ZOOGEOGRAPHY OF AMPHIBIANS AND REPTILES
IN CÁDIZ PROVINCE, SPAIN

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INTRODUCTION

Cádiz Province, Spain, situated between latitudes 37° 30' 08" N and 36° 04' 00" N is continental Europe's most southern political unit (Fig. 1). The province occupies 735,294 hectares, 48% of which are less than 100 m in elevation. Of 266,000 ha of relief, only 40,000 approach or exceed 500 m. The highest point, Pico de la Pilita de la Reina, Sierra del Pinar, is 1,654 m (Inst. Nac. Invest. Agron., 1971 and Fig. 1). Cádiz is bordered on the north by Sevilla Province, and on the east by Málaga. Two hundred sixty-one km of the 586 km perimeter of Cádiz are coastal. Walter (1971: Table 3) characterizes southern Spain as a warm temperate-subtropical zone with shrub vegetation, having between 500 and 1000 mm of rainfall annually. The population density is 120 persons per square kilometer. Settlements (Fig. 2) are generally small, and 29% of the population is agrarian.

Iberia (composed of Andorra, Portugal, and Spain) occupies a unique position in Europe. Isolated by the Atlantic Ocean on the west, the Mediterranean Sea on the east, and the Straits of Gibraltar to the south, Iberian

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Fig. 1. (Upper): Geographic position of Cádiz within Iberia; (Lower): Generalized physiographic structure of Cádiz (Star = Pico de la Pilita de la Reina at 1,654 m).
terrestrial vertebrates face the additional barrier of the Pyrenees Mountains to the north.


Twenty-one amphibian and 36 reptile species are found in Iberia (Salvador, 1974); of these, Cádiz supports populations of 10 amphibians (48%) and 19 reptiles (52%). Analyses of endemism within Iberia are few, but Almaga (1968) suggests 20% endemism at the species level for Amphibia and 9% for Reptilia. Another analysis (Almaga, 1971) provides figures of 20% amphibian and 11% reptilian endemism. Of the endemic taxa listed by Almaga (1971), Salamandra salamandra bejarae, Triturus marmoratus pygmaeus, Acanthodactylus erythrurus erythrurus, and Chalcides bedriagai are found within Cádiz Province.

**Materials and Methods**

Collection of 1859 adult amphibians and 1510 adult reptiles from Cádiz Province was accomplished by 96,000 km of road driving and general collecting between April, 1969 and March, 1972. After initial reconnaissance, the province was divided into four sections. I attempted to spend equal time collecting in all sections over two years, during both night and day. An attempt was made to secure equal collections of all species (Table 1) by sex and month of capture over the entire year. Not all locality records are documented by vouchers. Road kills, anuran calling sites, and turtle basking sites are included within distributional data (Figs. 3-30). All species recorded, with the exception of Psammodromus hispanicus and both species of Chalcides, were found either on roads or along roadsides, as well as in natural habitats. Collections are deposited principally in Carnegie Museum of Natural History. Data gathered in the field were supplemented by museum records.

In the biogeographic analysis the following faunal elements were omitted: (1) faunal introductions; (2) marine turtles; (3) the fauna of the Mediterranean islands; and (4) Algyroides hidalgoi Boscá, 1916, from San Ildefonso, Spain, which although possibly a valid species, is of questionable status (see Salvador, 1974).
Fig. 2. Collecting localities within Cádiz (Spellings follow the 1961 United States Board on Geographic Names Gazetteer for Spain. Latitudes and Longitudes are provided only for those localities not listed in the Gazetteer). (1) Olvera; (2) Alcalá del Valle; (3) Algodonales; (4) La Algaida; (5) Trebujena; (6) Espera; (7) Villamartín; (8) El Gastor; (9) Setenil; (10) Zahara; (11) Bonanza; (12) Bornos; (13) Sanlúcar de Barrameda; (14) El Bosque; (15) Benamahoma; (16) Grazalema; (17) Arcos de la Frontera; (18) Chipiona; (19) Benaocaz; (20) Villaluenga del Rosario; (21) Jerez de la Frontera; (22) Ubrique; (23) San Isidro de Guadalete (36°40'N,6°00'W); (24) La Barca de la Florida (36°40'N,5°55'W); (25) Tempul; (26) Algar; (27) El Torno (36°38'N,5°57'W); (28) Rota; (29) San José del Valle (36°37'N,5°46'W); (30) Puerto de Santa María; (31) Cádiz; (32) Puerto Real; (33) Galis (36°32'N,5°34'W); (34) Paterna de Rivera; (35) Alcalá de los Gazules; (36) San Pablo; (37) Medina Sidonia; (38) Jimena de la Frontera; (39) Chiclana de la Frontera; (40) Benalup de Sidonia; (41) Conil de la Frontera; (42) Casas del Castaño (36°18'N,5°35'W); (43) San Enrique (36°18'N,5°17'W); (44) Vejer de la Frontera; (45) San Roque; (46) Barbate de Franco; (47) Cabo Trafalgar; (48) Los Canos; (49) Los Barrios; (50) Zahara de los Atunes; (51) Facinas; (52) Algeciras; (53) Tarifa.
Faunal lists for comparison were compiled from sources as follows: Iberia (Salvador, 1974), France (Angel, 1946), Italy (Tortonese and Lanza, 1968), Greece (Böhme, 1975; Wettstein, 1953), Israel (Dor et al., 1963-1964 [1965]), Egypt (Marx, 1968), Tunisia and Algeria (Domergue, 1956-1966, 1959), and Morocco (Hoogmoed 1972; Pasteur and Bons, 1959, 1960; Stemmler, 1971).

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Caudata—The salamander species of Morocco and Cádiz were derived from Mesozoic stock which entered Iberia prior to evolution of the Pyrenees. Both Salamandra and Triturus are known from Oligocene deposits in Europe (Romer, 1966) but Pleurodeles fossils remain undiscovered.

Pleurodeles may have migrated from Iberia to Morocco during a brief period of contact in the Paleocene or Eocene, but Miocene flooding of the Guadalquivir Basin would not have created a significant barrier as the genus is able to tolerate salinity (Knoepffler, 1962). This taxon’s survival in arid regions is also well documented (Salvador, 1974; Valverde, 1960, 1967) and lack of differentiation within P. walli (Pasteur, 1958) suggests a well-adapted, conservative species. Pleurodeles has a wider distribution in North Africa than Salamandra, which suggests a longer history on the continent and may indicate dispersion both with and without glacial-induced precipitation.

The genus Salamandra, however, is well differentiated at the subspecies level in Iberia (Fachbach, 1976). Bons (1973) believed that Moroccan populations might be differentiated at the species level. Salamandra appears to be less resistant to desiccation than Pleurodeles since it survives in Cádiz only in well-forested, high-humidity areas with substantial rainfall and its distribution in Morocco is restricted to montane areas (Bons, 1975). Migration to Morocco during Oligocene-Miocene is indicated and the possibility of recent genetic exchange, even through rafting, appears remote.

Triturus does not occur in Morocco, but is relatively common in Cádiz. T. marmoratus ancestors probably migrated south from northern Europe, crossed the Pyrenees during the Oligocene, and maintained populations in northern Spain during Miocene inundations. With this possibility, Triturus would have reached southern Spain during the Pleistocene, probably in advance of the glaciations, at a time when the Straits of Gibraltar were already functioning as a one-way, south to north, filter.

Anura—Within the Discoglossidae, two genera (Alytes and Discoglossus) are found in Spain and Morocco. Species of Discoglossus, different from D. pictus, are known from both the Lower Oligocene of Europe and from the Miocene of Morocco (Vergnaud-Grazzini, 1966). Bons (1973) and Knoepffler (1962) did not recognize subspecies of D. pictus. Bons
(1973) suggested that *Alytes obstetricans maurus* of Morocco might warrant specific status. *Discoglossus* and *Alytes* may have crossed from Spain to Morocco during brief continental contact during the Oligocene or Miocene. The presence of *Alytes* in Cádiz is expected, but no collection records are available. Konrad Klemmer (*pers. comm.*) reported having heard what he believed to be *Alytes* calling along the road between Jerez de la Frontera and Sevilla. The apparent absence of *Alytes* from Cádiz at the present time may represent a northward contraction of the Iberian range precipitated by the Miocene flooding of Cádiz. Knoepffler (1962: 42) stated that *D. pictus* larvae transform normally in water with a salt content of 2.47-6.08 g/l, and are thus better adapted to salinity than the insular *D. sardus* (1962:46). This may explain, in part, survival of *Discoglossus* in Cádiz through Miocene inundations, and presents the possibility of two-way exchange of individuals across the Straits.

The family Pelobatidae had achieved a Holarctic distribution by the Paleocene-Eocene and modern species had evolved by the Miocene (Estes, 1970). *Pelobates* was probably circum-Mediterranean by the Miocene and the present disjunct distribution may be the result of glaciation and climatic change. *Pelobates varaldii*, most closely related to *P. cultripes* (Estes, 1970:327), probably diverged from a *cultripes*-like stock before the Miocene, after its migration to Morocco from Spain. The absence of *Pelodytes* from Morocco suggests southward expansion into Cádiz during the Pleistocene, when the Straits were already functioning as a barrier.

Within the Bufonidae, only one species, *Bufo bufo*, occurs in both Spain and Morocco. Miocene fossils from Beni-Mellal, Morocco, more closely resemble *B. regularis* than *B. bufo* (Vergnaud-Grazzini, 1966) but it is conceivable that *B. bufo* entered Morocco during the Oligocene-Eocene. Differentiation of *Bufo calamita* from a *viridis*-like stock probably occurred in eastern Europe during late Miocene and *B. calamita* subsequently reached southern Spain after the Straits had opened.

*Hyla arborea* probably entered Iberia and Morocco through the eastern Mediterranean after the Oligocene and followed the dispersal route diagrammed by Bons (1974: Fig. 1,B). *Hyla meridionalis* was distributed throughout northern Morocco and southern Iberia after its pre-Miocene differentiation from *H. arborea* but before the Miocene inundations of Cádiz. Miocene flooding may have forced *H. meridionalis* northward in Iberia but it later reinvaded the south during the Pleistocene.

The genus *Rana* is known from European Eocene deposits (Romer, 1966) and Moroccan Miocene deposits (Vergnaud-Grazzini, 1966). Since *Rana ridibunda* has a circum-Mediterranean distribution, contemporaneous entry into Africa and Europe across Asia is a possibility.

Testudines—The genus *Mauremys* is known from Eocene deposits in Europe and Holocene deposits in North Africa whereas *Emys* is known
as early as the European Eocene but has not been discovered prior to the Pliocene in North Africa. Salinity tolerance in *Mauremys* was documented by Schoffeniels and Tercafs (1966) and a Miocene crossing from Spain in spite of the saline basins in south Spain is probable. *Emys* followed a similar pattern and recent extinction in Cádiz may be related to the current agricultural use of water. Whether two specimens (MCNM 46) collected in Cádiz were imported, or represent a relictual population, is problematical. *Emys orbicularis*, widespread from France to Morocco (Hellmich, 1962) and abundant on the Coto Doñana (Valverde, 1960), was not seen in Cádiz between 1969 and 1972. Peter Hopkins (pers. comm.) reported an observation from Grazalema, but this sighting remains unverified.

The genus *Testudo* probably arrived in Spain around the eroded eastern Pyrenees before the Oligocene (Bergounioux, 1958). *Testudo graeca*, however, may have reached Spain with the assistance of man after the Pleistocene. Loveridge and Williams (1957) postulate a continuous population of *Testudo graeca* across southern Europe, and invasion of northwest Africa via Spain. Post-Pleistocene *Testudo* (cf. *graeca*) have been reported from Gorham’s Cave, Gibraltar (Delair, 1964), suggesting that southern Spanish *Testudo* populations are relictual, but the origin of these populations remains questionable. Lortet (1887) and Alvarez López (1934) believed that *Testudo* had been widely introduced in Spain as a garden animal. Machado (1859) reported the species as common in Huelva Province on the sandy soils of Doñana, but Valverde (1960) stated that the Doñana population had been re-introduced from Morocco since 1949. The species has long been a popular part of the world-wide pet trade (Busack, 1974). None were observed in suitable coastal habitat in Cádiz, and the question of natural occurrence in southern Spain is not resolved. In summary, Morocco derived populations of *Mauremys* and *Emys* from Cádiz, and the Spanish *Testudo* populations are probably recent introductions from North African sources.

*Sauria*—The lizard family Gekkonidae has probably been influenced more by man in its present distribution than any other lizard family. McCoy (1970) mapped *Hemidactylus turcicus* localities which, in addition to being circum-Mediterranean, are also in the Americas, Africa, and Asia. *Tarentola mauritanica* also demonstrates a circum-Mediterranean distribution, although the genus *Tarentola* is clearly African. Both species could have entered Cádiz through northern Spain as they expanded their ranges around the Mediterranean, they may have rafted across the Straits, or some combination of these factors may be responsible for their present occupation of southern Spain. Both species probably achieved their present distributions by the Holocene.

Holocene fossils of the largely African family Chamaeleonidae are known from southern Europe and Africa (Romer, 1966), and whether
Chamaeleo chamaeleon arrived in Cádiz from Morocco through rafting or man-assisted transport remains a mystery. Populations of the species along coastal Cádiz could be the result of either mode of transport. The city of Cádiz has been continuously inhabited for 3000 years and the present circum-Cádiz (city) distribution of Chamaeleo lends itself to either interpretation.

Amphisbaenians, on the other hand, known from European Eocene and Moroccan Miocene deposits (Hoffstetter, 1961), would have been subjected to an Eocene-Oligocene crossing to Morocco and an additional coastal dispersion to Greece along the north shore of the Mediterranean. Post-Pleistocene habitat changes probably removed Blanus from parts of a continuous range across the northern Mediterranean countries.

Eocene fossils representing the Lacertidae are known from Europe (Hoffstetter, 1961) and an Oligocene-Miocene migration to Morocco is indicated. Lacerta lepida, Podarcis hispanica and Psammodromus algirus are shared by Spain and Morocco. Psammodromus hispanicus is restricted to Europe and probably evolved later, when Miocene flooding of Cádiz either prevented or restricted faunal exchange between Spain and Morocco. Acanthodactylus erythrurus probably evolved in North Africa, and entered Iberia during the Pleistocene.

Miocene representatives of the Scincidae from Beni-Mellal, Morocco, and the lack of Tertiary skink fossils from Europe, made Hoffstetter (1961) skeptical about Vindobonian connections at Gibraltar. Chalcides chalcides presently occurs from Morocco through France and Italy and may have achieved residency on southern Iberia through rafting before or during the Miocene. The endemic C. bedriagai is presently distributed through Iberia in the region which would have served as a glacial retreat area, and it is conceivable that, if Miocene flooding in Cádiz separated northern and southern populations of chalcides-like stock, C. bedriagai was derived from that isolated southern stock. Chalcides bedriagai, with its present northern limit at mid-peninsula, differentiated on Iberia relatively recently. Reinvasion of south Spain by C. chalcides could have been from the north, stimulated by Pleistocene climatic changes, from Morocco by rafting, or, most likely, from both directions. Post-glacial expansion of both species' ranges did, in fact, occur after the Straits had opened.

Serpentes—Colubrid snakes probably entered Spain both through the Pyrenees and by rafting from Morocco. Coronella girondica, Malpolon monspessulanus and Natrix natrix probably entered the Iberian peninsula through the Pyrenees before the completion of their circum-Mediterranean expansion. Natrix natrix and C. girondica were probably eliminated from Israel and Egypt as a result of Pleistocene climatic changes whereas Malpolon survived around the Mediterranean and expanded to the edges of the Sahara. The absence of Natrix maura from Israel, Egypt, and Greece suggests much the same analysis but offers an alternative hypoth-
esis as well. If *Natrix maura* had evolved from Asiatic stock in North Africa its absence from Greece would be the result of incomplete post-glacial expansion rather than habitat modification or competitive exclusion. This latter explanation is favored. *Macroprotodon cucullatus* probably evolved in North Africa, entered Iberia by rafting, and expanded its range during and after the Pleistocene. *Coluber hippocrepis* is obviously an African immigrant and the lack of *Elaphe* in Morocco points to a European origin for *E. scalaris*.

Viperids are known from the Pliocene of Europe (Romer, 1966), when the Gibraltar Straits were already functioning as a one-way filter. Circum-Mediterranean distribution of the genus *Vipera* and the littoral sand-dune habitat of *V. latasti* in Huelva Province, Spain (Valverde, 1960, 1967) leads me to suspect a crossing from Africa via the straits during or after the Pleistocene. At this time *V. berus* and *V. aspis* were invading Iberia through the Pyrenean filter. *Vipera latasti* has been documented throughout most of Iberia and northwest Africa by Bieling et al. (1936), Gasc (1968) and Salvador (1974), but its occurrence in Cádiz is currently open to question. Böttger (1881:372) stated that, in spite of its alleged abundance around Algeciras, he spent many hours during October and November, 1880, searching unsuccessfully for the species. Steward (1971:168) stated “I have been told by the owners of a cork-oak plantation in the hills north of Algeciras in south Spain, that they keep serum available and expect to have to treat up to six cases of viper bite each year . . . but have never known any fatalities . . .” Hopkins (pers. comm.) reports having seen what he believed to be a viper in the vicinity of Grazalema. Intensive search was made in the area between Algeciras and Grazalema between 1969 and 1972 but no *Vipera* were seen.

**Discussion**

Plate tectonics does not provide all the answers to the questions of Iberian faunal evolution as “Spain presents something of a problem in that it must be rotated independently of Europe to fit into the Bay of Biscay” (Glen, 1975:147). Bosellini and Hsü (1973:144) believed the “Spanish Betic Cordillera and Moroccan Rif were never far apart during Mesozoic and Cainozoic.” Le Pichon (1968) reconstructed the area using two different sets of data, and found that Africa and Spain were in contact during the entire Cenozoic and that Spain should have been separated from Europe by as much as 1500 km during the Paleogene. The “key” to the question of land bridges, dispersal routes, and a totally workable geologic scheme is probably many years away, but we have sufficient data to speculate conservatively.

Dispersal centers, as defined by Lattin (1957), are refugia in which animals and plants survived widespread unfavorable environmental condi-
tions (aridity, glacial advance, competitive pressure) and are important only if long-term conditions do not cause extinction of the biotic communities present. Spain and North Africa, defined as arboreal dispersal centers by Lattin (1957) and Müller (1974), form part of the Atlantomediterranean subdivision of a Mediterranean Center within the Palaeartic Region (Müller, 1974).

Distribution of several Mediterranean vertebrate species, at first sight, suggests a link across the western Mediterranean Sea at Gibraltar. But Corbet (1967) believed that mammals could have been introduced by man or dispersed through formerly continuous habitat around the eastern Mediterranean. To support this hypothesis, he stated (1967:334) that “the Sahara appears to have existed throughout the Tertiary and although it has fluctuated in size and degree of aridity . . . there are no reasons to suppose that continuity of forest or moist woodland has been anything but marginal and sporadic” and that “recent mammals give little support for the existence of an additional terrestrial connection across the Mediterranean at any time” (1967:325). Former continuity, albeit marginal and sporadic, and an eastern migratory route for vertebrates was also postulated by Arambourg (1963), Biberson (1970), Fairbridge (1962), Savage (1967), and Tchernov (1975). Ranck (1968:54) suggested that the modern rodents of North Africa and the eastern Mediterranean be placed in a Sahara-Sindien faunal region.

Late Oligocene faunas which shown an affinity to France are well represented in Spain (Savage, 1967), and Osborn (1915) mentioned that forests and meadows of southern Europe maintained a northern Eurasian fauna throughout the Pleistocene.

Osborn (1915), however, also suggested that the Eurasian fauna entered Africa in the latter part of the Pleistocene and survived in forested regions of present and prehistoric times. De Bruijn (1973) believed that a limited faunal exchange was possible between Africa and Spain at some brief period during the late Miocene, when an insurpassable marine barrier did not exist. This latter interpretation is further supported by Savage (1967), who noted that no African mammal elements were known in Europe before mid-Miocene.

Recent detailed geologic information regarding the Straits of Gibraltar is available (Gaibar-Puertas, 1973). The current Straits separate Europe and Africa by 14 km and measure, at a maximum, 935 m in depth. The gradual slope of the channel’s margins (Gaibar-Puertas, 1973:Fig. 10) indicates erosion rather than major tectonic activity as the primary factor in development. Surface current direction and flow (Gaibar-Puertas, 1973:Fig. 1) are indicated as north-eastward from 2.16 km/hr off Tanger in NW Africa to 0.68 km/hr off SE Gibraltar. Stanley et al. (1975:Figs. 11-13) indicated a counterclockwise current flow in Algeciras Bay. From these data, then, it is assumed that rafting from NW Africa to SE Spain.
Table 1. Cádiz Herpetofauna and Zoogeographic Affinities

<table>
<thead>
<tr>
<th>TAXON</th>
<th>ORIGIN OF IBERIAN POPULATION</th>
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<tr>
<td></td>
<td>Africa</td>
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<td>Amphibia</td>
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<td><strong>CAUDATA</strong></td>
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<tr>
<td>(Salamandridae)</td>
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<tr>
<td><em>Pleurodeles waltl</em> Michaeelles, 1830.</td>
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<tr>
<td><em>Salamandra salamandra</em> (Linnaeus), 1758.</td>
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<tr>
<td><em>Triturus marmoratus</em> (Latreille), 1800.</td>
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<tr>
<td><strong>ANURA</strong></td>
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<tr>
<td>(Discoglossidae)</td>
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<td><em>Discoglossus pictus</em> Otth, 1837.</td>
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<tr>
<td>(Pelobatidae)</td>
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<tr>
<td><em>Pelobates cultripes</em> (Cuvier), 1829.</td>
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<tr>
<td><em>Pelodytes punctatus</em> (Daudin), 1802.</td>
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<td>(Bufonidae)</td>
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<td><em>Bufo bufo</em> (Linnaeus), 1758.</td>
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<td><em>B. calamita</em> Laurenti, 1768.</td>
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<td><em>Hyla meridionalis</em> Böttger, 1874.</td>
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<td>(Ranidae)</td>
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<td><em>Rana ridibunda</em> Pallas, 1771.</td>
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<tr>
<td><strong>Reptilia</strong></td>
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<td><strong>TESTUDINES</strong></td>
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<td><strong>SAURIA</strong></td>
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<td>(Gekkonidae)</td>
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<td><em>Tarentola mauritanica</em> (Linnaeus), 1758.</td>
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<td><em>Acanthodactylus erythrurus</em> (Schinz), 1833.</td>
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<tr>
<td><em>Lacerta lepida</em> Daudin, 1802.</td>
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<td><em>Podarcis hispanica</em> (Steindachner), 1870.</td>
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<td><em>Chalcides bedriagai</em> (Boscâ), 1880.</td>
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<td><em>C. chalcides</em> (Linnaeus), 1758.</td>
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<td><em>Coluber hippocrepis</em> Linnaeus, 1758.</td>
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<td><em>Coronella girondica</em> (Daudin), 1803.</td>
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<td><em>Elaphe scalaris</em> (Schinz), 1822.</td>
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<td><em>Macropotodon cucullatus</em> (Geoffroy Saint-Hilaire), 1827.</td>
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<td><em>Malpolon monspessulanus</em> (Hermann), 1804.</td>
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<tr>
<td><em>Natrix maura</em> (Linnaeus), 1758.</td>
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<td><em>N. natrix</em> (Linnaeus), 1758.</td>
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is both possible and probable and the entire land bridge argument becomes moot.

Having arrived on the Peninsula through various migration routes at various geologic times, Iberian amphibians and reptiles later dispersed to achieve their present distributions under the influence of environmental and geomorphological change. Amphibians probably arrived from more northerly Europe prior to the evolution of the Pyrenees, whereas reptiles followed two distinct patterns. Migration from Africa by rafting or via temporary land connections established some reptilian species in Spain while others arrived directly from Europe. Geckos and terrestrial turtles, however, have been much influenced by man and their presence around the Peninsula is difficult to explain with any certainty.

Cádiz fits into the Iberian zoogeographic picture as the southern-most province both of Spain and of continental Europe, and distributions of its herpetofauna provide insight into past dispersal patterns. Absence from Morocco of species found in Cádiz indicates arrival of these taxa in south Spain from more northern localities at a time when the Straits of Gibraltar were already operating as a one-way (south to north) filter. The presence in Morocco of species absent from Cádiz, but present in more northern Spain, suggests a relatively recent extinction in Cádiz due, perhaps, to man’s activities or to relatively recent environmental change.

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Figs. 3-30. Distribution maps for amphibians and reptiles of Cádiz (Solid symbols represent museum specimens; hollow symbols are sight records):

Fig. 3. Pleurodeles waltl.
Fig. 4. Salamandra salamandra.
Fig. 5. Triturus marmoratus.
Fig. 6. Discoglossus pictus.
Fig. 7. Pelobates cultripes.
Fig. 8. Pelodytes punctatus.
Fig. 9. Bufo bufo.
Fig. 10. Bufo calamita.
Fig. 11. Hyla meridionalis.
Fig. 12. Rana ridibunda.
Fig. 13. Mauremys caspica.
Fig. 14. Hemidactylus turcicus.
Fig. 15. Tarentola mauritanica.
Fig. 16. Chamaeleo chamaeleon.
Fig. 17. Blanus cinereus.
Fig. 18. Acanthodactylus erythrurus.
Fig. 19. Lacerta lepida.
Fig. 20. Podarcis hispanica.
Fig. 21. Psammodromus algirus.
Fig. 22. Psammodromus hispanicus.
Fig. 23. Chalcides bedriagai.
Fig. 24. Chalcides chalcides.
Fig. 25. Coluber hippocrepis.
Fig. 26. Coronella girondica (circles), Natrix natrix (triangles).
Fig. 27. Elaphe scalaris.
Fig. 28. Macroprotodon cucullatus.
Fig. 29. Malpolon monspessulanus.
Fig. 30. Natrix maura.
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