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FAUNA I. FAUNA OF PERSIA

FAUNA, the assemblage of animal species, generally excluding domestic animals (q.v.), living within a defined geographical area or ecological zone.

i. FAUNA OF PERSIA

The Persian fauna is known in piecemeal fashion from studies of various groups of animals, but there has so far been no coordinated effort to record the entire range systematically, as there has been for the Persian flora (e.g., Rechinger) and for the fauna of the former Soviet Union, former British India, and the Arabian peninsula (Büttiker; Büttiker, Wittmer, and Krupp). In Persia some invertebrate groups have been studied systematically, and studies have been undertaken for all vertebrate groups, but the scientific literature is vast and scattered; a preliminary attempt to include the most important works in an annotated bibliography was undertaken by R. L. Burgess and his colleagues in 1966; Henry Field's bibliography, also prepared with the assistance of colleagues, is even larger. Bashir E. Allus's bibliography on the vertebrates of Iraq and neighboring countries is also very useful, as are comprehensive bibliographies on the fish, amphibians, and reptiles of Turkey by Ibrahim Baran and his colleagues and on the mammals by Hans Kumerloeve.

SURVEY OF LITERATURE ON THE PERSIAN FAUNA

The first European naturalist to visit Persia was Samuel Gottlieb Gmelin, employed by the Russian government to explore parts of Gīlān and Māzandarān in 1770-72 (1774; 1784; Pallas). Subsequent explorers who made zoological collections included Guillaume A. Olivier, who went to Isfahan and Tehran in 1796; Édouard Ménétriés, who worked in the mountains of Ṭāleš; Carl Eduard von Eichwald (1834-37; 1841), who touched at two or three places on the Persian coast during his exploration of the Caspian shores in 1825-26; Rémi Aucher-Eloy, a French botanist who made zoological collections on his visits to Shiraz, Būšehr, Bandar-e ʿAbbās(ī), the Baḵtīārī mountains, Hamadān, Tehran, and Tabrīz but failed to note the precise locations where each sample was taken; William K. Loftus, who collected some zoological specimens along the Persian-Turkish border region in 1849-52; Alexander Keyserling, who collected a few reptiles and fish in Khorasan in 1858-59; and Theodor Kotschy, a botanical collector who brought some reptiles, without adequate location notes, to the Naturhistorisches Museum in Vienna.

Apparently the first attempt to compile a list of all the vertebrates known from Persia was that of Filippo De Filippi, who included 30 mammals, 167 birds, 39, 3 amphibians, and 22 fishes. He also provided a list of land and fresh-water mollusks. A more thorough and systematic synopsis of the vertebrates, exclusive of fish, was prepared by the Persian Boundary Commission of 1870-72 under the direction of Frederic Goldsmid (q.v.). William Thomas Blanford listed 89 mammals, 383 birds, 92 reptiles, and 9 amphibians, as well as providing a survey of scientific natural history in Persia up to 1876. He included a brief descriptive analysis of the fauna and considered the relations between the faunas of various regions of Persia and those of neighboring regions. No other author has attempted such a comprehensive survey of the Persian fauna.

After Blanford's work the pace of studies of Persian fauna increased. The Russian ornithologist N. A. Zarudny traveled extensively in Persia in the late 18th and early 19th centuries, collecting birds and other vertebrates (Zarudny; Nikol'skiĭ, 1903; idem, 1907); the greater part of his collections is in the zoological museum in St. Petersburg. Persian birds have probably been studied more extensively and by more workers than any other group of fauna (for bibliography, see BIRDS IN IRAN). The most important synoptic lists, handbooks, and papers include those of Simon H. Jervis Read (1958; idem in *Camb. Hist. Iran*); Charles Vaurie; François Hué and Robert D. Etchécopar;

Hermann Heinzel and his colleagues; Derek Scott and his colleagues; Stanley Cramp and K. E. L. Simmons; Colin James Oliver Harrison; and Philip Arthur Dominic Hollom and his colleagues. According to Scott, 491 species are known to occur in Persia.

Mammals, particularly game species, have also been investigated, most notably in reports of the Persian Game and Fish Department (Sāzmān-e šekārbānī wa naẓārat bar ṣayd), later incorporated into the Department of Environmental Conservation (Sāzmān-e ḥefāẓ-e moḥīṭ-e zīst; see ENVIRONMENTAL PROTECTION). The most comprehensive synopsis of Persian mammals is that of Douglas Lay, who accompanied the Street expedition in 1962-63. He provided descriptions of habitats, remarks on specimens collected by the expedition, and a synoptic list of the 125 mammal species known in Persia in 1967, with summaries of their distribution. Xavier de Misonne published a descriptive zoogeographic analysis of the mammals, as well as brief descriptions and characterizations (1959; idem in *Camb. Hist. Iran*). Fred Harrington produced a guide to Persian mammals under the auspices of the Department of the environment; it was organized by type of habitat, rather than taxonomically, and included 148 species, 112 of them illustrated. Probably the most detailed systematic study of a group of mammals in Persia is that of the bats (q.v.) undertaken by Anthony DeBlase, who accompanied the 1968 Street expedition; he recognized thirty-eight species and provided a detailed account of each, as well as a brief zoogeographic analysis of Persian bats.

Among important papers on Persian reptiles published since Blanford's work are those by A. M. Nikol'skiĭ (1903; 1907), based on Zarudny's collections; Franz Werner, who published a list of known species and a descriptive zoogeography; and Steven Anderson (1963) on a collection from southern Persia, including a list of the reptiles, a zoogeographic discussion, and a bibliography. Anderson (*Camb. Hist. Iran*) provided a zoogeographic analysis of lizards and an updated list (1974) and synopsis (1979) of turtles, crocodiles, and amphisbaenians. Maḥmūd Laṭīfī of the Rāzī institute (Moʾassasa-ye Rāzī; see DĀM-PEZEŠKĪ) at Karaj near Tehran, one of the foremost producers of snake antivenin in the world, compiled a handbook on the snakes of Persia, including keys for identification, descriptions, illustrations, distributions, and information on snakebite; in the English translation Alan Leviton and George Zug provided an emended list of Persian snakes, totaling seventy-five taxa.

Amphibians have traditionally been considered together with reptiles. In

addition to the papers by Werner and Anderson (1963), Anderson (see AMPHIBIANS) listed six species of salamanders (a seventh, *Salamandra salamandra semenovi*, has since been recorded) and seventeen species of frogs from Persia. The most detailed amphibian study so far is that by Josef Eiselt and J. F. Schmidtler on the frogs of Persia.

Apart from studies of commercially important species undertaken by members of the Department of the Environment, the fishes (q.v.) have received attention from several zoologists. Nelson Annandale and S. L. Hora (1920) reported on those of Sīstān; Lev S. Berg provided the first list of fresh-water fish since that of De Filippi; and M. A. G. Saadati attempted a systematic treatment. N. B. Armentrout (1969; 1980) compiled a checklist of Persian fresh-water fish, and the list has been extended and updated in the publications of Brian Coad (1979; 1980; 1987), who has recorded 155 native fresh-water species and has provided the only published zoogeographical analysis.

Insects constitute the largest segment of Persian fauna. Although there has been no comprehensive treatment, there is a large literature on individual species. An important series, “Contribution à la faune de l’Iran,” has been published in *Annales de Société Entomologique de France*. In a symposium volume on the fauna and zoogeography of the Middle East, edited by Friedhelm Krupp, Wolfgang Schneider, and Ragnar Kinzelbach, a number of important papers shed light on distribution patterns and relationships among the insects of Persia and neighboring countries, includingOdonata (Schneider), Raphidiopetera (H. Aspöck), Trichoptera (Malicky), and Zygaena (Naumann).

Arthropods (q.v.) that have been studied in Persia include a number of arachnids (q.v.), like ticks, mites, spiders, scorpions (see especially Vachon and Kinzelbach for a review of taxonomy and distribution in the Middle East), pseudoscorpions, and solpugids; centipedes; millipedes; and such crustaceans as fresh-water crabs and terrestrial isopods.

Fresh-water and terrestrial gastropods and oligochaetes also occur in Persia.

[See now Firouz, 2005—e.g., Figure 1.]

RELATIONS OF THE FAUNA

The vast, arid, and physiographically complex tract stretching across North Africa, southwestern Asia, and northwestern India is home to a complex of species, many of them distinct from those of sub-Saharan Africa, tropical Asia,

and northern temperate Eurasia. Their relations at the generic and family levels are, however, for the most part with those of Eurasia, and they form part of the fauna classically termed Palearctic. Persia is the most geographically complex area within this region and consequently has the greatest biological diversity for its size in southwestern Asia.

In this article only a descriptive outline of the distribution of Persian fauna in relation to physiographic and ecological features can be presented, with no speculation upon historical factors that have produced the present complex of species. Except for faunal elements shared with other regions, southwestern Asian species are distributed between two broad types of landscape. One is the region generally known as the Iranian plateau, stretching from the Anatolian highlands across Persia and Afghanistan to the Solaymān range in the southeast. Species occupying this area have been labeled Irano-Turanian by most zoogeographers. Anderson (in *Camb. Hist. Iran*) divided them into Iranian elements, restricted to the uplands, and Aralo-Caspian elements, concentrated mainly on the plains and basins of Turkmenistan and neighboring republics of Central Asia (see iii, below). The second major landscape type, encompassing the low-lying desert areas along the southern margins of the Palearctic from North Africa to northwestern India, is home to the Saharo-Sindian group of fauna. Within these regions are species and associations of species with much more restricted distribution. Considering the fauna of western Asia as a whole, various authors have introduced a confusing array of terms, attempting to systematize patterns of distribution within particular taxa. In addition to the labels already mentioned, there are Holarctic for the temperate and boreal latitudes of the northern hemisphere, including North America; Western and Eastern Palearctic; Euro-Siberian for the northern latitudes of the Palearctic; Eremian for Saharo-Sindian plus the arid portions of Irano-Turanian; Ethiopian or Afrotropical for sub-Saharan Africa; Oriental for southern and southeastern Asia, Paleotropical for Ethiopian plus Oriental; Mediterranean for southern Europe and the North African littoral plus the Levant; and various subdivisions that are more or less self-explanatory. Although some authors have used these terms descriptively, to others they have implied areas of origin. When used here they are simply descriptive.

Fishes. The native fresh-water fishes of Persia include 155 species in 24 families. In his concise analysis of the zoogeography of Persian ichthyofauna Coad (1987) recognized 19 major drainage basins, all but 4 of which are

endorheic. The fishes are principally Palearctic but include Oriental and Ethiopian elements, particularly in those few basins that drain into the Persian Gulf. The Sīstān basin also contains Oriental species and species derived from the Hindu Kush in Afghanistan. Three families, Cyprinidae, Cobitidae, and Gobiidae together comprise 73.6 percent of the species in Persia. The Caspian is the most diverse drainage basin, with 15 families, whereas the Tigris basin contains 11. The basins that drain into the Persian Gulf have 5 to 7 families each, and the remaining internal drainages have 4 or fewer. According to Coad, the most important factors in determining the present distributions at species level are transgressions of the Caspian, which shares elements of Black Sea/Mediterranean fauna; drainage captures owing to orogeny and erosion, which have enabled fish to move between adjoining basins; river highways that over time have connected habitats at very different elevations (e.g., the Helmand river between the Hindu Kush and the Sīstān basin); marine penetration from one basin to another in southern Persia, causing fresh-water fishes to develop a tolerance for salinity; and possibly human intervention. Because of rugged terrain and extreme climate (q.v.) Coad believes that historically most human relocation of native fish has been within, rather than between, basins.

Shifts in climate and devegetation affect all biota in the environment. Coad has discussed the impact of such environmental changes on fresh-water fishes (1980). The pace and impact of devegetation have increased as the Persian population has grown and industrialization expanded. Overgrazing by larger and larger flocks and herds of domestic stock and deforestation for fuel and to clear land for agriculture have altered local climates, reduced rainfall and retention of water, and increased rates of erosion and silting of streams, lakes, and marshes. Extensive irrigation projects have deflected water from natural watercourses while at the same time providing new aquatic habitats like *qanāt*s. Dam construction can have a cascade of effects deleterious to aquatic life, whereas wells may lower water tables, leading to loss of springs and marshes without providing new habitats for fish. Agricultural and industrial runoff introduces silt and toxic chemicals into aquatic habitats. A number of exotic fish species have been introduced into Persian waterways for mosquito control and both commercial and sport fishing; such introductions alter ecological relations and may have profound consequences for native species. Overfishing has reduced stocks of such important food fishes as Caspian sturgeon, Caspian “salmon,” *safīd māhī* (*Rutilus frisii kutum*), *Rutilus rutilus caspicus*, *Cyprinus carpio*, clupeid species, and the like.

Amphibians. Persian amphibians (q.v.) are far less numerous than other groups of vertebrates, being restricted to environments that reliably provide at least seasonal water for breeding and are thus most available in the mountain drainages of the north and west. Two families of salamanders occur in Persia: The Hynobiidae, which is temperate Asian in distribution, is represented by two species of the genus *Batrachuperus* in northern Persia, and the Salamandridae, Holarchic in distribution, is represented by one species each of the European or Euro-Siberian genera *Salamandra* and *Triturus* and three species of the Anatolian-Iranian genus *Neurergus*. All are restricted to springs, caverns, and permanent streams on the windward slopes of the Zagros, Alborz, and Kopet-Dag ranges. Frogs and toads are more tolerant of arid conditions and thus more broadly distributed. They represent four or five genera in four widely distributed families. *Hyla savignyi* is a Middle Eastern representative of a Euro-Siberian species of a genus that is primarily neotropical in distribution, with a few Holarctic species; in Persia its distribution corresponds approximately to that of the salamanders. *Pelobates syriacus*, which occurs along the southern Caspian coast, represents the Western Palearctic group of “spadefoot” toads. The genus *Bufo* is nearly worldwide in distribution; two species or species groups represented in Persia are Western Palearctic: *Bufo bufo*, with one subspecies just entering northern Persia, and *Bufo viridis*, with several populations and related isolated species in all provinces. Two Oriental species, *Bufo olivaceus* and *Bufo stomaticus* occur in eastern Persian Baluchistan. The Ranidae are represented by four genera in Persia: *Rana ridibunda* and *Rana macrocnemis*, which are Western Palearctic; *Rana camerani*, which is Anatolian; and *Rana* (*Euphlyctis*, according to some authors) *cyanophlyctis*, an Oriental species extending into eastern Persian Baluchistan and Sīstān.

Reptiles. To the observant traveler, reptiles, particularly lizards, are among the most familiar animals, as many are diurnal and most active during the hours of least extreme temperature. Certain general ecological types occur in most geographical regions of Persia, where 113 species of lizards are currently recognized. Of the Agamidae large rock-dwelling lizards of the genus *Laudakia* (or *Stellio*) are common in mountainous and foothill regions, where deep crevices provide retreats. Smaller species of the genus *Trapelus* move from the ground onto small rock piles or into branches of shrubs, where they watch for passing insects. On the flat plains of the central plateau toad-headed agamids, *Phrynocephalus*, sit and wait for ants, termites, and other small ground prey; several different species occur on the various types of substrate: loose sand,

gravel, silt, and so on. In southwestern Persia and on the plateau, where alluvial soils permit burrowing, large herbivorous spiny-tailed *Uromastyx* are sometimes seen. The largest lizards in Persia are monitors of the genus *Varanus*, which occur in most provinces; they are active predators, hunting other lizards, rodents, and prey of comparable size. Two widely distributed Western Palearctic legless lizards in the family Anguidae extend into northern Persia, *Anguis fragilis*, a somewhat specialized feeder on slugs and snails inhabiting the Hyrcanian forest floor, and *Ophisaurus apodus*, a more active predatory lizard tolerant of drier conditions, found in northern Persia and the western foothills of the Zagros. Active foragers for insects in nearly all Persian environments are the relatively small, quick lizards of Lacertidae, often called “race runners.” Several genera occur on various substrates, and these lizards are common in most habitats. The genus *Lacerta* is generally Euro-Siberian in distribution and is represented by species in northern and mountainous regions of Persia; *Eremias* is a genus with many species throughout the Irano-Turanian region and is common on the plains, steppes, and interior foothills of the Iranian plateau, whereas there is only one genus of *Ophisops* on the plateau in Persia. *Mesalina* and *Acanthodactylus* are Saharo-Sindian genera; most species of the latter are specialized for running on loose sand. The shiny-scaled skinks are less numerous but occur in most habitats; some species are adapted to rocky habitats, others to burrowing in loose sand. The most diverse lizard family at the generic level is the geckos, many species of which are adapted to specialized substrates and environmental conditions. Most are nocturnal, but some are crepuscular and a few abroad even during the day. Most familiar to the traveler are species that live in and around houses and can be seen every evening clinging to plaster walls, waiting for insects attracted to the lights.

In his study of the lizards Anderson (in *Camb. Hist. Iran*) found that only a few species with broad ecological tolerance extend throughout the greater part of either the Saharo-Sindian or Irano-Turanian regions. Although each area has been penetrated by species characteristic of the other, relatively few species are broadly distributed in both regions. Entering southwestern Asia from the northwest and extending into Persia are elements related to European species, primarily those with Mediterranean distribution. Aralo-Caspian desert species occur in northern Persia in areas that are physiographic extensions of lowland Central Asia. A few Oriental faunal elements occur in southeastern Persia, primarily Baluchistan.

The Persian fauna includes seventy-five species and subspecies of snake (Laṭīfī, 1985; idem, 1991). Although every province is rich in species, snakes are less commonly seen than lizards, partly because they are well camouflaged and usually remain motionless in the presence of large animals. Because they feed higher on the food chain, the population densities of snakes tend to be much lower than those of lizards. All are predators, the larger species feeding mainly on rodents, whereas small and medium-sized species feed on lizards and occasionally birds and the smallest on arthropods. A few, like the grass snake (*Natrix*), eat fish, amphibians, or both. Although many species may be considered beneficial because they feed on rodent pests that compete with humans for crops and stored foods, a few are dangerous to human beings, particularly if barefoot or lightly shod. There are several genera and species of viper, and some, like the small saw-scaled vipers of the genus *Echis*, are quite aggressive, whereas others, like the false horned vipers (*Pseudocerastes*) and *Vipera lebetina* are large and capable of injecting quantities of venom. Vipers are well camouflaged, "ambush" predators, and may thus be trod upon by unwary humans and livestock. The cobra, *Naja oxiana*, an Oriental species that occurs in northeastern Persia, is an active forager and may be drawn to villages by the presence of rodents. Most snake species belong to the family Colubridae. Many are diurnal and forage actively for their prey; perhaps just as many, including vipers, are primarily nocturnal, at least during the hottest seasons. The Persian Gulf waters are rich in species of sea snakes, which prey primarily on fish; all are dangerously venomous and pose a hazard to net fishermen. The relations of Persian snakes are primarily Western Palearctic, particularly at the generic level. A few genera are Holarctic in distribution, for example, *Coluber*, *Elaphe*, and *Agkistrodon*. No species is Holarctic, however. *Eryx*, *Natrix*, *Malpolon*, *Telescopus*, *Vipera*, and *Echis* are Western Palearctic genera, *Eirenis* and *Pseudocrastes* Iranian in their primary distribution. *Spalerosophis*, *Lytorhynchus*, *Walterinnesia*, and *Cerastes* are Saharo-Sindian, whereas *Lycodon*, *Oligodon*, *Boiga*, and *Naja* are Oriental. The sea-snake genera are widely distributed along the shores of the Indian Ocean. At the species level the relations are far more complex.

There are few turtles in Persia. They include two aquatic species, the European pond turtle (*Emys orbicularis*) in the northwest, extending along the southern shore of the Caspian, and the Mediterranean stripe-necked turtle (*Mauremys caspica*) in the permanent streams, ponds, and lakes of western and northern Persia. A third aquatic species, *Rafetus euphraticus*, a soft-shelled turtle of the Tigris and Euphrates drainages occurs in the Kārūn River and possibly some

other drainages of the western Zagros. Adapted to arid regions are the herbivorous terrestrial tortoises *Testudo graeca ibera* and *Testudo graeca zarudnyi*, distributed over the western and central Persian plateau. Also extending onto the central plateau in Khorasan is the Irano-Turanian species *Testudo* (or *Agrionemys*) *horsfieldii*. Widespread pantropical marine turtles, *Caretta caretta*, *Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea*, and *Dermochelys coriacea*, have been recorded in the Persian Gulf or are likely to occur there (Anderson, 1979).

A single species of crocodile (q.v.), the marsh or mugger crocodile (*Crocodylus palustris*), an Indian species, dwells in isolation in the Sarbāz River of southeastern Persian Baluchistan (Anderson, 1979).

Birds and mammals. There are very few species or even subspecies of birds and mammals that are as narrowly restricted in distribution as are the lizards, for example. A number of familiar animals are in fact Holarctic in distribution. Examples include the wolf, red fox, lynx, brown bear, golden eagle, osprey, and various migratory waterfowl. Many other species represent Holarctic genera.

Scott (1989) found that of 324 species of birds breeding in Persia only 24 are Palearctic, with restricted ranges in the Middle East. He noted that 131 Persian species occur widely in the Palearctic region; in addition, there are 81 Western Paleartic species, reaching the easternmost extremities of their ranges in Persia, whereas 19 are typically Eastern Palearctic, reaching the westernmost tips of their ranges in Persia. He distinguished 25 species as characteristic of the Saharo-Sindian desert belt. He considered the birds of southern Persian Baluchistan and the southern Persian Gulf coast predominantly Oriental, with 29 breeding species of primary distribution in the Oriental region reaching the northwestern extremities of their ranges in Persia, whereas in southwestern Persia there is a small Afrotropical influence, with 6 breeding species of primarily African distribution. Nine species of sea and shore birds that occur throughout the Indian Ocean breed on islands in the Persian Gulf and the Straits of Hormoz. The Persian fauna is greatly enriched owing to the country's position on the principal annual migration routes of birds. Eighty-six species of winter visitors have their breeding grounds in northern and Central Asia; many are waterfowl (including important game species) and birds of prey. In spring and autumn 24 species migrate between northern breeding grounds and southwestern or southeastern wintering grounds. An additional 57 species have been recorded as vagrants and rare stragglers (for details and examples,

see Scott, 1989). Hollam and his colleagues (1988) have published maps of breeding distribution for Middle Eastern species, and C. J. O. Harrison has included summer, winter, and resident ranges in his maps of Western Palearctic birds. He has discussed distribution patterns of Western Palearctic species with respect to climatic and vegetation zones and has attempted to interpret them in the context of Pleistocene events. He has also divided the Western Palearctic into faunal areas, two of which include portions of Persia: the Caspian and Mediterranean area, a potential refuge for a number of species during the climatic changes of the Pleistocene, and the Middle East, which he believes was a speciation center for some birds, with possible refuges along the Tigris and Euphrates valleys and around the Persian Gulf.

In his analysis of the mammals, de Misonne (in *Camb. Hist. Iran*) defined the Persian fauna as a composite, in which autochthonous elements are combined with elements of more general Palearctic character and with others of African or Indian origin. He found that endemic species were concentrated in Khorasan, extending into Baluchistan and western Afghanistan (characterized by high-altitude and semidesert adaptations), and in Kurdistan, a more enclosed region with more severe winters.

Harrington listed 152 Persian mammalian species in the following orders: Insectivora, 14; Chiroptera, 38; Carnivora, 28; Pinnipedia, 1; Perissodactyla, 1; Artiodactyla, 13; Lagomorpha, 2; Rodentia, 47; and Cetacea, 8. The large mammals have received the most public attention, as they include both game species and predators on game species and domestic livestock. They are also the most vulnerable to changes in human land use and to overhunting. Extensive efforts have been made by the Department of the Environment to preserve their habitats and to protect game and other species by setting aside reserves and national parks. Several populations of mountain sheep (*Ovis ammon*) survive in the rugged mountain ranges, as does the Persian ibex (*Capra hircus aegagrus*), progenitor of the domestic goat. The genus *Gazella* is represented by three species, which are favored game in the southern provinces and the steppes of the central plateau (see AHŪ; CHINKARA). The Persian fallow deer, once distributed generally throughout the southwest, had dwindled to a small population along the Karḵa River but, thanks to efforts at preservation and captive breeding, has been making a comeback. Herds of red deer (*Cervus elaphus*) live in the forest meadows of the Caspian region, whereas the much smaller, more solitary roe deer (*Capreolus capreolus*) is found in the forested areas of Azarbaijan, Kurdistan, Gīlān, and Māzandarān;

both are widely distributed Euro-Siberian species (see DEER). The wild boar (q.v.), *Sus scrofa*, a species distributed throughout both the Palearctic and Oriental regions, is found in a variety of habitats in Persia, wherever permanent water supplies exist. The Persian wild ass, or onager (*Equus hemionus*), which once roamed many steppe and desert regions, now survives mainly in national parks and wildlife refuges in Khorasan, Kermān, and Fārs. It is a Palearctic species that ranged from the Mediterranean to Mongolia within historical times.

Large and medium-sized carnivores include the wolf, jackal, fox (three species), brown bear, Baluchistan black bear, striped hyena, small cat (four species), lynx, and caracal. The leopard occurs throughout Persia, wherever large game species are present. The cheetah was once common throughout the drier steppe regions of southwestern Asia but has been driven to near extinction with the reduction of rangelands and declining populations of its prey, primarily gazelles. In Persia it has made a significant comeback in the northeast, with the establishment of protected areas and increased abundance of gazelles. The Persian lion was present in the oak forests throughout recorded history into the 20th century but is now extinct throughout its Eurasian range, except for a small population in the Gir forest of western India. The Caspian tiger was also known in the Caspian region but has not been seen since 1337 Š./1958 and is almost certainly extinct. Two species of mongoose are found in southern Persia, both primarily Oriental in distribution but ranging into the Arabian peninsula. Of seven species in the family Mustellidae six are widespread Palearctic taxa; the seventh, the honey badger (*Mellivora capensis*), is Afrotropical, extending well into Asia.

DeBlase (1980) analyzed the distribution of thirty-eight Persian bat species: twenty-seven restricted or nearly restricted to the Palearctic faunal region, one common to all four major faunal regions of the eastern hemisphere, two widely distributed in both Palearctic and Afrotropical regions and a third more widely distributed in the Afrotropical than in the Palearctic, and six that are essentially Paleotropical, extending into the Palearctic only in the region of southwestern Asia that links the Oriental and Afrotropical regions. The Egyptian fruit bat is the only member of Megachiroptera in Persia, occurring in the southeast, though it is not common.

The small mammals of Persia are generally less noticed by travelers, partly because most have secretive habits and many are nocturnal. Among the insectivores there are four species of hedgehogs, eight of shrews, and two of

moles. There are only two lagomorphs in Persia, the rufescent pika (*Ochotona rufescens*), a species of the eastern Iranian plateau, and the Cape hare (*Lepus capensis*), which occurs in Africa, as well as in Eurasia and every province of Persia. The largest group of Persian mammals is the rodents, forty-seven species from nine families. It includes squirrels, porcupines, nutrias (introduced), jerboas, dormice, murid rats and mice, hamsters, gerbils and jirds, and voles. Jochen Niethammer (1987) has provided a list of all recently observed Middle Eastern rodents and has discussed their distribution in terms of small and far-ranging species, species of different origins, and endemic species.

The only pinniped in Persian waters is the Caspian seal (*Phoca caspica*), an endemic species. Several cetaceans inhabit the Persian Gulf, including four species of whales and three of dolphins. All are either worldwide in distribution or Indian Ocean species.

Arthropods. According to Max Vachon and R. Kinzelbach (1987), in Persia there are twelve genera of scorpions in two families. The genera *Androctonus*, *Buthotus*, *Compsobuthus*, *Orthochirus*, and *Scorpio* occur throughout the entire Middle East. *Mesobuthus* is distributed primarily in Central Asia. Some endemic genera of the family Buthidae also occur in Persia, but study of them had not yet been completed by 1987; only *Kraepelinia* and *Liobuthus* had been described. *Hemiscopius* occurs in southern Persia, eastern and southern Arabia, the Horn of Africa, and Socotra. The authors noted that the scorpions of North Africa and the Middle East as far as the Indus are extremely homogeneous at the genus and family levels; there is, however, a strong line of demarcation in the south, generally along a line from Dakar to Djibouti in Africa. The scorpions consist of a central Saharo-Sindian element and, along the extreme northern edge of their distribution, influence from European-Mediterranean elements; in the northeast the basic Saharo-Sindian fauna are overlaid by species of *Mesobuthus* from Central Asia. Territorial separation and extensive division into subspecies partly results from the steadily increasing aridity of the Middle East, with resulting isolation of populations, but the distribution pattern of the genera has undoubtedly been determined by paleogeographical factors.

Insects. A brief review of the small group of snake-neck flies (Raphidioptera; H. Aspöck, 1987) reveals only four species in Persia, two endemic. Because they are strictly arboreal, they occur only in the forested regions of the Alborz. At the generic level the Raphidioptera of the Middle East are related to those of

southeastern Europe, whereas those of Afghanistan are Central Asian. The order as a whole is almost strictly Holarctic in distribution. There are 108 species of caddisflies (Trichoptera) in Persia; according to Malicky (1987), they are clearly related to European species, whereas the 60 species of Afghanistan have affinities with those of the Indian subcontinent. The caddisflies of both countries share some species with Central Asia.

In his biogeographical analysis of Middle Eastern and Arabian butterflies T. B. Larsen (1987) considers only southern Persia (Fārs, Būšehr, and Baluchistan). In this region alone there are 113 species, 89 (79 percent) of them Palearctic in their relations, though many are limited to the higher elevations of the Zagros system; only 3 species are Afrotropical. This situation is in sharp contrast to that in Oman on the other side of the Persian Gulf, where the butterflies are 30 percent Afrotropical and only 15 percent Palearctic. Four Persian species are Oriental, nine Eremian, and seven Paleotropical.

C. M. Naumann analyzed the distribution patterns of a single genus of diurnal moth, *Zygaena*, in the Near and Middle East. It is a large Palearctic genus represented by fifty species in the region, hence well suited to distribution analysis. The life histories of the species are tied to the distribution of their larval food plants, and their ecological relations can be divided into three major types: arboreal, eremic, and oreal. Representatives of each can be found in Persia: arboreal species in the Alborz and Zagros, eremic in *Artemisia/Astragalus* steppe areas, and oreal at the xeromontane elevations of the Alborz and northwestern Zagros.

FAUNAL AREAS

Anderson (in *Camb. Hist. Iran*) delineated thirteen faunal areas in Persia, based on physical geography, climate, and distribution of lizards. This schema can be extended to the fauna as a whole, though other authors might well categorize the areas differently, depending upon distribution of other groups. For example, distribution of fishes and other fresh-water organisms is most readily characterized according to drainage systems, whereas the more vagile animals (especially nonpasserine birds), some flying insects, and many mammals are less constrained by topography than most reptiles, amphibians, fishes, terrestrial mollusks, and arthropods.

The central plateau. The internal drainage basin of the plateau lies entirely within Persian borders and is rimmed by mountains. Although some species

range broadly over this entire region, others are confined to particular types of habitat, for example, mountain slopes, sandy plains, gravel plains and slopes, and salt depressions, or are associated with particular types of vegetation or plant species.

The Urmia basin. The mountain fauna of the area of the Iranian plateau that drains into Lake Urmia have affinities with those of the eastern Mediterranean, Transcaucasia, and Anatolia. Other species generally represent the fauna of the plateau but are distinctive at the species and subspecies levels.

The Sīstān basin. The inclusion of this portion of the Helmand drainage within the borders of Persia adds a number of species to the fauna of the country. The affinities of these fauna are primarily with those of the Iranian plateau, though some species are shared with the eastern deserts and the Aralo-Caspian region. Anderson (1968) found that the majority of lizard species belong to two basic categories, widely distributed Iranian plateau forms, found primarily in the uplands, and an endemic sand-adapted Helmand type having affinities with those on the plateau.

The Caspian region. This region includes the northern slopes of the Alborz, especially the lower elevations covered in Hyrcanian forest, and the narrow coastal region. The fauna is related to those of Mediterranean Europe and Transcaucasia, and a few Aralo-Caspian elements are found along the western shore north of the Aras River. Contact with Aralo-Caspian fauna occurs in the vicinity of Gorgān and Pahlavī Dež.

The Ḵūzestān plain and the Persian Gulf coast. The fauna of this region, geographically an extension of the Mesopotamian plain, is closely related to those of lowland Iraq and northern Arabia. Apparently the Tigris basin has served as a barrier to some taxa, however. The fauna is not uniformly distributed, certain species being reported only from the more humid coastal plain. With some exceptions, the species of this region may be identified as Saharo-Sindian.

Persian Baluchistan and the Makrān coast. There are two main elements in these fauna, an Iranian element composed of wide-ranging plateau forms, many of them confined primarily to the rugged, folded terrain of Baluchistan, and a Saharo-Sindian element, largely confined to the coastal region. Many species in the latter group range no farther west than Bandar-e Lenga. It is

primarily in Baluchistan and the Makrān that a few Oriental elements, wide-ranging species of broad ecological tolerance, exist in Persia. The large Jāz-e Mūrīān depression is a low internal basin rimmed by mountains and having extensive eolian sand deposits on its floor. The fauna is incompletely known, but some endemic species occur there.

The Turkmen steppe. Small portions of these low plains are enclosed within Persian borders in the northeastern corner of the country and in a narrow wedge east of the Caspian, between the shore and the mountains. Anderson found that fewer than half the lizards could be considered truly Aralo-Caspian, the remainder being species from the Iranian plateau or confined primarily to mountain slopes.

The Mogān steppe. A portion of this region, drained by the Aras River, falls within the northernmost part of Persian Azarbaijan. There are species with Medi terranean and Transcaucasian affinities, as well as as with forms from the Iranian plateau.

The Zagros. This long mountain chain forms both a barrier between the plateau and the Mesopotamian lowlands and a corridor for the southward distribution of northern faunal elements. Unfortunately, available zoological information is very sketchy, though the southern extent of many northern species is known. A number of species are also endemic to these mountains. The best-known are those of the lower passes, species that range widely through southwestern Asia and are broadly distributed at various elevations in lowland and mountain areas.

The western foothills of the Zagros. This area, too, has been relatively little studied. Although it shares species with both the Zagros proper and the Mesopotamian lowlands, there are also endemic species that lend it a unique character. Some species are most closely related to species of highland Arabia, others to those of Baluchistan and Sind. Anderson found that strictly Iranian species were absent among the lizards, and in this respect the region differs sharply from Baluchistan, where such species are an important element.

The Alborz. The fauna of this range consists of two fairly well-defined segments, that of the dry southern slopes (included in the discussion of the central plateau) and that of the much wetter, forested northern slopes (included in the section on the Caspian coast). A few species cross the passes, and a few range along the lower crests. In addition, a few endemic taxa from

these mountains have been described.

The Kopet-Dag. The fauna of the more arid mountain folds stretching along the border between Persia and Turkmenistan east of the Alborz has not been studied in any detail on the Persian side. One reason is that the routes crossing the border run west and east of the mountains. The relatively low Atrak valley divides the two main folds of the range and has been little traveled by zoological collectors. Several endemic taxa occur in this region.

Islands of the Persian Gulf. Knowledge of the fauna of these islands, most of which lie close to the Persian coast, is incomplete, but it seems to represent the Saharo-Sindian group.

TYPES OF HABITAT

In analysis of the lizards Anderson (1968) emphasized the importance of the substrate to the occurrence of particular species; he also considered the relationship of climate types and lizard distribution. Harrington (1977) organized his guide to the mammals of Persia according to thirty-one types of habitat. Although Harrington's scheme is useful in classifying the considerable diversity of ecological conditions in Persia, most of the representative mammals mentioned have much greater ecological tolerances and occur in many different types of habitats. Furthermore, his plates and accompanying texts represent a mixture of habitat types and more general geographical areas containing several habitats. Lay, in his study of mammals, described the geographical areas investigated by the Street expedition of 1962-63 and within this context provided a more detailed description of habitat types than that by Harrington.

Scott (1989) identified eight major habitat types for birds in Persia: true desert and semidesert, semiarid steppes of the desert rim and foothills, high mountains, forests and woodlands, hot southern lowlands, wetlands, habitats of the Persian Gulf and Makrān coasts, and offshore islands.

See also ĀHŪ; AMPHIBIANS; BIRDS; FISH; and other articles on individual animal species and genera.

BIBLIOGRAPHY

M. Abai, “List of Cerambycidae Family in Iran,” *Entomologie et Phytopathologie Appliquées* (Tehran) 28, 1969, pp. 47-54.

B. E. Allus, *A on the Vertebrate Fauna of Iraq and Neighbouring Countries*, 3 vols., Baghdad, 1954-55.

S. C. Anderson, “Amphibians and Reptiles from Iran,” *Proceedings of the California Academy of Sciences*, ser. 4, 31(12), 1963, pp. 417-98.

Idem, “Zoogeographic Analysis of the Lizard Fauna of Iran,” in *Camb. Hist. Iran* I, pp. 305-71.

Idem, “Preliminary Key to the Turtles, Lizards and Amphisbaenians of Iran,” *Fieldiana. Zoology* 65, 1974, pp. 27-44; tr. Y. Seyrānī as *Kelīd-e šenāsāʾī-e mārmūlakhā-ye Īrān*, Tehran, 1356 Š./1977.

Idem, “Synopsis of the Turtles, Crocodiles, and Amphisbaenians of Iran,” *Proceedings of the California Academy of Sciences*, ser. 4, 41(22), 1979, pp. 501-28.

N. Annandale, ed., *Report on the Aquatic Fauna of Seistan*, Records of the Indian Museum 18, Calcutta, 1919-21.

Idem and S. L. Hora, “The Fishes of Seistan,” in Annandale, ed., pp. 151-91.

C. Arambourg, “Sur des poissons fossiles de Perse,” *Comptes Rendus Hebdomadaires des Séances de l’Académie des Sciences* 209 (24), 1939, pp. 898-99.

Idem, “Les poissons oligocènes de l’Iran,” *Notes et Mémoires sur le Moyen-Orient* 8, 1967, pp. 9-247.

Idem and U. Aspöck, “Untersuchungen über die Raphidiopteran-Fauna des Iran,” *Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen* 22, 1970, pp. 89-95.

N. B. Armentrout, “The Fishes of Iran: A Preliminary Checklist,” manuscript, Bandar Enzeli, Iran, 1969.

Idem, “The Freshwater Fishes of Iran,” Ph.D. diss., Oregon State University, Corvallis, 1980.

H. Aspöck, “The Raphidioptera of the World. A Review of Present Knowledge,” in J. Gepp, H. Aspöck, and H. Hölzel, eds., *Recent Research in Neuropterology*. *Proceedings of the 2nd International Symposium on Neuropterology, Hamburg* , Graz, 1986, pp. 15-29.

Idem, “The Raphidioptera of the Middle East: A Review (Insecta: Neuropteroidea),” in F. Krupp, W. Schneider, and R. Kinzelbach, eds., p. 28.

U. Aspöck, “Die Raphidiopteran der Erde: Eine zoogeographische Analyse (Insecta: Neuropteroidea),” *Mitteilungen der Deutschen Gesellschaft für allgemeine und angewandte Entomologie* 3, 1981, pp. 171-73.

Idem, “The Berothidae (Neuropteroidea: Planipennia) of the Middle East,” in F. Krupp, W. Schneider, and R. Kinzelbach, eds., pp. 160-73.

I. Baran, B. Coad, and M. Kuru, *Zoologische Bibliographie der Türkei: Pisces, Amphibia, Reptilia*,Heidelberg, 1986.

J. Baraud, “Contribution à la faune de l’Iran 10. Coléoptères Scarabaeoidea,” *Annales de la Société Entomologique de France*, N.S. 4, 1966, pp. 915-25.

K. H. Batanouny, *Natural History of Saudi Arabia: A* I, Jiddah, 1978.

G. Ya. Beĭ-Bienko and L. L. Mishchenko, *Saranchevye fauny SSSR i sopredel’nykh stran*, 2 vols., Moscow, 1951; ed. and tr. as *Locusts and Grasshoppers of the USSR and Adjacent Countries*, 2 vols., Jerusalem, 1963-64.

D. Benyamini, “The Zoogeography of the Butterflies (Lepidoptera, Rhopalocera) of Israel and Nearby Areas,” in Y. Yom-Tov and E. Tchernov, eds., *The Zoogeography of Israel: The Distribution and Abundance at a Zoogeographical Crossroad*, Monographiae Biologicae 62, Dordrecht, 1988, pp. 309-24.

L. S. Berg, “Presnovodnye ryby Irana i sopredelnych stran,” *Trudy Zoologicheskogo Instituta Akademii Nauk SSSR* (Leningrad) 8, 1949, pp. 782-858; tr. as *Freshwater Fishes of the USSR and Adjacent Countries*, Jerusalem, 1948-49.

W. T. Blanford *Eastern Persia: An Account of the Journeys of the Persian*

Boundary Commission, 1870-71-72 II: *The Zoology and Geology*, London, 1876.

P. Bonadona, "Contribution à la faune de l'Iran 18. Coléoptères Anthicidae," *Annales de la Société Entomologique de France*, N.S., 6, 1970, pp. 379-83.

R. Bott, "Potamidae (Crustacea, Decapoda) aus Afghanistan, West Asien und dem Mittelmeerraum (Eine Revision der Untergattung *Potamon* spp.)," *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening* 130, 1967, pp. 7-43.

R. O. Brinkhurst and B. G. M. Jamieson, *Aquatic Oligochaeta of the World*, Edinburgh, 1971.

R. L. Burgess, A. Mokhtarzadeh, and L. Cornwallis, *A Preliminary of the Natural History of Iran*, Pahlavi University College of Arts and Sciences, Science Bulletin 1, 1966.

W. Büttiker, "Zoological Survey of Saudi Arabia," in F. Krupp, W. Schneider, and R. Kinzelbach, eds., pp. 29-40.

Idem, W. Wittmer, and F. Krupp, eds., *Fauna of Saudi Arabia,* Basel, 1979– .

L. Cernosvitov, "Oligochaeta from Various Parts of the World: Iran, Egypt, Palestine, Turkestan," *Proceedings of the Zoological Society*, Ser. B/3 (3-4), 1942, pp. 197-236.

B. W. Coad, "A Provisional Annotated Check-List of the Freshwater Fishes of Iran," *Journal of the Bombay Natural History Society* 76, 1979, pp. 86-105.

Idem, "Environmental Change and Its Impact on the Freshwater Fishes of Iran," *Biological Conservation* (Barking, U.K.) 19/1, 1980, pp. 51-80.

Idem, "Zoogeography of the Freshwater Fishes of Iran," in F. Krupp, W. Schneider, and R. Kinzelbach, eds., pp. 213-28.

S. Cramp and K. E. L. Simmons, eds., *The Birds of the Western Palearctic*, 2 vols., Oxford, 1977-80.

G. B. Corbet, *The Mammals of the Palaearctic Region: A Taxonomic Review*, London, 1978; suppl., London, 1984.

J. W. N. Cumming, "Birds of Seistan, Being a List of Birds Shot or Seen in

Seistan by Members of the Seistan Arbitration Mission 1904-1905," *Journal of the Bombay Natural History Society* 16, 1905, pp. 686-99.

R. Damoiseau, "Contribution à la faune de l'Iran 13. Coléoptères Bostrychidae," *Annales de la Société Entomologique de France*, N.S. 5, 1969, pp. 143-44.

F. De Filippi, *Note di un viaggio in Persia nel 1862*, Milan, 1865.

A. F. DeBlase, *The Bats of Iran: Systematics, Distribution, Ecology*, Fieldiana: Zoology, N.S. 4, Chicago, 1980.

J. Delève, "Contribution à la faune de l'Iran 19. Coléoptères Dryopoidea," *Annales de la Société Entomologique de France*, N.S. 6, 1970, pp. 701-03.

P. Dispons and A. Villiers, "Contributions à la faune de l'Iran 2: Hémiptères Reduviidae," *Annales de la Société Entomologique*, N.S. 3, 1967, pp. 1067-85.

J. A. Douglas, *Contributions to Persian Paleontology*, 3 vols., London, 1927-29.

W. Eckweiler and P. Hofmann, "Checklist of Iranian Butterflies," *Nachrichten des entomologischen Vereins Apollo*, suppl. 1, 1980, pp. 1-28.

C. E. von Eichwald, *Reise auf dem Caspischen Meere und in den Caucasus, unternommen in den Jahren 1825-1826*, 2 vols., Stuttgart, 1834-37.

Idem, *Fauna Caspio-Caucasica*, St. Petersburg, 1841.

J. Eiselt and J. F. Schmidtler, "Froschlurche aus dem Iran unter Berücksichtungen ausseriranischer Populationsgruppen," *Annalen des Naturhistorischen Museums in Wien* 82, 1973, pp. 387-422.

C. Érard and R. D. Etchécopar, *Contribution à l'étude des oiseaux d'Iran. Résultats de la mission Etchécopar 1967*, Mémoires du Muséum National d'Histoire Naturelle, N.S. A66, 1970.

H. Field et al., *on Southwestern Asia*, 7 vols., Coral Gables, Fla., 1953-62; suppls., 8 vols., Coral Gables, Fla., 1968-72.

E. Firouz, *The Complete Fauna of Iran*, London and New York, 2005.

L. Fishelson, "Biogeography and Ecology of the Acridofauna of Israel and Neighboring Countries (Acridoidea, Orthoptera)," in F. Krupp, W. Schneider,

and R. Kinzelbach, eds., pp. 124-47.

S. G. Gmelin, *Reise durch Russland zur Untersuchung der drei Natur-Reiche* III. *Reise durch das nördliche Persien in den Jahren 1770, 1771 bis April 1772*, St. Petersburg, 1774; IV. *Reise von Astrachan: ungleichen zweite Persiche Reise in den Jahren 1772 und 1773, bis im Frühling 1774, Nebst den Leben des Verfassers*, ed. P. S. Pallas, St. Petersburg, 1784.

F. A. Harrington, Jr., *A Guide to the Mammals of Iran*, Tehran, 1977.

C. J. O. Harrison, *An Atlas of the Birds of the Western Palearctic*, Princeton, N.J., 1982.

H. Heinzel, R. Fitter, and J. Parslow, *The Birds of Britain and Europe with North Africa and the Middle East*, London, 1972.

A. Hoffman, "Contributions à la faune de l'Iran. 6. Coléoptères Curculionidae et Bruchidae," *Annales de la Société Entomologique de France*, N.S. 4, 1968, pp. 145-54.

P. A. D. Hollom et al., *Birds of the Middle East and North Africa*, Vermillion, S.D., 1988.

F. Hué and R. D. Etchécopar, *Les oiseaux du Proche et du Moyen Orient*, Paris, 1970.

D. Jay, *Annotated on Locusts in Southwestern Asia*, ed. H. Field, Field Research Publications, Study 52, Chicago, 1970.

S. H. Jervis Read, "A Provisional Check-List of the Birds of Iran," *Entešārāt-e Dānešgāh-e Tehrān/Publications of the University of Tehran* 465, 1958, pp. 1-25.

Idem, "Ornithology," in *Camb. Hist. Iran* I, pp. 372-92.

Z. Kaszab, "Contribution à la faune de l'Iran 8. Coléoptères Meloidae," *Annales de la Société Entomologique de France*, N.S. 4, 1968, pp. 749-76.

F. Krupp, W. Schneider, and R. Kinzelbach, eds., *Proceedings of the Symposium on the Fauna and Zoogeography of the Middle East*, TAVO Beihefte A28, Wiesbaden, 1987.

P. L. Kramp, "Medusae of the Iranian Gulf," *Videnskabelige Meddelelser fra*

Dansk Naturhistorisk Forening i Kjobenhavn 118, 1956, pp. 235-42.

H. Kumerloeve, “Die Säugetiere (Mammalia) der Türkei. Die Säugetiere (Mammalia) Syriens und des Libanon,” *Veröffentlichungen der Zoologishen Staatssammlung München* 18, 1975, pp. 69-225.

T. B. Larsen, “Biogeographical Aspects of Middle Eastern and Arabian Butterflies,” in F. Krupp, W. Schneider, and R. Kinzelbach, eds. pp. 178-99.

P. Lastovka and L. Matile, “Contribution à la faune de l’Iran 16. Diptères Mycetophilidae des Provinces Caspiennes 2. Genre *Mycetophila*,” *Annales de la Société Entomologique de France*, N.S. 5, 1968, pp. 681-86.

M. Laṭīfī, *Mārhā-ye Īrān*, Tehran, 1363 Š./1984; tr. S. Sajadian as *The Snakes of Iran*, Oxford, Ohio, 1991.

D. M. Lay, *A Study of the Mammals of Iran*, Fieldiana: Zoology 54, Chi cago, 1967.

A. E. Leviton et al., *Handbook to Middle East Amphibians and Reptiles*, Oxford, Ohio, 1992.

H. Malicky, “Die Köcherfliegen (Trichoptera) des Iran und Afghanistans,” *Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen* 38, 1986, pp. 1-16.

Idem, “A Survey of the Caddisflies (Insecta: Trichoptera) of the Middle East,” in F. Krupp, W. Schneider, and R. Kinzelbach, eds., pp. 174-77.

Z. Matic, “Contributo alla conoscenza dei Lithobiidae dell’Iran (Chilopoda, Lithobiomorpha),” *Fragmenta Entomologica* 6, 1968, pp. 87-114.

L. Matile, “Contribution à la faune de l’Iran 14: Diptères Mycetophilidae des Provinces Caspiennes,” *Annales de la Société Entomologique de France*, N.S. 5, 1969, pp. 239-50.

E. Ménétriés, *Catalogue raisonné des objets de zoologie recueillis dans un voyage au Caucase et jusqu’aux frontières actuelles de la Perse*, St. Petersburg, 1832.

A. Mesghali, “Phlebotominae (Diptera) of Iran 3: Studies on Sandflies in the Areas of Bandar Abbas and Jask (Littoral Areas of Hormuz Strait and Sea of

Oman),” *Bulletin de la Société Pathologie Exotique* 58, 1965, pp. 239-76.

X. de Misonne, *Analyse zoogéographique des mammifères de l’Iran*, Mémoires de l’Institut Royal des Sciences Naturelles de Belgique 59, 1959, pp. 1-157.

Idem, “Mammals,” in *Camb. Hist. Iran* I, pp. 294-304.

Z. Moubayed, N. Giani, and E. Martinez-Ansemil, “Distribution of Aquatic Oligochaeta and Aphanoneura in the Near East,” in F. Krupp, W. Schneider, and R. Kinzelbach, eds., pp. 80-90.

C. M. Naumann, “Distribution Patterns of *Zygaena* Moths in the Near and Middle East (Insecta: Lepidoptera, Zygaenidae), in F. Krupp, W. Schneider, and R. Kinzelbach, eds., pp. 200-12.

S. Navai, “Ceratopogonidae (Diptera) of Iran V. Culicoides from Mazanderan,” *Mosquito News* 30/1, New Brunswick, N.J., 1970, pp. 6-8.

J. Niethammer, “Rodent Distribution in the Middle East,” in F. Krupp, W. Schneider, and R. Kinzelbach, eds., pp. 318-29.

A. M. Nikol’skiĭ, “On Three New Species of Reptiles Collected by Mr. A. N. Zarudny in Eastern Persia in 1901,” *Annales du Musée Zoologique de l’Académie Impériale de Science* (St. Petersburg), 8, 1903, pp. 95-98 [in Russian].

Idem, “Reptiles and Amphibians Collected by Mr. A. N. Zarudny in Persia in 1903-04,” *Annales du Musée Zoologique de l’Académie Impériale de Science* (St. Petersburg), 10, 1907, pp. 260-301 [in Russian].

S. I. Ognev, *Zveri vostochnoĭ Evropy i severnoĭ Azii* III: *Zveri SSSR i prelezhashchikh stran*, Moscow, 1928; tr. as *Mammals of the U.S.S.R. and Adjacent Countries*, Jerusalem, 1963.

G. A. Olivier, *Voyage dans l’Empire Othoman, l’Egypte et la Perse*, Paris, 1807. P. S. Pallas, *Zoographia Ross–Asiatica*, 3 vols., St. Petersburg, 1811-42.

K. Paludan, “Zur Ornis des Zagrosgebietes, W. Iran,” *Journal für Ornithologie* 86, 1938, pp. 562-638.

H. Perrin, “Contribution à la faune de l’Iran 17. Coléoptères Curculionidae,” *Annales de la Société Entomologique de France*, N.S. 6, 1970, pp. 359-66.

F. Pierre, “Contribution à la faune de l’Iran 12. Étude écologique et biogéographique des *Tenebrionides pimeliine* s. nov. de régions désertiques et semi-désertiques de l’Iran,” *Annales de la Société Entomologique de France*, N.S. 4, 1968, pp. 997-1036.

H. D. Radcliffe, “List of the Birds of Baluchistan Part II,” *Journal of the Bombay Natural History Society* 24, 1916, pp. 156-69.

G. Radjabi, “Contribution à la connaissance de la faune de Buprestides de l’Iran,” *Entomologie et Phytopathologie Appliquées* (Tehran) 27, 1968, pp. 69-79.

A. Rafyi, A. A. Nainy, and H. Rak, “Les espèces de mites rencontrés en Iran,” *Journal of Veterinary Faculty, University of Tehran* 23, 1967, pp. 38-45.

K. H. Rechinger, *Flora Iranica: Flora des iranischen Hochlandes und der umrahmenden Gebirge. Persien, Afghanistan, Teile von West-Pakistan, Nord-Iraq, Azerbeidjan, Turkmenistan*, Graz, 1964-.

W. Richter and E. Shüz, “Zoologische Arbeiten des Stuttgarter Museums über Iran (Bibliographie),” *Stuttgarter Beiträge zur Naturkunde* 22, 1959, pp. 1-8.

E. Rivalier, “Contribution à la faune de l’Iran 5. Coléoptères Cicindelidae,” *Annales de la Société Entomologique de France*, N. S. 3, 1967, pp. 1099-1102.

G. Roth, “Data on the Distribution and Faunal History of the Genus *Theodoxus* in the Middle East (Gastropoda: Neritidae),” in F. Krupp, W. Schneider, and R. Kinzelbach, eds., 1987, pp. 73-79.

M. A. G. Saadati, *Taxonomy and Distribution of the Freshwater Fishes of Iran*, M.S. thesis, Colorado State University, Fort Collins, 1977.

F. Schmid, “Trichoptères d’Iran,” *Beitrage zur Entomologie* 9, 1959, pp. 200-19, 376-412, 683-98, 760-99.

W. Schneider, “The Genus *Pseudagrion* Selys, 1876 in the Middle East—A Zoogeographic Outline (Insects. Odonata. Coenagrionidae),” in F. Krupp, W. Schneider, and R. Kinzelbach, eds., pp. 114-23.

E. Schüz, *Die Vogelwelt des südkaspischen Tieflandes*, Stuttgart, 1959.

D. A. Scott, Ḥ. Morawwej Hamadānī, and A. Adhamī Mīr-Ḥosāynī, *Parandagān-e Īrān*,Tehran, 1975 (with Latin names).

F. Starmüller, “Ein weiteres Beitrag zur Wassermollusken des Iran,” *Sb. Österreichischer Akademie der Wissenschaften*, Math.-nat. Kl., Abt. 1/7, 1965, pp. 171-84.

J. Thérond, “Contribution à la faune de l’Iran 4: Coléoptères Histeridae,” *Annales de la Société Entomologique,* N.S. 3, 1967, pp. 1093-97.

C. B. Ticehurst, et al., “Birds of the Persian Gulf Islands,” *Journal of the Bombay Natural History Society* 39, 1925, pp. 725-33.

M. Vachon, “Liste des scorpions connus en Égypte, Arabie, Israel, Liban, Syrie, Jordanie, Turquie, Irak, Iran,” *Toxicon* 4, 1966, pp. 209-18.

Idem and R. Kinzelbach, “On the Taxonomy and Distribution of the Scorpions of the Middle East,” in F. Krupp, W. Schneider, and R. Kinzelbach, eds. pp. 91-103.

C. Vaurie, *The Birds of the Palearctic Fauna. A Systematic Reference*, 2 vols., London, 1959-65.

A. Villiers, “Contribution à la faune de l’Iran I. Coléoptères Cerambycidae,” *Annales de la Société Entomoloqique de France*,N.S. 3, 1967, pp. 327-79.

E. Wagner, “Contribution à la faune de l’Iran 7. Hémiptères (pro parte),” *Annales de la Société Entomologique de France*, N.S. 4, 1968, pp. 437-53.

H. Weidner, “Die Termiten von Afghanistan, Iran und Irak (Isoptera),” *Abhandlungen und Verhandlungen des Naturwissenschaftliche Vereins in Hamburg* 4, 1959, pp. 43-70.

F. Werner, “Reptilien und Gliedertiere aus Persien,” in *Festschrift zum 60. Geburtstage von Professor Dr. Embrik Strand* II, Riga, 1936, pp. 193-204.

W. Wittmer, “Contribution à la faune de l’Iran 3: Coléoptères Malachiidae,” *Annales de la Société Entomologique*, N.S. 3, 1967, pp. 1087-91.

N. A. Zarudny, “Verzeichnis der Vögel Persiens,” *Journal für Ornithologie* 59, 1911, pp. 185-241.

M. Zohary, *On the Geobotanical Structure of Iran*, Bulletin of the Resource Council of Israel 11D Suppl., 1963 (with map).

Idem, *Geobotanical Foundations of the Middle East*, 2 vols., Stuttgart and Amsterdam, 1973.