ECOLOGICAL SURVEY OF BURULLUS NATURE PROTECTORATE

MAMMALS

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INTRODUCTION

Lake Burullus is located along the Mediterranean coast, between the two branches of the Nile. The lake is about 56 km in length and varies in width from 6 to 16 km. It is connected to the sea through a 50m. wide outlet near the village of Burg El-Burullus. The depth of the lake varies between 0.5 to 1.6 m, with the eastern part being the shallowest (Meininger and Mullie, 1981). The land bar that separates the lake from the sea varies in width from a few hundred meters to about 7 km and is mostly covered with sand dunes (Abu Al-Izz, 1971). There are more than 30 islands in the lake covering a total area of 1196 ha. To the south of this, extensive areas of saltmarshes are found. These extensive marshes are described as “the most virginal community of the Nile Delta” (Goodman et al., 1989).

The coastal land to the east of the exit of lake is covered by sand dunes that extend for about 15 km east of the outlet. The strip of land to the west of this outlet has no sand dunes comparable to those on the east. This pattern is repeated at the sites of all the several branches of the Nile that emptied directly into the Mediterranean until the ninth century. The sand was obviously brought to the shore-line with the Nile sediments discharged at the mouth (Zahran, 1992).

The first modern treatment of the Egyptian mammalian fauna was Anderson’s (1902). Numerous papers were published which dealt with local collections and descriptions of new forms, and these were summarized by Flower (1932). Numerous publications followed including those by Innes (1932), Wassif (1944; 1949; 1953 a; b; 1954; 1956; 1960 a; b; 1962), Setzer (1952; 1957; 1958 a; b; 1961 a; b). Wassif and Hoogstraal (1953) and Sanborn and Hoogstraal (1955) were dealing mostly with distributions and taxonomically aspects of the Egyptian mammalian fauna, provided valuable information on the habitats of these animals. Hoogstraal (1962; 1963; 1964) reviewed the literature on Egyptian mammals since Flower’s paper (1932). Osborn and Helmy (1980) wrote the most yet comprehensive monograph on the land mammals of Egypt that also included considerable ecological data on many of the species covered.

This report presents the results of a field survey of the mammals of Lake Burullus in northern Nile Delta. The survey aimed to study the diversity of the mammalian fauna of this area and gather information on their ecology and distribution. The study also covers other species that have not been collected during
this survey but are known or expected to occur in the area. Detailed description of each species and its habitats, along with other information that may in its field identification are also included. The status of each species in Egypt is also included using the standard IUCN categories (ANNEX I) and based on threatened species lists prepared by Saleh (1993, 2000). Status of species that are not covered in these lists are assessed on the basis of available data and according to IUCN criteria (ANNEX II).
METHODS

The area was explored to identify main types of habitats, to sample the mammalian fauna of these areas, and gather information on their local distribution and other ecological data.

Identification of habitats has been described in this report. A number of sites were selected for sampling mammalian fauna. These sites cover the Mediterranean coast, sand dune, salt marshes and islands of the area especially that covered by sand. Two large islands only in the lake are studied intensively, and the others extensively. At each site, several methods were used to survey the mammalian fauna.

Larger mammals and easily observable diurnal species were observed directly in the field, or their presence in the study area was confirmed by observing their tracks, dropping or remains. On the other hand, small carnivores and other mid-size mammals were captured in large, folding live traps baited with sardine or meat bait. In most cases, trapped animals were examined, identified, measured and then released at the point of their capture.

Rodents were collected using folding Sherman live traps and snaptraps set near their burrows or at expected foraging areas and baited with peanut butter and bread. Animals collected in the snap traps were examined, measured then prepared into study skin with their skulls, stomach contents and reproductive systems preserved for further examination at the laboratory. Rodents captured into live traps were examined, measured and released at the site of their capture.

At the laboratory, the stomach contents and fecal pellets were weighed, examined and categorized into main items. The identification of plant fragments in the stomach contents or fecal pellets were based on the comparison of plant epidermal remains with a reference collection prepared from plants present at the study area. The reference slides were prepared using Storr’s method (1961). Frequency of occurrence of different food items was calculated according to the method developed by Sparks and Malechek (1968). Animal items in the food were identified to the smallest possible taxonomic category. Identification to the species level was possible if the entire animal or fragments representing characteristic morphologic feature of the species represented the item (Basuony, 1998).
RESULTS

Mammalian Fauna of Lake Burullus Nature Protectorate

A total of fifteen species of mammals were recorded in Burullus area representing ten families belonging to four orders (Table 1). In the following species account a description of these mammals is presented. Materials examined are listed according to collection locality. Scientific and common names, distribution, habitats and status as well as some ecological data of each species are given. The system of classification followed is that adopted by Osborn and Helmy (1980) and Qumsiyeh (1985). The status of each species is given using IUCN categories (IUCN, 1996) and based on status lists of Egyptian mammals (Saleh, 1993; 2000).

Table 1: Mammals recorded from Burullus Nature Protectorate and adjacent areas.

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| 4 | 10 | 13 | 15 |
SPECIES ACCOUNT

Order Insectivora

Family Erinaceidae

Hemiechinus auritus (Gmelin, 1770)

Common names: Long Eared Hedgehog, Qunfid.

Collection/ observation locatities: Kom El-Aakolla (N 31 31 50, E 31 48 56) and Abu Slyman (N 31 35 22, E 31 06 42)

Distribution: H. auritus has a range that extends from the coast of Libya and Egypt to Asia Minor, northern Arabia, southern USSR, Iran, Pakistan, Chinese Turkistan and Mongolia. In Egypt, it is distributed along the Mediterranean coast, Nile Delta, Nile Valley south to Samalut and El-Faiyum.

Hemiechinus auritus  Photo by M. Saleh

Distribution of H. auritus in Delta

Description: A small hedgehog with long ears. Face is pale brown to buffy white; belly is white and base brownish. A foot is whitish to pale brown. Tips of dorsal spines white. Gap in spines of forehead lacking. Adult head and body length averages 181 mm, tail 24 mm, foot 35 mm, ear 41 mm and condyloincisive length 44.7 mm.

Comparison: Hemiechinus auritus is distinguishable from other Egyptian hedgehogs by smaller dimensions, paler colour and lack of gap in forehead spines.

Habitats and ecology: It inhabits gardens, olive gardens, cultivated areas and more densely vegetated areas of the coastal desert. Nocturnal species and feeds on insects (Osborn and Helmy, 1980) as well as lizards (Saleh and Basuony, 1998).

Status: Lower Risk, least concern.

Remarks: This hedgehog has been collected only from Baltim and El-Burg, north of Baltim, by Flower (1932), Wassif (1953b), Setzer (1957b) and Osborn and Helmy
(1980). The study adds another locality of this species in the area. The subspecies occurring in the Delta is *aegyptius* (Osborn and Helmy, 1980)

Tracks of *Hemiechinus auritus*

Skull of *Hemiechinus auritus* (After Osborn and Helmy, 1980).
Family Soricidae

*Crocidura flavescens deltae* Haim de Balsac and Barloy, 1966

**Common names:** Giant Musk Shrew, Far, Ersa.

**Collection/observation localities:** West of El-Burg (N 31 34 34, E 30 57 51)

**Distribution:** Egypt, Sudan, Ethiopia and the rest of Africa south into South Africa; West Africa north to Sierra Leone. In Egypt, it inhabits Nile Delta and Valley as far south as Dahshour and in El-Faiyum.

**Description:** Large white toothed shrews. Head and body length 70 mm or more. Fur short and dense. Ear scarcely protruding beyond fur. Tail with conspicuous and scattered bristle hairs on proximal two-thirds. Venter dark gray and hind foot length 18 mm or more. Condylolincisive length 15 mm or more.

**Comparison:** *Crocidura flavescens* is distinguishable from other species of Egyptian shrews by its larger size.

**Habitats and ecology:** This species inhabited richly weeded canal margins in Nile Delta and Valley (Hoogstraal, 1962) and dry wells in summer. It is nocturnal species. Nests are balls of grass and always moist and feeds on insects as well as snail shells (Hoogstraal, 1962).

**Status:** Lower Risk, least concern.

**Remarks:** Osborn and Helmy (1980) recorded this species from Baltim only.

**Skull of *Crocidura flavescens deltae*. After Osborn and Helmy (1980)**
**Crocidura floweri** Dollman, 1915

**Common name:** Flower’s shrew.

**Collection/observation localities:** El-Hanafy (N 31 31 45, E 31 49 10)

**Distribution:** Egypt, Sudan, Ethiopia and the rest of Africa south into South Africa; west Africa north to Sierra Leone. In Egypt, it inhabits Nile Delta and Valley, Wadi El-Natroun and El-Faiyum.

**Description:** Small white toothed shrews. Head and body length 72 mm or less. Fur short and dense. Ear scarcely protruding beyond fur. Tail with inconspicuous and limited bristle hairs on proximal one-half. Dorsum brownish; cranium convex and hind foot length 12 mm or more. Condyloincisive length 20 mm or less.

**Comparison:** This species can be distinguished from any other Egyptian shrews by relatively small size but larger than *C. nana*.

**Habitats and ecology:** This shrew inhabits fields and gardens

**Status:** Lower Risk, least concern.

**Remarks:** Flower (1932) collected only one specimen from the stomach of cattle egret.
Order Rodentia

Family Cricetidae

_Gerbillus andersoni andersoni_ De Winton, 1902

Common names: Anderson’s Gerbil, Bayoudi.

Collection/observation localities: Kom El-Aakolla (N 31 31 50, E 30 48 56).

Distribution: Jordan, Egypt, Libya and Tunisia. In Egypt, it is recorded only from northeastern Sinai.

_Gerbillus andersoni_ Photo by M. Saleh

Distribution of _G. andersoni_ in Delta

Description: Desert gerbil with brownish orange dorsal sides. Side is clear orange and its colour extends onto upper foreleg and heel. A whitish postorbital and postauricular area is small and inconspicuous. Ear and sole is pigmented.

Comparison: _Gerbillus andersoni_ can be distinguished from other Egyptian _Gerbillus sp._ by generally darker colour.

Habitats and ecology: Nocturnal species that inhabited sandy areas. However, it does not inhabit more rigorous desert areas (Hoogstraal, 1963).

Status: Lower Risk, least concern.

Remarks: This subspecies is darker than _bonhote._
**Psammomys obesus** Cretzschmar, 1828

**Common names:** Fat Sand Rat, Jerdy, Jarada.

**Collection/observation localities:** Mastroh (N 31 28 55, E 30 41 15) and El-Kom El-Akhdar (N 31 26 58, E 30 49 24)

**Distribution:** North Africa, Sudan, Arabia and Palestine. In Egypt, it distributes in the northern part of Sinai and northern part of eastern desert

**Psammomys obesus Photo by M. Saleh**

**Distribution of P. obesus in Delta**

**Description:** Stocky rodents. Dorsal surface is blackish to reddish orange while side and venter is yellowish. Short, rounded and densely haired ears. Tail is thick and shorter than head and body (less than 85%) with black prominent tip. The skull is angular and strongly ridged.

**Habitats and ecology:** Habitats of *Psammomys obesus* are saline soils and salt marshes with stands of succulent halophytic such as *Anabasis articulata* of the study area. This is a colonial desert rodent. Sand rats are strictly diurnal, but Atallah (1967) testified to its nocturnal activity in Jordan. Tunnels of a burrow system are seldom deeper than 0.5 m., but may be several meters in length. The number of openings 6-21 with an average of 11 (Osborn and Helmy, 1980).

**Comparison:** The only Egyptian rodent with which *Psammomys obesus* might be confused is *Meriones crassus*, however, slightly longer tail and ears, bicoloured tail tip, which belly in *Meriones* distinguish that species from *Psammomys obesus*

**Status:** Lower Risk, least concern.

**Remarks:** This species has not been recorded from Delta region except one specimen collected from Quweisna and recorded as subspecies *obesus* (Osborn and Helmy, 1980)

Skull of *Psammomys obesus* (After Osborn and Helmy, 1980)
Family Muridae

*Rattus rattus* (Linnaeus, 1758)

**Common names:** House Rat, Black Rat.

**Collection/observation localities:** El-Hannafy (N 31 31 45, E 31 49 10)

**Distribution:** Cosmopolitan species. In Egypt, *Rattus rattus* is distributed in Nile Valley and Delta, coastal towns and certain oases in western desert.

**Description:** Large murids with relatively harsh pelage that brownish dorsally. Tail is slender and bicoloured and length is more than 100% of head and body. Ear length is more than one-half hind foot length. Skull massive and strongly ridged.

**Comparison:** *Rattus rattus* differs externally from *R. norvegicus* in having head and body length averaging shorter, tail longer rather shorter than head and body length, and ear more than one-half hind foot length.

**Habitats and ecology:** It is commensal with man. Diurnal and nocturnal, and feeds on vegetables and seeds.

**Status:** Lower Risk, least concern.

**Remarks:** The specimens of the study seem to be darker than that of Sinai.

**Skull of Rattus rattus** (After Osborn and Helmy, 1980)
*Rattus norvegicus* (Berkenhout, 1769)

**Common names:** Norway Rat, Brown Rat, Sewer Rat.

**Collection/observation localities:** Baltim (N 31 35 52, E 31 05 47) and El-Hanafy (N 31 31 45, E 31 49 10) in addition to one specimen accidented by a car in El-Banayen village.

**Distribution:** Nearly cosmopolitan species due to accidental transportation by man. In Egypt, it is known in coastal towns, Nile Delta and Valley.

**Description:** Large murids (as twice as *Rattus rattus*) with relatively harsh pelage that brownish dorsally. Tail is thick and bicoloured and length is less than 100% of head and body. Ear length is less than one-half hind foot length. Skull massive and strongly ridged.

**Habits and ecology:** Commensal with man. Mainly nocturnal species. Diet of *R. norvegicus* to be omnivorous.

**Status:** Lower Risk, least concern.

**Remarks:** Although this animal is widespread, Osborn and Helmy (1980) collect only one specimen from Baltim and another one from Al-Hamoul.

**Skull of Rattus norvegicus (After Osborn and Helmy, 1980)**
*Mus musculus praetextus* (Brants, 1827)

**Common names:** House Mouse, Far, Sisi.

**Collection/observation localities:** El-Kom El-Akhdar Island (N 31 26 58, E 30 49 24) and Kom Deshema Island (N 31 25 01, E 30 40 10)

**Distribution:** Cosmopolitan species. In Egypt, *Mus musculus* is distributed in Mediterranean coastal areas, Nile Valley and Delta and oases of western desert.

**Mus musculus Photo by M. Saleh**

**Distribution of M. musculus in Delta**

**Description:** Small murids with soft pelage that grayish to brownish in dorsal surface. Tail is usually slightly longer than head and body length. Their annulations almost concealed by hairs. The skull is fragile and rounded.

**Comparison:** *Mus musculus* can be distinguished from most other Egyptian mice by small size; lack of contrasting head, side and rump markings; and tail lacking a brush.

**Habitats and ecology:** It inhabits houses, tents, grain stores, gardens and salty areas. Nocturnal species. Burrows is shallow and usually under shrubs.

**Status:** Lower Risk, least concern.

**Remarks:** The colour of the specimens captured during this survey is black when compared with the same species in other localities. Four individuals are captured from one burrow in Kom Deshema Island with insect remaining.

**Skull of Mus musculus (After Osborn and Helmy, 1980)**
**Order Carnivora**

**Family Canidae**

*Canis aureus* Linnaeus, 1758

**Common names**: Abu Soliman, Jackal, Deeb, Ibn Awee.

**Collection/observation localities**: El-Tolombat (N 31 30 51, E 31 03 51) by verbal locals.

**Distribution**: Canis aureus extends from southeastern Europe through Asia Minor and southern USSR to Iran, India, Burma and Thailand. It also ranges widely in Africa, from Senegal to Egypt, south to Sudan, Ethiopia and Kenya. In Egypt, it is known in Sinai, northern part of eastern desert, Nile Delta and Valley and bordering deserts, western Mediterranean coastal desert and oases of western desert.

**Description**: Dog-like carnivore with broad dorsal mane. Agouti nature of hairs on hip gives an impression of broken stripes. Side is yellowish with scattering of black- and white-tipped hairs. There is black marking on anterior of forelimb. Tail is relatively short with black tip. Pupil of eye is rounded. Frontal region of skull is inflated and cranial ridges are high and prominent.

**Comparison**: *Canis aureus* is distinguishable from other Egyptian canids in having the dorsum blackish and maned, frontal region of skull elevated, a prominent postorbital swelling, cranium broadest at bases of zygomatic processes and larger dimensions.

**Habitats and ecology**: Along the rivers and cultivated lands. Frequently seen in isolated cliffs and rocky hillocks in semi-barren desert. Nocturnal scavenger. Their dens are found in tombs, natural caves and crevices.

**Status**: Vulnerable.
Remarks: This species has not been recorded from the Nile Delta. Their scavenging habits frequently render them a nuisance in the vicinity of human settlements, and they are often killed with poisoned baits, a practice that is seriously threatening their survival. Attacks of humans are rare, but not unknown (Harrison and Bates, 1991). There appears to be no evidence to support the view of Flower (1932) that the large Egyptian race *Canis aureus lupaster* occurs in Palestine and recent studies suggest that this form is in fact a wolf (Ferguson, 1981)

Skull of *Canis aureus* (After Osborn and Helmy, 1980)
*Vulpes vulpes* (Linnaeus, 1758)

**Common names:** Taalab, Abu Hussein, Red Fox.

**Collection/observation localities:** Coastal plain from El-Burg to Mastroh (especially at site of N 31 31 50, E 30 49 05) and tracks seen in the islands of the lake.

**Distribution:** *V. vulpes* is very widely distributed, with a range that includes Europe and continental Asia, northern India, peninsular Indochina, Japan, Palaearctic Africa and North America. In Egypt, it is found in it is known in Sinai, northern part of eastern desert, Nile Delta and Valley and western Mediterranean coastal desert.

**Description:** Large reddish fox. The dorsal surface is reddish to reddish brown; side is yellowish gray and venter is brownish or blackish. Tail is long, bushy and club-shaped with white tip. Ear is relatively large and black posteriorly. Pupil of eye is elongate vertically. Skull is broadest on sides, narrower at base and frontal region of is not inflated.

**Comparison:** *Vulpes vulpes* differs from other Egyptian foxes by darker colour, back of ear being black instead of pale brown in *V. rueppelli*, venter blackish and presence of black mark on foreleg.

**Habitats and ecology:** Inhabits date and fruit groves, cultivated areas and suburban gardens. Not strictly nocturnal. Commonly seen during daylight hours. Feeds on birds, rodents and insects (Basuony, 1998).

**Status:** Lower Risk, least concern.

**Remarks:** According to Osborn and Helmy (1980) this fox is belonging to subspecies *aegyptiaca* that widespread in Nile Delta and Valley.

Family Viverridae

Skull of *Vulpes vulpes* (After Osborn and Helmy, 1980)
**Herpestes ichneumon ichneumon** (Linnaeus, 1758)

**Common names:** Egyptian Mongoose, Nims.

**Collection/observation localities:** El- Kom El-Akhdar Island of Lake Burullus (N 31 26 58, E 30 49 24)

**Distribution:** *H. ichneumon* ranges widely in Africa, from Morocco and Egypt in the north to Cape Province in the south. It is also known from Spain, Portugal and Turkey. In Egypt, it is known from Nile Delta, Nile Valley south to Asyut, El-Faiyum and Burg el Arab.

*Herpestes ichneumon* Photo by M. Saleh

**Description:** Weasel-like carnivore. Body is elongated. Pelage is long, coarse with blackish brown grizzled. Tail is long and tapering with black tip and flattened base. Palm and sole are naked. Claws are noncontractile. Ear is short, broad and rounded. Skull is elongated and broadest at the base of zygomatic process.

**Comparison:** *Herpestes ichneumon* is distinguishable from all other Egyptian carnivores by its speckled colouring; long and tapering tail; short and broad ears; high and narrow skull.

**Habitats and ecology:** Cultivated areas of Nile Valley and Delta, near water. Terrestrial species, but readily enters water and swims well. Diurnal and crepuscular. Feeds on rodents, bird, poultry, reptiles, frog and various aquatic and terrestrial invertebrates (Harrison and Bates, 1991). It is hunt their prey by speculation and tend to take a variety of species (Cloudsley- Tompson, 1996).

**Status:** Lower Risk, least concern.

**Remarks:** The only specimen was seen as jumping from the island land to reed bed through water canal.

Skull of *Herpestes ichneumon* (After Osborn and Helmy, 1980)
Family Felidae

*Felis chaus nilotica* De Winton, 1898

**Common names:** Jungle Cat, Swamp Cat, Qut Barri.

**Collection/observation localities:** El-Kom El-Akhdar Island of Lake Burullus (several tracks were seen at position: N 31 26 54, E 30 49 41)

**Distribution:** It ranges from Egypt through to Asia Minor, eastern Transcucasia and north along the west shore of the Caspian Sea to the Volga delta. It is also known from Iran, Afghanistan, Chinese Turkestan, India, Sri Lanka, Burma and Vietnam. In Egypt, it is known in Nile Delta, Nile Valley south to Aswan, El-Faiyum, Farafra and Dakhla oases and western Mediterranean coastal desert.

**Description:** Large cats. Colour is dark, grizzled is buff. Lacrimal stripe is dark brown and prominent. Chick stripe is absent. Ear is reddish brown with black tip and small tuft. Tail is relatively short (one-third head and body length) with several black distal rings and black tip. Skull is large and condyloincisive length over 95 mm.

**Comparison:** Felis chaus can be distinguished from other Egyptian felids by less conspicuous body markings; cheek stripe lacking; black ear tufts; tail shorter and skull more elongate.

**Habitats and ecology:** Low cultivated or marshy ground, reed beds or any similar thick cover (Anderson, 1902; Flower, 1932; Osborn and Helmy, 1980). We saw a specimen in reed swamp, *Phragmites australis*. It is primarily diurnal. Its diet consists principally of birds, small mammals, frogs and snakes of the genus *Coluber* and *Psammophis* (Harrison and Bates, 1991).

**Status:** Vulnerable.
Remarks: The previous record of *Felis chaus* from Egyptian desert is from western desert, Nile Valley and southern corner of the Nile Delta (Saleh, 1993). The record of the present study added new geographical record of this species.

Skull of *Felis chaus* (After Osborn and Helmy, 1980)
**Order Chiroptera**

Several species of bats are known to occur in Delta region (Qumsiyeh, 1985). Bats apparently belonging to more than one species were observed flying over the area at night. The identity of these bats, however, could not be ascertained since I was not able to find any roosts within the boundaries of the protected area. The following is brief account of the species that are most likely to be at least foraging in the Burullus area.

**Sub-Order Megachiroptera**

**Family Pteropodidae**

*Rousettus aegyptiacus* (Geoffroy, 1810)

**Common names**: Egyptian Fruit Bat, Khafash El-Fawakeh, Khafash Masri.

**Distribution**: *R. aegyptiacus* ranges westwards from Baluchistan, south-east Iran, Kishim Island in the Persian Gulf through to Arabia, Turkey, Cyprus and Africa, where it is widely distributed from Egypt and Eritrea west to Ghana and south to Angola and the Cape.

In Egypt, it is known in most cultivated areas of Nile Valley and Delta.

**Habitats**: It roosts in large colonies in mosques, wells, old ruins, tombs and deserted houses.

**Ecology**: Nocturnal and become active shortly after dusk and have another peak of activity in the early morning hours. It feeds on sycamore, mulberries, dates and figs (Anderson, 1902; Madkour, 1977).

**Status**: Lower Risk, least concern.

**Remarks**: Anderson (1902) recorded this species from Baltim.

**Sub-Order Microchiroptera**
Family Rhinopomatidae

Rhinopoma microphyllum (Brunnich, 1782)

**Common name:** Greater Mouse-tailed Bat.

**Distribution:** Rhinopoma microphyllum distributed widely from Morocco, Senegal and Nigeria to East Africa, Arabia, Iran, Afghanistan, Pakistan, India, Thailand and Sumatra.
In Egypt, it is known from Nile Valley, particularly around Cairo, and Delta region.

**Habitats:** Dry caverns, ruins, ancient temples and old buildings.

**Ecology:** Nocturnal. Pellets of the owl, Tyto alba, is containing three skulls of this bat (Dor, 1947).

**Status:** Lower Risk, least concern.

**Remarks:** Anderson (1902) recorded this species from Baltim.

Family Vespertilionidae

Pipistrellus kuhlii (Kuhl, 1819)

**Common name:** Kuhl’s Pipistrelle.

**Distribution:** P. kuhlii is a very widely distributed bat with a range that extends from southern Europe to Pakistan and most of Africa; from Morocco to Egypt and south to South Africa.
In Egypt, it is abundant around human populated areas in northern Egypt.

**Habitats:** Crevices in the walls and roofs of building as well as underground tunnels.
**Ecology**: Colonial species.

**Status**: Widespread but not common.

**Remarks**: Anderson (1902) recorded this species from Baltim.
Zoogeography of mammals in the study area

Of fifteen species that recorded from Burullus and adjacent areas, three are Afrotropical species with wide distribution in Africa south of the Sahara: *Crocidura flavescens*, *Rousettus aegyptiacus* and *Herpestes ichneumon*. The latter occurs north through the eastern Mediterranean to Turkey. The same can be said for *Rousettus aegyptiacus*, the distribution of which reach to Cyprus and Iran, and *Crocidura flavescens* occurs only in Africa.

Table 2: The mammals recorded from Burullus and their major zoogeographical subdivisions. AF= Afrotropical, SS= Saharo-Sindian, PL= Pluriregional, WD= Widespread and EN= Endemic species.

<table>
<thead>
<tr>
<th>Species</th>
<th>AF</th>
<th>SS</th>
<th>PL</th>
<th>WD</th>
<th>En</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Hemiechinus auritus</em></td>
<td>+</td>
<td></td>
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<tr>
<td><em>Crocidura flavescens</em></td>
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<tr>
<td><em>Crocidura floweri</em></td>
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<tr>
<td><em>Rousettus aegyptiacus</em></td>
<td>+</td>
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<tr>
<td><em>Rhinopoma microphyllum</em></td>
<td>+</td>
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</tr>
<tr>
<td><em>Pipistrillus kuhlii</em></td>
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<td>+</td>
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<tr>
<td><em>Gerbillus andersoni</em></td>
<td>+</td>
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<td></td>
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<tr>
<td><em>Psammomys obesus</em></td>
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<tr>
<td><em>Rattus rattus</em></td>
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<tr>
<td><em>Rattus norvegicus</em></td>
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<tr>
<td><em>Mus musculus</em></td>
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<td></td>
<td></td>
<td>+</td>
<td></td>
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<tr>
<td><em>Canis aureus</em></td>
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<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Vulpes vulpes</em></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Herpestes ichneumon</em></td>
<td>+</td>
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<td></td>
<td></td>
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<tr>
<td><em>Felis chaus</em></td>
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<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><strong>15</strong></td>
<td><strong>3</strong></td>
<td><strong>4</strong></td>
<td><strong>1</strong></td>
<td><strong>6</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

Four species occurring in the study area are distributed in the intermediate zone between the Palearctic and the Ethiopian regions (that is, North Africa, Africa and southwest Asia), with some reaching the Oriental region. These are *Rhinopoma*...
microphyllum, Hemiechinus auritus, Gerbillus andersoni and Psammomys obesus. These species are adapted for semidesert habitats especially oases and wadi beds and may be termed Saharo-Sindian (Atallah, 1977) or Saharo-Arabian (Zohary, 1973).

The pluriregional species that common to Mediterranean and Saharo-Sindian regions is represented by Jungle cat, Felis chaus. On the other hand, Crocidura floweri is the only endemic species that occur in the Nile Valley of Egypt.

Finally there are six widespread species including Pipistrillus kuhlii, Rattus rattus, Rattus norvegicus, Mus musculus, and two carnivores: Canis aureus and Vulpes vulpes (Table 2).
Mammalian habitats

Fifteen species of mammals were recorded from the different habitats of the study area. Coastal plain, sand dunes and salt marshes represent the basic, recognizable habitat types in the area. The results indicated that the coastal plain is inhabited by the largest number of the mammalian species (13 species; 87% of mammalian species). Salt marshes comes next that inhabited by eight species (53% ), whereas 6 species (40% of mammalian species) were recorded from sand dune habitat type(Table 3).

Table 3: Mammals recorded from Burullus and adjacent areas.

<table>
<thead>
<tr>
<th>Species</th>
<th>Coastal plain</th>
<th>Sand dunes</th>
<th>Salt marshes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Hemiechinus auritus</em></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Crocidura flavescens</em></td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Crocidura floweri</em></td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Rousettus aegyptiacus</em></td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Rhinopoma microphyllum</em></td>
<td>+</td>
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<td></td>
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<tr>
<td><em>Pipistrillus kuhlii</em></td>
<td></td>
<td>+</td>
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<tr>
<td><em>Gerbillus andersoni</em></td>
<td>+</td>
<td>+</td>
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<tr>
<td><em>Psammomys obesus</em></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Rattus rattus</em></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Rattus norvegicus</em></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Mus musculus</em></td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Canis aureus</em></td>
<td>+</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><em>Vulpes vulpes</em></td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Herpestes ichneumon</em></td>
<td>+</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><em>Felis chauss</em></td>
<td>+</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>15</td>
<td>13</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

The results showed that five species are restricted to only one habitat type belonging to the genera *Hemiechinus, Rhinopoma, Pipistrillus* and *Rattus*. Eight species including *Crocidura flavescens, C. floweri, Rousettus aegyptiacus, Gerbillus andersoni, Psammomys obesus, Canis aureus, Herpestes ichneumon* and *Felis chauss*
were recorded in two habitat types. Only two species were found in three habitat types namely: *Mus musculus* and *Vulpes vulpes*.

A statistical comparison of the mammalian faunal assemblages of the habitat types of the study area was carried out using Morton and Davidson’s (1988)-similarity index. The similarity index between the mammalian faunal assemblages of the study area was relatively high. The highest value of similarity index (0.67) was recorded between coastal plain and salt marsh habitats. The lowest similarity index (0.42) was found between the mammalian assemblages of coastal plain and sand dune habitats. A similarity index of 0.43 was calculated for the mammalian fauna of sand dunes and salt marshes.
RECOMMENDATIONS

Wetlands are among the most productive ecosystems in the biosphere. They provide tremendous economic benefits to mankind through fishery production. They also provide critical habitats for many species of mammals as well as other animals. One of the Egyptian wetlands is Lake Burullus in the northern Nile Delta.

The results of the survey showed that the study area is rich in its biodiversity. Of the mammals inhabiting the study area, two species are threatened. These are the Wolf Jackal *Canis aureus lupaster* and the Jungle Cat *Felis chaus*. The protected area will play a key role in the preservation of these species. It is critically important, however, that the area be sufficiently large to provide the diverse habitats that can sustain the present faunal diversity. Areas that appear to contain the highest mammalian diversity in the protectorate include the area from the town of El Borg, through Kom Al-Akolaa to Mastaroh north of the international road and the two large sandy islands of El-Kom Al-Akhdar and Kom Deshema. These areas should receive careful management considerations, possibly as core area(s) to preserve their valuable mammalian biodiversity.

Mammals of the area, particularly those that are known to be threatened, require further, more detailed studies. These may include the ecology and biology of these species covering basic aspects such as population size and dynamics, home range, habitat requirements, competition with feral domestic mammals, impact of human activities, etc. In addition basic knowledge of the present and expected interactions between species inhabiting the area requires more detailed studies than was possible during this survey. Particularly important, from a management point of view will be the investigation of trophic relationships among key mammalian species in the area.

Certain mammalian species may also serve as indicators of the effectiveness of the management practices and the general ecological health of the protected area. These potential indicators should be selected and studied in detail to allow their inclusion in the monitoring plan of the area.
REFERENCES


