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MAMMALS I. MAMMALS OF IRAN, AFGHANISTAN, AND CENTRAL ASIA

MAMMALS

i. Mammals of Iran, Afghanistan, and Central Asia

History and literature. The first effort to publish a comprehensive account of the mammalian fauna of Iran within the context of modern taxonomy was that of Filippo De Filippi (1862-65; see bibliography at FILIPPI, FILIPPO DE) in his attempt to deal with all Iranian vertebrates. His 1865 work dealt with 30 mammalian species. William T. Blanford (1876), who traveled in Iran along with Indian collectors during the Persian Boundary Commission Survey of 1870-72, was the next naturalist to attempt a comprehensive report on the vertebrates. By this time, Iranian mammals numbered 89. It was not until 1959 that a zoogeography of Iranian mammals was published by Xavier Misonne. Douglas Lay (1967) published an account of the mammals collected by the 1962-63 Street Expedition to Iran, in which he gave detailed accounts of the localities and habitats visited by the expedition. That work included the complete mammal fauna as known at that time. In 1977 Fred Harrington produced a useful popular guide to the mammals of Iran as part of a series envisioned by the Department of Environment during that department's most ambitious and productive period.

Following the Islamic Revolution of 1978-79, some academic work and wildlife work with mammals continued, and E. Etemad (1978, 1980, 1982) published a three-volume synopsis of the mammals in Persian, but it was not until 2005, with the publication of the *Complete Fauna of Iran* by Eskandar Firouz, that a complete, up-to-date list of the mammals along with natural history information was published in a Western language. Ziaie (2006) published a field guide to the mammals in Persian, and M. Karami et al. (2008) published an annotated checklist of the mammals of Iran. Here I have relied on these last three publications for the checklist of the Iranian mammal fauna included here (see below). The most comprehensive academic study of a single taxonomic group of Iranian mammals is that of Anthony DeBlase (1980) for the bats. Other publications on individual species or higher taxa can be found In the accompanying bibliography. Lacking as of this writing is an academic synoptic treatment of the mammals of Iran, with keys, maps, descriptions, and synonymies.

The mammals of Afghanistan have been less studied than that of Iran, but the literature is surprisingly large, considering the turbulent history of the nation and the difficulties of access. Blanford's (1888-91) treatise on the mammals In the multivolume Fauna of British India series does not cover Afghanistan *per se*, but Afghanistan is included In the distribution statements of Indian and Pakistan species known to extend into that country. A second, updated edition of the mammals of British India was published by R. I. Pocock (1941). O. L. Thomas (1889), on the mammals of the Afghan Delimitation Commission, and Murray (1892) appear to have been among the first to deal with the zoology of Afghanistan, although their short accounts dealt only with portions of boundary areas. In the 20th century there were intermittent studies, all by Westerners, e.g., Aellen (1959) on the bats of Afghanistan. The 1960s and 1970s were the period of greatest zoological activity, primarily by German researchers, e.g. Gaisler et al. (1967a, 1967b) on the mammals of the Jalalabad region, Gaisler (1970) on a collection of bats, Kullman (1965) and Niethammer (1965, 1967, 1975) on specific groups of mammals. The most encompassing study until the present century was that of Hassinger (1968, 1973), reporting on the 1965 mammal survey conducted by the Street Expedition to Afghanistan. Apparently there is (or was) in Kabul an unpublished report on the distribution and status of mammals in Afghanistan (Habibi, 1977; cf. idem, 1983), and this was expanded into the most comprehensive coverage of the Afghan mammal fauna to date (Habibi, 2003). I have relied on this latter work In the checklist included here.

Mammals of the former Soviet Union, including the republics of Central Asia, have been studied in far more detail than those of Iran and Afghanistan, owing to the greater number of resident Russian and European-trained scientists. For purposes of this article, only those countries of Central Asia that border on Iran and Afghanistan are covered, i.e., Turkmenistan, Uzbekistan and Tajikistan. There have been a significant number of synoptic treatments of the fauna of the Russian empire throughout the modern period. In addition to taxonomic studies, other aspects of the natural history of individual species and groups, e.g., ecology, life history, anatomy, etc. have been published. A sampling of this literature is included In the bibliography. Among these are Gromov and Baranova (eds., 1981); Heptner and Naumov (eds., 1967); Heptner and Sludskiĭ (1972); Heptner et al. (1988).

Also important for the fauna of our area of focus are synopses and checklists for surrounding regions, e.g., Allouse (1954), Hatt (1959) for Iraq; Harrison (1964, 1968, 1972, 1981), Nader (1990), Harrison and Bates (1991), Kingdon (1991) for Arabia; Ognev (1928, 1831, 1935, 1947, 1948, 1950); McNeely and Neronov (1992) for the western Palearctic; Siddiqi (1961), Roberts (1997) for Pakistan.

Worldwide and Palearctic reviews of entire taxa are particularly important for studies of the mammals of the countries considered here, as are the accounts and checklists of mammals of the world, such as Honacki, et al. (1982), Anderson and Jones (1984), Macdonald (1984), Corbet, and Hill (1991), Nowak (1991), and Wilson and Reeder (1993).

Biodiversity. Iran, Afghanistan, and the bordering countries of Central Asia with their variety of landscapes and habitats have a diversity of mammals perhaps unexpected within the generally arid climatic zones of southwestern Asia. Many of the best-known and/or spectacular of these animals have been covered in previous articles or will be the subjects of forthcoming articles in *Encyclopaedia Iranica*. These will be only briefly mentioned In the current article. The appended list of species represents those known to inhabit these areas, but additional species are added to this list each year as study of the natural history of the fauna of Southwest Asia increases.

The insectivores (Order Insectivora) have been covered in a previous article. These include nine species of shrews, fierce predators on small animals, three species of moles, which lead a subterranean existence and eat insects and earthworms encountered in their tunneling, and four species of hedgehogs

(Figure 1), which have a more diversified diet, including reptiles and birds' eggs, as well as insects. The information contained In the aforementioned article will not be repeated here, except to point out that the hedgehogs have been removed from the Insectivora and placed In the order Erinaceomorpha, while the shrews and moles have been removed to the order Soricomorpha to avoid papraphyly in the Insectivora by Hutterer (2005). Thus, by this taxonomy, there are no insectivores in our area. Some 40 species of bats (Order Chiroptera) live in our area. These, too, have been the subject of a previous *Encyclopaedia Iranica* article. Most species are insectivorous, and collectively, these small flying mammals take over the nocturnal roles performed by insect-eating birds during the day. Like the earth-bound insectivores, they have high metabolic rates and consume many times their own weight in insects over their lifetimes. Many species occur in large populations and serve as important controls on flying insects. A single species of fruit bat, the Egyptian fruit bat, occurs in Iran. During the day, many bat species hang up in caves and other dark places relatively safe from predators, although there is at least one species of snakes that search them out, and fallen baby bats are eaten by other predators, even including a species of salamander.

Other than humans, the only primate species (Order Primates) to occur in our area is the rhesus macaque, a widespread South Asian monkey that extends into eastern Afghanistan. Large groups can be found In the forests of eastern Afghanistan. These animals can be a great nuisance in rural agricultural and village areas, where they pillage anything edible.

Hares, two species, and two species of pikas (Order Lagomorpha) live in our area. Both feed on vegetation, hares on grasses and forbs in steppe and grassland areas, pikas on similar fare in rocky mountain regions, where they cut and store grasses for the winter months. They are preyed upon by carnivorous mammals and predatory birds such as hawks and eagles.

Rodents (Order Rodentia) are the most abundant and the most species-diverse mammals wherever they occur; in our area there are over 60 species in at least 6 families. Most are almost exclusively vegetarian, various species eating different plants and different plant parts. They serve as prey for the many species of mammal, reptile, and bird predators. Such predators are important controls on their often large and sometimes explosive populations. These highly morphologically diverse animals vary in size from tiny mice to squirrels, beavers, and porcupines. The order is far too large to cover fully in

this article: (1) Family Sciuridae: squirrels. This family of rodents includes tree squirrels, flying squirrels, ground squirrels, and marmots. (2) Family Muridae: Old World rats and mice. This largest family of rodents includes the familiar rats and mice that have been among the most serious of pests, destroying tons of stored food products, and causing more human deaths through rat-borne diseases than all the wars of the last millennium. As well as these introduced murids, there are numerous native rats, hamsters, voles, gerbils, and jirds that make up the most numerous species of small herbivores In the Western Palearctic, all adapted to survive In the arid biomes of this region. (3) Family Dipodidae comprises the jerboas (Figure 2), animals that move bipedally on their long hind legs. (4) Family Gliridae (or Myoxidae): dormice. There are four species in our area, including the fat or edible dormouse, a species of rodent that was actually raised as a delicacy by the Romans and still is such in areas of Europe. (5) Family Hystricidae, Old World porcupines, are large rodents that rely on their long, detachable spines for defense. (6) Family Capromyidae, nutrias and allied South American rodents, the coypu, are semiaquatic animals introduced to Eurasia and raised for their fur and flesh; they invariably escapes from captivity, becoming unwelcome members of local faunas in many areas of the world. (7) Family Castoridae: beaver. Once resident in Iran, as recently as the Neolithic, it has reentered the country from the Caucasus.

The Order Carnivora includes the most familiar large predatory mammals, such as lions, tigers, and bears, as well as many smaller and medium-sized predators from hyenas to foxes to mongooses. Our region of western Asia has a considerable diversity of theses animals, although many species are in danger of extinction, or, like the Persian lion and the Caspian tiger, have recently become extinct. This highly variable and diverse evolutionary lineage is united by a single morphological character: four carnassial teeth, adapted for the shearing of flesh In the more predaceous species.

Members of the cat family (Felidae) in Iran, Afghanistan, and adjoining Central Asia include three species of large cats, while two other species have become extinct in recent historical times. The snow leopard inhabits the Hindu Kush of Afghanistan and the Altai Range of Central Asia. Because population densities of its prey species are low, each individual cat ranges over a large geographic area, moving in elevation with the migrations of the larger prey, such as ibex and markhor. It will take prey of large size, including wild sheep, pigs, and deer; it also feeds on smaller animals from marmots to mice and birds.

Although protected by law throughout its range, the beautiful pelt of the snow leopard makes it a target for poachers. Skins can sometimes be seen In the bazaars in remote areas of eastern Iran, Afghanistan, and Central Asia. Lions were once common throughout the Middle East, from southern Europe (Balkans) through Iran. Much persecuted by hunters during the classical periods, they became extinct throughout most of their range, persisting in Iran until the first half of the last century. In the late 1800s, the valley of Dašt-e Arjan, 57 km west of Shiraz in Iran, was well known for its lions. In 1942 American engineers building a railway observed a pair of lions near Dezful; this is the last known report of lions in Iran (Heaney, 1943). There are no confirmed records of lion presence in central or eastern Iran, nor Afghanistan or Baluchistan. The last remnants of the Asian lion exist now only In the Gir Forest of western India. The genetic distance between Asiatic and African lions indicates that the two populations separated as recently as 100,000 years ago (Asiatic Lion Information Centre).

Tigers have lingered longer in populations throughout Asia; however, the Caspian tiger became extinct in Iran and Turkmenistan some time during the last century.

The secretive and nocturnal leopard has so far been more successful and persists in our area as well as in Africa and South Asia. Because of its depredations on domestic stock and the desirability of its pelt In the fur trade, its populations are declining through most of its range. The diet of the leopard is more varied than that of the other big cats. They are able to hunt in trees as well as on the ground, and they feed on insects, rodents, fish, and larger game such as antelope. Leopards also prey upon domestic dogs, and domestic stock is sometimes a major component of leopard diets outside protected areas. Leopards usually hunt nocturnally, stalking their prey before they make the kill by biting the throat, suffocating their prey. Where trees are available, they drag their prey up into the branches, away from scavengers. Leopards are able to carry prey three times their body weight into trees. Of the Persian leopard (*Panthera pardus saxicolor*), no more than 2,000 individuals are thought to remain in Iran, Afghanistan, and Turkmenistan. There is a stone carving of a leopard from the South Portico of the Terrace of Persepolis.

The cheetah (Figure 3) was once prized by royalty as a hunting companion, and young individuals were captured for that purpose. These lean cats, with a loose and rangy build can attain speeds of over 100 km/hr In the brief chases with which they run down prey such as hares, wild sheep, wild goats, and

gazelles. Females are solitary animals apart from mating encounters and the period in which the female is with her cubs. Males often occur in coalition groups made up of littermates that together defend a territory. Persian cheetahs reach sexual maturity at 20-23 months. The mating season is mainly in December and after 3 months gestation, 3-4 cubs are born in March-April. Iranian cheetahs live in semi-desert and desert terrain dominated by foothills and mountainous habitats. There is a conservation group in Iran, the Iranian Cheetah Society, dedicated to preserving the cheetah. The Iran Department of Environment has established five protected areas in which they live: Kavir National Park, Kharturan National Park Wildlife Refuge and Biosphere Reserve, Naybandan Wildlife Refuge, Bafq Protected Area, and Dar-e Anjir Wildlife Refuge. The Iran Cheetah Project has estimated that there are only 50-100 cheetahs remaining in Iran. The cheetah appears to be extinct in Central Asia (Turkmenistan), but a small population may still occur in Afghanistan. Probably, the most comprehensive published report on the cheetah in Iran is that of Asadi (1997).

We have two medium-sized and five small cat species in our area. Like cheetahs, caracals were once trained to hunt for the nobility in India and Iran. Their diet consists mainly of birds and small mammals, particularly hares. Occasionally they are able to take larger prey, including adult gazelle. Caracals have also been observed to feed on carrion. The caracal is widely distributed through the region from North Africa north of the Sahara, through Southwest Asia and southern Central Asia to India. It is absent from true desert, favoring mountain ranges and semi-arid woodlands. It is typically associated with either well-vegetated or rocky areas, which provide cover for hunting as well as shelter.

The Eurasian lynx is a medium-size cat with relatively long legs, and large feet, which provide for more efficient travel through deep snow. In winter, the fur grows very densely on the bottom of the feet. The coat is grayish, with tints varying from rusty to yellowish. There are three main coat patterns: predominantly spotted, predominantly striped, and unpatterned. These cats have long, prominent black ear tufts, and short black-tipped tails. The Eurasian lynx has a “phenotype set” typical of a large felid: it is large, long-lived, kills prey at least half its own body weight, forages over wide areas, and generally exists at low densities. Lynx activity peaks In the evening and morning hours, with resting mainly around mid-day and midnight. Lynx are capable of killing prey 3-4 times their own size, and where available, small

ungulates are the preferred prey, and lynx will generally only take small prey when ungulates are scarce. The Eurasian lynx has one of the widest ranges of all cat species. Although in Europe and Siberia lynx are associated primarily with forested areas, which have good ungulate populations, in Central Asia, lynx occur in more open, thinly wooded areas and are found throughout the rocky hills and mountains of the desert regions. The lynxes of the Central and Southwest Asian deserts and high mountains inhabit ecosystems quite different from the cold, coniferous forests with which the species is primarily associated. They appear to prey mainly on hares and rodents, rather than ungulates, but their ecology has been little studied in these parts of their range. As with all the cats, they have been hunted and trapped for their pelts throughout their range.

The sand cat is well adapted to the extremes of a desert environment and a sand-dwelling, existence. Their diet includes rodents, birds, reptiles, and arthropods. Sand cats are found in both sandy and stony deserts. There are no museum specimens from Afghanistan and Iran (although there are reports and photographs from the vicinity of Tehran and from the Moteh and Touran preserves), and they are protected by law from hunting in Iran. They are distributed at least sporadically throughout North Africa, Arabia, northeastern and eastern Iran, Transcaspia, southern Afghanistan and western Pakistan. They are probably under-reported as a result of their harsh environment and nocturnal, subterranean and secretive habits.

The jungle cat of Afghanistan and Central Asia is slender with long legs, a short tail (about 40 percent of head and body length), and black ear tufts. The coat is dark to light brown, without pattern except for stripes on the legs. They are often seen during the day. Their diet consists of rodents, hares, birds, reptiles, amphibians, arthropods, and young of larger mammals, such as gazelle and wild pigs. Strong swimmers, they will dive for fish and amphibians and to escape pursuit. Family groups, consisting of male, female and cubs, have been seen. Jungle cats are associated with water and dense vegetation, especially reed swamps, marsh, and littoral and riparian environments, and have adapted well to irrigated cultivation; they are seen in many different types of agricultural situations, especially those that give rise to large rodent populations. In sandy and stony desert country, they occur along riverbeds or near oases. They are often seen in human settlements and are frequently reported to take domestic fowl.

The small, solitary wildcats of Central and southern Asia differ from European

wildcats in having a more grayish-yellow or reddish background color, marked distinctly with small black or red-brown spots. The Asiatic wildcats also tend to be smaller in size than their European counterparts, weighing between 3-4 kg. Some researchers consider the Asiatic wildcats and African wildcats to be conspecific (*Felis lybica* ssp.), and the European wildcat (*F. silvestris*) a separate species, while others consider all three conspecific. Fossils indicate that the European form of the wildcat is the oldest, descended from Martelli's cat (*Felis [silvestris] lunensis*) about 250,000 years ago (Kurtén, 1968). Molecular analysis (Randi and Ragni, 1991) indicates that the African wildcat diverged from the European form only about 20,000 years ago. Fossil specimens of African wildcats are known with certainty only from the late Pleistocene. The domestic cat was estimated to have been derived from African wildcats between 4-8,000 years ago by Clutton-Brock (1981), Davis (1987), and others. However, recently a 9,500-year-old human and cat burial has been discovered in Cyprus, an island where no native wildcats are known (Vigne, et al., 2004). The diet of wildcats includes rodents—jerboas, gerbils, voles and mice—hares, young ungulates, birds, insects, lizards, and snakes. Asiatic wildcats rest and den in burrows and are frequently observed In the daytime. They are typically associated with scrub desert, ranging up to 2,000-3,000 m in mountain areas with sufficient dense vegetation. They are often found near cultivated areas and human settlement. Usually occurring near water sources, they are also able to live in waterless desert. In Central Asia, Asiatic wildcats are found In the low-lying desert and semi-desert areas adjoining the Caspian Sea (Heptner and Sludskiĭ, 1972). According to Habibi (1977) there has been widespread hunting of the wildcat for the fur trade in Afghanistan in the past, and he states that large numbers of pelts were seen for sale in Kabul bazaars. However, at present there is little international trade in Asian wildcats. Hybridization with domestic cats has been reported from many areas and is thought to occur throughout their range.

Pallas's cat, or manul cat, is generally crepuscular, but is occasionally seen at mid-day. It has hair on its underparts and tail nearly twice as long as that on the top and sides; this presumably helps keep the animal warm when it hunts on snow, cold rock, or frozen ground. Its pelage varies from gray to fox-red. It has a stout body, with short legs marked with indistinct black bands, and a thick, short, black-tipped tail (about 45 percent of head-body length). Its low-set ears are small and rounded, giving the head a low profile, an adaptation to hunting in open country where there is little cover. Pikas and small rodents form its principal prey, and birds are also taken. They den in small caves and

rock crevices or take refuge in the burrows of other animals such as marmots, foxes and badgers. They are widely distributed in Central Asia, extending into Iran, Afghanistan, and Pakistan. They are found in stony alpine desert and grassland habitats, but are generally absent from lowland, sandy desert basins, although they may extend into these areas along river courses. This cat has disappeared in recent years from much of the Caspian region. Pallas's cat has long been hunted for its fur in relatively large numbers, although there has been little international trade in recent years.

The leopard cat is distributed into Afghanistan as a representative of the Southeast Asian fauna. A good climber and swimmer, this small spotted cat preys on rodents and birds.

The dog family (Canidae) includes wolves, jackals (Figure 4), and foxes. These are covered in previous or forthcoming articles. One species not covered in these articles is the dhole, a wild canid that occurs in Tajikistan, the northwestern limit of its South and Southeast Asian range. These much-persecuted dogs hunt in packs and kill by disemboweling their larger prey species, such as deer and stags. As with most canids, dholes are omnivorous, taking fruit, lizards, and insects as well as larger prey. The pack is an extended family of 5-12, in which a single female breed and other pack members assist in feeding the lactating mother and her pups.

The Hyaenidae is a family of carnivores represented in Asia by a single species, the striped hyena. A strikingly patterned dog-like animal with black stripes on a whitish background, this solitary scavenger also feeds on small animals and vegetable matter, such as fruit.

The bear family (Ursidae) is represented by two species, the brown bear, a Holarctic species complex of northern Eurasia and North America, and the Asian black bear (Figure 5), a South Asian bear, a subspecies of which occurs in Baluchistan and is threatened with extinction. Bears have been covered in a previous article.

The only civets (Viverridae) extending into our region from Southeast Asia are two species occurring in Afghanistan. These small, cat-like, solitary predators are primarily nocturnal, ambushing small vertebrates and arthropods. The masked palm civet is arboreal and the small Indian civet is terrestrial. The palm civets include much fruit in their diets. Like most civets, they have perineal scent glands. The oils produced from these glands are used in social

communication, such as territorial marking and conveying breeding status, gender, etc. Civet oil has several components and is highly valued In the perfume industry. It has medical uses as well. Synthetic civet components have largely superseded it In the perfume industry of developed countries.

The mongoose family (Herpestidae), a diverse family in Africa and South Asia, has only two representatives in Iran and Afghanistan, the Indian gray mongoose and the small Indian mongoose (Figure 6). These are elongate small predators that feed on arthropods, frogs, reptiles, and small mammals. They will feed on carrion and refuse, and their feeding strategies adapt them to frequent agricultural and village habitats. In contrast to the other small predators of our region, they are primarily diurnal, solitary, rather than organized into extended family groups, as are some familiar African species.

The family Mustelidae is made up of a number of medium to small-sized predators, such as otters, badgers, martens, weasels, and polecats. For the most part, they represent a northern Eurasian element of the fauna of this region. They are elongate, short-legged creatures sharing strong-smelling excretions from their anal glands—the characteristic that gives them their family name. They are unusual among mammals in that many species have delayed implantation. Rough, prolonged copulation stimulates ovulation and the fertilized egg, or blastula, remains dormant In the uterus until environmental and physiological conditions are right for implantation and continued development. Many of the species have been trapped and hunted for their valuable silky pelts.

Otters are extremely agile, active creatures, most at home in waterways; thus, they are restricted to the wetter parts of the region having permanent aquatic habitats. Their populations are much impacted by human projects to divert water sources. They feed on fish, frogs, and other aquatic organisms.

Martens are similarly graceful animals living in a variety of habitats, from forests, where they prey on squirrels, to rural areas, where they are important controls on rodents, including those that are serious agricultural pests.

The largest mustelid In the region, the European badger, differs from most members of the family in living communally in extended families, constructing permanent, complex burrows. It is also omnivorous, eating roots and other vegetable foods as well as arthropods and small vertebrates. Badgers are fiercely defensive, standing their ground against much larger

intruders, including humans.

The ratel, or honey badger, is a distinctive mustelid, with whitish back and contrasting black face and underparts. Its diet is much like that of the badger, but it is more solitary and an agile tree-climber. It has an unusually large area of distribution, ranging from the African Cape Region to Central Asia. Like all badgers, it is a determined defensive fighter with a strong, loose skin that protects it. It is known for never relaxing its grip once it bites. At least in Africa, where it has been better studied, its favorite food is honey, and it uses its powerful forelimbs and stout claws to tear open bees' nests.

Weasels are the smallest members of the family. They are famous for having very high metabolic rates, necessitating frequent feeding on large quantities (relative to their size) of high-protein food sources. They are capable of bringing down hares and rodents considerably larger than themselves. They feed on any small vertebrate prey, including reptiles and birds, and will eat arthropods as well. They are good climbers, and their small size enables them to pursue small prey into narrow spaces and burrows.

There are two mustelids commonly called polecats in our area. The steppe polecat is in the same genus as weasels, stoats, and ermine (*Mustela*) and is found in Central Asia and Afghanistan, but not Iran. The more widely distributed marbled polecat occurs in all of the countries under consideration here. Like other mustelids, it is an agile, slender predator with a rank, defensive odor.

The family Procyonidae is represented only by the raccoon, introduced from North America into several Eurasian countries for the fur trade. These omnivorous creatures with their sensitive, manipulative forepaws have recently migrated from the Caucasus countries into northern Iran. It will be interesting to see if they displace any native small predators or expand out of Gilan into other provinces.

The Order Pinnepedia has a single representative in our area, the Caspian seal in the family Phocidae. As the name implies, it is endemic to the Caspian Sea. The Caspian Basin was once connected to the Black Sea and thus to the Mediterranean. The Caspian seal is a species derived from more broadly distributed phocid ancestors. These seals feed on small fish, molluscs, and crustaceans. Although they do not feed on commercially important fishes, they are often caught in fishermen's nets, where they drown or are killed after

being hauled on deck.

Hooved mammals with an odd number of toes (Order Perissodactyla) are also represented in our region with a single species, apart from domestic, sometimes feral equids, the wild ass, or onager (family Equidae). Once occurring throughout the steppes and semi-deserts of our region, grazing pressure from domestic stock and sport hunting have driven its greatly reduced populations into a few remote desert refuges. Like the majority of wild equids, they apparently have never been tamed for work or riding, but have been a game animal throughout history. They breed in early summer and give birth after a year's gestation.

Those hoofed mammals with an even number of toes (Order Artiodactyla) include pigs, deer, sheep, goats, and antelope and are well represented.

The wild boar (family Suidae, Figure 7) occurs wherever there is suitable habitat. They are omnivorous, rooting up soil for acorn mast and plant roots, consuming also insects, bird's eggs, and other animal matter, including carrion. In modern times they have been rarely hunted for food, as their flesh is proscribed to faithful Muslims. These powerful animals are dangerous adversaries. Nonetheless, they are an important prey species for leopards. Domestic pigs have been derived from wild boar independently in Europe, China, and Southeast Asia. When feral for a few generations, they revert morphologically to the wild appearance.

Both Bactrian and dromedary camels (Camelidae) once lived in wild populations in parts of our area. The two species were independently domesticated, the dromedary in southwestern Asia, probably Arabia, the Bactrian in Central Asia. They now occur only as domesticates in our region and will not be dealt with further in this article.

The horned artiodactyles of our area occur in three families.

The Cervidae, or deer family is represented by the red deer, or maral, throughout our region. In Iran, it is now confined to the Caspian region, protected in a few reserves. It was once more widely distributed through forested areas, but habitat destruction and alteration, as well as uncontrolled hunting have eliminated it from most of its range. The Persian fallow deer once extended from the eastern Mediterranean to western Iran, but was long considered extinct throughout its range until its rediscovery along the

Karkheh and Dez rivers in Khuzestan in the middle of the last century. Following relocation of part of the population to various protected regions, the species is recovering. The much smaller roe deer has a distribution from Europe to northern Iran. As with most other large mammals, its range has been diminished by deforestation and overhunting. All three species are preyed upon by leopards, wolves, and bears. The cervids are characterized by annual growth and shedding of the antlers in males.

A single species of musk deer (family Moschidae) occurs only in the forested mountains of eastern Afghanistan. Musk deer have an extensive distribution in the mountains of East Asia. They are characterized by a lack of antlers in either sex, and protruding tusks In the males. They are named for the musk, which accumulates in a pouch on the abdomen of the male. This substance is highly sought after by perfume makers, and in China musk deer are raised in captivity for this purpose.

The Bovidae are a large, diverse family that includes cattle, sheep, goats, and antelopes. Both sexes have true horns with a bony core covered by a horn sheath, never shed. They are ruminants, that is, a bolus of food from the complex, chambered stomach is chewed again to extract more nutrients. Two gazelles occur in our area, the chinkara, or jebeer (Figure 8), gazelle lives in hilly terrain in the arid areas of the southern Central Plateau in Iran. Resistant to dehydration, it can live in areas without water, deriving its needs from vegetation. The goitered gazelle occurs In the slightly less arid areas throughout much of Iran and Afghanistan and the steppes and plains of southern Central Asia. Hunting from vehicles has severely reduced populations of these animals.

The Persian ibex, the progenitor of domestic goats, lives in steep mountainous areas with near-vertical escarpments in Iran, Afghanistan, and Turkmenistan. They have long been a favorite game animal, and uncontrolled hunting has eliminated them from all but a few Protected Areas and National Parks. The males have spectacularly long, scimitar-like horns, which make them particularly desirable to trophy hunters. Their range has largely been taken over by flocks of domestic sheep and goats, constantly exceeding the carrying capacity of these overgrazed lands. Two other wild goats, the markhor (Figure 9) and the Siberian ibex, occur in Afghanistan and Central Asia.

The saiga is a peculiar goat-antelope of Central Asia that extends into Turkmenistan. It has an unusual convex proboscis that in males becomes

swollen during the rut, and tufts beneath the eyes fill with a sticky, musky glandular secretion from preorbital glands.

Wild sheep, or mouflon, range over our entire area and beyond. From one mountain range to another they differ in color pattern, horn size and shape, and even chromosome number. In intervening areas occur supposed hybrids of the named subspecies. This situation has resulted in a much disputed taxonomy, too byzantine to discuss here.

The Himalayan goral probably extends west into Afghanistan, but this requires confirmation. It lives among precipitous cliffs in dry climates. It tolerates snowy conditions. The snow leopard is its predator where the two species occur together.

The blue sheep, or bharal, is a Himalayan sheep that lives on slopes near steep cliffs. It extends west into Tajikistan. It is the favorite prey of the snow leopard.

Domestic bovids, cattle and water buffalo, are not discussed here, other than to state that there is a population of feral buffalo along the Karkheh River in Khuzestan (Anderson, personal observation, 1975).

The Persian Gulf provides habitats for a variety of marine mammals. The Order Sirenidae has a single species In the Gulf, the dugong. These gentle herbivores are adapted to shallow waters where their seagrass diet grows. Dugongs, a single species today, occur in scattered populations from the southwestern Pacific westward to the Persian Gulf. Unlike their manatee relatives, they are exclusively marine and do not enter freshwaters. They have proved difficult to study, as they are shy animals living in turbid waters, where they root out seagrass; hence, relatively little is known about their behavior. They have been hunted for meat, oil, and for the tusks of the males.

Whales, dolphins, and porpoises (Order Cetacea) are represented by three families and several species In the Persian Gulf. According to Firouz (2005), whales are rarely seen in Iranian waters. Modern whaling techniques have severely reduced populations of whales worldwide. In the Persian Gulf, overfishing of food species and pollution from petroleum and other industrial waste has compounded the problem. Cetaceans navigate and communicate using sonar. The use of sonar in naval exercises has been blamed for mass strandings of whales and dolphins around the world. U.S. Naval maneuvers In the Persian Gulf are believed to have been the cause of a number of strandings

on the coasts of bordering countries (Afrasiabi, 2008).

The four species of whales reported from Iranian waters are In the family Balaenopteridae, the rorqual baleen whales, *i.e*., those having baleen rather than teeth, to filter small food items. The blue whale, largest of the whales, indeed, of all animals, feeds primarily on krill. The fin whale eats krill in addition to fish and squid, while Bryde's whale and humpback whales eat krill and crustaceans.

The family Delphinidae contains five species In the Gulf, common dolphin (the most commonly seen species); Risso's, or gray, dolphin; false killer whale, Indopacific humpback dolphin; and bottlenose dolphin. All of the dolphins have teeth and differ in their diets. All feed on fish, but Risso's dolphin feeds mainly on squid, also eaten by the common dolphin and false killer whale and the Indopacific humpback dolphin eats molluscs as well. The bottlenose dolphin adds a variety of crustaceans to this diet, as well as sharks and rays (Firouz, 2005).

The family Phocoenidae is represented In the Persian Gulf only by the finless porpoise, characterized by the lack of a dorsal fin. It feeds on crustaceans, squid, and fish. Porpoises, unlike dolphins, occur principally in small family groups, not in sizable pods. The finless porpoise is frequently solitary.

Biogeography. Biogeography has been addressed from several points of view. Traditional descriptive biogeography emphasizes where organisms are distributed relative to features of the environment, such as topography, climate, soil type etc. and characterizing biota according to distributional associations and in comparison to other associations. Ecological biogeography attempts to explain co-occurrences of organisms in association with habitat features, such as elevation, similar adaptations to temperature, etc, and associates plants and animals with "life zones." Historical biogeography attempts to explain current distribution patterns in terms of paleogeographic events that have resulted In the formation of corridors and barriers, these events having resulted in isolation and distribution, which have promoted speciation in adaptive response to changed conditions. Currently, historical biogeography emphasizes "phylogeography," which relies on association of cladistic relationships with the changes in topography that have occurred through plate tectonics and other geological events, such as erosion and glaciation. To date, there have been too few phylogeographic studies of mammals of our region to draw sweeping conclusions about the evolution of

entire biotas. For descriptive zoogeographic accounts of the vertebrates of Iran, see Anderson (1989) and Firouz (2005). As a fairly detailed account has been given In the current encyclopedia in the article Fauna, the same information will not be repeated here. Suffice it to say that the fauna of the countries considered here shares species and genera with other regions of the Western Palearctic, as well as representatives of the Oriental and Afrotropical areas in the east and south, respectively.

Interactions with humans. Whatever scholars and philosophers may believe, it is actual human/animal interactions that will determine the fate of animals. The major threats to animals everywhere in the world are habitat loss and destruction, expansion of the "built" society, the poisoning of soil and water, and the effects of human-created global climate change.

On a positive note, with the growth of an educated middle class in Iran and elsewhere, there is a concomitant growth of interest and concern about conservation. Zoology has become a field of academic study in the many universities around Iran; special interest groups focused on observation and photography of many kinds of animals are proliferating. The advent of affordable technology has made fieldwork in both professional and amateur study of nature much more broadly available. But government and legal action has been slow to follow (personal observations, 1958 to the present).

Relations between humans and other mammals have been varied. Large fur-bearing species have been exploited through history, and the larger herbivores have been hunted as game and for sport. Predatory species, especially those that prey on domestic stock, have been shot and trapped, while smaller predators that help to control rodent populations have often been unappreciated, hence persecuted as vermin. Some have been feared as carriers of disease, and rabies has been justly dreaded, especially before the advent of vaccine. Some, particularly murine rodents, are pests on crops and spoilers of stored products. As human population growth has soared in concert with modern technology, destruction of habitat threatens the continued existence of many species owing to deforestation, overgrazing, diversion and storage of water for irrigation. Modern weapons and motorized hunting vehicles, as well as growing affluence, have greatly facilitated sport hunting, poaching, and the intentional extermination of predators.

At the same time, a growing realization of the importance of conservation has caused the development of hunting regulations, protected areas, national

parks, etc. As secondary and post-secondary education has spread, a growing middle class, with an enthusiasm for outdoor sports and activities has generated a more widespread interest In the protection of nature. Efforts at conservation in Iran have been chronicled by Firouz (2005) and in Iran and Afghanistan by Firouz and Balland in the article ENVIRONMENTAL PROTECTION in *Encyclopaedia Iranica*.

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