

A Review of the Terrestrial Mammalian Fauna of Egypt: New Records, Distribution Records, and Extinctions

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Received: June 27, 2026; Revised: July 19, 2026; Accepted: July 25, 2026

Abstract

The present review deals with the changes that occurred in the list of the terrestrial mammals of Egypt during the last 50 years. A total of 14 newly-recorded species and subspecies, belonging to four orders: Eulipotyphla, Rodentia, Carnivora, and Hyracoidea—were documented, the presence of 3 of which is questionable. New collection localities of 19 species and subspecies, belonging to the 4 orders Eulipotyphla, Rodentia, Carnivora, and Artiodactyla were documented, and the local extinction or extinction of five species of order Artiodactyla was declared. The total number of the terrestrial mammals of Egypt has thus increased from 108 to 115 species and subspecies over the last 50 years, i.e., an increase of about 6.5% of the original number.

Keywords: Egypt; terrestrial mammals; new records; new distribution records; local extinctions.

Introduction

The first published works on the mammals of Egypt date back to the 18th century. Osborn and Helmy (1980) cited the works of several early naturalists such as Alpin (1735), Forskal (1775), and Bruce (1790).

The monumental work: “Description de L’Égypte”, published in a series of volumes over a period of about 13 years (1809–1822) (published online by the Bibliotheca Alexandrina starting from 2007) addressed, among other aspects of Egypt, the natural history of the country. The “Histoire Naturelle” volumes contained highly artistic plates of Egyptian bats, lagomorphs, rodents,

and artiodactyls collected by the French naturalists who accompanied Napoleons’s military campaign on Egypt (1798-1801).

Several works on the taxonomy, description, biology, and geographical distribution of Egyptian mammals have been published since the beginning of the 20th century. The earliest and most comprehensive work was the Anderson’s “Zoology of Egypt: Mammalia” published in 1902. He described the taxonomy and geographical distribution of Egyptian bats as well as land and marine mammals. Many years later, Flower (1932) updated the list of the mammalian species of the country including the domesticated ones. The work of El-Nigoumy (1952), in Arabic, presented brief notes on the description and geographical distribution of the mammalian species known from Egypt and introduced them with scientific and Arabic vernacular names.

The second most comprehensive work on the Egyptian mammals was that of Osborn and Helmy (1980), who gave detailed cranial, dental, and morphological descriptions, taxonomic revisions with lists of synonyms, detailed distribution maps, and notes on the biology and ecology of the Egyptian modern land mammals. Qumsiyeh (1985), five years later, reviewed the systematics, zoogeography, and ecology of the Egyptian bats.

Wassif and Soliman (1993) wrote on the habitat diversity and Egyptian mammals, and Wassif (1995) presented, in Arabic, an illustrated guide to the mammals of protected areas of Egypt. Few years later, Hoath (2003) presented an illustrated field guide to the Egyptian mammals, including bats, land and marine mammals. He described the known forms of Egyptian mammals and discussed

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the probability of the presence of several new mammalian species.

Scattered information on the taxonomy, ecology, and biology of Egyptian mammals are also found in other works on the mammals of neighboring countries such as Libya (Ranck, 1968; Hufnagl, 1972), Arabia (Harrison and Bates, 1991), and the Holy Land (Qumsiyeh, 1996). A lot of information included in the above works is based on the publications of many Egyptian and visiting naturalists. The list of these publications is too long to be reviewed herein.

The distribution of animals is a dynamic process. Since 1980, the year of Osborn and Helmy's published work, new species records and collection localities were documented and the local extinction of other species was declared. The present work briefly reviews the changes that occurred in the list of

Egyptian land mammals over nearly the past 50 years. Taxonomic, biological, ecological, and behavioral aspects that correlate with the below-mentioned mammalian species are beyond the scope of the present work.

Materials and Methods

The study areas

Geography: A brief description of the geography, topography, and biogeography of Egypt is given below. For more details, refer to Osborn and Helmy (1980). Egypt is divided, on geographical and topographical bases, into the following five provinces: Sinai Peninsula, Eastern Desert, Nile Delta and Valley, Western Mediterranean Coastal Desert, and Western Desert (Figure 1).

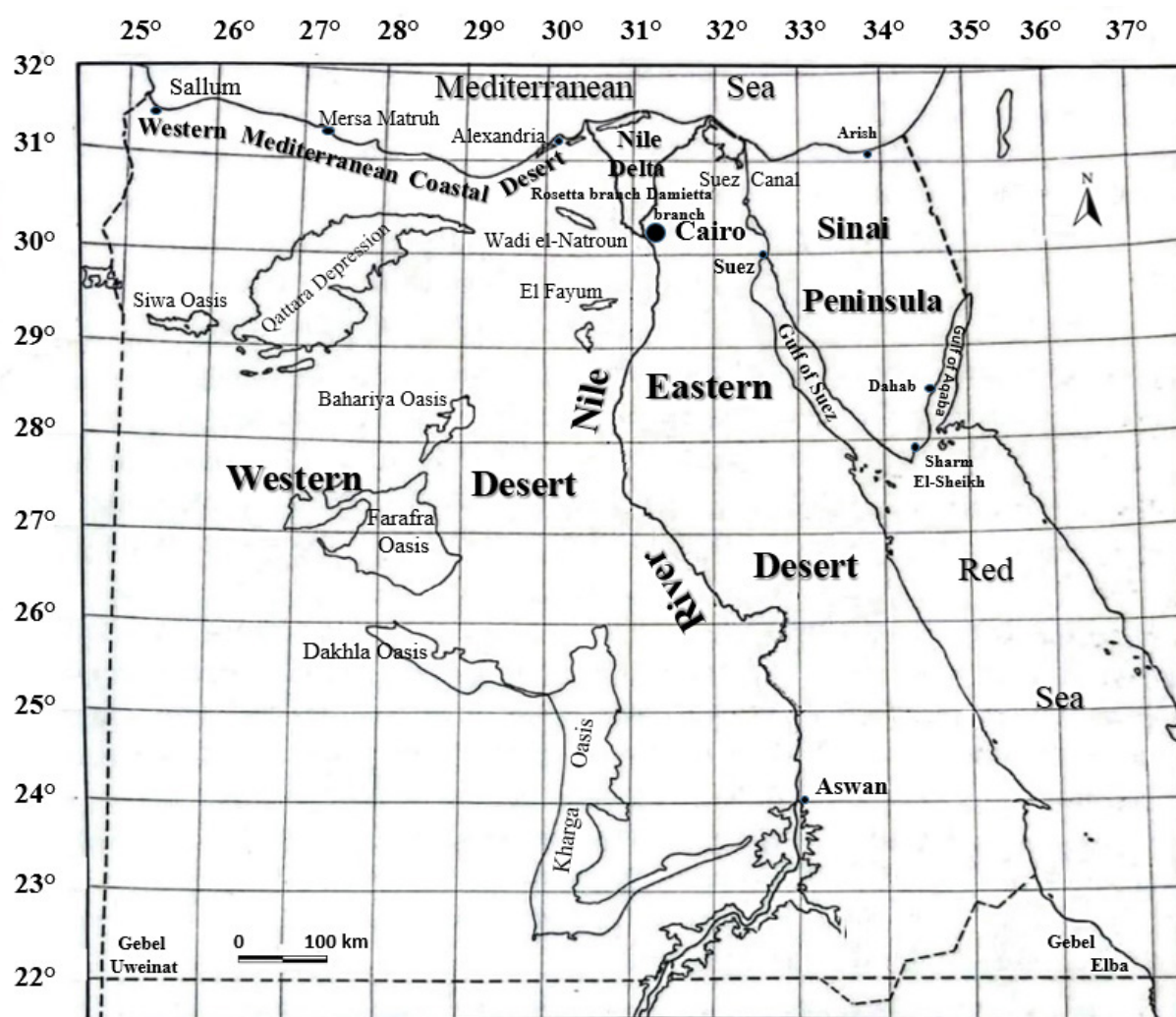


Figure 1. Geographic and topographic provinces of Egypt, showing the country's division into five major regions: the Sinai Peninsula, Eastern Desert, Nile Delta and Valley, Western Mediterranean Coastal Desert, and Western Desert.

Sinai is considered as a part of Asia and serves as a link for the exchange of Asian and African fauna.

At the extreme southeastern corner of the Eastern Desert, the outstanding Gabal Elba is located. The Nile Delta and Valley divides the mainland of Egypt into two different parts: the Eastern and Western Deserts. It serves as a link between south and north and a barrier between east and west.

The Western Mediterranean Coastal Desert is a distinct northern belt of the Western Desert. It acts as a corridor for the spread of terrestrial Libyan fauna to Egypt (Ayyad and Ghabbour, 1986). The Western Desert is characterized by depressions and oases. The highest point of the Western Desert is Gabal Uweinat at the southwestern corner of Egypt.

Biogeography: The Egyptian land is part of the Sahara Desert of north Africa. Several opinions had been proposed for assigning the Sahara to a given biogeographical region. It was considered by some authors to be a transitional area between the Mediterranean and Ethiopioan regions (Ayyad and Ghabbour, 1986). Some other naturalists considered the Sahara as part of a much broader area that extends from the Sahara to Sind in northwestern India; namely, the Saharo-Sindian region (Zohary, 1954; Ranck, 1968). They based their opinion on the close taxonomic similarities of the plant and animal species of this vast area. The mammals of the Sahara and Arabia thus became known as the Saharo-Sindian mammals (Atallah, 1977). Osborn and Helmy (1980), from a zoogeographical point of view, suggested the name "Saharo-Sindian Sub-region of the Palearctic". It is a meeting place of species from the Ethiopian, Palearctic, and, to a much lesser extent, the Oriental or Indomalayan Biogeographical Regions (Ghabbour, 1997).

Baseline list of terrestrial mammals of Egypt

A review of the recent literature dealing with the terrestrial mammals of Egypt was carried out using online search engines. Reference was also made to many publications related

to the taxonomy, ecology, and geographical distribution of Egyptian mammals that the author collected during the last 50 years. The results of field surveys and ecological studies that were conducted by the author and his colleagues, and by other Egyptian colleagues, on the Egyptian mammals were also considered. These field surveys covered many parts of Egypt such as Sinai Peninsula, the Western Desert, Gabal Elba region in the Eastern Desert, and villages of the Nile Delta region (Soliman, 2006; Soliman and Muhallal, 2006, 2014, 2016). During field trips, verbal information provided by locals was taken into consideration. As a review article, the different opinions regarding the proper identification of the species and subspecies treated in the present work were thoroughly discussed. Reference was made to the latest version of the IUCN Red List of threatened species for two reasons; firstly, to check the present status of the Egyptian mammals, and secondly, to check the updated scientific names of the mammalian species of the present work.

The baseline list of mammals for this review is based upon the detailed work of Osborn and Helmy (1980) on the contemporary land mammals of Egypt. They reviewed all the former publications on the taxonomy and distribution of the terrestrial mammals of the country and added more collection localities of them. Reference was also made to two other important works on Egyptian mammals: the "Zoology of Egypt: Mammalia" (Anderson, 1902) and the updated list of Egyptian mammals published by Flower (1932).

Results and Discussion

I- New records:

1. Order: Eulipotyphla

Family: Erinaceidae

North African hedgehog, *Atelerix algirus* (Lereboullet, 1842)

The presence of this species in Egypt is based on seven specimens collected from near el-Negila village west of Mersa Matruh during

the period extending from 2001 to 2011 (Saleh and Basuony, 2014b). The geographic range of the species extends from western Egypt through North Africa to Morocco. The nearest locality from which the species was recorded was Derna, Libya (Hufnagl, 1972), about 500 km to the west. According to the same author, the species geographical range had also extended to Spain.

2. Order: Rodentia

Family: Muridae

Subfamily: Gerbillinae

Allenby's lesser gerbil, *Gerbillus andersoni allenbyi* (Thomas, 1918)

It was recorded for the first time in Egypt by Soliman and Muhallal (2006). They based their record on 14 specimens (7 males and 7 females) collected from al-Dhahir and Wadi el-Agra, and two specimens collected from al-Matly Island of al-Zaranik protected area, all located in northeastern Sinai Peninsula. Harrison and Bates (1991) considered *allenbyi* as a subspecies of *G. andersoni* and briefly compared between it and *bonhotei*, which is the subspecies known from Sinai and northern Jordan. The conspecific status of *allenbyi* and *andersoni* was confirmed by Qumsiyeh (1996).

Family: Dipodidae

Long-legged lesser Egyptian jerboa,
Jaculus Jaculus longipodus Soliman and Mohallal, 2006

A sample of 88 individuals of this subspecies was collected from three localities in northeastern Sinai: namely, al-Dhahir, al-Gora, and Wadi el-Agra. (Soliman and Mohallal, 2006). The subspecies differs from the other four subspecies known from Egypt, especially *J. j. schlueteri* of Sinai and the Holy Land, in a number of morphological and cranial characters and measurements. A prominent difference was that the average length of the hind foot was longer than that of *J. j. schlueteri*, characterized by having the longest hind feet of all Egyptian subspecies of *J. jaculus*.

Family: Hystricidae

Indian crested porcupine, *Hystrix indica* Kerr, 1792

The first record of a porcupine in Sinai was that of Wassif (1953), who collected a porcupine's quill, presumably of *Hystrix cristata*, from Ain Gudeirat, 90 km southeast of el-Arish, northeastern Sinai. Osborn and Helmy (1980) thought that the Sinai quill might belong to *H. indica*, which is present in the Arabia and the Levant, not to *cristata*. They based their opinion on the probable limited distribution of the latter species in Egypt, which is confined to the cliffs north of el-Sallum of the Western Desert where it is possibly extinct. In 1990, two specimens of porcupines were collected by Bedouins from Nekhel and Bir el-Hasana, 70 and 135 km south of el-Arish, respectively (Wassif, 1995). Saleh and Basuony (1998) collected three specimens of porcupines from Gabal el-Maghara in northern Sinai. They compared the external and cranial characters of these specimens with the corresponding ones of *H. indica*, and *H. cristata* and indicated that their external characters were clearly closer to those of *indica* and that the rest of characters overlapped with those of the other two species. Due to the small number of Sinai specimens (only 3 specimens), they could not reach at a definite conclusion regarding the specific identification of the collected specimens and recommended that further examination of more specimens must be carried out. Hoath (2003) thought that the widely separated geographical ranges of the two species of porcupines under consideration—one close to the western and the other close to the eastern frontiers of the country—would exclude any confusion about their identification. He also pointed out the two individual porcupines of el-Arish Zoo that were captured in Wadi el-Arish and were tentatively identified as *H. indica*. He considered, however, that the presence of the Indian crested porcupine in the country had not been proven yet.

3. Order: Carnivora

Family: Canidae

Golden jackal, *Canis aureus* Linnaeus, 1758

Golden jackals were recorded from Egypt for the first time by Saleh and Basuony (2014a). They identified two subspecies: the Syrian golden jackal, *C. a. syriacus* Hemprich and Ehrenberg, 1833 of Sinai Peninsula and the Qattara desert jackal, *C. a. qattarensis* Saleh and Basuony, 2014 of the northern region of the Western Desert. According to Saleh (2024), the previous records of the golden jackal in Egypt belong, in fact, to the Egyptian/African golden wolf, *Canis lupaster* Hemprich and Ehrenberg, 1833 that was erroneously identified as a subspecies of the golden jackal under the name *C. a. lupaster*. Flower (1932), however, wrote on the wolf-like jackal or the so called "Egyptian Wolf", *Canis lupaster* and described it as having an intermediate size between the real wolves of northern countries and the jackals of other parts of Africa and Asia. Wolves were widely distributed in Egypt except Sinai (El-Nigoumy, 1952; Osborn and Helmy, 1980). The record of the true golden jackal in northeastern Sinai was based on an adult female from el-Magdaba, north Sinai, and a male from near Quosiyima, eastern Sinai (Saleh and Basuony, 2014a). The animals were repeatedly recorded afterwards in considerable numbers in different parts of southern Sinai, such as Ras Mohammed National Park and the neighboring Sharm el-Sheikh area, the coastal plain of Nabq Nature Protectorate, and Saint Catherine Nature Protectorate (Saleh, 2024)). These records were based on photographs captured in 2023 and early 2024 and sight records of the species obtained by rangers of the protected areas as well as on dead golden jackals including museum specimens. The number of observed jackals ranged between one or two individuals, to up to seven animals. The record of *C. a. qattarensis* of the northern region of the Western Desert of Egypt was based on nine specimens collected from Qattara Depression, el-Dabaa, Sitra and Siwa Oases, and el-Fayum (Saleh and Basuony, 2014a).

Grey wolf, *Canis lupus* Linnaeus, 1758

The presence of the Arabian wolf in Sinai was questionable since it depended on sight records or verbal information by local Bedouins. The real presence of this wolf in Sinai was documented by Saleh and Basuony (2014a). They collected 5 specimens from the Saint Catherine area and west of Dahab in south Sinai, and Quosiyima, east Sinai. They also depended on sight records and photographs captured by rangers of Saint Catherine Natural Protectorate and Ras Mohammed National Park, and tracks observed in Abu Gallum, Ras el-Naqab, Quosiyima, and Wadi el-Arish. Based on these observations, they concluded that the Arabian wolf is widely distributed throughout Sinai, from sea level to the high elevations of south Sinai mountains. They referred the Arabian wolf of Sinai to the subspecies *C. l. arabs* Pocock, 1934.

Blanford's fox, *Vulpes cana* (Blanford, 1877)

Many authors have recorded the presence of this fox species in Egypt. According to (Hoath, 2003), the first specimen of the Blanford's fox from Egypt was collected in 1977 from Sinai. A skull was recovered from Gabal Sirbal by Mendelssohn et al. (1987) and a specimen of this fox was collected in 1988 at Wadi Quoseib, about 60km south of Suez along the coast of the Gulf of Suez (Peters and Rödel, 1994), which was a confirmation that Blanford's fox has extended its distribution to the African Continent. Hoath (2003) indicated that very few specimens were known from southeastern Sinai since the early 1980s and wondered whether this fox species was very rare or just extremely elusive. Sight records of the Blanford's fox were later reported by Saleh and Basuony (1998) who observed a very small fox with large ears and huge bushy tail for several minutes in a rocky wadi north of Ras Mohammed, southern Sinai. They also mentioned the repeated observation of this fox by the members of the Multinational Peace Keeping Forces on the summit of

Gabal el-Rashrash, southeastern Sinai, who described it as a small agile fox with a large bushy tail. The foot tracks of a probable Blanford's fox in Abu Gallum, south Sinai, were also observed by the same authors.

Family: Mustelidae

The common badger, *Meles meles* (Linnaeus, 1758)

It was recorded for the first time in Egypt from northeastern Sinai Peninsula by Soliman (2006). A skeleton of the animal together with a bunch of its hair were provided to the author by a local Bedouin in "Sayalat Al-Bawati" area, about 30 km to the south of the Mediterranean seashore and about 5 km to the west of the eastern frontiers of Egypt, in winter 2004. The animal is locally known as "Al-Ke'eby". It seemed that it was killed by locals since the left frontal of the skull was severely damaged. Several years later, Saleh and Basuony (2014b) included the common badger among the mammalian records from the country. They based their record on a live specimen captured by a Bedouin in 2006 near Ein el-Godierat in northeastern Sinai. They added that another specimen had been captured by Bedouins in the same area and sold to an animal collector in Cairo.

The honey badger, *Mellivora capensis* (Schreber, 1776)

The honey badger is a close relative of the common badger. It was believed to be found along the eastern frontiers of Egypt (Hoath, 2003). The first record of the animal was reported by Saleh and Basuony (2014b). It was based on a captive male captured by Bedouins just south of Ein el-Godierat, northeastern Sinai. They indicated that the species was very rare in the area since locals neither had seen it before nor known any local name of it. A skull of an adult animal was found in March, 2023 in a sandy shrubland area, about 5 km from Zaranik Protected Area in northeast Sinai (Rabia, 2025).

The marbled polecat, *Vormela peregusna* (Güldenstädt, 1770)

It was recorded for the first time in Egypt by Saleh and Basuony (1998) from Bir el-Abd and Gabal el-Maghara (fragmented skull) in northern Sinai Peninsula. They also observed the tracks of the animal in sandy habitats throughout this region and indicated that the species was common and well known to local Bedouins throughout northern Sinai. The tracks of the animal were also observed throughout Wadi el-Agra in northeastern Sinai by Soliman and Mohallal (2016) who collected a specimen from the same Wadi. Bedouins of Wadi el-Agra know the species by the local name "Do'wai". Two other dead specimens from unknown locality in Sinai were also provided by an animal collector to the authors.

Family: Herpestidae

White-tailed mongoose, *Ichneumia albicauda* (G. Cuvier, 1829)

The species has a wide distribution that extends through sub-Saharan Africa and southern Arabia. The possible presence of this species in Egypt was suggested by Taylor (1972). The inclusion of this species in the list of Egyptian mammals was considered by Hoath (2003) to be without a basis and did not depend on a collection locality. He added, however, that if the species was present in Egypt, it would most likely occur in the Gabal Elba region, southeast of the Eastern Desert. Egypt was included again among the African and Asian countries covered by the geographical range of this species (Do Linh San, 2015). The map provided by the author includes the southeasternmost part of the country as part of the species geographical range.

Family: Hyaenidae

Spotted hyena, *Crocuta crocuta* (Erxleben, 1777)

The first record of the spotted hyena in Egypt was published by Mahdy *et al.* (2024). They

based their record on an adult male killed by local people on March 24th, 2024 in Wadi Yahmib, Elba Protected Area, southeast Egypt. Nagy *et al.* (2025), however, published a record of a spotted hyena and said that it was the first record of the species in modern Egypt since its extinction from the country over 5,000 years ago. They based their record on an individual hyena killed on February 24th, 2024 by local people, also in Wadi Yahmib. They added that the record was 500 km north of the known range of the spotted hyena and discussed the possibility of its dispersal from neighboring Sudan along a corridor created by increased rainfall and grazing practices. It is strongly believed, based on the dates and locality of observation, and a photograph of the killed hyena, that the above two records are based on the same individual hyena.

4. Order: Hyracoidea

Family: Procaviidae

Bush hyrax or Yellow-spotted hyrax, *Heterohyrax brucei* (Gray, 1868)

The presence of the yellow-spotted hyrax in Egypt is questionable. Its presence in the Red Sea hills and Sinai was mentioned by several authors (e.g., Barry and Shoshani, 2000; Hoath, 2003) without giving specific localities for sight records or collected specimens. The records of this species along the Red Sea coast of Egypt, however, were thought to be erroneous and relate to *Procavia* (Hoffman *et al.*, 2008). They have concluded, based on a review of the literature and classification of this species, that there was no evidence to support the presence of *H. brucei* in Egypt, or anywhere north of northern Eritrea and the Sudan. The same authors added that collecting further materials in the form of specimens, photographs, and tissue materials for genetic analysis was required before taking a final decision on the northern range of this species.

II- New distribution records:

1. Order: Eulipotyphla

Family: Erinaceidae

Desert hedgehog, *Paraechinus aethiopicus deserti* (Loche, 1858)

The desert hedgehog, identified by Osborn and Helmy (1980) as *P. d. deserti*, was previously recorded from the northwestern margin of the Nile Delta and the Western Mediterranean Coastal Desert of Egypt. Saleh and Basuony (2014b) collected an adult male and reported on several sight records of this hedgehog from an olive grove in Siwa Oasis. According to these authors, the new records were several hundred kilometers far from the nearest known points of the distribution of this species.

Sinai desert hedgehog, *Paraechinus aethiopicus pectoralis* (Heuglin, 1861)

This subspecies, identified by Osborn and Helmy (1980) as a *P. d. dorsalis*, was recorded from different localities in southern Sinai. The subspecies proved to be more widespread in Sinai since it was recorded by Saleh and Basuony (1998) from a wider area that included northern, central, and southern parts of the Peninsula.

Family: Soricidae

Dwarf shrew, *Crocidura nana* Dobson, 1890

The geographical range of the species included the southern part of Nile Delta and possibly Nile Valley (Osborn and Helmy, 1980). An adult female was collected later from a densely vegetated, sandy island located about 5 km from the eastern shore of Lake Bardawil of northern Sinai (Saleh and Basuony, 2014b).

Guldenstadt's shrew, *Crocidura gueldenstaedtii* (Pallas, 1811)

The presence of this species in Egypt was based on a single female specimen recorded from South Sinai at an elevation of 1,500 m inside a small monastery west of St. Catherine (Osborn and Helmy, 1980, Hoath, 2003). Two more specimens were later collected from Wadi el-Arish in northeastern Sinai (Saleh and Basuony, 1998).

House shrew, *Suncus murinus* Linnaeus, 1766

The house shrew was known in Egypt only from a single specimen collected from a house in Suez on the Red Sea (Osborn and Helmy, 1980). A female specimen was later collected from a house in Motobus, Kafr El-Sheikh Governorate, Nile Delta (Saleh and Basouni, 2014b).

2. Order: Rodentia

Family: Muridae

Subfamily: Gerbillinae

Lesser Egyptian gerbil, *Gerbillus gerbillus* (Olivier, 1801)

It is a widely distributed desert rodent in Egypt. Different subspecies of the lesser gerbil are found in Sinai Peninsula, northern and southern parts of the eastern Desert, Nile Delta and Valley, and Western Desert (Osborn and Helmy, 1980). 13 specimens of this gerbil were recently collected from Baltim, Kafr el-Skeikh Governorate, at a Mediterranean coastal area of the Nile Delta (Younis, 2023). He did not refer the collected specimens to any known subspecies from Egypt, but he noticed that they were larger than them all.

Pleasant gerbil, *Gerbillus amoenus* (de Winton, 1902)

It is grouped either under the genus *Gerbillus* or *Dipodillus*. It is a widely distributed dipodil in Egypt since it is known from different localities in the Western Desert of Egypt including, Wadi el-Natroun, el-Fayum and Dakhla Oasis, and from southern Eastern Desert including Wadi Allaqi (Osborn and Helmy, 1980). Four individuals were collected from different localities of Gabal Elbaregion in the far southeast of Egypt, just to the north of the Egyptian-Sudanese frontiers (Mohallal, 2007). These localities represent the southeasternmost collection localities of this species in Egypt. It was suggested that the charming dipodil could exploit the southern part of the Eastern Desert of Egypt by trans-Nubian Nile crossing (Ayyad and Ghabbour,

1986). Specimens of this species were also collected for the first time from four localities in Siwa Oasis; namely, al-Gabal al-Akhdar, al-Senoseya, Gabal Zomat, and al-Ghweisat (Soliman and Mohallal, 2014). The disjunct distribution of the species suggests that it is more widespread than the records indicate (Hoath, 2003).

Pigmy gerbil, *Gerbillus henleyi* (de Winton, 1903)

It is grouped either under the genus *Gerbillus* or *Dipodillus*. Specimens of this species (2 males and one female) were collected from three localities in northeastern Sinai; namely, Wadi Umm Shehan (gravely habitat), Bir Lehfen (moderately vegetated habitat), and Wadi el-Agra (soft sand and moderate vegetation) (Soliman and Mohallal, 2016). The three areas represent new collection localities of this rodent species from Sinai, since it was collected before only from the southwest of the Peninsula (Osborn and Helmy, 1980).

Libyan jird, *Meriones libycus* Lichtenstein, 1823

The distribution of the Libyan jird covers the northern part of the Western Desert (Osborn and Helmy, 1980). It was recently recorded by Mohalla and Ahmed (2018) from Kharga and Dakhla Oases. No details about the number of collected specimens or the names of collection localities were given.

Shaw's jird, *Meriones shawi* (Duvernoy, 1842)

The species is known to occur in various localities of the Western Mediterranean Coastal Desert and el-Maghra (Osborn and Helmy, 1980). According to Hoath (2003), the southernmost collection locality of this species was the northeastern corner of Qattara Depression. It was recorded for the first time by Soliman and Mohallal (2014) from an area close to Siwa Oasis, far south to the Mediterranean coastline. They

collected a single individual of this jird from Umm Hwemel, about 300 km south of the Mediterranean Coastal Desert, in a sparsely vegetated locality characterized by the presence of isolated scattered trees of genus *Vachellia* (= *Acacia*). The specimen may belong to a relict population of this species.

Fat tailed gerbil, *Pachyuromys duprasi* Lataste, 1880

The distribution of the species covered various localities in the northern part of the Western Desert of Egypt including Wadi el-Natroun, and Abu Rawash in Giza Governorate (Osborn and Helmy, 1980). A male gerbil was collected from a barren isolated stand of 14 trees of *Vachellia raddiana* east of Qattara Depression, about 280 km southwest of Cairo and 350 km south of the Mediterranean coastline (Saleh and Basuony, 2014b). They trapped and released 5 more specimens (2 males and 3 females) in the same locality during the period extending from 1995–2006, and suggested that these individuals belong to a relict isolated population of this gerbil.

Subfamily: Murinae

Brown rat, *Rattus norvegicus* (Berkenhout, 1769)

The distribution of this commensal rat in Egypt covers the coastal towns and Nile Delta and Valley (Osborn and Helmy, 1980). Hoath (2003) added Aswan, el-Fayum, Suez Canal area, with one isolated record from Gabal Elba area. It was recently recorded from Kharga and Dakhla Oases by Mohallal and Ahmed (2018). The authors did not give details about the numbers of collected specimens or the names of collection localities.

House mouse, *Mus musculus* Linnaeus, 1758

This commensal mouse is widely distributed in Egypt. It was recorded from different localities in Sinai Peninsula, Suez Canal area, Red Sea coast, Nile Delta and Valley,

Western Mediterranean Coastal Desert, and oases of the Western Desert (Osborn and Helmy, 1980). According to Hoath (2003), it is absent from the Eastern Desert except the settlements along the Red Sea coast south to Mersa Alam. Four males were later collected from two localities in Gabal Elba region in far southeastern Egypt; namely, Abu Ramad and Sarara Eshabae just north of the Egyptian-Sudanese frontiers (Mohallal, 2007). Commensal rodents likely expand their range following the spread of new human societies.

Family: Dipodidae

Four-toed jerboa, *Allactage tetradactyla* (Lichtenstein, 1823)

The former geographic range of this species in Egypt included the northern part of the Western Mediterranean Coastal Desert. It was reported to be locally extinct or threatened with extinction since early 1960s (Hoogstraal, 1963). The threats facing this rodent species were attributed to anthropogenic activities such as habitat destruction through land reclamation (Hoogstraal, 1963), summer resort development along the Mediterranean coast (Hoath, 2003), and the extensive collection of this rodent for commercial purposes in response to the great demand for it as a house pet (Saleh and Basuony, 2014b). The last authors added that the animal became a locally extinct species in Egypt except for a very small area near el-Negila, west of Mersa Matruh, where they observed some individual jerboas and captured and released some others.

3. Order: Carnivora

Family: Canidae

Red fox, *Vulpes vulpes* (Linnaeus, 1758)

The red fox is widely distributed in Egypt (Osborn and Helmy, 1980) and continuously expands its range of distribution in the country as it follows the spread of human activities (Hoath, 2003). It was recorded for the first time from Siwa Oasis by Soliman and Mohallal (2014), who collected three

individuals (2 males and one female) from Ghet-Akhlel area. The tracks of this fox were also observed by the authors in different localities of the Oasis. According to Osborn and Helmy (1980), the fox was recorded from various localities in north Sinai coastal areas and the northern coast of the Gulf of Suez. A live specimen was later collected from the Wadi el-Agra area in northeastern Sinai by Soliman and Mohallal (2016). The fox has also become very common throughout southern Sinai from sea level up to 1800 m altitude (Saleh and Basuony, 1998). According to Hoath (2003), the red fox has extended its distribution range as far south as Ras Mohammed.

Fennec fox, *Vulpes zerda* (Zimmermann, 1780)

The distribution of the species covers Sinai Peninsula and the Western Desert south of the Mediterranean Coastal Desert, where it was recorded from various localities including el-Maghara, Wadi el-Natroun, el-Fayum, Wadi el-Rayan, Farafra, Dakhla and Kharga Oases (Osborn and Helmy, 1980). The presence of this fox in Siwa oasis was inferred from the observation of its foot tracks, a burrow opening in Ain al-Safa, probably belonging to it, as well as verbal information of local people (Soliman and Mohallal, 2014). The species was also very common in sandy areas of northern Sinai (Saleh and Basuony, 1998).

Family: Felidae

Sand cat, *Felis margarita* Loche, 1858

The distribution of this elusive little cat in Egypt is not well known. Flower (1932) wrote about a very long-haired wild cat of unknown locality which he did not examine but he thought it was a sand cat. He also reported on two living cats that he saw in the Zoological Garden at Zagazig, east of Nile Delta, in the years 1912–1914, which were collected from sandy tracts of unknown localities. The external features of these two cats conformed with those of the sand cat. This cat species was not, however, recorded

among the cats of Egypt by El-Nigoumy (1952). The presence of the sand cat was confirmed in southeastern part of Egypt by the collection of only one specimen by Ibrahim Helmy in 1975 (Osborn and Helmy, 1980). Several specimens of the sand cat were later collected. The following records of sand cats were reported by Hoath (2003): records from the Qift-Quseir road in the Eastern Desert and Ras Abu Fatma in the far southeast of Egypt in 1980s; an individual cat trapped in North Sinai and sent to al-Arish Zoo in 1995; several specimens obtained from northeastern Sinai; 7 live cats of unknown locality possessed by an animal dealer in 1996 and at least 4 stuffed specimens of unknown locality displayed in Kerdasa, an important center of animal trade, since 1990. Five specimens of this cat species were collected by Saleh and Basuony (1998) from northern Sinai Peninsula: a male and a female from Bir el-Abd and a male and two females from Gabal el-Maghara. They also observed the tracks of this cat throughout the sandy desert of northern Sinai. The above records indicate that the sand cat is widespread in Egypt.

4. Order: Artiodactyla

Family: Bovidae

Dorcas gazelle, *Gazella dorcas* (Linnaeus, 1758)

Different subspecies of the dorcas gazelle are present in the Sinai Peninsula, Eastern and Western Deserts (Osborn and Helmy, 1980). They did not examine any specimens from Sinai Peninsula. Anderson (1902) recorded this gazelle from Ayun Musa in western Sinai. According to El-Nigoumy (1952), the dorcas gazelle was observed in el-Fayum desert, the oases of the Western Desert and the Nile Valley. This gazelle became greatly reduced over much of its former range in both the Western and Eastern Deserts, and Sinai (Hoath, 2003). Due to the illegal hunting of this species, he did not publish the details of the sight records of this gazelle outside protected areas of Egypt. Individuals and small herds of this gazelle species were sighted in Sahl El-Qa, Nabq Protected Area

to the west of Dahab, southeast Sinai by Saleh and Basuouny (1998), and the presence of this gazelle in St. Katherine Protected Area, south Sina, was reported by Hoth (2003).

Mountain gazelle, *Gazella gazella* (Pallas, 1766)

The presence of the Arabian gazelle in Egypt is based on sight records in Wadi el-Arish in north Sinai (Flower, 1932). According to El-Nigoumy (1952), Arabian gazelles also inhabited the valleys of Sinai Peninsula between Suez and el-Tor in the south. It was not collected from Sinai Peninsula by Osborn and Helmy (1980), who only examined four specimens from Saudi Arabia. Few individuals of Arabian gazelle together with the foot tracks and fresh fecal pellets were observed in sandy areas close to Wadi el-Agra in northeastern Sinai (Soliman and Mohallal, 2016). A local Bedouin provided the authors with a part of male gazelle head covered with skin, with only one ear pinna and one horn, and a leg shaft with hoofs.

III- Locally extinct species:

The following five mammalian species of order Artiodactyla were already locally extinct in Egypt in 1980, the time of publishing the work of Osborn and Helmy on the contemporary land mammals of Egypt. They, however, included them in their book.

Order: Artiodactyla

Family: Suidae

The wild boar, *Sus scrofa* Linnaeus, 1758

The wild boar is locally extinct in Egypt (Keuling and Leus, 2019). They added that over-hunting and changes in land use had resulted in the extermination of this species from many parts of its geographical range, including North Africa. The distribution of this species in the prehistoric and historic times of Egypt included the Nile Delta, Wadi el-Natroun, el-Faiyum, and probably most of the Nile Valley (Osborn and Helmy, 1980). They were observed, perhaps for the last time in Egypt in Wadi el-Natroun

in 1895 and in the neighborhood of Damietta in 1897 (Anderson, 1902). Before that time, wild boars occurred in many parts of the country during the 19th century (Flower, 1932).

Family: Hippopotamidae

The hippopotamus, *Hippopotamus amphibious* Linnaeus, 1758

The hippopotamus is locally extinct in Egypt (Lewison and Pluháček, 2017). They added that until about the year 1700, the animal sporadically occurred in Egypt in two areas: the Nile Delta to the north, and upper Nile to the south. It was, however, not present in Rosetta branch (Osborn and Helmy, 1980). The animal was not present in Egypt at the time of Anderson (1902), who concluded that it had disappeared after the spread of firearms. According to Flower (1932), the animal became extinct in Egypt within the 19th century. Based on information provided by early writers, he reported that the last hippopotamus in the Nile Delta had been killed near Damietta in the year 1815, and that the last sight record of the animal in the upper Nile was documented 37 km north of Aswan in about the year 1816.

Family: Bovidae

The scimitar horned oryx, *Oryx dammah* (Cretzschmar, 1827)

The scimitar horned oryx is extinct from Egypt (IUCN SSC Antelope Specialist Group, 2023). The date of the disappearance of the species from the country is not clear cut. Flower (1932) considered this animal species to be extinct in Egypt and added that the last individual had been killed in about the year 1850. About 125 years later, however, an individual oryx was observed by Ibrahim Helmy in 1975, about 160 km south of Mersa Matruh, Western Desert (Osborn and Helmy, 1980). It was perhaps the last sight record of the oryx in Egypt. The distribution of the animal in the early years of the 19th century included the west side of Giza Province and round el-Fayum (Flower, 1932). He added, based on collected reports, that a small herd of oryx was observed in the desert near Wadi el-Natroun about the year 1831.

The addax, *Addax nasomaculatus* (Blainville,

1816)

The addax is locally extinct in Egypt (IUCN SSC Antelope Specialist Group, 2016). The previous distribution of the addax in the country probably included most of the Western Desert (Osborn and Helmy, 1980). The geographical range of the animal progressively shifted southwards until it disappeared from Egypt (Malinus, 2000). There is, however, no agreement about the date of the disappearance of addax from the country. It was thought that the last individual addax in Egypt was shot in about the year 1900 at a district located more than 60 km to the west of Alexandria (Flower, 1932). Malinus (2000), however, reported that a stray living addax was killed in a car collision southwest of the Kharga depression in 1931, and El-Nigoumy (1952) mentioned that a live addax was collected from the desert areas to the south of Gebel Uweinat of southwest Egypt and brought to the Giza Zoo. According to Malinus (2000), only few animals still visited the extreme southwest of the country in search of food plants during the period extending from the beginning of the 20th century and the end of the 1960s. Hoath (2003) wrote that it was unlikely that this endangered species still existed in the country. If so, he added, it would only be present in very small numbers in the remote parts of the Egyptian deserts. On a worldwide basis, the addax is listed today as a critically endangered species and almost all of its remaining individuals live in Niger (IUCN SSC Antelope Specialist Group, 2016).

The bubal hartebeest, *Alcelaphus buselaphus* (Pallas, 1766)

Bubal hartebeest is extinct worldwide (IUCN SSC Antelope Specialist Group, 2017). The previous distribution of the animal in Egypt included Oases and oasis-like depressions of the Western Desert and the Western Mediterranean Coastal Desert (Osborn and Helmy, 1980). Based on verbal information, the animal was present west of el-Fayum in the Western Desert of Egypt until 1893 (Anderson, 1902). There were no records of wild individuals of the species from the country thereafter (Flower,

1932).

Conclusion

The distribution of animals on a national, regional, or a worldwide scale is a dynamic process; new species cross the borders from neighboring areas, others become locally extinct or exceedingly rare, while new collection localities are discovered. The reasons for this dynamic nature of animal distribution are many and are related to such factors as anthropogenic activities (habitat destruction, fragmentation, or degradation) and global climatic changes. The regular survey of the fauna of different parts of the world is badly needed to update the lists of animal groups inhabiting different parts. Updated lists are needed by conservation authorities to set priorities and propose conservation action plans for saving threatened or near-threatened species from going extinct. According to the baseline list of Osborn and Helmy (1980), the total number of the terrestrial mammals of Egypt was 108 species and subspecies. During the last 50 years, a total of 14 species and subspecies were added to this list, the presence of 3 of which is questionable. They were, however, discussed in the present work, but not added to the list of the present mammals of Egypt, to draw the attention of Egyptian naturalists to the probable presence of these species. A taxonomic revision of genus *Canis* in Egypt (Saleh and Basuony, 2014a) increased the number of canid species and subspecies to 5 (3 of which are included in the newly recorded forms in the country) instead of one subspecies in the baseline list. Five extinct species were, on the other hand, removed from the baseline list. The total number of the extant mammals of Egypt has thus raised to 115 species and subspecies (Appendix 1). In other words, during the last 50 years, the list of Egyptian mammals increased by 7 species and subspecies that represent about 6.5% of the original number of species and subspecies (108) of the country.

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Appendix 1: Updated List of Egyptian Mammals

1. Order: Eulipotyphla

Family 1: Erinaceidae

- Hemiechinus auritus aegyptius* (Fischer, 1829)
H. a. libycus (Ehrenberg, 1833)
Paraechinus aethiopicus deserti (Loche, 1858)
P. a. aethiopicus (Ehrenberg, 1833)
P. a. pectoralis (Heuglin, 1861)
Atelerix algirus (Lereboullet, 1842)

Family 2: Soricidae

- Crocidura flavescens deltae* Heim de Balsac and Barloy, 1966
C. floweri Dollman, 1916
C. nana Dobson, 1890
C. gueldenstaedtii (Pallas, 1811)
C. suaveolens matruhensis Setzer, 1960
Suncus murinis sacer (Ehrenberg, 1833)
S. etruscus Savi, 1822

2. Order: Lagomorpha

Family: Leporidae

- Lepus capensis sinaiticus* (Ehrenberg, 1833)
L. c. aegyptius (Dresmarest, 1822)
L. c. isabellinus (Cretzschmar, 1826)
L. c. rothschildi (De Winton, 1902)

3. Order: Rodentia

Family 1: Muridae

Subfamily 1: Gerbillinae

- Gerbillus pyramidum pyramidum* I. Geoffroy St. Hilaire, 1825
G. p. gedeedus Osborn and Helmy, 1980
G. p. elbaensis Setzer, 1958
G. floweri (Thomas, 1919)
G. perpallidus Setzer, 1958
G. a. andersoni De Winton, 1902
G. a. inflatus (Ranck, 1968)
G. a. bonhotei (Thomas, 1919)
G. a. allenbyi (Thomas, 1918)
G. gerbillus asyutensis Setzer, 1960
G. g. sudanensis Setzer, 1956
G. g. gerbillus (Olivier, 1801)
G. amoenus (de Winton, 1902)
G. h. henleyi (de Winton, 1903)
G. h. mariae (Bonhote, 1909)
Dipodillus campestris wassifi (Setzer, 1958)
D. c. haymani (Setzer, 1958)
D. c. patrizii (de Beaux, 1932)
D. c. venustus (Sundevall, 1843)
D. d. dasyurus (Wagner, 1842)
D. mackilligini Thomas, 1901
D. simoni kaiseri (Setzer, 1958)
Sekeetamys c. calurus (Thomas, 1892)
S. c. makrami (Setzer, 1961)

Meriones c. crassus Sundevall, 1842
M. c. perpallidus Setzer, 1961
M. c. pallidus Bonhote, 1912
M. sacramenti Thomas, 1922
M. libycus Lichtenstein, 1823
M. shawi (Duvernoy, 1842)
M. t. tristrami Thomas, 1892
Pachyuromys duprasi natronensis De Winton, 1903
Psammomys o. obesus Cretzschmar, 1828
P. o. nicoli Thomas, 1908
P. o. terraesanctae Thomas, 1902

Subfamily 2: Murinae

Arvicanthis n. niloticus (Desmarest, 1822)
Rattus rattus (Linnaeus, 1758)
R. norvegicus (Berkenhout, 1769)
Mus musculus praetextus (Brants, 1827)
Acomys r. russatus (Wagner, 1840)
A. r. aegyptiacus Bonhote, 1912
A. c. cahirinus (Desmarest, 1819)
A. c. viator (Thomas, 1902)
A. c. hunter (De Winton, 1901)
A. c. dimidiatus (Cretzschmar, 1826)
A. c. megalodus (Setzer, 1959)
A. c. helmyi Osborn, 1980
Nesokia indica suilla (Thomas, 1907)

Family 2: Spalacidae

Nannospalax ehrenbergi (Nehring, 1898)

Family 3: Muscardinidae

Eliomys quercinus melanurus (Wagner, 1840)
E. q. cyrenaicus (Festa, 1921)

Family 4: Dipodidae

Allactaga tetradactyla (Lichtenstein, 1823)
Jaculus o. orientalis Erxleben, 1777
J. j. schlueteri (Nehring, 1901)
J. j. flvillus Setzer, 1955
J. j. butleri Thomas 1922
J. j. longipodus Soliman and Mohallal, 2006
J. j. jaculus (Linnaeus, 1758)

Family 5: Hystricidae

Hystrix cristata Linnaeus, 1758

4. Order: Carnivora

Family 1: Canidae

Canis aureus syriacus Hemprich and Ehrenberg, 1833
C. a. qattarensis Saleh and Basuony, 2014
C. lupus arabs Pocock, 1934
C. lupaster lupaster (Hemprich and Ehrenberg, 1833)
C. l. doederleini Hilzheimer, 1906
Vulpes v. aegyptiaca (Sonnini, 1816)
V. v. arabica Thomas, 1902
V. r. rueppelli (Schinz, 1825)
V. zerda (Zimmermann, 1780)
Vulpes cana (Blanford, 1877)

Family 2: Mustelidae

Poecilictis l. libyca (Hemprich and Ehrenberg, 1833)
Ictonyx striatus erythrae De Winton, 1898
Vormela peregusna (Güldenstädt, 1770)
Mustela nivalis numidica (Hemprich and Ehrenberg, 1833)
Meles meles (Linnaeus, 1758)
Mellivora capensis (Schreber, 1776)

Family 3: Viverridae

Genetta genetta senegalensis (Fischer, 1829)

Family 4: Herpestidae

Herpestes i. ichneumon (Linnaeus, 1758)

Family 5: Hyaenidae

Hyaena hyaena dubbah (Meyer, 1793)
Crocota crocuta (Erxleben, 1777)
Proteles cristatus pallidior Cabrera, 1910

Family 6: Felidae

Felis chaus nilotica De Winton, 1898
F. sylvestris libyca (Froster, 1780)
F. s. tristrami (Pocock, 1944)
F. m. margarita Loche, 1858
Caracal caracal schmitzi (Matschie, 1912)
Panthera pardus jarvisi Pocock, 1932

P. p. pardus (Linnaeus, 11758)
Acinonyx jubatus (Schreber, 1776)

5. Order: Hyracoidea

Family: Procaviidae

Procavia capensis syriaca (Schreber, 1784)
P. c. ruficeps (Hemprich and Ehrenberg, 1832)

6. Order: Perissodactyla

Family: Equidae

Equus asinus africanus (Fitzinger, 1857)

7. Order: Artiodactyla

Family: Bovidae

Gazella l. leptoceros (F. Cuvier, 1842)
G. dorcas littoralis (Blaine, 1913)
G. d. dorcas (Linnaeus, 1758)
G. d. saudiya (Carruthers and Schwarz, 1935)
G. gazella arabica (Lichtenstein, 1827)
Capra ibex nubiana (F. Cuvier, 1825)
Ammotragus lervia ornatus (I. Geoffroy St. Hilaire, 1827)