



Mammals of the State of Kuwait

Mohammad A. Abu Baker, Yousef A. Buhadi,
Abdulrahman Alenezi and Zuhair S. Amr



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(Photo by A. Al Yousef)

1 Introduction



1 Introduction

1.1 Introduction to the project

IUCN Regional Office for West Asia (ROWA) implemented a project for *“Monitoring and documenting the biodiversity in Kuwait”* funded by the Environment Public Authority of Kuwait (EPA), the main purpose of the project was to document all the biodiversity elements in the State of Kuwait based on collecting previous records and updating the biodiversity components through selected field surveys. The project also aimed at raising the capacity of the EPA staff in biodiversity research and introducing them to modern techniques and most recent research standards and procedures.

The project outcomes contribute to establishing a biodiversity database that will enhance the decision-making process related to protected areas and biodiversity conservation. The general objectives of this project included the following: a) Developing a long-term plan for inventory and taxonomic study of Kuwait’s biodiversity. b) Providing technical training for national teams in different fields including biodiversity research methods, taxonomy and biodiversity monitoring. c) Establishing a national biodiversity database that is linked with the state’s research and educational institutions. The database will contribute to the following: identifying the ecological hot spots and priority sites for conservation, monitoring the implementation of the obligations of the State of Kuwait towards regional and international conventions related to biodiversity conservation (the international Convention on Biological Diversity, Convention on International Trade in Endangered Species of Wild Fauna and the Convention on the Conservation of Wildlife and Natural Habitats in the Countries of the Gulf Cooperation Council.



(Photo by Faisal Al Nomas)



(Photo by A. Al-Yousef)

2 General description



2 General description

2.1 Location and topography

The total area of the State Kuwait is 17,818 km² of land and about 1,000 km² of off-shore islands. It is situated in the most northwestern corner of the Arabian Gulf (Figure 1). Kuwait is an arid country and consists mainly of desert land. It is bordered by Saudi Arabia to the south and southwest and with Iraq to the north and northwest. The landscape is relatively flat, broken only by occasional low sand dunes and shallow depressions. The surface elevates gently from east to west reaching about 300 m above sea level at Al-Shigaya and Al-salmi. The eastern part of the state, including all of the inhabited area, is overlooking the Arabian Gulf with coastline that extends about 195 km.

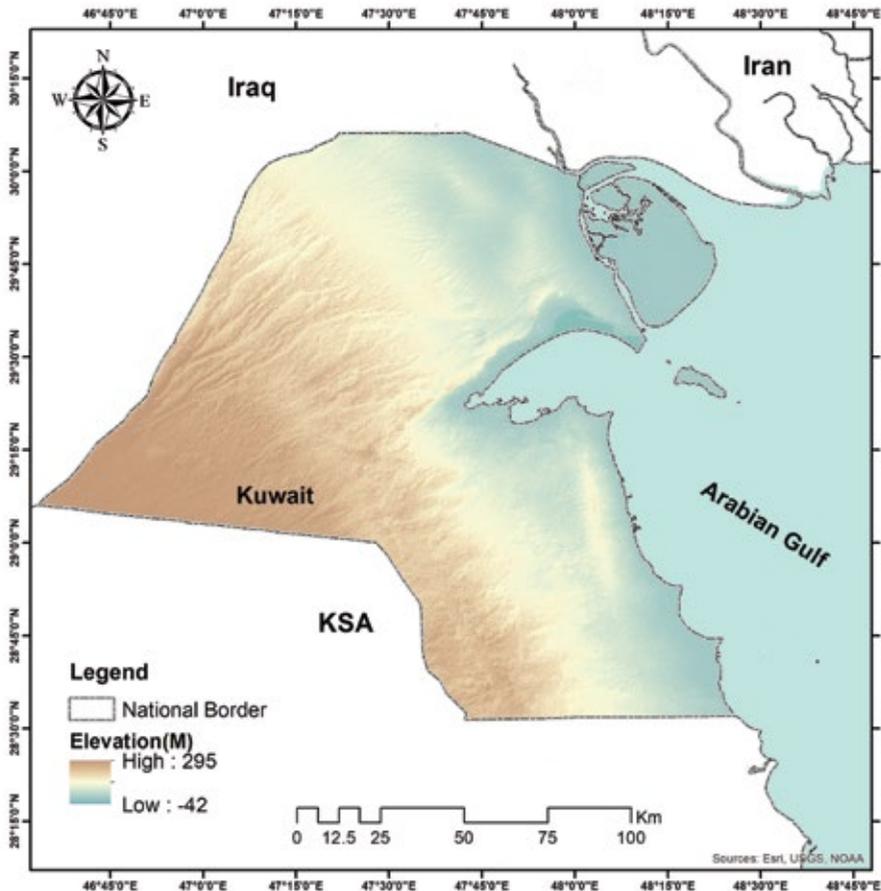


Figure 1: Map showing location of the State of Kuwait (Source: IUCN, H. Haddad)

2.2 Geographical setting

The total area of the State Kuwait is 17,818 km² of land and about 1,000 km² of off-shore islands. It is situated in the most northwestern corner of the Arabian Gulf (Figure 1). Kuwait is an arid country and consists mainly of desert land. It is bordered by Saudi Arabia to the south and southwest and with Iraq to the north and northwest.

The landscape is relatively flat, broken only by occasional low sand dunes and shallow depressions. The surface elevates gently from east to west reaching about 300 m above sea level at Al-Shigaya and Al-Salmi. The eastern part of the state, including all of the inhabited area, is overlooking the Arabian Gulf with coastline that extends about 195 km. The surface consists of flat sandy plains interspersed with some low-rise hills, some of which reach a height of nearly 145 meters, and in northern Kuwait there are a series of hills such as Jal Al-Zour ridge, the hills of Al-Marw and Al-Liah. In the south, hills in the form of domes are common in the regions of Warah and Burgan. Sand dunes areas are mostly located in northwestern Kuwait along Al-Huwamiliyah-Al-Nimritayn zone reaching Al Atraf area. Kuwait is crossed by several dry desert wadi systems, such as Wadi Al-Batin, extending along the Kuwaiti-Iraqi borders about 150 km, and runs along the western borders of Kuwait, with a width in some parts reaching about 10 km and a maximum depth of about 57 meters. To the north lies the Rawdatain Plain, consisting of flat land that slopes towards the east and the northeast.

Kuwait includes nine islands in the Arabian Gulf, the largest is Bubiyan Island (683 km²). The coastal strip extends for about 500 km, with a number of small bays and lagoons. The largest of are Kuwait and Kazma Bays, with several lagoons; Abdullah, Boubyan, and Al Subiya khawrs in the north, and Al Maftah and Al Amma khawrs in the south.

2.3 Physical parameters

The physical factors mainly in the form of extreme temperature fluctuations and elevated salinity exert considerable natural stress on the marine and coastal ecosystems of the Gulf. As a consequence, the biodiversity is significantly lower compared with the Indian Ocean. Because of the relative shallowness, the Gulf supports highly productive coastal habitats, such as the extensive intertidal mudflats and seagrass beds. Along parts of the coast there are also areas of dwarf mangrove and coral reefs. However, the coral reefs show relatively very low biodiversity. Many species of corals as well as other species of animals and several plants in the area live close to their tolerance thresholds. In the northern Gulf, most of the subtidal areas are soft sediment bottoms. Extensive seagrass beds mostly cover these sediments, which

supports a number of commercially important species such as the prawn. Algae mats associated with the tidal flats are also highly productive as they are covered with blue-green nitrogen-fixating algae during part of the year. These tidal flats are a key feeding area for wintering and migrating waders (Lindén et al., 2004).

2.4 Vegetation of Kuwait

The native vegetation of Kuwait is of high values as it represents semi-arid and arid vegetation of the region and contains highly adaptable genes to the harsh environment, extreme drought, poor soil and organic matter and tolerates high salinity (Zaman et al., 2009). The vegetation types of Kuwait are mainly defined by geomorphological changes, soil types and climatic conditions.

Four main vegetation types are recognised in Kuwait according to Halwagy and Halwagy (1974b), Halwagy (1986), and Omar (2000):

1. Sand dune vegetation:

- Comprises a series of low coastal dunes which extends along the southern to northern coastal strips.
- The soil is composed of loose coarse sand. It is usually dominated by *Zygophyllum qatarense* and/or *Seidlitzia rosmarinus*, with occasional by *Atriplex leucoclada* and *Nitraria retusa*
- Common associates are *Lycium shawii* and *Pennisetum divisum*.

2. Salt marshes 'sabkha' and saline vegetation:

- The marshes are influenced by tidal action and the shallow saline water table.
- Soil ranges from loamy sand to sandy clay.
- This vegetation type dominates in areas of Kuwait bay coasts and Khor Al-Sabiyah.
- It is also found in Bubiyan and Warba Islands.
- *Chenopodiaceae* dominates the vegetation with *Halocnemum strobilaceum* common near the shore and *Nitraria retusa* and *Zygophyllum qatarense* further inland.

3. Desert plains vegetation:

This type dominates most of the desert land area (west of the coastal region) and is represented by a number of communities:

- *Cyperus* steppe: dominated by *Cyperus conglomeratus* and common to the south and south-west of Kuwait City. Commonly associated with *Panicum turgidum*. The soil is of deep, moderately loose, coarse sand.

- Rhanterium steppe: dominated by *Rhanterium epapposum* and found in the central and north-east of Kuwait. Common associates are *Convolvulus oxyphyllus*, *Moltkiopsis ciliata* and *Stipagrostis plumosa*. Found on shallow to moderately deep soils with a calcareous hardpan.
- Haloxylyon steppe: dominated by *Haloxylyon salicornicum* found mainly in northern areas of Kuwait. Found on shallow soils with a hardpan.

4. The desert plateau vegetation:

Found mainly in the extreme west of Kuwait; dominated by *Haloxylyon salicornicum* with *Citrullus colocynthis* also occurring frequently. Annual plants



Figure 2: Habitats in Kuwait **A.** Water frontier on the Arabian Gulf **B.** Al Jahrah Nature Reserve **C.** Idrea'. **D.** The Jal Al-Zour Ridge **E.** Al Hewysat **F.** Um Al Rimam (Photos by A. Alenezi)

densely cover areas where perennial plants are absent. These include *Arnebia* spp. *Helianthemum* spp. *Astragalus* spp. and *Schismus barbatus*. *Zilla spinosa* dominates Wadi Al-Batin area. Found on thin soils consisting of generally of few inches of course or soft loamy sand, often mixed with pebbles and gravel, over a hardpan.

2.5 Distribution of the vegetation

Abdullah (2017) gave a comprehensive review on the distribution of vegetation in Kuwait. The following is a summary based on Abdullah, (2017). The first attempt to define the vegetation cover of Kuwait goes back to the mid fifties; where in her book "Wild Flowers of Kuwait and Bahrain", Dickson (1955) included a map showing four plant communities; *Rhanterium epapposum*, *Haloxylon salicornicum*, *Panicum turgidum* and *Cyperus conglomeratus*. Later, Kernick (1963) modified the later map by adding a fifth vegetation type, *Zygophyllum qatarenses*. Kernick (1966) modified the map and included *Anabasis* vegetation community within the *Haloxylon* community to the west of Kuwait.

Halwagy (1973) and Halwagy et al., (1982) studied the ecology of the desert vegetation of Kuwait, with emphasis on salt marshes vegetation. Halwagy and Halwagy (1974a) identified the physical environment along with the geology of the State of Kuwait. In general, the country is a flat to moderately rolling desert with very limited elevations, wadis, with some low sand dunes and salt marshes. They also included some details on the soil types and the climate of Kuwait.

Halwagy and Halwagy (1974b) recognised the five different plant communities, their proposed map showed that the *Haloxylon* plant community was the most widely distributed across Kuwait, followed by the *Rhanterium* community, while the *Panicum* plant community decreased and the *Zygophyllum* community decreased around coastal areas (Figure 3).

Omar et al. (2001) employed modern Geographical Information system (GIS), based on soil types and vegetation data. This comprehensive study covered all Kuwait (Figure 4). The final map showed eight different vegetation types: *Centropodietum*, *Cyperetum*, *Halophyletum*, *Haloxyletum*, *Panicetum*, *Rhanterietum*, *Stipagrostietum*, and *Zygophylletum* (Omar et al., 2007).

2.6 Changes to plant communities

Over a period of 25 years (1974-2001), Omar et al. (2001) compared vegetation communities of Kuwait based on Halwagy and Halwagy (1974b) and recent studies showed significant changes to the vegetation cover. It was concluded that some plant communities decreased while others had increased. Perennial shrubs accounted for about 27% of the studied area while perennial

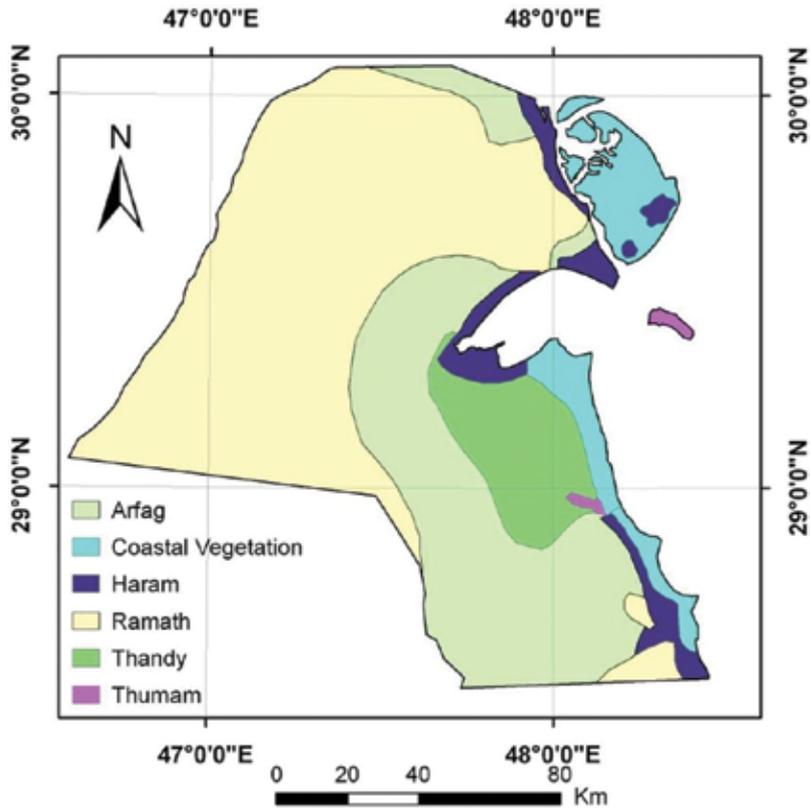


Figure 3: Vegetation map of Kuwait showing five plant communities (After: Halwagy & Halwagy, 1974b).

grass and sedge represented 67.9% (Omar et al., 2001). The main causes of land degradation in northern Kuwait were addressed by Brown (2003). He showed that *Rhanterium epapposum* community in northern Kuwait was replaced by *Haloxylon salicornicum*, due to over grazing of livestock on the edible and preferred *Rhanterium*.

Al-Awadhi et al. (2005) gave a comprehensive account on land degradation in Kuwait, thus affecting the vegetation cover. These changes were attributed to environmental factors; including climate change and human activities (e.g. over-grazing, uprooting of shrubs, soil compaction, military activities, and soil oil pollution). Uddin et al. (2010) addressed the micro-climatic variations as a result of land-cover changes. They stated that the environmental catastrophes that emerged during the Gulf war (e.g. oil lakes and spills over land) left permanent damages. Additionally, Kuwait exhibited large scale of urban expansion. All these accounted for changes in the vegetation cover country

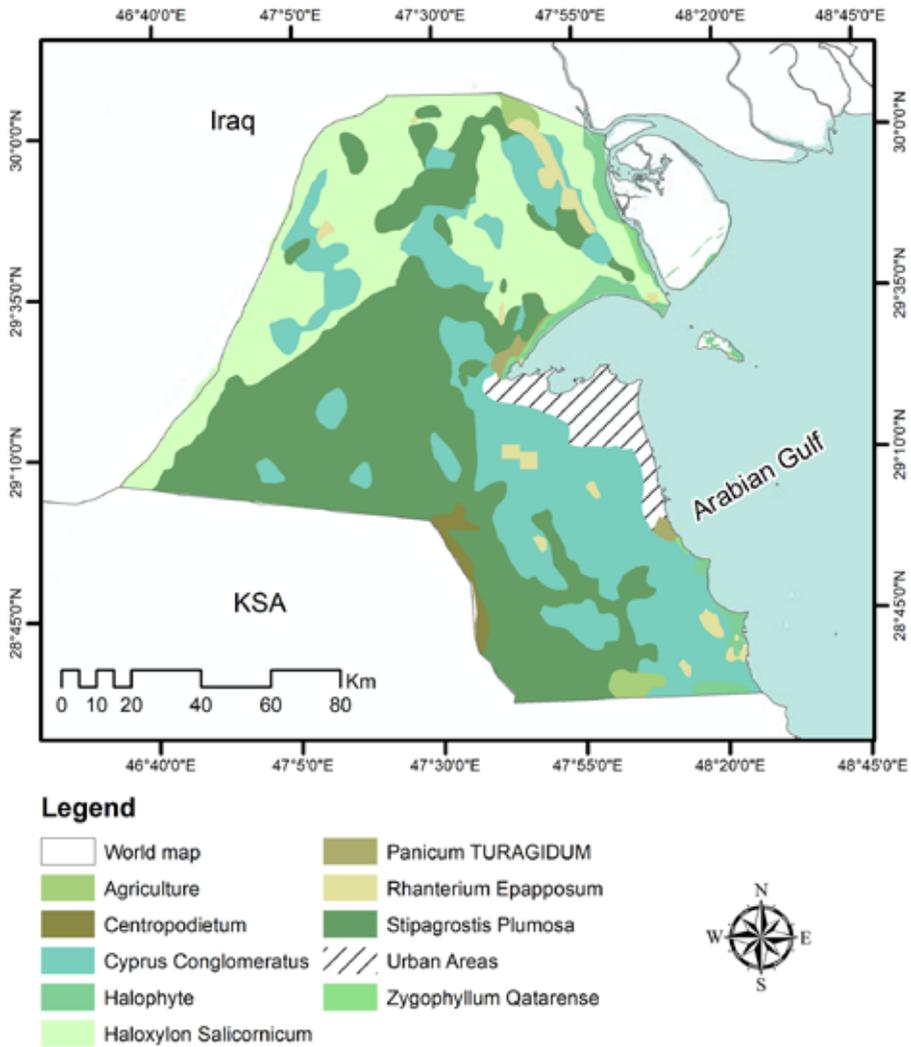


Figure 4: Current vegetation map of Kuwait (Source: Omar et al., 2001).

wide. Abdullah (2017) stated that the current status of vegetation communities in Kuwait underwent intensive land deterioration and reduction of plant communities such as *Rhanterium* spp. and *Haloxylon* spp., while on the other hand, grasses and sedges communities increased (e.g. *Stipagrostis* spp. and *Cyperus* spp.).



(Photo by A. Al Sirhan)



(Photos by M. Abu Baker)

3 Methodology



3. Methodology

3.1 General overview of the methodology

Standard methods for studying and monitoring mammalian diversity were conducted to record species presence and distribution in Kuwait. This included rapid diagnosis surveys to validate available information and to fill in information gaps through on-foot transects, opportunistic observations, Sherman trapping and camera traps within selected localities (Wilson et al., 1996; Braun, 2005). The methods provided sighting for diurnal and nocturnal animals. Rapid diagnosis visits were conducted to record species presence in the study sites. This included rapid diagnosis surveys to validate available information and to fill in information gaps through on-foot transects, opportunistic observations, trapping and camera traps within selected localities (Wilson et al., 1996; Long et al., 2008). Direct (trapping and observations) and indirect methods (transects for animals and their signs such as footprints, scats and dens) were adopted to record species presence in the study sites. On-foot transects, opportunistic observations, Sherman trapping, and remote-sensing camera traps were used. These methods provide direct observations for diurnal and nocturnal animals as well as information about the abundance of each species. The study sites were distributed to cover the two peak activities of animals, the morning peak and the afternoon peak. Specimens for different species caught during the study were collected as a reference collection for further identification and studies. Observed animals and their signs were identified in the field. GPS coordinates, photographs, and notes on the habitat will be recorded for each transect. Observations on agricultural expansion and urban development, livestock grazing, off-road driving, wood-cutting, and touristic activities were recorded within all visited sites to evaluate the threats on the mammalian diversity.

The following methods will be used to assess the mammalian diversity within the study area:

3.2 Literature review and previous records

A literature review was conducted based on the biophysical and natural environment of Kuwait. The review covered all available publications of scientific papers, books, technical ecological, biodiversity reports, and communications on personal observations. A list of all cited references was compiled and included the biogeographic zones, bio-climatic zones, ecosystems, key biological habitat, sensitive and important habitat, species diversity with more emphasis on red list, indicator and key species.

3.3 Spoor transects, car transects, and on-foot day transects

Transects for mammals and their signs (footprints, scats and dens) will provide direct and indirect recordings for species presence in the study sites. On-foot transects, car-transect, and opportunistic observations were conducted within the study sites. Most on-foot transects will be conducted in the wadis and in areas with dense vegetation cover, whereas, car transects and opportunistic transects will be used to cover the vast distances between selected sites. Observed animals and their signs will be identified in the field (Figure 5). GPS coordinates, photographs, and notes on the habitat will be recorded for each transect.



Figure 5: Animal signs recorded during the daytime transects: red fox footprints, gazelle footprints, and gazelle scats (Photos by M. Abu Baker).

3.4 Small mammal trapping

Sherman live traps (Figure 6) were used to determine the presence of small mammals, specifically gerbils and jirds. A mix of oat and peanut butter were used as baits, traps were set in transect lines and/or grid format in the late afternoon and checked early in the morning. Animals were handled and identified in the field to species level (Figure 6), marked, and released. The traps set in the late afternoon and check early in the morning and were positioned in locations close to identified burrows and suitable habitats.



Figure 6: A Sherman live trap used to survey rodents. *Gerbillus dasyurus* captured in Sherman trap (Photos by M. Abu Baker).

3.5 Camera trapping for medium and large-sized nocturnal mammals

Camera trapping was adopted to record the presence of medium to large-sized nocturnal mammals in the study sites. Remote-sensing camera traps equipped with motion sensors were distributed along animal trails and areas with active dens within the study sites. This non-invasive method provides sightings for diurnal and nocturnal animals as well as information about the abundance of species with minimal disturbance. Cameras were set for 1-2 night in sites that were determined after scouting for signs and possible trails used by the animals. Depending on the size of the target species, the cam-

eras were fixed on tree branches (or poles) at appropriate heights (about 1m above ground), Figure 7.



Figure 7: Camera trap used to survey medium to large-sized mammals. Red fox photcaptured using camera traps (Photos by M. Abu Baker).

3.6 Bat surveys

The presence and distribution of bats in Kuwait was recorded through personal observations, bat capturing using mist nets, and bat detectors (Figure 8). Suitable habitats for bats (shelters and day roost sites) were determined using the following methods: inspection for physical signs of bats activity (signs for feeding, faecal remains), surveying roosting sites such as abandoned and/or old buildings and caves, and visual sighting and remote sensing of bat activity (bat detectors: Song Meter) to determine activity patterns of bats in the study sites.



Figure 8: Study methods for bats: mist nets and bat detectors (Source: Wildlifeacoustics.com).



(Photo by Faisal Al Nomas)

4 Mammals of Kuwait

The image features a blurred background of a tree trunk and green foliage. The tree trunk is on the left side, showing a rough, brown bark. The foliage is on the right side, with thin, green branches and leaves. The text '4 Mammals of Kuwait' is overlaid in white, bold font in the upper left quadrant.

4. Mammals of Kuwait

So far, a total of 32 species of mammals are known to occur in Kuwait (Table 1, 2). These species belong to seven orders (Artiodactyla, Carnivora, Cetacea, Chiroptera, Eulipotyphla, Lagomorpha and Rodentia). Species of order Rodentia constitutes the highest number. Cowan (2013) gave the most comprehensive review on the mammals of Kuwait. He listed 25 species of confirmed presence, four uncommon or rare visitors, seven used to occur and are considered by now extinct (Table 2), and two of doubtful provenance. Clayton and Pilcher (1983) and Clayton and Wells (1987) reported on several mammalian species in Kuwait.

Here, species descriptions and distributions are based on Harrison and Bates (1991) and Cowan (2013). Range of distribution and valid names were followed as in the IUCN Red List, Mammal Species of the World, National Museum of Natural History, Smithsonian Institution. Common names were given as possible, based on Harrison and Bates (1991) and Cowan (2013). The geographic names for localities and their coordinates follow the Gazetteer of Jordan (Anonymous, 1990).

The acronyms are BMNH British Museum of Natural History, FMNH Field Museum of Natural History, HZM Harrison Zoological Museum, SMNH Smithsonian Museum of Natural History.

Table 1: Summary of extant mammalian taxa occurring in Kuwait.

Order	Common name	Species
Eulipotyphla	Long-eared hedgehog	<i>Hemiechinus auritus</i> (Gmelin 1770)
	Ethiopian hedgehog	<i>Paraechinus aethiopicus</i> (Ehrenberg 1833)
Chiroptera	Naked-rumped tomb bat	<i>Taphozous nudiventris</i> Cretzschmar, 1830
	Trident leaf-nosed bat	<i>Asellia tridens</i> (E. Geoffroy 1813)
	Kuhl's pipistrelle	<i>Pipistrellus kuhlii</i> (Kuhl 1819)
Carnivora	Red fox	<i>Vulpes vulpes</i> (Linnaeus 1758)
	Honey badger	<i>Mellivora capensis</i> (Schreber 1776)
	Indian grey mongoose	<i>Herpestes edwardsi</i> (E. Geoffroy 1818)
	Wildcat	<i>Felis silvestris</i> (Schreber 1777)
	Sand cat	<i>Felis margarita</i> (Loche 1858)
Cetacea	Sei whale	<i>Balaenoptera borealis</i> Lesson, 1828

	Blue whale	<i>Balaenoptera musculus</i> (Linnaeus 1758)
	False killer whale	<i>Pseudorca crassidens</i> (Owen 1846)
	Indo-Pacific humpback dolphin	<i>Sousa chinensis</i> (Osbeck 1765)
	Indo-Pacific bottlenose dolphin	<i>Tursiops aduncus</i> (Ehrenberg 1833)
	Finless porpoise	<i>Neophocaena phocaenoides</i> (G. Cuvier 1829)
Lagomorpha	Cape hare	<i>Lepus capensis</i> (Linnaeus 1758)
Rodentia	Indian crested porcupine	<i>Hystrix indica</i> Kerr, 1792
	Euphrates jerboa	<i>Allactaga euphratica</i> Thomas, 1881
	Lesser jerboa	<i>Jaculus jaculus</i> (Linnaeus 1758)
	Black rat	<i>Rattus rattus</i> (Linnaeus 1758)
	Brown rat	<i>Rattus norvegicus</i> (Berkenhout 1769)
	House mouse	<i>Mus musculus</i> Linnaeus, 1758
	Baluchistan gerbil	<i>Gerbillus nanus</i> Blanford, 1875
	Wagner's gerbil	<i>Gerbillus dasyurus</i> (Wagner 1842)
	Cheesman's gerbil	<i>Gerbillus cheesmani</i> Thomas, 1919
	Indian gerbil	<i>Tatera indica</i> (Hardwicke 1807)
	Libyan jird	<i>Meriones libycus</i> Lichtenstein, 1823
	Sundevall's jird	<i>Meriones crassus</i> Sundevall, 1842

Table 2: Extinct mammals of Kuwait and their IUCN conservation status.

Common name	Species	IUCN Global status	IUCN Regional status
Wolf	<i>Canis lupus</i> Linnaeus, 1758	LC	LC
Caracal	<i>Caracal caracal</i> (Schreber 1776)	LC	NT
Cheetah	<i>Acinonyx jubatus</i> (Schreber 1776)	VU	EN
Arabian oryx	<i>Oryx leucoryx</i> (Pallas 1777)	VU	EN
Saudi gazelle	<i>Gazella saudiya</i> (Carruthers & Schwarz 1935)	EX	
Arabian sand gazelle	<i>Gazella marica</i> (Thomas 1897)	VU	
Fennec fox	<i>Vulpes zerda</i> (Zimmermann 1780)	LC	LC
Dugong	<i>Dugong dugon</i> (Müller 1776)	VU	

Key to the Orders

1. Forelimb equipped with a membrane, flying formsOrder Chiroptera
Forelimb not equipped with a membrane, terrestrials forms 2
2. Hind and forelimbs equipped with hoofs Order Artiodactyla
Hind and forelimbs equipped with claws 3
3. Upper incisors chisel-shaped or tusk like, canines absent.....4
Upper incisors not chisel-shaped, canines present 5
4. Four upper incisorsOrder Lagomorpha
Two upper incisors Order Rodentia
5. Carnassials present Order Carnivora
Carnassials absent 6
6. Dorsum covered by spines.....Order Erinaceomorpha
Dorsum not covered by spines Order Soricomorpha

4.1 Order Soricomorpha

This order includes all the shrews, solenodons and moles.

4.1.1 Family Soricidae

This family contains the shrews. This group of mammals is distinguished by their long, narrow, and pointed snout. The family includes the smallest living mammals, some species do not exceed 4 cm long and weigh 2 grams. They are short legged, with five toes per foot. Shrews are known for their extremely high metabolic rate and their rapid heart rate. They feed exclusively on lower invertebrates and insects.

4.1.1.1 Savi's Pigmy Shrew, Pygmy White-toothed Shrew *Suncus etruscus* (Savi 1822)

This is the smallest shrew in Arabia, it is less than 85 mm in total length. The tail is longer than the head and body length, usually bicoloured covered by short hair. The hair on the base of tail is whitish with brown upper part. The fur colour is grey dorsally, whitish on the ventral side. A sharp line on the flanks separates the dorsal and the ventral aspect. The skull is extremely small and delicate. The upper jaw has 4 unicuspid teeth.

This species is found in moist habitats within semiarid areas. Large number of skulls were recovered from owl pellets in Jordan (Amr, 2012). No official records have been made for this species from Kuwait, however, it was recently recorded from Al Jahra based on a dead specimen. A photograph of a Isabelline shrike (*Lanius isabellinus*) also seen in Al Jahra with a small shrew in its beak, most likely of this species (Figure 9). The closest records in Arabia come from Basra area, southern Iraq (Harrison & Bates, 1991).



Figure 9: An Isabelline shrike (*Lanius isabellinus*) from Al Jahra with a small shrew (likely *Suncus etruscus*) in its beak (Photo by O. Al Shaheen).

4.2 Erinaceomorpha (formerly known as Insectivora)

4.2.1 Family Erinaceidae

This family includes the hedgehogs.

They are characterized by the presence of spines that covers the dorsal and the lateral aspects of their body. The tail is short and stumpy. Eyes are rather small but well developed. Hedgehogs are nocturnal animals. They remain in sheltered areas for most of the day, and become active by dusk, where they seek small animals as prey (insects and lizards). Some species hibernate during winter. Hedgehogs are the most primitive mammals in the Arabian deserts, some became very adapted to live in the arid regions of the Middle East (Bates, 1996).

Key to the family Erinaceidae

Ears large, small in size, base of scapular spines with black bar
.....*Hemiechinus auratus*

Ears short, medium in size, muzzle dark gray to black, base of scapular spines without a black bar *Paraechinus aethiopicus*

4.2.1.1 Long-eared hedgehog *Hemiechinus auritus* (Gmelin 1770)

Small species of hedgehogs. Characterized by distinctive long and pointed ears (Figure 10). Ears are not covered by hair. Tips of dorsal spines are white.



Figure 10: The long-eared hedgehog, *Hemiechinus auritus* (Photo by J. Al-Matar).

Base of the scapular spines black. A gap in the forehead spines is lacking. Face with white hair and with little brown hair around the eyes, but without a facial mask. The muzzle has a grey tint. Belly buff white. 4-5 pairs of mammae present in the female. Small and delicate skull. Large tympanic bullae. First upper incisors are pointed forward. Elevated crown of lower second premolar biscuspid.

This is a common resident in Kuwait (Clayton, 1983; Clayton & Wells, 1987; Harrison & Bates, 1991; Al-Sirhan, 2021; Pope, 2012). Specimens from Kuwait are found in the BMNH and HZM collections. Additional records are in Khalil & Abdul Salam (1985). An inhabitant of Al-Jalia desert area southeast Kuwait (Eissa et al., 1975). One specimen of *Hemiechinus auratus* from Salimieh is found at the FMNH. One specimen of *Hemiechinus auratus* from Ali Al Salem Air Force Base is found at the SMNH.

It feeds on various insects, centipedes and land snails (Schoenfeld & Yom-Tov, 1985). This species could tolerate extreme arid conditions, it is known to inhabit forested as well as open areas in the Mediterranean biotope.

4.2.1.2 Ethiopian hedgehog *Paraechinus aethiopicus* (Ehrenberg 1833)

Medium-sized hedgehog. Possesses a distinctive facial mask, the muzzle being dark grey to black, else face is white from eyes up to the forehead (Figure 11). Ears large, slightly rounded at the tips and extending beyond the upper surface of the spines. Dark terminal end of the dorsal spikes. Anterio-me-



Figure 11: The Ethiopian hedgehog, *Paraechinus aethiopicus* (Photo by A. Al-Sirhan).

dian gap of spines on head is a distinguishing character of this species. The ventral side is pure white, legs and feet are dark brown. Fur fine and dense. Skull is robust and broad, with a wide braincase. Strongly inflated tympanic bullae, with their cavities extending into the pterygoids.

This species is considered as an uncommon or rare resident in Kuwait (Cowan, 2013; Clayton, 1983; Clayton & Wells, 1987). It was reported from Al-Salmi, western Kuwait, April 2007 (Al-Sirhan, 2021; Cowan, 2013).

4.3 Order Chiroptera

Order Chiroptera includes the flying bats, one of the most successful mammal groups that spread throughout the world. Their forelimbs are modified into a membranous-wing like structure enabled bats to fly and cross continents. Bats are crepuscular or nocturnal; they seek flying insects and look for a water source to drink. Bat's eyes are usually small in size, with some exception as the fruit bats. They depend entirely on echolocation to make their way and capture its prey. In Jordan, some bats hibernate during winter; while other migrates on seasonal basis.

Only three species of bats belonging to three different families (Emballonuridae, Hipposideridae, and Vespertilionidae) have been previously recorded in Kuwait, all insect-eating microchiropterans (Cowan, 2013).

Key to the families of bats in Kuwait

1. Tail arises from the upper middle of the interfemoral membrane..... Family Emballonuridae (Figure 12a)
2. Tail completely surrounded by the interfemoral membrane..2 (Figure12b)
3. Nose leaf absent, Ears long, always extends beyond the top of the head, tragus long Family Vespertilionidae (Figure 12c)
Nose leaf present, posterior nose leaf tridentate, anterior nose leaf flat and not elaborateFamily Hipposideridae (Figure 12d)

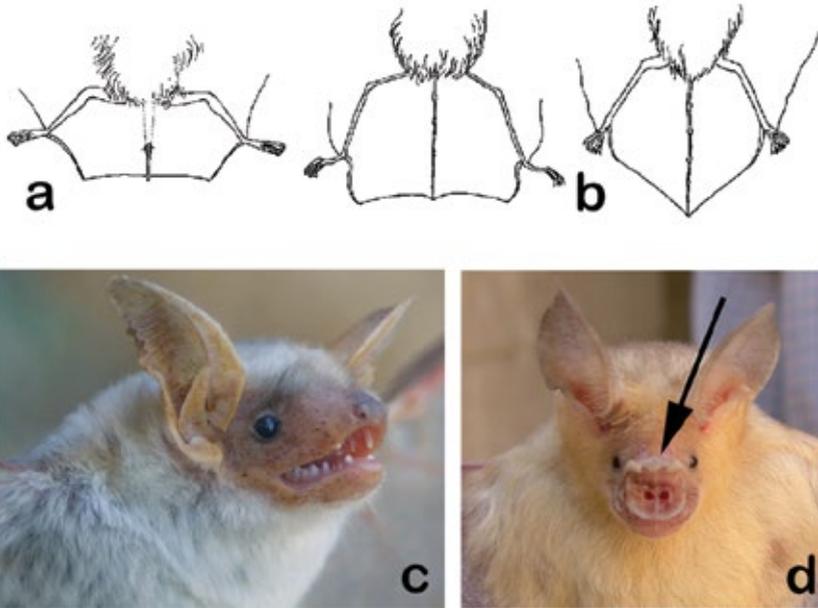


Figure 12: Tail and interfemoral membrane for the bat families of Kuwait. a. Family Emballonuridae. b. Family Hipposideridae, and Vespertilionidae. c. Nose leaf absent, Ears long, always extends beyond the top of the head, tragus long (Family Vespertilionidae). d. Posterior nose leaf tridentate (Family Hipposideridae), after Amr (2012).

4.3.1 Family Emballonuridae

4.3.1.1 Naked-rumped tomb bat *Taphozous nudiventris* Cretzschmar, 1830

Large bat. A distinctive tragus with a wide curved anterior and a rather wide base. Muzzle blackish brown, with very few hairs. Pelage colour dorsally light brown, lighter on the underside with a grayish tone (Figure 13). Feet covered with long hair which extend beyond the back of toes, the lower back and abdomen are entirely naked. Skull large and robust with a well-developed sagittal crest. *Taphozous nudiventris* roosts in deserted and old buildings as well as narrow crevices.

In Kuwait, it is a rare visitor presumably from Iraq (Clayton, 1983; Clayton and Wells, 1987). Large roost of ca. 500 or more found at a farm on outskirts of Kuwait City 16 September 2002 (Al-Sirhan, 2021). Flying individuals there at sunset early December 2007 after “many bats erupted from one of the farm buildings” (Pope, 2012). Photographed at the farm April 2008 and 2009 and



Figure 13: The naked-rumped tomb bat, *Taphozous nudiventris* (Photo by A. Al-Sirhan).

droppings found there November 2007 and December 2009, all suggesting it is a regular roost site and that the bats may well be resident (Al-Sirhan, 2021).

4.3.2 Family Hipposideridae

4.3.2.1 Trident leaf-nosed bat *Asellia tridens* (E. Geoffroy 1813)

Has a characteristic nose leaf with three projections. Large, tall ears. Thin tail, tip extending a very short distance beyond the interfemoral membrane. Fur colour variable, in general greyish-brown dorsally, with whitish hair on the shoulders, underside is much paler, nearly white, getting lighter towards the posterior. Orange-brownish variants are known to occur.

The Trident Leaf-nosed Bat is a desert adapted colonial species. Its colonies were found in caves and underground shelters and buildings (Kowaliski & Rzebik-Kowalska, 1991). Roosting sites in Iraq are abandoned during winter suggesting a migratory behavior (Harrison, 1957).

In Kuwait, it is considered uncommon or rare visitor presumably from Iraq (Clayton, 1983; Clayton & Wells, 1987; Cowan, 2013).

4.3.3 Family Vespertilionidae

4.3.3.1 Kuhl's pipistrelle *Pipistrellus kuhlii* (Kuhl 1819)

Small in size, forearms 30-37 mm in length. Well-developed antitragus, tragus tall and narrow. Wing membrane with a distinct white posterior margin (Figure 14). Fur colour pale buff dorsally, underside white (Harrison & Bates, 1991; Amr, 2012).

This is a wide-spread species inhabiting a variety of habitats ranging from Mediterranean to arid areas. It frequently uses houses, small cave, and crevices around human habitation (Harrison & Bates, 1991; Amr, 2012).



Figure 14: Kuhl's pipistrelle, *Pipistrellus kuhlii* (Photo by A. Al-Sirhan).

Kohl's bat is common in Kuwait and it is most commonly seen in Kuwait City. It is seen in public and home gardens near the coasts, far from the desert and on farms. It feeds on insects while flying at sunset. It is very useful for humans as it controls the numbers of insects and keeps their numbers in check. It has a wide distribution as it spreads from southern Europe and North Africa in the west to the Arabian Peninsula in the south and to the northern Caspian Sea and the Black Sea, extending to Pakistan, Afghanistan and Turkmenistan in the east (Harrison & Bates, 1991). Clayton and Wells (1987) and Cowan (2013) reported it as a fairly common urban resident Harrison & Bates (1991) mentioned three records of *Pipistrellus kuhlii* based on specimens at the British Museum of Natural History (BMNH).

4.4 Order Carnivora

4.4.1 Family Canidae

4.4.1.1 Red fox *Vulpes vulpes* (Linnaeus 1758)

This is the largest fox in Arabia. It has a pointed snout with prominent large bluntly pointed ears. The tip of each ear is brown, back of ear black or greyish black in colour (Figure 15). The anterior edge of the ear is covered by white



Figure 15: The Red fox, *Vulpes vulpes* (Photo by J. Al Ajmi).

hair that extends backwards. A black spot is usually located on each side of the muzzle. Tail tip usually white. Black mark on the foreleg. The Red Fox colouration varies from brown, light brown to red-yellow, with a very dark ventral side. Skull robust with a moderately elongated rostrum. Tympanic bullae less inflated. Posterior part of mandible high. Upper carnassial with a well-formed inner lobe, and a distinct cup is present. Lower canine tall and strongly curved.

It can inhabit all types of habitats and perhaps considered a pioneer species in newly established cultivated areas in the desert. The Red Fox is known to feed on small rodents, small birds and reptiles as well as figs, grapes and other fruits.

This is a common resident throughout the Arabian Peninsula found in all regions (Harrison & Bates, 1991). It is considered common to Kuwait (Clayton & Wells, 1987; Harrison & Bates, 1991; Al-Sirhan, 2021; Pope, 2012). Al-Khalifa et al. (2012) reported the red fox, *vulpes vulpes* from Al Wafra area. A specimen from 129 km SW of Kuwait is found at the BMNH. Fourteen specimens labeled *Vulpes* sp. from Ali Al Salem Air Force Base are found at the SMNH.

4.4.2 Family Mustelidae

4.4.2.1 Honey badger *Mellivora capensis* (Schreber 1776)

This is a large and robust mustelid. It has white hair across dorsal surface, ventral surface black, with a very well-defined line of demarcation (Figure 16). Ears very short, almost completely covered by the fur. Fore limbs equipped with very strong digging claws. Males are larger than females. Tail short, but longer than that of males. Two pairs of mammae (inguinal). Skull large, with a short and wide rostrum and a broad braincase. Lachrymal process not present. Zygomatic arches slender. Sagittal crest not very well developed. Palate short and broad. Tympanic bullae strongly inflated. Upper premolar powerful. Molar small.



Figure 16. The honey badger, *Mellivora capensis* (Photos by A. Al-Sirhan).

It is widely distributed in the Arabia Peninsula (Harrison & Bates, 1991). In Kuwait, specimens from the vicinity of Dimma and Mutla are in the British Museum (Harrison, 1968). It is currently considered as a rare resident in Kuwait (Clayton, 1983; Clayton & Wells, 1987; Harrison & Bates, 1991). Sightings and road-killed specimens occasionally found within and in the vicinity of Sabah Al-Ahmad natural reserve (Jal Az-Zor national park) (Al-Sirhan, 2021).

4.4.2.2 Indian grey mongoose *Herpestes edwardsi* (E. Geoffroy 1818)

This is a medium-sized mongoose, its tail is covered with coarse hair and has a terminal tuft. It has a tawny grey or iron grey fur. The hair around the muzzle and eyes is also brown but with a stronger rusty red colouring. The tail is bushy, the tip of the tail -if coloured- is pale yellow or white. Their tail length (45 cm on average) is about the head and body length (36-45 cm). It weighs 0.9-1.7 kg with males being significantly larger than the females.

The distribution this species in Arabia is restricted to the areas bordering the Persian Gulf, including a specimen obtained from Kuwait for the BMNH collection (Harrison & Bates, 1991).

Clayton and Wells (1987) stated: "As recently as forty years ago they [Indian grey mongooses] were reported as being very common in Kuwait City. However, they are unlikely to be found in the modern city and nowadays have been relegated to outlying districts such as Jahra or Fahaheel." They probably originated as stowaways on trading dhows or as escaped pets (Clayton & Wells, 1987).

4.4.3 Family Felidae

4.4.3.1 Wildcat *Felis silvestris* (Schreber 1777)

This is a small cat. Its fur colour is buff to olive brown with darker bands and spots, ventral side whitish (Figure 17). The ears are short, rusty brown on back. It has long distinct stripes on the face and a distinct stripe on the cheek is present. The tail is long, much larger than $\frac{1}{2}$ of head body length with several distinct black bars across and a black tip. The soles of the feet are naked. Hind limbs with several dark bands across. Skull small, with a short rostrum. Sagittal crest very weak. Tympanic bullae moderately inflated. Mandible with an upturning anterior extremity. Postorbital not swollen. The nasal branch of premaxilla is broad. Upper incisors are small. Upper canine well developed and slender, first upper premolar very small. Lower incisors and canine weaker than upper ones.

The wild cat was recorded from the northern region of Kuwait (Clayton, 1983; Clayton & Wells, 1987; Harrison & Bates, 1991) and perhaps still pres-

ent (Cowan, 2013). A specimen from Hawalli is found at the BMNH (Harrison & Bates 1991). The subspecies *Felis silvestris iraki* was described from northern Kuwait (Cheesman, 1921).



Figure 17: The wildcat, *Felis silvestris* (Photo by M. Abu Baker).

4.4.3.2 Sand cat *Felis margarita* (Loche 1858)

This is one of the smallest cats in Arabia, with a weight of 2 to 3.5 kilograms, and body length 45 to 55 cm. It is distinguished from the rest of the species with a large and wide head, large ears, and the ears are always in a horizontal position (Figure 18).

The sand cat still lives in the wilds of Kuwait, despite its exposure, like other mammals, to the pursuit of the abusers, who throw hunting rifles as if they were a valuable catch.

Kitten photographed at Wafra on the Kuwait border (Harrison and Bates, 1991). Several live individuals, apparently caught in Kuwait, were donated to the Desert Animal Facility (Kuwait Institute for Scientific Research, Kabd) and The Scientific Center (Kuwait city) from 2001 (Cowan, 2013). Four cats were seen in the Jal Az-Zor national park 26 June 2003 two of which were photographed (Al-Sirhan, 2021).



Figure 18: The sand cat, *Felis margarita* (Photos by A. Al-Sirhan).

4.5 Order Cetacea

Unlike cetacean populations in other parts of the world, many species remain poorly known, especially in the Arabian region (Baldwin et al., 2004; Bishop & Alsaffar, 2008). In Kuwait waters, the species described in reports documenting opportunistic sightings of the genus *Sousa* in Kuwait local waters was believed to be of the *chinensis* species (Bishop & Alsaffar 2008; Nithyanandan, 2010). Bishop & Alsaffar (2008) made sightings of the Indo-Pacific Humpback Dolphins (*Sousa chinensis*) in the immediate vicinity of Boubyan Island. This was believed to be an inaccurate identification by Bishop et al., (2008) however and (Nithyanandan, 2010) rectified their view on the species name after paramount evidence was presented in more recent research. New findings were issued in a report published in 2014 that stated that the species sighted in those regional waters was in fact believed to be *Sousa plumbea* (Jefferson & Rosenbaum, 2014), Figure 19. Other species found in the region received an even a lesser slice of attention than *Sousa*. Most claims below might lack the sufficient evidence to solidify them as facts, as most are based on public sightings and ongoing research still. But they represent the best the scientific community currently can lean on in hopes of studying the marine mammals in Kuwait. There have been sightings of both baleen and toothed whales in Kuwait waters in recent years. Dugong was reported before the 1950's from Kuwait and it is still present in the Arabian Gulf (Preen, 2004; Al-Abdulrazzak. & Pauly, 2017). The conservation status of marine mammals in the Arabian Gulf is summarized in Table (3).

Table 3: Threatened marine mammals reported from Kuwait and their IUCN conservation status.

Common name	Species	IUCN Global Status
Indo-Pacific humpback dolphin	<i>Sousa chinensis</i>	VU
Indian ocean humpback dolphin	<i>Sousa plumbea</i>	EN
Common dolphin	<i>Delphinus delphis</i>	LC
Indo-Pacific bottlenose dolphin	<i>Tursiops aduncus</i>	NT
Killer whale	<i>Orcinus orca</i>	DD
False killer whale	<i>Pseudorca crassidens</i>	NT
Indo-Pacific finless porpoise	<i>Neophocaena phocaenoides</i>	VU
Sei whale	<i>Balaenoptera borealis</i>	EN
Blue whale	<i>Balaenoptera musculus</i>	EN
Bryde's whale	<i>Balaenoptera edeni</i>	LC
Dugong	<i>Dugong dugon</i>	VU

4.5.1 Suborder: Odontoceti (toothed whales or odontocetes)

4.5.1.1 Family: Delphinidae

4.5.1.1.1 Indo-Pacific humpback dolphin *Sousa chinensis* (Osbeck 1765)

According to Cowan (2013), this species was previously reported from Kuwait (Henningesen & Constantine, 1992). It is observed year-round in the north off Boubyan island with a maximum pod size of 30 individuals, and routinely observed in Kuwait bay (Bishop and Alsaffar, 2008), it was also recorded off Fahaheel and in the south off Khiran (Cowan, 2013). Recent sightings between Mina Al-Zour and Khiran included calves (Nithyanandan, 2010; Pope, 2012; Cowan, 2013).

4.5.1.1.2 Indian Ocean Humpback Dolphin *Sousa plumbea* (G. Cuvier, 1829)

Known predominantly to be a coastal species, this species thus interacts, and is affected by anthropogenic activity more than other offshore species comparatively. Significant morphological aspects that distinguish them include Colouration (Baldwin et al., 2004) where their color is observed to be dark grey, to which the authors in the cited reference mention that is the reasoning for naming it the “Plumbeous dolphin”; it has the darkest tone of gray among its kin in the genus, see Figure 19. (Jefferson & Hung, 2004).

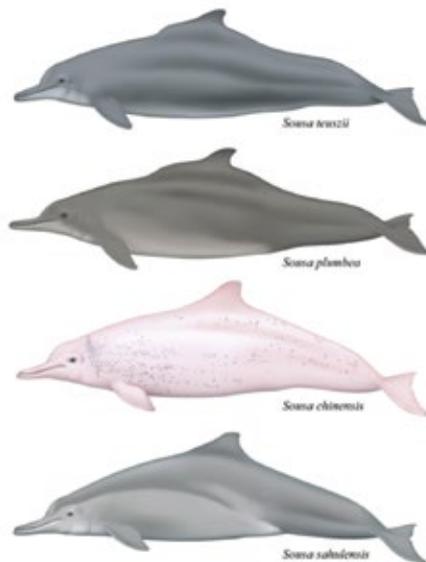


Figure 19: Illustrations of the different species found in the *Sousa* genus. This figure represents adult males. It shows the different morphological features that distinguish each species. (Photo by Jefferson and Rosenbaum, 2014).

Sousa plumbea is known to be more comfortable around humans, with instances of them snatching food falling off of fishing vessels. They can be seen in areas with human activity, as well as other secluded areas (Figure 20, 21).

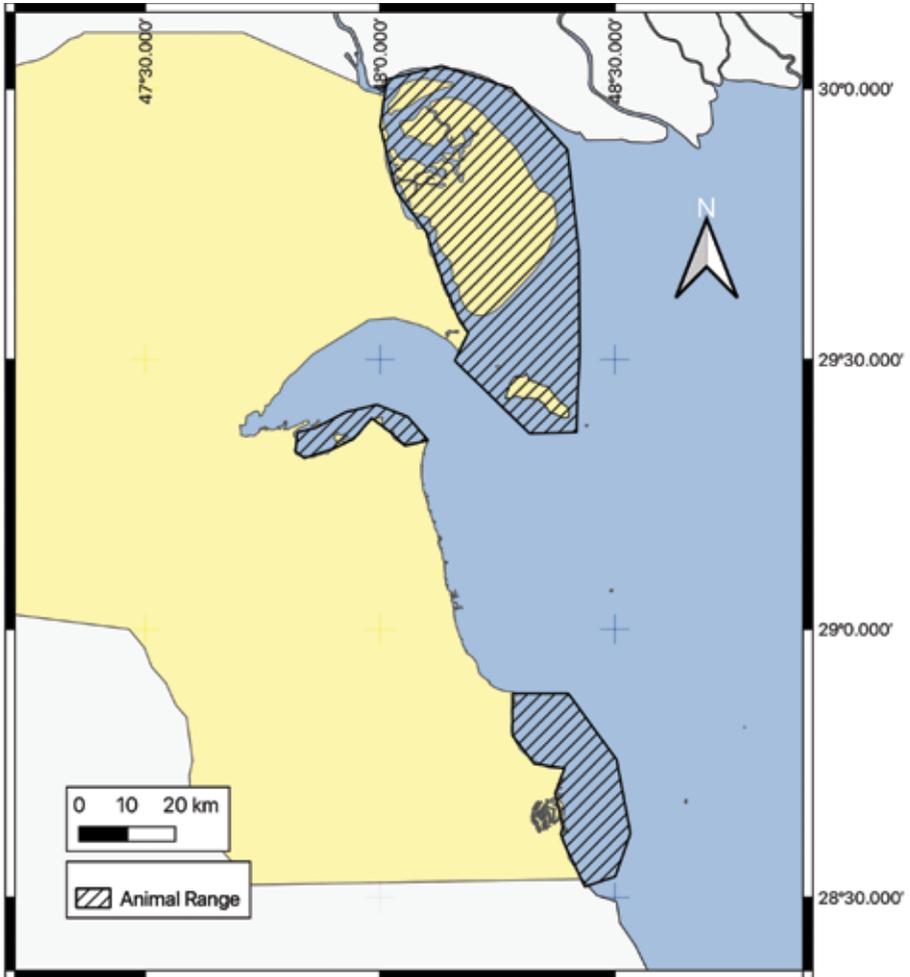


Figure 20: The distribution of *Sousa plumbea* (Source: Y. Buhadi).

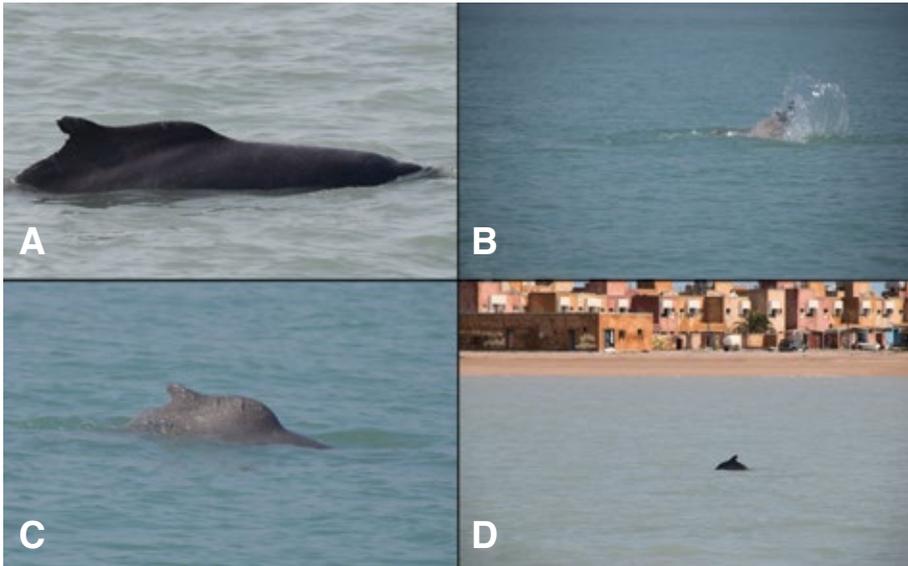


Figure 21: Photos of *Sousa plumbea* near Failaka Island. A: The animals of this genus are distinguished by the prominent hump before the dorsal fin. B: Animal exhibited swimming belly-side up and splashing fluke, the exact reason for such behavior is unclear, but it is believed to be performed within some social context. C: And animal with clear scar marks on its hump, these can be entanglement marks. D: Animals are known to approach the coast lines often, and in some instances even swim around human activity in an unalarmed manner (Photo by Y. Buhadi).

4.5.1.1.3 Common Dolphin *Delphinus delphis* Linnaeus, 1758

Known to be an open water dweller, these animals may also be seen in shallower/coastal waters. Although there aren't any official photos for the species here in Kuwait. Many of the public confirm their presence around Kuwait Bay and what makes this species easy to distinguish from other animals is the hourglass pattern on its side, as well as the creamy yellow colors seen on the pattern (Figure 22).

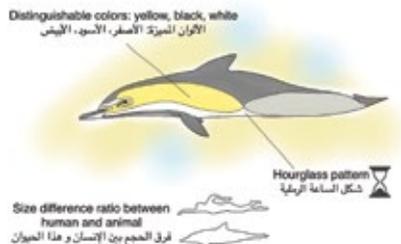


Figure 22: A representation sketch of *Delphinus delphis* showing the distinguishing characteristics (Source by Y. Buhadi).

Public sightings confirm its presence in Kuwait Bay, as well as near Failaka Island. Given the species' known existence in deeper waters, it is not uncommon to see it also in other areas (Figure 23).

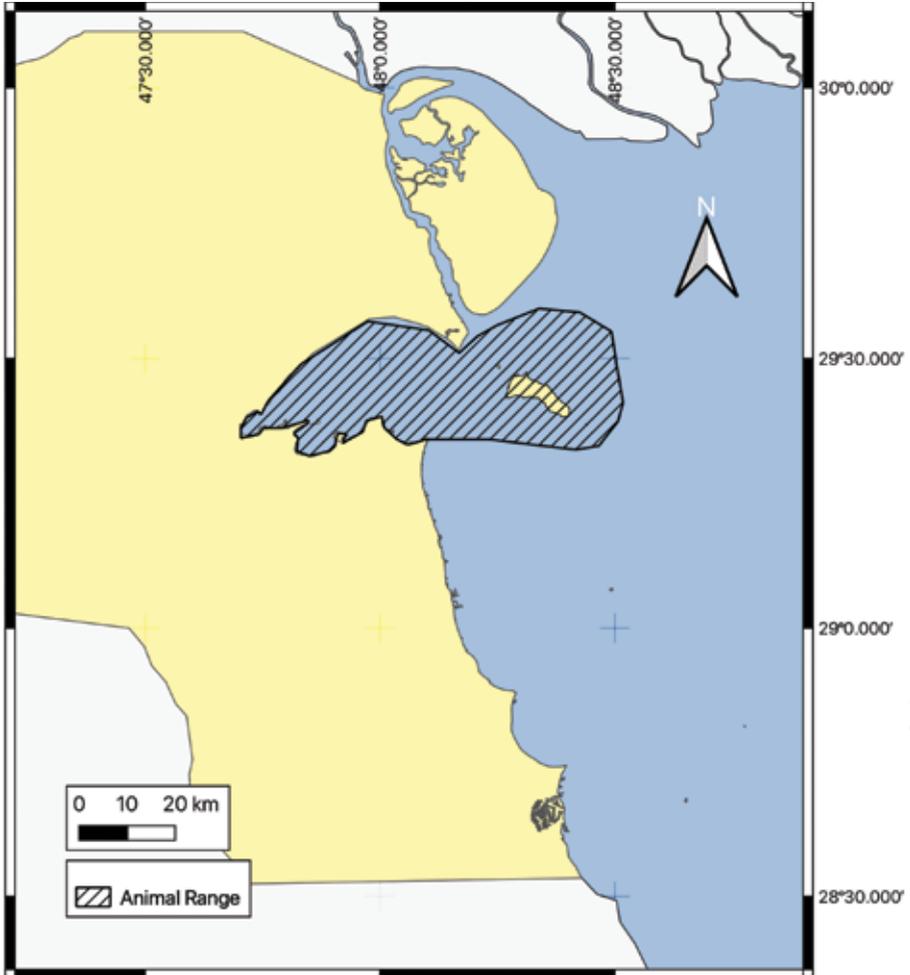


Figure 23: The distribution of *Delphinus delphis* (Source: Y. Buhadi).

4.5.1.1.4 Indo-Pacific bottlenose dolphin *Tursiops aduncus* (Ehrenberg 1833)

One of the main differences between this species and the Indian Humpback Dolphin (*Sousa plumbea*) is the erect dorsal fin (Figure 24). While this species is primarily found in open waters, it has been observed in shallower coastal



Figure 24: Photo of *Tursiops aduncus* in Al-Zour in the southern parts of Kuwait. The erect dorsal fin is a key feature that distinguishes it from the Indian Humpback Dolphin (Photo by Y. Buhadi).

waters also. They can be found in large groups (pods) as well as smaller pod sizes, so it is important to note these variances as not a discerning characteristic for the species.

This animal has been sighted in both coastal and more frequently open waters within the southern range (Figure 25), it should be noted that they can be seen in northern waters also. This may be the commonest dolphin in Kuwait (Farmer, 1983). It is found year-round with fewer sightings during the winter,

the majority seen in southern waters from Fahaheel southwards (Pope, 2012; Cowan, 2013).

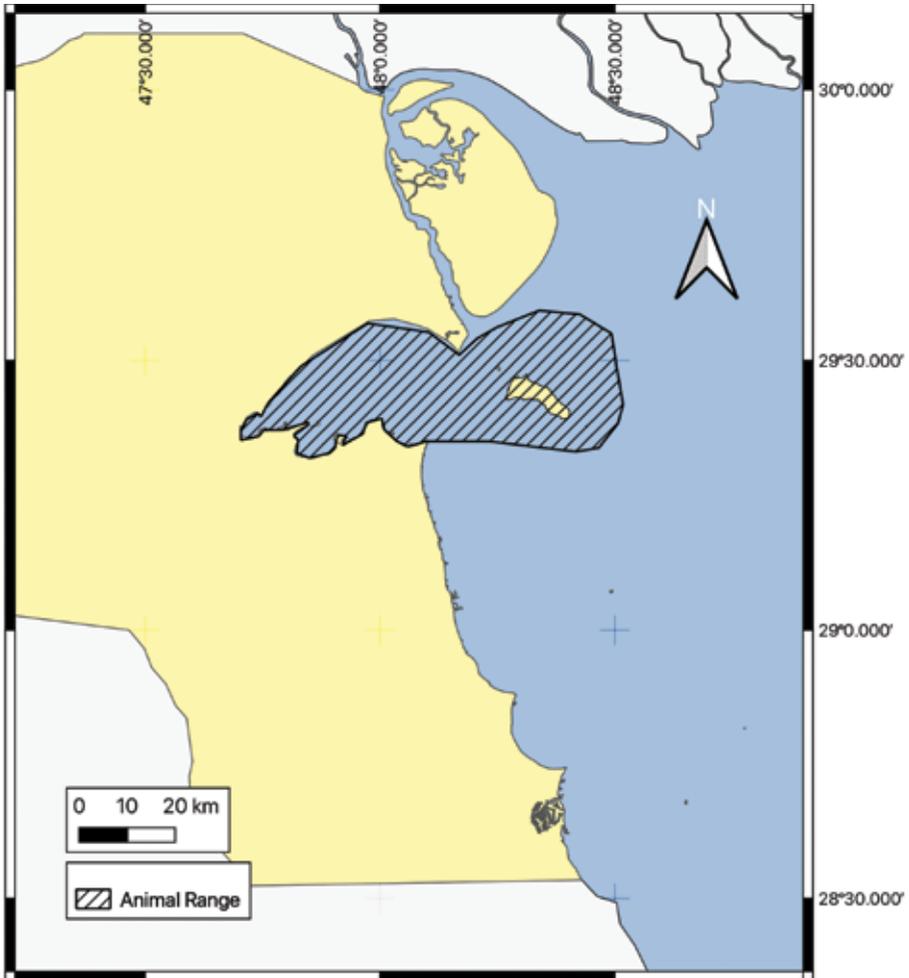


Figure 25: The distribution of *Tursiops aduncus* (Source: Y. Buhadi).

4.5.1.1.5 Killer Whale *Orcinus orca* (Linnaeus 1758)

Little is known about the presence of *Orcinus orca* in Kuwait waters. It is believed that the public sightings of these animals are of individuals that are known to frequent UAE waters. One particular sighted individual has been identified as being part of the local UAE population (Figure 26, 27).



Figure 26: Photo of *Orcinus orca* found in Kuwait waters. Individual was believed to be part of the UAE population (Photo is an excerpt from a video taken by Thamir Al-Enizi).

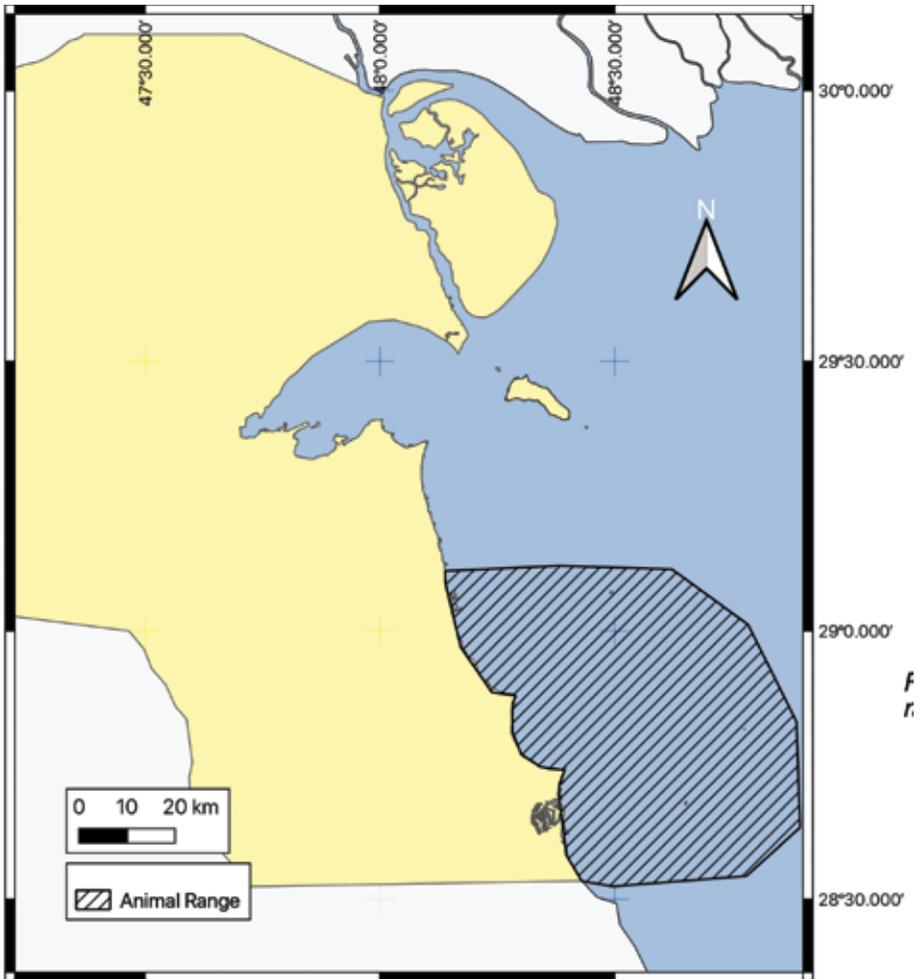


Figure 27: The distribution of *Orcinus orca* (Source: Y. Buhadi).

4.5.1.1.6 False killer whale *Pseudorca crassidens* (Owen 1846)

According to Cowan (2013), the presence of this species in Kuwait is based on one specimen found south of Kuwait city in 1964. Its skeleton was mounted and displayed in the Natural History Museum of Kuwait (Al-Robaae, 1971a).

4.5.1.2 Family Phocoenidae

4.5.1.2.1 Indo-Pacific finless porpoise *Neophocaena phocaenoides* (G. Cuvier 1829)

As one of the smaller marine mammals seen in Kuwait, *N. phocaenoides* is one of the harder animals to spot in the wild. The fact that it lacks a dorsal fin lends more to it being an elusive animal. In general, they are shy animals that do not approach boats, but calves of this species have been seen approaching and interacting with vessels.

Calves start out light grey, and as they grow older, they adopt a black overall coloration (Figure 28A). Unfortunately, adult animals are only seen in strand- ing incidents (Figure 28B,C), there are no conclusive deviance that explains

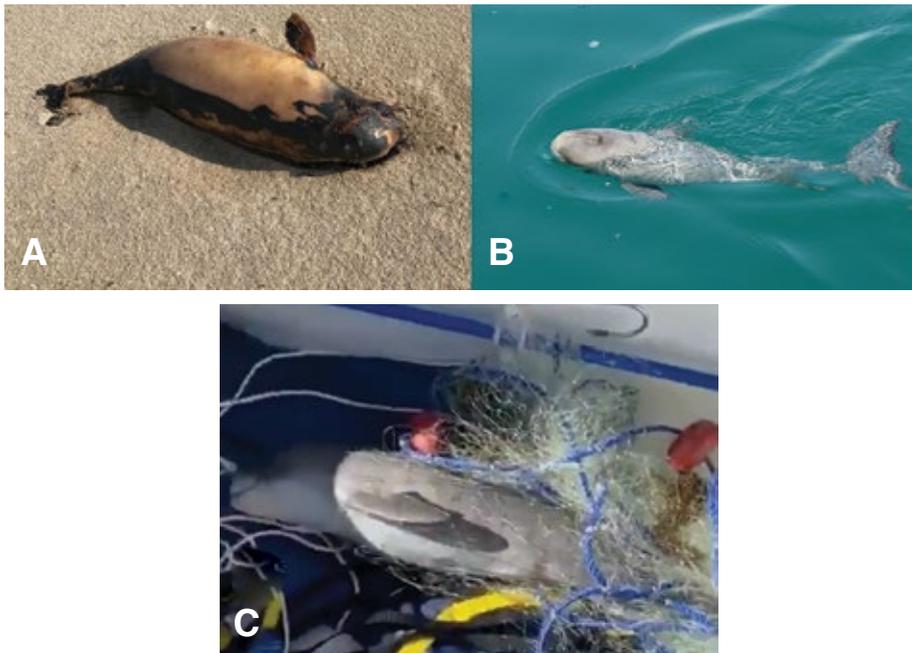


Figure 28: Photos of *Neophocaena phocaenoides*. A: A stranded adult on Failaka Island, after prolonged exposure to the sun the black skin starts to peel off as the degradation process takes place (Photo credit: Abu Omar). B: A calf seen swimming close to a vessel (Photo credit: Nithyanandan Manickam and Mike Pope). C: A juvenile found dead and entangled in fishing gear (Photos by Bashar Al Hunaidi).

the fluctuation in their mortality rates. However, there are instances in which juveniles get caught in fishing gear and die.

The Indo-Pacific finless porpoise is known to inhabit shallow waters and are thus seen around islands and the shores of Kuwait (Figure 29). This species was recorded based on a photo of a stranded individual (Farmer, 1983). Henningsen and Constantine (1992) reported a group of two and a group of five in Kuwait bay about 2 km from shore. Several sightings and stranding were previously reported (Cowan, 2013).

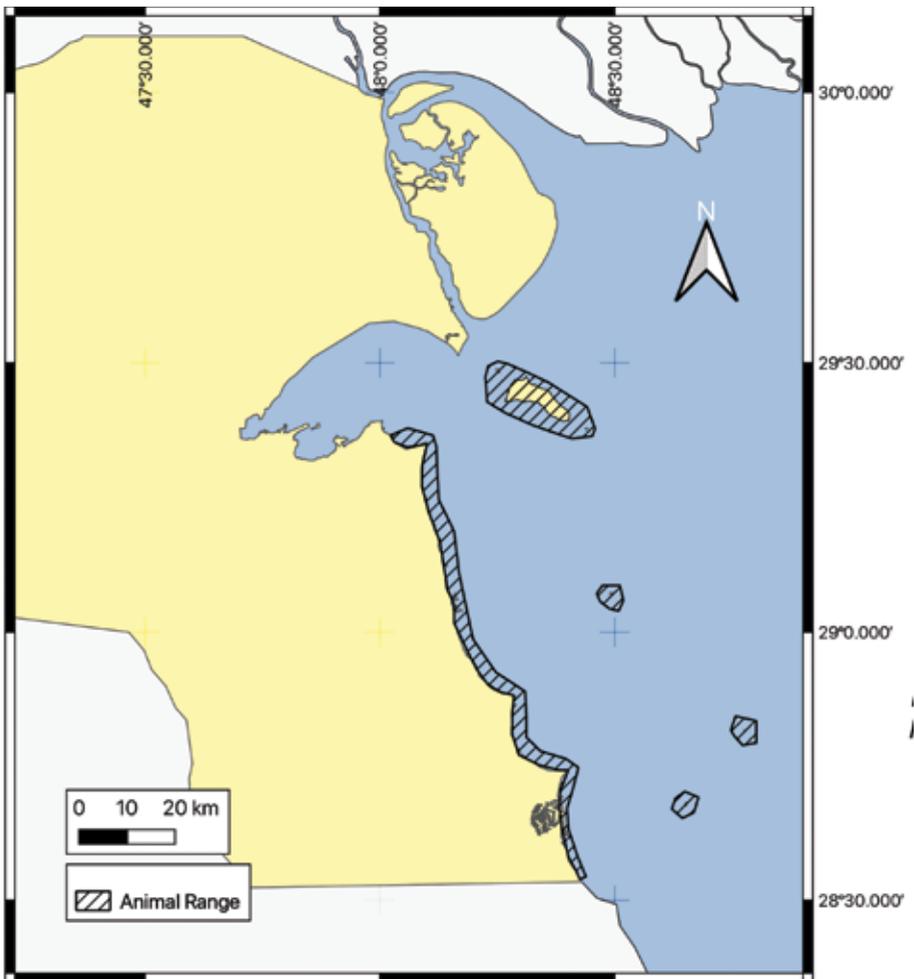


Figure 29: The distribution of *Neophocaena phocaenoides* (Source: Y. Buhadi).

4.5.2. Suborder: Mysticeti (baleen whales or mysticetes)

4.5.2.1 Family: Balaenopteridae

4.5.2.1.1 Bryde's whale *Balaenoptera edeni* Anderson, 1879

As one of the larger marine mammals seen in Kuwait waters, its appearance can be a cause of wonder and concern, especially if found stranded. In the past, this species used to be mixed with the Sei whale due to their similarities (Kato & Perrin, 2009), and for some time that was the case with the recent stranding incidents. But upon closer inspection, experts were able to distinguish most baleen whales stranded in recent years to be Bryde's whale. The triangular dorsal fins, the pronounced blow hole, and the number of ridges above the snout all help in distinguishing this animal from other members of the Mysticeti suborder (Figure 30).

For a whale, their presence in Kuwait waters was a mystery, especially since most were found dead. But upon inspecting the stranded carcasses, both the cause of their presence and death became apparent; Consultation with the necropsy team at the Public Authority of Agriculture Affairs and Fish Resources (PAAAF) revealed damaged skeletal parts (fractured ribs, split spine, etc...), which all point to death caused by ship strikes, most probably during nighttime when visibility is limited and the animal is resting. And upon examining the stomach contents of these carcasses it became clear that they target Kuwait waters for feeding.



Figure 30: Photos of *Balaenoptera edeni* in the southern parts of Kuwait. A: An animal seen traveling near Kubbar Island. B: Animal exhibited feeding behavior in an undisclosed location in the southern waters. Similar behavior has been recorded near Qaroh island (Photos are excerpts from videos taken by the public).

Currently, these animals have been observed throughout the first half of the year, with sightings in January, April, May, and July. The lack of sightings in the later half might suggest that they leave the area during that time. With only stranding incidents showing up in northern Kuwait waters, and based on the current live individuals' sightings, it is believed that these animals are present in the southern parts (Figure 31).

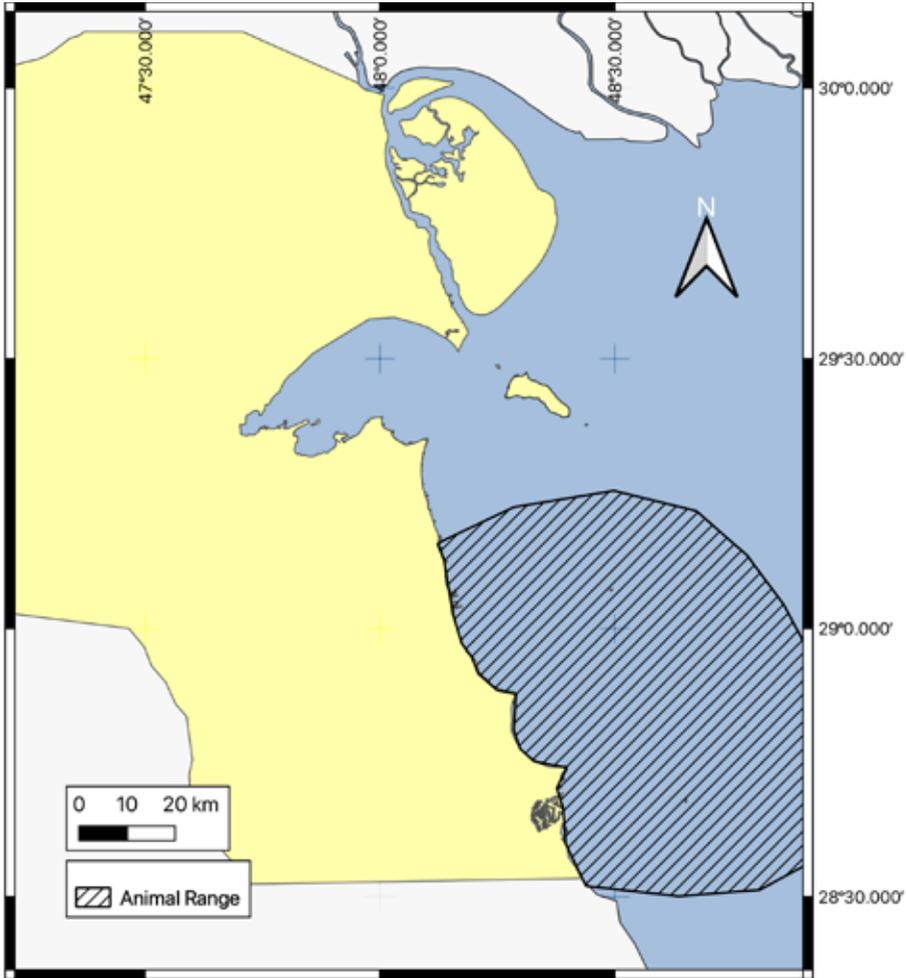


Figure 31: The distribution of *Balaenoptera edeni* (Source: Y. Buhadi).

4.5.2.1.2 Sei whale *Balaenoptera borealis* Lesson, 1828

Bishop and Alsaffar (2008) reported on a 10 m long whale carcass that washed ashore in March 1999 and was identified as *B. borealis* (Cowan,

2013).

4.5.2.1.3 Blue whale *Balaenoptera musculus* (Linnaeus 1758)

Cowan (2013), reported on three specimens previously identified as blue whales: a skeleton of a whale stranded at Kadhima in June 1963 was retrieved and placed in the Natural History Museum, later identified as that of *B. musculus* by Al-Robaee (1971b). The skeleton is currently in the Educational Science Museum (Cowan, 2013), a second skeleton at the museum labelled as blue whale (length 6.5 m) from the Khowaysat area between Kadmah and Doha 10 October 1976, while a third specimen, caught north of Shuaiba industrial area on 26 December 1980 and measuring 7 m in length, it is also on display at the museum (Nithyanandan, 2010; Cowan, 2013).

4.6 Order Artiodactyla

The antelopes and their conservation status in Kuwait were reviewed by Kingswood et al. (2001). Three species occurred in Kuwait: the Arabian oryx, Saudi gazelle, and the Arabian sand gazelle (Stewart, 1963; Harrison & Bates, 1991). There have been no recent sightings of any antelopes in Kuwait, and the three indigenous species are considered to be locally extinct (Kingswood et al., 2001). In 1972, there was a report of five gazelles that were seen grazing with a flock of sheep and goats in the area of Fahaheel and Fintas, south of the city of Kuwait (Kingswood et al., 2001). Faunal surveys were conducted throughout the country by the Ahmadi Natural History and Field Studies Group before 1990, however, none have been sighted in Kuwait for a number of years, and it is unlikely that populations of antelopes still survive in the present time (Cowan, 2013). The extermination of antelopes in Kuwait may have resulted from overhunting, overgrazing by domestic livestock, and agricultural expansion (East, 1992; Kingswood et al., 2001).

4.7 Order Lagomorpha

4.7.1 Cape hare *Lepus capensis* (Linnaeus 1758)

The cape hare is distinguished by its long ears long with black tips (Figure 32). Its body is covered with dense and soft fur, colour grey to grey-brown, underside white, neck and chest ventrally with a wide brown band. Its feet are covered with dense brushes of hair that nearly cover the claws. It has five digits on fore feet and four on hind feet. The tail is short with a tuft, colour dark dorsally and white ventrally. The hair around the eyes is white. Skull slender, with a small braincase. Zygomatic arches characteristically with nearly horizontal median parts. No sagittal crest. First upper incisor pro-odont with a deep groove anteriorly. Second upper incisor minute. Molars without roots.

The cape hare occurs virtually throughout the Arabian Peninsula, with several records from Kuwait (Harrison & Bates, 1991). Harrison & Bates (1991) identifies six subspecies in the regions, *L. c. arabicus* was designated for specimens from western Iraq, Saudi Arabia, Kuwait, and Yemen. Thus, any reintroduction plan would require geographically appropriate animals (Omar et al., 1986b; Harrison & Bates, 1991; Omar & Abdulraheem, 1996; Cowan, 2013). Two specimens from 97 km W of Kuwait and Dibdibbah are found at



Figure 32: The Arabian Hare, *Lepus capensis* (Photo by Shah Jahan).

the BMNH.

4.8 Order Rodentia

Rodents are by far the largest mammalian order, including over 1700 species world-wide. The most unique feature of this order is the reduction of the incisors to one on each side in the upper and lower jaws, and the absence of canines.

Most of the rodents in Kuwait are relatively small in size, with the exception of the Indian Crested Porcupine. The rodents of Kuwait are represented in three families (Dipodidae, Hystricidae, and Muridae) with six genera and nine species.

Vesey-Fitzgerald (1953) was the first to report on the rodents of Kuwait. Clayton (1991) recovered *Meriones libycus*, *Jaculus jaculus* and *Gerbillus cheesmani* from the Little Owl pellets in Kuwait. Other studies on the ectoparasites of rodents included distributional data (Al-Taqi et al., 1983) and endoparasites, whereas the nematode, *Abbreviata kuwaitensis*, was described from *Gerbillus cheesmani* and *Meriones crassus* (Damian & Behbahani, 1982). Al-Karmi & Behbahani (1980) found *Meriones crassus* in Kuwait infected with *Toxoplasma gondii*. Khalil & Abdul-Salam (1985) described new species of nematodes (*Seuratium kuwaitensis* and *Spirura auriti*) from the Long-eared Hedgehog, *Hemiechinus auritus*, from Kuwait. Zaghoul et al. (1986) studied the biology and parasites of the Indian Gerbil, *Tatera indica*. Salit et al. (1986) studied the morphology and ecology of *Tatera indica*. Badr & Asker (1980) studies the chromosomes of *Gerbillus cheesmani* from Kuwait. In a study on the epidemiology of cutaneous leishmaniasis in Kuwait (Hussein, 1983), specimens of *Meriones crassus*, *Gerbillus cheesmani*, *Rattus norvegicus*, *Mus musculus* and *Hemiechinus auratus* were collected.

Key to the rodents of Kuwait

1. Body covered with long spines (more than 150 mm). Large forms
..... Family Hystricidae (*Hystrix indica*)
Body not covered with long spines, small to medium sized forms2
2. Hind foot long, about 60 mm in length3 Family Dipodidae
Hind foot not long, about 40 mm in length4 Family Muridae
3. Hind foot with 5 digits (Figure 33) *Allactaga euphratica*
Hind foot with 3 digits (Figure 33) *Jaculus jaculus*

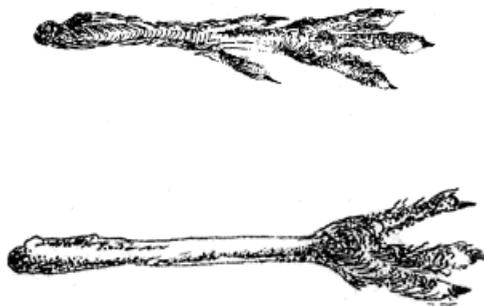


Figure 33: Hind foot for *Allactaga euphratica* (top) and *Jaculus jaculus* (bottom) (Drawing by Adwan Shehab).

- 4. Tail hairy and terminates with a tuft of various shape and size (Figure 34) 5 subfamily Gerbillinae
- Tail with few hairs, and have annuli, tail without a tuft (Figure 34) subfamily Murinae



Figure 34: Shape of tails: tail with annuli and not covered by hair (top), tail covered by hair (bottom) (Photo by M. Abu Baker).

- 5. Small form, with skull length not exceeding 30 mm 6
- Large form, with skull length exceeding 30 mm 8
- 6. Soles of fore and hind feet predominantly hairy (Figure 35), colouration of the back is bright orange sandy buff, well developed tympanic bulla *G. cheesmani*
- Soles of fore and hind feet predominantly naked (Figure 35)7

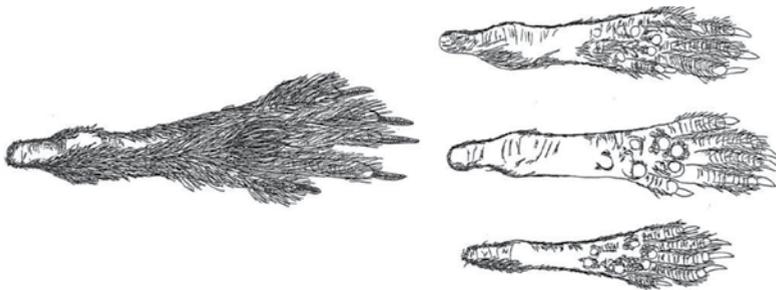


Figure 35: Hairy (left) and naked (right) soles of hind feet in the genus *Gerbillus*. (Photo by M. Abu Baker).

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7. Hair bases on the tail rump gray, smaller tympanic bulla, posterior margin of mastoid chamber never extends to the level of supraoccipital bone *G. dasyurus*
 *G. dasyurus*
 Hair bases on the tail rump white, well developed tympanic bulla, posterior margin of mastoid chamber exceeds the level of the supraoccipital bone *G. nanus*
8. Size large, rat-like gerbil, greatest length of skull exceeds 43 mm, tail bicolour, black above and below with pale sides, soles of hind feet naked *Tarera indica*
 *Tarera indica*
 Size large, robust jird, greatest length of skull 30-45 mm, tail colour uniform, soles of hind feet at least partly hairy 9
9. Claws black *Meriones libycus*
 Claws not black *Meriones crassus*
-

4.8.1 Family Hystricidae

4.8.1.1 Indian crested porcupine *Hystrix indica* Kerr, 1792

This is the largest rodent in Kuwait, weighing 11-18 kg. The body length is between 70 and 90 cm, tail length 8-10 cm. The dorsal side is covered with layers of modified hair called quills (Figure 36), with longer, thinner quills covering a layer of shorter, thicker ones. The quills are brown or black with alternating white and black bands. Quills can grow up to 50 cm long, smaller (20 cm) and more rigid quills are packed densely on the back and rump. These smaller quills are used for stabbing when the animal is threatened. The tail is short, its base contains shorter quills that appear white in colour, with longer, hollow quills that the porcupine can rattle to produce a warning sound when threatened. It has broad feet with long claws used for burrowing. Eyes and ears small, ears round and covered by hair. Long and well-developed vibrissae. Skull large and robust with small tympanic bullae. Infraorbital foramen very massive. Frontal region of skull very broad. Cheekteeth are strongly hypsodont and complexly folded with flat crowns.

Quills belonging to the porcupine were collected in the Kuwait/Saudi Arabia border area in Wadi al Batin, February 1995 by S.T. Spencer and C.W.T. Pilcher (Cowan, 2013). Dickson (1949) stated that it was common in the Summan region east of Saudi Arabia.



Figure 36: The Indian Crested Porcupine, *Hystrix indica* (Photo by Ehab Eid).

4.8.2 Family Dipodidae

4.8.2.1 Euphrates jerboa *Allactaga euphratica* Thomas, 1881

This jerboa is distinguished by its long hind foot with 5 digits (Figure 37). Its ears are distinctively long and narrow, more than one half of hindfoot length. Dorsal brown, ventral white. Five digits on hindfeet, soles are naked. Hindfoot with three functional and two vestigial digits. Four pairs of mammae. Tail com-



Figure 37: Euphrates jerboa, *Allactaga euphratica* (Photo by A. Al-Sirhan).

posed of three distinct bands; white anteriorly, brown medially and terminates with a white tip. Zygomatic arches widely flared posteriorly. Tympanic bullae small. Four upper cheekteeth, with a small first upper premolar. Angular process not perforated.

This species is present in Kuwait, but considered rare (Clayton, 1983; Harrison & Bates, 1991; Cowan, 2013). It was recorded from Al-Jalia desert area southeast Kuwait (Eissa et al., 1975), from Dibdibba on the Kuwait/Saudi border (Harrison & Bates, 1991) and was photographed in 2008 in western Kuwait (Al-Sirhan, 2021). One specimen from Dibdibbah, 129 km SW of Kuwait is found at the BMNH.

4.8.2.2 Lesser jerboa *Jaculus jaculus* (Linnaeus 1758)

This jerboa is distinguished by its long hind feet with three toes (Figure 38). The back feet also have large hair tufts. Central digit of the three toes is longest. Tail long terminating with white brush. Fur long, colour dorsally reddish-brown, ventral colour white. Four pairs of mammae. Skull with very large, inflated bullae. 3 upper cheekteeth. Small first premolar missing. Angular process with perforation that has a sharp projection beneath it.

This species is considered common throughout Arabia, including Kuwait (Clayton, 1983; Harrison & Bates, 1991; Al-Sirhan, 2021; Pope, 2012; Cowan 2013). The ecology of the Lesser Jerboa, *Jaculus jaculus*, was studied in Al-Jalila desert area (Eissa et al., 1975) and Kabd Research Station, 35 km southwest of Kuwait City (Al-Mutairi et al., 2012). Clayton (1991) recovered



Figure 38: The lesser jerboa, *Jaculus jaculus* (Photo by A. Al-Sirhan).

remains (including skulls, hind limbs, and tails) of *Jaculus jaculus* in 18 of 97 from the Little Owl pellets at the Jal Az-Zor escarpment in Kuwait. Two specimens are found at the HZM, one from Ahmadi and one from Khor al Mufatta. Five specimens are found at the BMNH, 1 from W of Shaibah and 4 labeled Kuwait. Four specimens of *Jaculus jaculus*, one from Al Kuwait, outside E Gate, one from Hamatizal, 50 Mi W of Al Kuwait, two from Araq Well, 60 Mi S of Al Kuwait are found at the SMNH.

4.8.3 Family Muridae

4.8.3.1 Subfamily Gerbillinae

4.8.3.1.1 Baluchistan gerbil *Gerbillus nanus* Blanford, 1875

This is a medium-sized gerbil of graceful built. Has white patches above eye and behind ear. Dorsal colour buff brown, under parts are white, with a distinct line of demarcation (Figure 39). Soles of hind feet naked. Hair bases on the rump just above the tail base are white. Skull small and delicate, with strongly inflated tympanic bullae. Braincase very broad, with short rostrum.

This gerbil is present in Kuwait, more common than *G. dasyurus* (Clayton, 1983; Clayton & Wells, 1987; Harrison & Bates, 1991). Specimens from Kuwait are in the BMNH and HZM collections (Harrison & Bates, 1991). One specimen is found at the BMNH from Abraj al Khalifa. One specimen of *Gerbillus nanus* from Kuwait, 16 Km S, Well Area is found at the SMNH.



Figure 39: Baluchistan gerbil, *Gerbillus nanus* (Photo by M. Abu Baker).

4.8.3.1.2 Wagner's gerbil *Gerbillus dasyurus* (Wagner 1842)

This is a medium-sized gerbil, dorsum brown grey, underside white, with a distinct line of demarcation. Distinct white patches behind ears and above eye present (Figure 40). Soles of hind feet devoid of hair. Bases of hair, above tail, greyish. Tail long, covered with hair and terminating with a pencil. Skull of this species is very similar in size to that of *G. nanus*, however, clearly distinguished by its smaller tympanic bulla. Zygomatic arches slender and delicate. Posterior occipital bone slightly constricted. Inferior posterior mastoid chamber extends down to the paraoccipital process.

This species has been recorded from Kuwait (Clayton, 1983; Clayton & Wells, 1987).



Figure 40: Wagner's gerbil, *Gerbillus dasyurus* (Photo by M. Abu Baker).

4.8.3.1.3 Cheesman's gerbil *Gerbillus cheesmani* Thomas, 1919

This is a beautiful pinky-sandy backed gerbil with white underparts (Figure 41). Fur colour sandy buff dorsally, without black speckling on rump, ventral site white with a distinct line of demarcation. White patches above eye and behind ear present. Soles of hindfoot hairy. Tail very long, more than head body length. Terminal pencil scanty. Skull with large tympanic bullae extending beyond the supraoccipital. It is strictly nocturnal and granivorous (feeds on grains and seeds). It prefers sandy environments and lives alone and digs its burrow to a depth of 125 cm.

This gerbil was recorded from the desert sand dune regions of Kuwait (Vesey-Fitzgerald, 1953; Khalil et al., 1979; Clayton, 1983; Bard & Asker, 1984; Harrison & Bates, 1991; Al-Sirhan, 2021). Remains of this species (along with *Meriones libycus*, *Jaculus jaculus*) were also found in 13 of 97 little owl pellets

collected at the Jal Az-Zor escarpment (Clayton, 1991). Five specimens are found at the BMNH, 3 from Kuwait, 1 from Adeliyeh, 1 from Burgan. Seven specimens of *Gerbillus cheesmani*, 1 from Burgan, 48 Km S of Kuwait, 5 from Kuwait, 10 Mi S, and one from Kuwait are found at the SMNH.



Figure 41: Cheesman's gerbil, *Gerbillus cheesmani* (Photo by A. Al-Sirhan).

4.8.3.1.4 Indian gerbil *Tatera indica* (Hardwicke 1807)

The Indian Gerbil is a large-sized rodent, of similar external appearance as *Meriones* but more robust. The head and body length is 17-20 cm and the tail length is 20-21 cm. The tail is conspicuously bi-coloured, covered with black hair on the dorsal and ventral sides while pale white on the lateral sides, with a black terminal tuft. The tail is slightly longer than the length of the head and body. The pelage is soft and dense, is light brown or light brown with rusty wash on the dorsal surface including entire head and flanks with greyish-black hair bases (Figure 42). The underparts are pure white with a distinct demarcation line. The ears are relatively large and rounded. The eyes are conspicuous, surrounded by white hair above the orbit. The hind foot is narrow, with five digits armed with heavy claws, the lateral toes are short. The soles are completely naked, with five pads. Females have four pairs of mammae. The skull is robust with a flattened brain case. The zygomatic arches are heavily built. The rostrum is narrow and elongated. The tympanic bullae are small-

er than in *Meriones* sp. and the mastoid portions do not reach the occipital bones. The upper incisor is powerful with a single longitudinal groove on its orange-yellow anterior surface (Shehab et al., 2011).

This large rodent was previously recorded (one female specimen, head and body length 20.5 cm., tail 22 cm.) living in warrens with large entrance holes in the immediate vicinity of some wells in a shallow depression just to the south of Kuwait City (Vesey-Fitzgerald, 1953; Harrison & Bates, 1991; Alyan, 1989). Probably eradicated by the Kuwait Ministry of Health (Al-Sirhan, 2021).

Seven specimens from Kuwait are found at the BMNH. Seven specimens of *Tatera indica*, two from Al Kuwait, outside Gate, and five from Abraj Khaitan, 13 Km S of Al Kuwait are found at the SMNH.



Figure 42: The Indian gerbil, *Tatera indica* (Photo by Klaus Rudloff).

4.8.3.1.5 Libyan jird *Meriones libycus* Lichtenstein, 1823

The Libyan jird is the second largest desert gerbil in Kuwait (after the Indian gerbil), its total body length is 29 cm and tail length 14 cm. Fur colour brown yellowish dorsally with some black speckling, ventral colour white. Ears are not pigmented. Claws black. Hindfeet with partially hairy soles. Tail colour light

reddish with well-pronounced black tip (Figure 43). Skull robust. Tympanic bullae large, extending beyond supraoccipital, accessory tympanum present. Form of the suprimeatal triangle of bullae distinguishes this species from *M. crassus*, in being smaller and nearly closed at its posterior end. Upper incisors with anterior median groove.

This jird is widespread in the deserts and steppes on the northern and eastern Arabia, it is considered common in some desert areas of Kuwait (Clayton, 1983; Clayton & Wells, 1987; Pope, 2012; Cowan, 2013; Al-Sirhan, 2021). Remains of this species (along with *Jaculus jaculus* and *Gerbillus cheesmani*) were found in 44 of 97 little owl pellets collected at the Jal Az-Zor escarpment (Clayton, 1991). Two specimens of *Meriones libycus* from Umm-Al-Ramam and Qortubais are found at the FMNH. Sixteen specimens labeled *Meriones sp.* from Ali Al Salem Air Force Base are found at the SMNH.



Figure 43: The Libyan jird, *Meriones libycus* (Photo by R. Al-Hajji).

4.8.3.1.6 Sundevall's jird *Meriones crassus* Sundevall, 1842

This is a large-sized desert rodent. Its fur colour is pale sandy dorsally, underside pure white, line of demarcation not very distinct (Figure 44). Ears small and not pigmented, claws white or pale. Hind feet covered with white hair. Tail terminates with a black brush (not as well developed as in *M. libycus*). Tail length is about equal to head body length. Skull robust, with extremely large bullae that extend quite beyond the supraoccipital. Braincase broad. The suprimeatal triangle of bullae large and widely open at its posterior end. Upper

incisors with anterior median groove.

This jird was previously recorded from the deserts of Kuwait (Vesey-Fitzgerald, 1953; Khalil et al., 1979; Clayton, 1983; Harrison & Bates, 1991), most recently in 2003 by Al-Sirhan (2021). Six specimens are found at the HZM, one from Ahmadi and five from Khor al Mufatta. 19 specimens are found at the BMNH, 6 labeled Kuwait, 8 from Nigarat As said, 1 Ahmadi, 1 Arraq Wells, 1 Tawil, 1 39 km S of Kuwait, 1 Adeliyah. Three specimens of *Meriones crassus* from Umm-Al-Ramam are found at the FMNH. Eight specimens of *Meriones crassus*, two from Khaitau, 12.8 Km S of Kuwait Town, one from Kuwait, 12.8 Km SE, Nigara, one from Kuwait, 1.6 Km S, one from Kuwait, 16 Km S, one from Kuwait, 48 Km S, and two from Kuwait, 12.8 Km S are found at the SMNH. Sixteen specimens labeled *Meriones sp.* from Ali Al Salem Air Force Base are found at the SMNH.



Figure 44: Sundevall's jird, *Meriones crassus* (Photo by A. Al-Sirhan).



(Photo by Yathin S. Krishnappa)

5 Introduced mammals to Kuwait



5. Introduced mammals to Kuwait

5.1 Black rat *Rattus rattus* (Linnaeus 1758)

This is a large rat with a head and body length up to 200 mm. It has large rounded ears. The fur colour is very variable, ranging from blackish dorsally to greyish to brownish, with the underside being lighter. The tail is longer than the head and body length. There is little and short hair on the tail. The skull is elongated in shape, with laterally curved tempoparietal ridges. It has large and well inflated tympanic bullae. The outer tubercles of upper molars are well developed. The first upper molar has an anterolateral cusp.

The black rat is found in Kuwait, but seems to be declining (Clayton, 1983; Cowan, 2013).

5.2 Brown rat *Rattus norvegicus* (Berkenhout 1769)

The brown rat is a larger, more robust rat, with a head body length about 380 mm, and tail about 175 mm. The fur colour is solid greyish brown above and below (Figure 45). It is similar to *R. rattus*, but the tail is shorter than head and body length. The tail also has distinctive epidermal scales. Females have six pairs of mammae. The skull is large and very elongated, with parallel tempo-parietal ridges. The tympanic bullae are small and only little inflated. First upper molar without an anterolateral cusp.

This species is considered locally common in Kuwait (Bezjak & Thornburn, 1983; Clayton, 1983; Clayton & Wells, 1987; Harrison & Bates, 1991; Cowan, 2013).



Figure 45: The brown rat, *Rattus norvegicus* (Photo by A. Al-Sirhan).

5.3 House mouse *Mus musculus* Linnaeus, 1758

The house mouse is small, with head and body length up to 90 mm. its ears are large and rounded at the edges. The fur colour is brown to greyish dorsally, usually lighter to white ventrally (Figure 46). Its feet are white. The tail is long and covered with hairs, but annulated. It has five pairs of mammae. The skull is very small, with a flattened braincase. The upper incisor has a distinctive notch. The crown area of the first upper molar is large in comparison to the second and third upper molars.



Figure 46: The house mouse, *Mus musculus* (Photo after Amr, 2012).

The house mouse is considered locally common in Kuwait (Clayton, 1983; Harrison & Bates, 1991). two specimens of *Mus musculus praetextus* from Auhha are found at the FMNH. Three specimens of *Mus musculus domesticus*, one from Khaitan, 12.8 Km S Al Kuwait, one from Al Kuwait, 12.8 Km S, and one from Zigarat Al Sayia, 19 Km S of Al Kuwait are found at the SMNH.

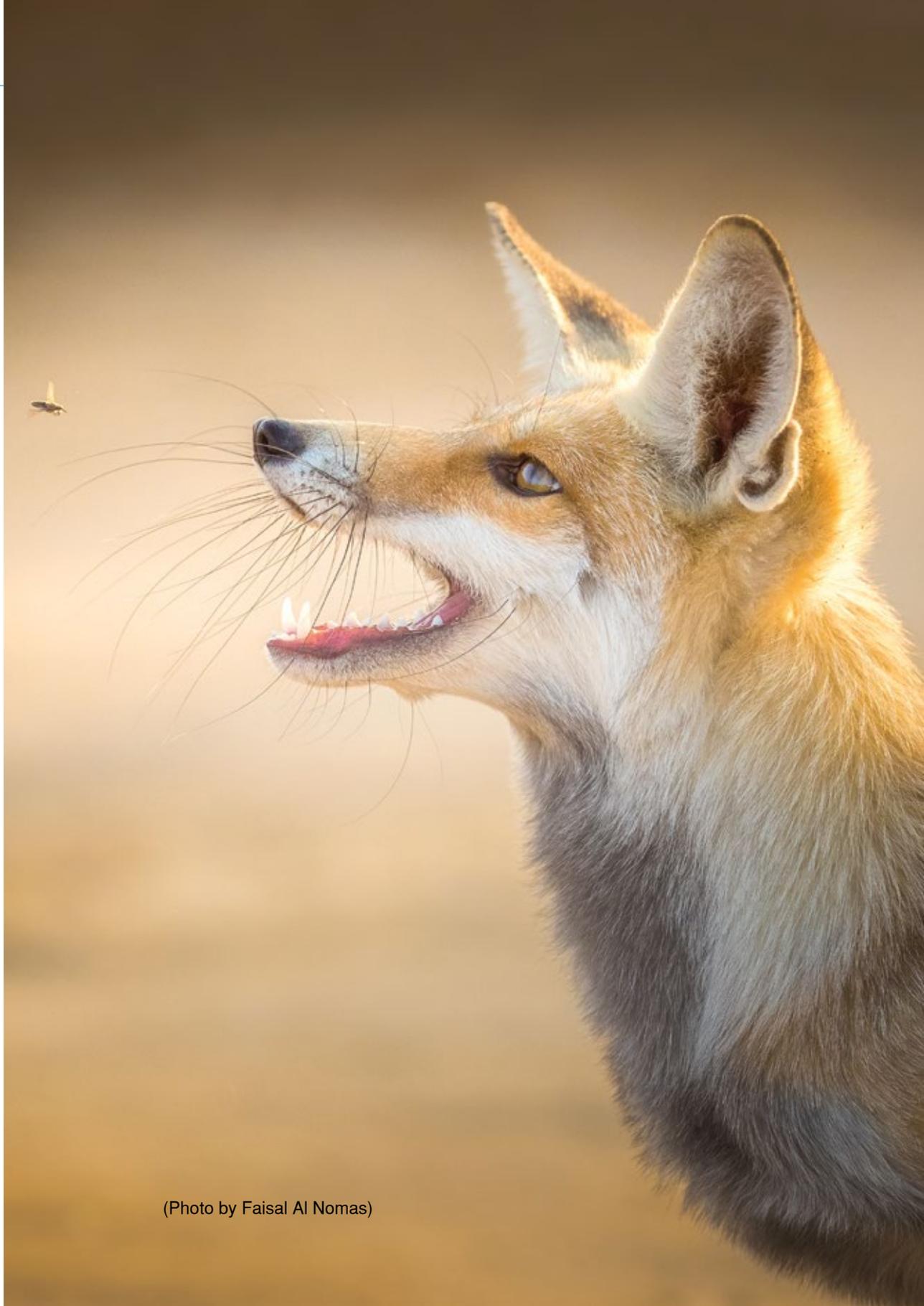
5.4 Indian palm squirrel/three-striped palm squirrel *Funambulus palmarum* (Linnaeus 1766)

This is a member of the family Sciuridae found naturally in India and Sri Lanka where it inhabits Tropical and subtropical dry deciduous forest, mangrove forest, grasslands, scrublands, plantations, rural gardens, urban areas. In Sri Lanka, found throughout the island except in deep jungles. In the late 19th century, the palm squirrel was introduced to eastern African islands and Australia, where it has since become a minor pest (Long, 2003).

This squirrel is about 15-20 cm long, its body is just a bit longer than its bushy tail. It has three gray-brown diagnostic stripes on its back (Figure 47). The stripes run from the head to the base of the tail, but the outer stripes begin at the squirrel's front legs and stop at their hind legs. The belly is cream-coloured, and the tail has long, black and white fur. The overall texture of the fur is soft and silky. It has small, triangular ears and large dark eyes on the sides of its head. The Indian palm squirrel weighs on average about 100 to 120 grams.



Figure 47: Indian palm squirrel, squirrel *Funambulus palmarum*. (Photo by Yathin S Krishnappa).



(Photo by Faisal Al Nomas)



6 Extinct mammals of Kuwait



(Photo by M. Abu Baker)

6. Extinct mammals of Kuwait

Currently, eight mammalian species have been eradicated locally but still exist elsewhere in the Arabian Peninsula (Alsdirawi, 1989). These include: the wolf (*Canis lupus*), wildcat (*Felis silvestris iraki*), caracal lynx (*Caracal caracal*), cheetah (*Acinoyx jubatus*), Arabian oryx (*Oryx leucoryx*), Saudi gazelle (*Gazella dorcas saudiya*), sand gazelle (*Gazella subgutturosa marica*), and cape hare (*Lepus capensis arabicus*). It is also believed that all wildlife in Kuwait are in imminent danger as long as the rate at which their habitats are being altered, fragmented, and destroyed is high (Alsdirawi, 1989). A priority system for reintroduction efforts for these species or other wildlife species in the area has been developed (Alsdirawi, 2003). This system aimed to help decision makers in their efforts to conserve Kuwait's wildlife biodiversity, its application requires the accumulation of basic information the target species, of which, the most important is the historic range and major extinction factors for each of the local species.

6.1 Arabian oryx *Oryx leucoryx* (Pallas 1777)

This species is distinguished by its very long, thin horns. Its ground colouration is white with dark facial and leg markings. Newborns are gray, quickly changing to brown then white. The Arabian oryx inhabited gravel plains, sand dunes, and wadis. Gravel plains were probably preferred for their food and shade, and sand dunes were preferred as refuge. Succulent grasses and shoots of *Tamarix* sp. and other shrubs are preferred foods; bulbs and tubers provide moisture. Oryx are known to wander great distances in search of pasture (Harrison & Bates, 1991; Kingswood et al., 2001).

Oryx leucoryx presumably occurred in the western and northwestern deserts of Kuwait prior to 1900 (Kingswood et al., 2001). Its reintroduction into Kuwait has been recommended in Al-Batin, however, because if its large home range and daily movement, a protected area of considerable size that spans over adjacent countries would be needed in addition to conservation measures to manage its population and mitigate the threats (Omar et al., 1986b; Omar & Abdulraheem, 1996; Kingswood et al., 2001; Alsdirawi & Faraj, 2004).

6.2 Dorcas gazelle *Gazella dorcas* (Linnaeus 1758)

This is a small gazelle, shorter than the other gazelles. Males are larger than females. The horns of males are long and straight, but both sexes have well-developed horns and annuli. Its fur colour is brownish red dorsally with facial markings, and white ventrally, flankstripes faint. Facial markings consist of

dark stripes extending from the posterior mouth opening to the eye and a dark broad stripe extending from nasals to bases of horns, else facial colour whitish. Its ears are very long and reach nostrils when laid forward. The posterior margin of nasals triangular in shape. The tail has a dark streak. The premaxillae is long and in touch with nasals, the nasal bones are narrow and widest anteriorly. Fenestrae of infraorbital fossa not present. Parietal ridges present.

The dorcas gazelle is known to have occurred in Kuwait based on specimens at the British Museum (Harrison & Bates, 1991).

6.3 Saudi gazelle *Gazella saudiya* (Carruthers & Schwarz 1935)

The Saudi gazelle was considered as a subspecies of the dorcas gazelle, however, recent genetic studies supported its position as a separate species (Rebholz et al., 1991). The Saudi gazelle also has shorter legs than the dorcas gazelle and was lighter in colour. The species was always rare and declining due to excessive hunting; it has not been seen for a few decades and was declared extinct in the wild in 1980 (East, 1992; Kingswood et al., 2001). Recent genetic analysis of all reported specimens of *G. saudiya* in captive collections has shown these represent different species or hybrids. Despite frequent surveys attempting to find pure Saudi gazelles in the wild and privately owned, no evidence of surviving individuals has been found. The Saudi gazelle was officially declared extinct by the IUCN in 2008.

Very little is known regarding the biology of this species. The Saudi gazelle was once found in gravel plains and sand deserts of Arabia (Harrison & Bates, 1991) and occurred singly or in groups of up to 20 (Morrison-Scott, 1939; Foster-Vesey-Fitzgerald, 1952).

This species has been recorded from Kuwait based on a specimen found at the BMNH (Harrison & Bates, 1991). However, Dunham et al. (2001) cast doubt on the existence of the species in the past in Kuwait because it was recorded on the western side of the Arabian Peninsula, with all records west of 47 °E except for one anomalous specimen from Kuwait, which reached the British Museum after a period of captivity at London Zoo (Cowan 2013). The Saudi gazelle is now considered extinct in the wild and may well be extinct in captivity too, as certain claimed captive *G. saudiya* populations have been shown not to be so (Kingswood et al., 2001; Hammond et al., 2001).

6.4 Arabian sand gazelle *Gazella marica* (Thomas 1897)

This is a large heavy-build gazelle with a rather short black tail. Males have a conspicuous swelling around the throat. The fur colour dorsally light clay brown, ventral white, with indistinct flank stripes (Figure 48). The facial colour



Figure 48: The goitred or reem gazelle, *Gazella subgutturosa* (Photo by A. Al-Sirhan).

white, with a faint facial stripe going from the anterior of the eyes to the muzzle. Its ears are short. The females either hornless or with very short, slender horns. Males with long annulated horns and lyrate and close together at base. Skull robust, distinctively large in size and with a large orbital width. Nasals in contact with premaxillae.

This species prefers desert plains, salt flats, and sand dunes. It is primarily a browser, but grasses and forbs are also eaten. Group sizes are usually one to nine, but herds may number in the hundreds or thousands; herds have been known to migrate long distances in response to rainfall and availability of forage. Females usually give born to one or two calves after a gestation period of five to six months (Kingswood & Blank, 1996).

Until recently, the Arabian sand gazelle was considered a subspecies of the goitred gazelle (*Gazella subgutturosa* Guldenstaedt, 1780), as *Gazella subgutturosa marica*. Wachter et al. (2010) established them within distinct lineages based on mitochondrial DNA analysis and it is now considered a separate species. The Arabian sand gazelle was even found to closely related to two North African gazelles, Cuvier's gazelle (*Gazella cuvieri*) and the rhim (*Gazella leptoceros*) (Hassanin et al., 2012).

Records include specimens of Arabian sand gazelles from Al-Batin and Dib-

dibbah (Kingswood et al., 2001), but they are probably now extinct in Kuwait (Harrison, 1968; Harrison & Bates, 1991; East, 1992). The goitred gazelle is known to have occurred in Kuwait based on specimens at the British Museum (Green, 1986; Harrison & Bates, 1991). 3 specimens of *Gazella subgutturosa* are found at the BMNH, 2 labeled Kuwait, 1 from Dibdibbah, 97 km SW Kuwait.

Today, this species survives in the wild in small, isolated populations in Saudi Arabia, the United Arab Emirates, Oman, and southeastern Turkey. Small numbers may also be present in Kuwait, Iraq, Jordan, and Syria. The total population of wild sand gazelles is thought to be less than 3,000. Significantly more are held in captivity, reserves, or breeding programs, perhaps more than 100,000. The reintroduction of the reem gazelle in Kuwait was proposed within its former range (e.g., Al-Batin). However, any reintroduction plan (Omar et al., 1986b; Omar & Abdulraheem, 1996) should consider the genetic background of stock that represent *G. s. marica* and not hybrids. (Kingswood et al., 2001) and should make efforts to monitor and manage reintroduced populations; and manage their habitat by eliminating the threats of habitat loss, competition with livestock, and hunting (Kingswood et al., 2001; IUCN 2017).

6.5 Wolf *Canis lupus* Linnaeus, 1758

The wolf is the largest member of the family Canidae. It is heavily built with an upright posture. Its body is robust with a large head. Its legs are strong and long. The tail is long with brush, pale yellowish in colour. The fur has elongated hair on the mid dorsum forming a dark crest along the back. The greatest Length of skull exceeds 180 mm. the skull is large, with well-developed sagittal crest and an abruptly elevated forehead. The tympanic bullae are large. The teeth are well-developed and more powerful than teeth of domestic dog and the jackal. Cingulum of the upper molars is small. The upper carnassial are large with a small lobe and very ill defined cusps.

The wolf is distributed throughout the northern hemisphere, including North America south to in Oaxaca (Mexico); Europe; Asia, including the Arabian Peninsula and Japan, excluding Indochina and S India. The wolf's occurrence in Arabia was formerly extensive. It was known from a large number of localities in Arabia including Kuwait from which three specimens are at the BMNH (Gasperetti et al., 1985; Harrison & Bates, 1991). No new records have been made in Kuwait, it is thus considered no longer present (Clayton & Wells, 1987; Cowan, 2013).

6.6 Cheetah *Acinonyx jubatus* (Schreber 1776)

It was first reported in Kuwait by Dickson (1949). However, the report is not

necessarily from within what are the present-day boundaries of Kuwait, it is presumed now long extinct (Green, 1986; Clayton & Wells, 1987; Harrison & Bates, 1991; Cowan, 2013).

6.7 Caracal *Caracal caracal* (Schreber 1776)

The caracal is a medium-sized cat. It is distinguished by the long black tufts on the ears, the back of the ears is black. The pupil of the eye is rounded. Its body colouration is reddish brown and sometimes creamy yellow, ventral side lighter. Face with black markings. Except for a few spots on the chest and inner side of front legs there are no patterns on the body. The limbs are long and slender. The soles of feet are hairy. The skull is robust with a strong developed sagittal crest. Its braincase is narrow in front. The nasal branch of the premaxilla is long. Tympanic bullae strongly inflated. Inferior margin on the mandible straight. Posteropalatal notches small. The space between upper canine and premolar is small. First upper premolar small and sometimes absent.

Dickson (1949) reported the caracal from Kuwait. Two specimens exist at the BMNH collection. No recent records have been made and it is considered no longer present in Kuwait (Clayton & Wells, 1987; Harrison & Bates, 1991; Cowan, 2013)

6.8 Fennec fox *Vulpes zerda* (Zimmermann 1780)

The fennec fox is a Saharan species that occurs as far east as Sinai in Egypt (Asa et al., 2004). The presence of this small fox in Arabia is very much doubtful and the previous records are suspicious (Stuart & Stuart, 2008; Cowan, 2013). One animal captured live near Jebel Hafit (UAE/Oman border) and put in Al-Ain zoo, was actually a Rüppell's fox *Vulpes rueppellii* (Harrison & Bates, 1991). Only one specimen was obtained in Kuwait and sent to London in 1935 (Gasperetti et al., 1985; Harrison & Bates, 1991). Omar & Abdulraheem (1996) stated that "Red and fennec foxes (*Vulpes vulpes* and *Fennecus zerda*) have been seen in Umm Ar-Rimman and Jal Az-Zor [nearby sites in Kuwait]..." and included the fennec fox in a list of species likely to be encountered within the Jal Az-Zor national park. Omar et al. (1986a, b) listed the fennec fox as part of the fauna of Jal Az-Zor national park based on a photo that depicted a red fox (Cowan, 2013). Almdirawi & Faraj (2004) indicated the presence of fennec fox in the Kuwait border demilitarized zone without proof, presumably on the basis of the Kuwait and Iraq individuals. These records may actually refer to young Rüppell's fox (Gasperetti et al., 1985; Cowan, 2013).

6.9 Dugong *Dugong dugon* (Müller 1776)

The dugong is a medium-sized marine mammal belonging to the order Sirenia (which includes three species of manatees). The dugong is easily distinguished from the manatees by its fluked, dolphin-like tail, but also possesses a unique skull and teeth. Its snout is sharply downturned, an adaptation for feeding in benthic seagrass communities. The molar teeth are simple and peg-like unlike the more elaborate molar dentition of manatees. The dugong's current distribution is fragmented, and many populations are believed to be close to extinction.

The dugong's body is large, cylindrical in shape. Its skin is thick and smooth, with a pale cream colour at birth, but darkens to brownish-to-dark-grey with age. The body is sparsely covered in short hair most developed around the mouth. The mouth has a horseshoe-shaped upper lip forming a highly mobile muzzle. Its tail flukes and flippers are similar to those of dolphins. An adult dugong grows up to 3 metres and weighs around 420 kilograms. The forelimbs are paddle-like flippers which aid in turning and slowing. The skull is enlarged with sharply down-turned premaxilla, stronger in males. The teeth do not continually grow back via horizontal tooth replacement. It has two tusks which emerge in males during puberty.

The Persian/Arabian Gulf is home to the second largest Dugong population in the world, yet little is known about their current or past abundance, distribution, and ecological role (Al-Abdulrazzak & Pauly, 2017). The historical changes in dugong distribution and perceived changes in their abundance was examined by Al-Abdulrazzak & Pauly (2017). They found that since 1950, dugong range may have contracted by one quarter, and despite their large population, their overall densities in the Gulf are far lower than in other areas within their range.

The global IUCN status for the dugong is vulnerable with its presence in Kuwait listed as "uncertain or vagrant" (Marsh & Soltzick, 2019) The dugong was reported in Kuwait from Failaka F5 and Tell Akkaz in Kuwait (Desse & Desse-Berset, 1990; Tome, 2003; Beech, 2010).



(Photo by F. Al Nomas)

7 Nature conservation in Kuwait



restricted and hunting is prohibited within the parks and reserves. Hunting is permitted throughout the country outside protected areas and there are no laws for its regulation (IUCN, 1992; Evans, 1994; Omar & Abdulraheem, 1996).

7.1 Conservation measures

The establishment and integrated management of a network of protected areas in Kuwait is of high priority for the conservation of threatened species. Protected areas provide refuge and suitable sites for the reintroduction of threatened and extinct fauna (such as antelopes). For example, the reintroduction of Arabian oryx and Arabian sand gazelles was recommended in Jal Az-Zor National Park (Omar & Abdulraheem, 1996). Other sites such as Umm Niga was identified for reintroduction of threatened species (e.g. *G. saudiya*) as it occurs within its former distribution range (Green et al., 1991). Populations of Arabian oryx and other antelopes exist in reserves and captive breeding programs in the region, thus, stocks are available for reintroduction efforts after careful examination of their taxonomic status. However, for the reintroduction efforts to succeed in Kuwait, the elimination of threats such as habitat loss, competition with livestock, and hunting, and it will require monitoring the reintroduced populations as part of the management programs of protected areas (Sausman & Correll, 1994). The reintroduction of antelope populations in Kuwait should also be managed as part of a regional joint efforts with neighboring countries to maintain minimum viable populations and provide areas that may support these desert species that roam over large home ranges Green et al., (1991).

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