* based on their large size (up to

140 cm), presence of three rows of unilateral or bilateral scales around the eye (instead of two), larger number of rows of anterior dorsal scales, more extensive development of the dorsal pattern and absence or poor definition of the ventral semilunar spots in adults. Those from Leros have been ascribed to *M. x. dianae* due to larger numbers of dorsal, anterior, mid-trunk and rear scale rows, presence of a dark subocular spot, and absence or inconspicuous presence of black specks on the pileus. Molecular confirmation of these subspecies is needed.

HABITAT

Often seems to favour a combination of dry rocky surfaces and more humid areas with dense vegetation: bushy hillsides with rocky outcrops, often in the vicinity of small streams, and meadows with dry-stone walls. In Asian Turkey in mountains up to 2,500 m, but in Thrace it appears to be largely restricted to coastal hills, in contrast to Nose-horned Viper *Vipera ammodytes* which is more common in more inland, cooler and less dry habitats. However, both species may coexist in some places.

BIOLOGY

Diurnal but tends to be nocturnal during warmer months. Generally a sluggish snake with a phlegmatic disposition. If disturbed, it will sometimes start hissing, and will strike readily and swiftly if cornered or provoked. Often basks in or around, often thorny shrubs. Adults feed mainly on small mammals and birds while juveniles feed on lizards and centipedes. Mating takes place between April and June. Females give birth to up to 20 live young in July and August.

VENOM

Toxicity of venom comparable with that of Blunt-nosed Viper, highly venomous and potentially lethal if untreated. Medical aid should be sought if bitten.

Adult Ottoman Viper. Greek Thrace.

Glossary

A number of anatomical features are shown in the schematic drawings at the start of the main sections in the species accounts.

Aegean: the islands and sea east of the Greek mainland.
aglyphous: refers to non-venomous snakes lacking grooves in their fangs (see p. 351).
amplexus: mating embrace, as seen in frogs and salamanders.
Anatolia: the western and central parts of the Asian part of Turkey; also known as Asia Minor.
Balkan(s): broadly, a peninsula comprising a large part of SE Europe.
C: in toponyms, Central.
carapace: the dorsal part of the shell of turtles, tortoises and terrapins.
cf.: 'confer' (Latin, roughly translated as 'compare'); placed between the genus and species name (e.g. *Pelophylax* cf. *bedriagae*), indicates that while the organism concerned probably belongs to that species, identification cannot (yet) be certain, pending further research.
cirri: tentacle-like protuberances on the upper lip of lungless salamanders (Plethodontidae).
cloaca: posterior opening that serves as a combined exit for the intestinal, reproductive and urinary tracts of (among others) amphibians and reptiles.
collar: a fold in the lower neck region of certain lizards.
cytotoxic: toxic to cells.
Dodecanese: the Greek islands close to the W Turkish coast.
dorsal: the upperside or back of an animal.
dorsolateral: folds, ridges, stripes, etc. on the area where the dorsal and lateral sides meet.
dorsoventral: along the direction, plane or axis running from back to belly.
E: in toponyms, East or eastern.
Eastern Adriatic: the coastal area east of the Adriatic Sea, running from extreme NE Italy south to N Albania.
eDNA: environmental DNA; a technique to establish the presence of a species by detection of traces of its genetic material in the environment.
endemic, endemism: a species is endemic to a certain area if it only occurs in that area.
envenomation: poisoning due to venom entering the body after a snake bite.
femoral pores: gland pores on the inside of the thighs of certain lizards. May be larger in males than in females.
garrigue: like maquis but usually less dense. Use of both terms often confuses their distinction.
genus: in taxonomy, the first widely used level above the species level, given as the first word, with a capital letter, in the species' scientific name. In '*Bufo bufo*', '*Bufo*' is the genus name and '*bufo*' the species name in a more narrow sense, while '*Bufo bufo*' is more commonly referred to as the 'species name' of this species.
hemipenis (plural: hemipenes): one of a pair of male sexual organs in lizards, worm lizards and snakes.
herpetofauna: an inclusive term for amphibians and reptiles.
herpetology: a subdivision of biology devoted to the study of amphibians and reptiles.
hybrid: offspring of parents of different species, generally sterile.
Iberian Peninsula: Spain and Portugal.
Ionian: the islands and sea west of the Greek mainland.
kl.: 'klepton' (Greek, translated as 'thief'); in between the genus and species name (e.g. *Pelophylax* kl. *esculentus*), indicates that the taxon is not a true biological species but originated from (initial) crossing of two different species.
lacerta: derived from the genus name *Lacerta*, and used in English to indicate part of the lacertid family, comprising the former definition of the genera *Lacerta* and *Podarcis*. In this book, this term covers the following genera – *Anatololacerta, Archaeolacerta, Dalmatolacerta, Darevskia, Dinarolacerta,*

Hellenolacerta, Iberolacerta, Lacerta, Podarcis, Teira, Timon and *Zootoca*.

lacertid: a lizard of the family Lacertidae, and as such a broader term than 'lacerta'.

lateral: relates to the sides or flanks of an animal.

maquis or macchia: Mediterranean scrubland habitat, typically with evergreen shrubs.

masseteric scale: a large scale on the cheek of lacertid lizards.

melanism: an unusual development of dark pigment, the opposite extreme being albinism.

metatarsal tubercle: a lump at the base of the first, inner toe of frogs and toads.

molecular: relates to research that focuses on DNA, proteins and other molecules in an animal's body.

monotypic: a species with no subspecies other than the nominate subspecies.

morphology: used here to refer to the external features of an animal.

N: in toponyms, North or northern.

nasolabial groove: a groove on the head of certain salamanders, running from the nostrils to the upper edge of the mouth.

NE: in toponyms, North-east or north-eastern.

neoteny: in the context of newts, refers to the ability to reach sexual maturity while still retaining larval characteristics, e.g. presence of gills.

neurotoxic: having a toxic effect on nerves and nerve cells.

nomenclature: a discipline devoted to the naming of species and other taxa from subspecies to superfamily level.

nominate subspecies: the first-named subspecies which bears the name of the species, e.g. *Lacerta agilis agilis*.

NW: in toponyms, North-west or north-western.

ocelli: round, (roughly) eye-shaped spots.

opisthoglyphous: refers to snakes with backward grooved fangs (see p. 351).

oviparity: development of the embryo inside the eggs, which are then eventually laid.

ovoviviparity: a largely defunct term (retained here for simplicity). Refers to the condition whereby embryos develop inside the eggs within the mother without placental feeding. The egg has only a soft membrane which is pierced instantaneously after leaving the mother's body.

parotoid: a swollen gland behind the eye, in the ear region of some amphibians such as *Salamandra* and true toad (Bufonidae) species.

pectoral: pectoral girdle is used here to refer to the part of the body where the front limbs are attached.

pelvic: pelvic girdle is used here to refer to the part of the body where the hind limbs are attached.

phrygana: a Greek term more or less equivalent to garrigue.

pileus: used here to refer to a lizard snout.

plastron: the ventral part of the shell of turtles, tortoises and terrapins.

refugium (plural: refugia): an area where populations persisted (or even retreated into) during the Ice Ages.

S: in toponyms, South or southern.

scute: the large body scales of turtles, tortoises and terrapins.

Sistema Central: mountain ranges in the centre of the Iberian Peninsula, more or less from Serra da Estrela in Portugal in the west to Sierra de Guadarrama in Spain in the east.

SE: in toponyms, South-east or south-eastern.

solenoglyphous: refers to snakes with pipe grooved fangs (see p. 351).

sp.: = 'species' singular; used when discussing an unnamed species of a genus.

spermatophore: a capsule containing spermatozoa produced, for example, by male tailed amphibians.

Sporades: a group of islands in the Aegean Sea.

spp.: = 'species' plural; used when discussing several or all species of a genus.

ssp.: = 'subspecies' singular.

subocular: row of scales between eye and supralabial scales, as seen in certain snakes.

subspecies: a taxon dividing species into (typically) geographically separated and distinct groups. A gradient (often called a cline) where one subspecies merges into another often exists if, and where, subspecies come into contact with each other. This taxonomic level is not accepted in some of the more novel definitions of 'a species' in general.

superfamily: a higher taxon, grouping related families.

supracaudal: above the tail.

supraciliary granules: a row of very small scales between the supraciliary and supraocular scales, which may or may not be present in lacertid lizards. See generalised schematic illustration on p.232.
SW: in toponyms, South-west or south-western.
SVL: snout-vent length; in tailed animals, this is the length of the body without the tail, running from the tip of the snout to the posterior end of the cloaca.
taxon (plural: taxa): a group of organisms at any level, e.g. subspecies, species, genus, family, etc.
taxonomy: a subject in biological science, concerned with the discovery, delimitation and grouping of taxa. It involves evidence-based data (morphology, DNA, behaviour, etc.) and is not to be confused with nomenclature. Ideally, taxonomy should reflect evolutionary history and the relatedness of taxa, rather than simple grouping of similar-looking taxa.
temporal: the sides of the head.
thermophile: heat-loving.
TL: total length; in contrast to SVL, includes the tail if present.
Tyrrhenian Islands: Corsica, Sardinia, and all associated islets.
ventral: the lower side or belly and throat of an animal.
vertebral: the centre of the back, e.g. a line or stripe running literally along the vertebral column.
viviparity: development of the embryo inside the body of the mother, eventually leading to live birth, as opposed to laying eggs.
W: in toponyms, West or western.

Snakebite emergency

While serious harm from snakebite is very rare in Europe, accidents do happen and fatalities may occur. The fitness of the person bitten plays a role. Older people and children are especially vulnerable, and severe allergic reactions lead to life-threatening situations at times. Other factors determining the severity of a bite's outcome include the body part bitten and the amount of venom administered.

Try to **identify** the snake or take its picture, taking special care to avoid additional bites. Attempts to catch or kill the snake, apart from often being illegal, involve the risk of additional bites.

FIRST AID

The composition of snake venom may differ between species and even subspecies or within populations. Venom containing components which attack the nervous system may, for example, have disastrous effects on the heart rhythm, but do not primarily result in local tissue damage, and a (not too tight) restriction of the local blood flow near the bite is a wise first step. In contrast, the impact of venom causing tissue damage may be aggravated when the bitten area is immobilised. These conflicting treatments are the subject of debate, especially when taking the variety of venomous species in different countries into account. Nevertheless, the points below are widely agreed.

- Try to remain calm. Stress increases blood circulation and the spread of the venom.
- Try to reach the nearest hospital for professional medical treatment.
- Place the bitten body part in a relaxed, comfortable position and lower than the level of the heart.
- Do not eat or drink, certainly not alcohol.
- Do not take any medication unless specifically instructed by a doctor.
- Remove clothing or jewellery etc. which may constrict the bitten limb if it swells.
- Keep as still as possible.
- Do not incise the bite, or try to suck out the venom.

Selected references and further reading

BOOKS

GENERAL

A German language text essential for European herpetology is the 'Handbuch der Reptilien und Amphibien Europas' series (published by Aula Verlag and edited by Wolfgang Böhme, Kurt Grossenbacher, Burkhardt Thiesmeier and others). A multi-volume work containing entries describing all of the species. The first volume was released in the 1980s, while the last volume is still to be published.

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Glandt, D. (2010, second edition 2015). *Taschenlexikon der Amphibien und Reptilien Europas. Alle Arten von den Kanarischen Inseln bis zum Ural*. Quelle & Meyer.

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Sindaco, R., Doria, G., Razzetti E., Bernini, F. (eds.) (2005). *Atlante degli Anfibi e dei Rettili d'Italia (Atlas of Italian Amphibians and Reptiles)*. Societas Herpetologica Italica, Edizioni Polistampa.

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Vacher, J.-P., Geniez, M. (2010). *Les Reptiles de France, Belgique et Luxembourg*. Collection Parthénope, éditions Biotope.

AUDIO

Roché, J.-C. (1997). *Au pays des grenouilles* (Frog Talk). Sittelle.

ONLINE RESOURCES

Amphibian Species of the World database – www.research.amnh.org/vz/herpetology/amphibia/

AmphibiaWeb – www.amphibiaweb.org

Bobby Bok's personal website – www.herpsafari.nl/

European field herping forum – www.fieldherping.eu

Herpetofauna.gr (Herpetofauna of Greece) – www.herpetofauna.gr

Iberian Vipers – www.viborasdelapeninsulaiberica.com/index-eng.html

Jeroen Speybroeck's personal website – www.hylawerkgroep.be/jeroen/

Societas Europaea Herpetologica (European Herpetological Society) – www.seh-herpetology.org/

The Reptile Database – www.reptile-database.org/

www.lacerta.de (the lizard site) – www.lacerta.de

Photographic credits

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Bobby Bok: 37 (bottom), 39 (top), 39 (bottom), 54 (3rd row right), 54 (bottom row left), 54 (bottom row right), 70 (bottom), 72 (bottom), 74, 84 (top), 119 (middle), 119 (bottom), 140 (bottom), 144 (top), 147 (right), 151 (top), 153 (top), 154, 160, 162, 178, 179, 187 (top), 189 (top), 189 (bottom), 194, 196, 200 (bottom), 208 (bottom), 222 (bottom), 227 (bottom), 229 (bottom), 231 (bottom), 333, 336, 341, 343, 346, 350 (2nd row left), 356, 380 (right), 387 (top), 390, 399, 403, 408 (bottom), 420

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