

2.3 EGYPT

Introduction

Egypt has an area of 1 000 250 km², a population of 46 000 000 (1984), and thus a mean population density of 46 persons/km². This however is very misleading, since some 70% of the people live in Cairo and the Nile Delta, and most of the remaining 30% in the Nile Valley. Population densities exceed 20 100/km² in some urban areas. Egypt is bounded by Libya in the west, Sudan in the south, and Israel in the east. The Mediterranean coast is almost 1100 km long, and the east coast, which includes the west coast of the Gulf of Aqaba, both coasts of the Gulf of Suez, and a length of Red Sea coast, is some 1780 km long. The country stretches 1095 km from north to south between latitudes 21°47' and 31°38'N, and about 1140 km from west to east between longitudes 24°42'E on the Libya/Egypt border and 35°47'E at Ras Binas on the Red.

The Nile divides the plateau across which it flows into two regions, the Western Desert and the Eastern Desert. The Western Desert, between Libya and the Nile, is arid and without wadis. In the west it comprises a great sea of blown sand, but nearer to the Nile it is rocky. It sinks to a number of large depressions in which there are oases, and rises to heights over 1000m in the extreme SW on the Gilf Kebir Plateau. This towers over the surrounding desert from which it ascends by cliffs and scarps.

The lower Nile Valley is a verdant strip across the desert, demarked by steep valley sides, except on the wet bank above Cairo, where land, after rising a little, slopes down to the depression and lake of Qârûn, 45 m below sea level. Below Cairo the valley flattens out and the river enters the delta which is criss-crossed by canals and distributaries. The delta is 300 km wide, 175 km deep and covers 26 000 km². A number of swampy lakes and large lagoons line its seaward face.

A discontinuous range of mountains in the Eastern Desert, orientated NNW-SSE separates the Nile Valley from the Gulf of Suez and the Red Sea, and reaches a high point of 2187 m at Gebel Shiyib el Banat (26°59'N/33°29'E). The Eastern Desert is extensively dissected by deep wadis which run down from these gullied mountains to the Nile, while to the east, other wadis lead to the sea across a narrow coastal plain. Parallel to the shore there is an almost continuous line of coral reefs.

Sinai is another desert. The hills along its two gulf coasts rise and converge southwards to form a sharply serrated range of a mountains near the tip of the peninsula. Here, Gebel Katherina (28°30'N/33°57'E) is the highest point in Egypt (2637 m asp. All of Sinai is gullied, with wadis leading directly to the gulfs on either side, or into the centre, to the anastomosing system of the Wadi el Arish which runs north to reach the Mediterranean Sea (31°08'N/33°52'E) near the town of El Arish.

Climate

The Tropic of Cancer runs through southern Egypt, 94.6% of which is true desert.

Precipitation over the Western Desert is minimal and many consecutive years may be completely rainless. Mean annual rainfall at Cairo is only 25 mm. However, the Mediterranean coast and the mountains along the Red Sea attract some winter rain. Alexandria (31°12'N/29°58'E) on the Nile Delta has a mean annual rainfall of 147 mm, but Hurghada (27°18'N/33°47'E) on the Red Sea coast receives only 3 mm/yr. Precipitation in the hills of the Eastern Desert and Sinai is very variable. In these places a stream may flow as a torrent for a day or so after a storm, during which over 100 mm of rain may fall, but it may thereafter remain dry for several years.

There are two seasons. Winter lasts from November to March, and summer from April to October. Winters are cool and mild, but summers are hot and dry. Then, in the deserts, daytime temperatures may reach 48°C but may fall to 10°C at night. Temperatures may also reach 48°C along the Red Sea, but seldom fall below 14°C at night. NE winds predominate in winter, but it is the occasional westerly winds that bring rain. In summer, winds are from the SW, off the Sahara. January is the coolest month throughout the country, when mean monthly minima and maxima are 9.3 and 18°C at Alexandria, 8.6 and 19.1°C at Cairo, 11.3 and 18°C at Port Said and 8 and 23.8°C at Aswan. August is generally the hottest month, and at this time mean monthly minima and maxima are 22.9 and 30.4°C at Alexandria, 21.6 and 34.8°C at Cairo, 24.9 and 30.9°C at Port Said and 24.7 and 41.3°C at Aswan.

Wetlands

There are some important wetlands on the Mediterranean coast, and others of lesser size and importance on the eastern coasts. In Sinai, and on the Red Sea, some small swamps exist in the lower valleys of intermittent watercourses and there are extensive saltmarshes along the littoral. Mangroves have a discontinuous distribution from the tip of Sinai southwards. There are lakes in some depressions of the Western Desert. The Nile has a floodplain and a delta, and it is impounded at Aswan to form Lake Nasser.

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1. Wetlands of the Nile Delta

Wetland Name: The Delta Proper

Country: Egypt

Coordinates: 30°07' -31°36'N/29°53' -32°31'E

Area: 2 292 500 ha (total delta)

Altitude: 0-30 m asl

Nearest Towns: Alexandria (at W edge); Port Said (at E edge)

General: The delta is symmetrical. It is 175 km from apex to base, i.e. from Cairo to the sea, and some 263 km wide at the sea. Since the construction of the Aswan High Dam the delta is no longer subject to annual flooding, and much of the marshland has been reclaimed for agriculture. Of the persisting marshland, most is associated with the lakes and lagoons along the seaward face and is discussed in the succeeding sections. However, coastal erosion is increasing now that the Aswan Dam impounds most of the silt coming down river, and the integrity of the delta lakes is threatened. Below Cairo the Nile divides into the Rosetta (western) and Damietta (eastern) branches which reach the sea at places of these names. Several major canals and numerous distributary streams branch off from these main rivers. A number of small lakes occur in the delta, many representing sections of abandoned river channel. To the west of the Rosetta channel, just below Cairo, there are the two El Mallah Lakes (30°05' -30°07' N/31°03'-31°04'E) and Lake el Qatta (30°12'N/30°59'E), and farther north a cluster of 15 small lakes (30°48'-30°57'N/ 30°16'-30°39'E) near El Dilingat. Between the Rosetta and Damietta branches, shortly below the bifurcation, there is Lake Faraontya (30°21'-30°28'N/30°56'-31°03'E) which is a section of abandoned channel. To the east of the Damietta branch there are Lakes Sinnera and Sanel Hagar (31°05'N/31°55'E), just south of the large coastal lagoon of Manzala, and the Miheishar Lakes (30°44'N/31°53'-32°04'E).

Flora & Fauna: The delta wetlands have coastal fresh water floras and faunas as discussed in the regional introduction. *Phragmites australis*, *Typha capensis* and *Juncus maritimus* are common here, together with some small sedges. Papyrus is now virtually absent from the delta. Some marine fishes enter the delta, e.g. *Anguilla* spp., *Mugil cephalus* and *Solea vulgaris*. Several European animals are present including *Lutra lutra* and *Vulpes vulpes* and there is an abundant avifauna.

Human Impact & Utilisation: Most of the delta wetlands have been reclaimed for agriculture, but since the construction of the High Dam at Aswan the upper delta has tended to become progressively more saline. This is due in part to the intrusion of seawater, but also to the use of artificial fertilisers in the lower Nile Valley to compensate for the loss of silt which used to be deposited by the flood each year. By contrast the delta

lakes have become less saline due to increased drainage from irrigation schemes.

Conservation Status: Unprotected.

Wetland Name: Bahra el Maryut

Country: Egypt

Coordinates: 31°07'N/29°53'E

Area: 2700 ha (lake proper)

Altitude: 3 m bsl (water surface) Nearest Town: Alexandria (2 km SW)

General: This lake fills a depression below sea level and is separated from the sea by a limestone ridge. The water surface is now 3 m bsl. The lake used to have an area of about 11 000 ha, but most of this was reclaimed between 1950 and 1980. The Nozha Hydro-dome was isolated from Lake Maryut in 1939 and is now enclosed by a 9 km concrete embankment and is used as a fish farm.

Hydrology & Water Quality: Water depths vary between 90-150 cm and the bottom is covered by silt, clay and shells. It is fed chiefly by the Qalaa Drain and water from the lake is pumped to the sea. Water temperatures range from 13-30°C and Secchi depths of 10-100 cm are obtained. pH ranges from 7.0-9.7 and is lowest near industrial inputs. Total dissolved solids range from 1750-11400 mg/l. Chloride ion concentrations range from 3-9 mg/l and silicate from 8-17 mg/l. High nitrate and nitrite concentrations have been recorded but these are not permanent. The lake may become deoxygenated when levels of organic matter are high. The lake is unstratified because of wind action. Pesticides such as DDT and Lindane have been detected in the water in comparatively high concentrations.

Flora & Fauna: The southern shores are covered by dense reedbeds (*Phragmites australis*), together with *Cyperus* and *Juncus* spp. *Ceratophyllum denzersum* and *Najas pectinata* occur in the centre of the lake. The lake is eutrophic and primary production is high. Most of the Nile delta birds and mammals are found here.

Human Impact & Utilisation: A fishery on the lake is highly productive yielding some 17 000 tonnes/yr, i.e. 6200 kg/ha/yr. Currently *Oreochromis* spp. comprise 77% of the catch and *Clarias* spp. 17%. The lake is polluted by industrial and agricultural effluents and there is evidence of both heavy metal and pesticide accumulation in the fish.

Conservation Status: Unprotected.

Wetland Name: Bahra el Idku

Country: Egypt

Coordinates: 31°12'-31°16'N/30°08'-30°18'E

Area: 10 400 ha

Altitude: sea level

Nearest Towns: Alexandria (17 km W); Cairo (162 km SE)

General: This shallow brackish lake contains a number of islands and is situated 15 km SW of the mouth of the Rosetta branch of the Nile. It is 16 km long, has a maximum width of 10 km, and is separated from the sea by a narrow sand barrier. An extensive reed swamp at the eastern side has been partially reclaimed in recent years.

Hydrology & Water Quality: Water is received by drainage of the surrounding delta lands and exchange with the sea occurs through the Bougaz el Maadiah, with inflow from the sea occurring principally in winter. The lake is usually well oxygenated and water

temperatures range from 15-29°C. Chloride ion concentrations range from 0.5-23 mg/l, and total dissolved solids from 1000-45 000 mg/l.

Flora & Fauna: The flora and fauna are much as described in the regional introduction. The lake supports *Ceratophyllum demersum* and dense mats of *Eichhornia crassipes*, with *Potamogeton crispus* and *P. pectinatus* in the most saline areas. It is eutrophic and highly productive. The eastern marshes are dominated by *Phragmites australis*. European animals such as *Lutra lutra* occur here.

Human Impact & Utilisation: There is a flourishing fishery in which *Oreochromis* spp. account for 82% of the catch, *Anguilla anguilla* for 10% and *Mugil* spp. for 6%.

Conservation Status: Unprotected.

Wetland Name: Bahra el Burullus

Country: Egypt

Coordinates: 31°22'-31°35'N/31°31'-32°08'E

Area: 71 000 ha

Altitude: sea level

Nearest Towns: Alexandria (57 km SW); Cairo (154 km S)

General: This is a shallow brackish lagoon with numerous small islands. It is open to the sea through a narrow mouth at the northern extremity near the town of El Burg. Depths vary from 0.7-2.4 m, and changes in water level expose large areas of shoreline. The northern shore is separated from the sea by a long dune covered spit. The bottom is muddy along the southern shore, but sandy on the northern side.

Hydrology & Water Quality: Inflows from the land occur from 7 major drains along the southern shore, and discharges from these, together with rainfall and seepage from the Rosetta branch of the Nile, cause the lake level to rise and induce a net discharge to the sea in summer. However, seawater may enter in winter. Water temperatures range from 11°C in winter to 30°C in summer. The water is well mixed and well oxygenated, although turbid, with Secchi depths of only 8-37 cm. Chloride ion concentrations range from 0.3-14 mg/l, while silicate levels may reach 400 mg/l.

Flora & Fauna: This is essentially as described in the regional introduction. There are extensive reed beds dominated by *Phragmites australis*, with *Potamogeton* spp. dominant in the lake. *Ceratophyllum demersum*, *Eichhornia crassipes* and *Lemna gibba* are also present; *Lemna* forms scums on stagnant backwaters while *Eichhornia* is dominant in the drains. About 30 different fishes have been recorded from the lake including species of *Anguilla*, *Mugil* and *Solea*.

Human Impact & Utilisation: There is a fishery on the lake.

Conservation Status: Unprotected.

Wetland Name: Bahra el Manzala

Country: Egypt

Coordinates: 30°51'-31°33'N/31°45'-32°35'E (total system)

Area: 90 000 ha (open water) + 68 800 ha salt- marsh

Altitude: sea level (saltmarsh partly below sea level)

Nearest Towns: Port Said (at E end); Cairo (135 km SW)

General: This is the largest of the delta lagoons. It is situated between the Damietta Branch of the Nile and the Suez Canal, while the El Manzala Canal, which traverses the

lagoon, connects Port Said with Damietta. The lagoon is shallow, with a mean depth of 1 m, and salt-marshes extend southwards and eastwards from the SE corner. Some 48 800 ha of the salt-marsh, east of the Suez Canal, are below mean sea level. Because of reclamation the open water area has been decreasing steadily, from 170 000 ha at the turn of the century, to 90 000 ha in 1983. The present lagoon is 64 km long with a maximum width of 49 km and contains numerous islands.

Hydrology & Water Quality: There are several connections with the sea, the largest being at El Gamil. A number of drains enter on the southeastern shore, the largest of these being the Bahr el Bagar Drain and the Hadous Drain which between them discharge 5 billion m³/yr. The lake is moderately well oxygenated, but concentrations may fall to 4-5 mg/l or less in the south at night. Salinity has fallen over the last 50 years due to increased fresh water inputs from irrigation schemes and decreased connection with the sea. In 1926 mean salinity was in the region of 17‰, but this had decreased to a value of 3‰ by 1982. Salinity is now lowest in September-October and highest in March-April.

Flora & Fauna: Marshlands on the periphery are dominated by *Phragmites australis* and *Typha capensis*. The southern part of the lake supports beds of *Ceratophyllum demersum*, *Potamogeton crispus* and *P. pectinatus* and there is a dense phytoplankton. The lake is eutrophic and highly productive. *Eichhornia crassipes* is present and has been fought by aerial spraying. The fauna of peripheral wetlands is as described in the regional introduction.

Human Impact & Utilisation: The lagoon is the site of important capture fisheries and fish farms, the yields from which have increased with eutrophication. The total catch from open water fisheries in 1979-80 was 40 000 tonnes, while fish farms produced an additional 20 000 tonnes. *Oreochromis niloticus* is the most important species landed, closely followed by *O. aureus*, *O. galilaeus* and *Tilapia zillii*. *Liza ramada* used to be the most important species taken, but its proportion in the annual catch has declined to 2%. Other components of the catch include the marine species *Anguilla anguilla*, *Dicentrarchus labrax*, *D. punctatus*, *Liza saliens*, *Mugil cephalus*, *Sciæna aquila*, *Sparus aurata* and the shrimp *Palaemon elegans*, together with the freshwater species *Bagrus bayad*, *Clarias lazera*, *Labeo niloticus* and *Lates niloticus*, the latter now very scarce. Some 17 000 fishermen work the lagoon using 4000 boats. In addition some 14 300 ha of hoshā (fish-farm) enclosures are in operation, employing a further 9000 people. Part of the discharge of the El Bagar Drain, which is rich in Cairo sewage water, is being diverted to the Um el Rish Lake where a similar program of intensive exploitation is starting.

Conservation Status: Unprotected. A general danger to all the delta lakes is that of erosion which has increased since the building of the High Dam and the consequent lack of silting.

Wetland Name: Sabkhet el Bardawil

Country: Egypt

Coordinates: 31°02' -31°14' N/32°41' -33°36' E

Area: 68 100 ha (open water)

Altitude: sea level

Nearest Towns: Port Said (38 km W); El Arish (19 km W)

General: The Sabkhet el Bardawil is a salt water lagoon, 90 km long and up to 24 km wide, on the Mediterranean coast of Sinai. It is bounded on the seaward side by a long

narrow spit, and on the landward side by a sandy coastal plain 25-20 km wide. It is open to the sea, through a narrow mouth, towards the eastern end. The lagoon is not presently exploited, but there are plans for the development of a fishing port. Rainfall over the lagoon is about 125 mm/yr, evaporation is about 2000 mm/yr, and some fresh water enters along the southern shore after rain.

2. The Lower Nile Valley

General: The Nile Valley below Aswan varies between 20-30 km in width and is confined by steep sides, particularly on the east. Since the closure of the High Dam at Aswan the valley is no longer flooded each year. It is however, irrigated and traversed by a number of streams and canals on the western side. The longest of these, flowing in parallel with the Nile is the Bahr Yûsef. This receives water from the Nile at various points and terminates in vicinity of El Faiyûm, from where, ultimately, its waters drain to Lake Qârûn. A number of small lakes also occur along the western side of the valley. A succession of deep wadis run down from the eastern hills to the right bank of the river, and comparatively little agriculture occurs on this side of the valley. The valley is becoming progressively more saline as a consequence of the use of artificial fertilisers. These are now used to compensate for the silt which is no longer deposited by the annual floods.

3. The Suez Canal & Associated Lakes

General: The Canal runs from Port Said (31°17'N/32°18'E) on the Mediterranean Sea to Suez (29°59'N/32°33'E) at the head of the Gulf of Suez, a distance of 160 km. It traverses en route, the eastern end of Manzala Lagoon, Lake Timsah (30°31'-30°35' N/ 32°16'-32°20'E) near Ismâ'iliya, and the Bitter Lakes (30°10'-30°25'N/32°18'-32°35'E). Lake Timsah occupies about 2500 ha while the two Bitter Lakes, actually one water body, are 35 km long, up to 12.5 km wide, and have an open water surface of 31 250 ha. The canal and lakes are tidal. In the north the canal traverses the saltmarshes at the eastern end of Manzala Lagoon, and yet other saltmarshes between El Qantara (30°52'N/ 32°19'E) and El Firdan (30°41'N/32°19'E). The flora and fauna of these marshes is as described in the regional introduction.

4. The Gulfs of Aqaba & Suez, & the Red Sea

General: Mangrove vegetation is absent from the Gulf of Suez where in places the coastal plain is absent and the mountains rise straight from the sea, e.g. at Kashm el Galala some 60 km south of Suez, at Ras Zeit at the entrance to the Red Sea, and around Abu Durba (28°28'N/33°20'E) on the Sinai shore. The shores of the Gulf of Aqaba are even steeper and less hospitable, but the most northerly stand of mangroves on the East African coast occurs here, near the tip of the peninsula, in the shallow Marsa Lagoon (27°47'N/34°15'E). Only *Avicennia marina* is present, with sponges and algae growing on the pneumatophores in clear water. On the Egyptian Red Sea coast *Avicennia* makes its appearance at Myos Hormos Bay (27°25'N/33°39'E), 22 km north of Hurghada. From here, southwards to the Egyptian border at latitude 23°N, mangrove vegetation characterises the littoral. *Avicennia marina* grows in

monospecific stands, either as clumps of isolated trees or as dense belts several kilometres long. It also grows densely on Abu Minciar Island (27°15'N/32°51'E) off Hurghada, and on Safaga Island (26°44'N/ 33°57'E). *Rhizophora nzucronata* joins the mangrove association near the Tropic of Cancer growing as a co-dominant with *Avicennia marina*. The Red Sea coasts are fringed by raised Quaternary coral reefs, into which many small bays have been cut, and these provide sheltered habitats for mangroves with floors of sandy mud. Soil reactions are generally alkaline with a pH range of 7.5-8.5. In places *Avicennia* occurs above the tidal zone, apparently having survived the silting of the shoreline, e.g. in the delta of the Wadi Gimal (24°40'N/35°04'E). This Wadi Gimal drains the northern end of the Gebel Hamada Range (1977 m asl) and reaches the sea in a bay, the mouth of which is sheltered by Wadi Gimal Island. The stream, like several others along the coast, flows torrentially after storms in the mountains. Various marine angiosperms occur seaward of the mangrove trees, principally *Cymodocea ciliata*, *C. rotundata*, *Diplanthera uninervis*, *Halophila ovalis* and *H. stipulacea*. Reed swamps occur at the mouths of some wadis, as described in the regional introductions and saltmarshes extend along much of the Egyptian littoral. Often it is difficult to determine the limit of tidal inundation as the saltmarsh vegetation grades into salt desert vegetation. Common species are given in the regional introduction.

5. Oases

Wetland Name: The Siwa Depression

Country: Egypt

Coordinates: 29°02 – 29°28'N/25°12 – 26°06'E

Nearest Towns: Cairo (525 km ENE); Siwa (at W end)

General: The lowest point of the Siwa Depression, which is underwater, is about 25 m below sea level. The depression has developed in limestones of Eocene and Miocene age, and is bounded by steep slopes on the northern side, reaching about 120-160 m asl, but by much gentler slopes to the south and southeast. Here, slopes rise into the plateau of the Western Desert which comprises limestone covered by wind blown sands. The depression occupies 108 800 ha. It is 82 km long and has a maximum width of 28 km, but narrows in places to 2 km. A number of small basins on the floor of the depression hold little lakes, about a dozen in total, mostly surrounded by marshes. These are the remnants of larger Pleistocene lakes, and fossil shorelines can be seen at altitudes of 8-12 m below sea level. The levels of the present lakes fluctuate seasonally and some dry up in summer. The principal lakes, some of which are not named, are situated at 29°20'N/25°09'E (Shiyata -250 ha); 29°13'N/25°18'E (el Maraqi -900 ha); 29°13'N/ 25°28'E (Siwa -3200 ha); 29°14'N/25°35'E; 29°11'N/25°39'E; 29°12'N/25°40'E; 29°11'N/25°43'E (el Zaytim -1600 ha); 29°21'N/25°55'E; 29°18'N/25°59'E; 29°17'N/ 25°59'E; 29°17'N/26°01'E (el Ma'asir -400 ha); and 29°14'N/26°04'E. All the lakes are saline but are supplied with fresh water from springs. Mean annual precipitation in the depression is 8 mm, but many years are rainless. Temperatures may exceed 48°C in summer, while frosts are not uncommon on the surrounding limestone plateau in winter. Potential evaporation (Class A Pan) exceeds 2300 mm. Relative humidity is generally very low 15-30%, but this may increase to 50% at night, and may fall to 1% when the hot dry Khamsin wind blows in summer.

Flora & Fauna: The lakes contain *Chara*, and both unicellular and filamentous algae occur in the springs. Reeds and sedges grow in the saline marshes, as discussed in the

regional introduction. Among fish, *Aphanius dispar* is indigenous and *Tilapia zillii* has been introduced. Water birds, including ducks and ibises are often abundant while *Felis caracal*, *F. lybica* and *Vulpes rupellii* are resident mammals.

Human Impact & Utilisation: The depression has long been inhabited and stone tombs are present at the western end. Subsistence agriculture is practised using water from the springs and from wells which have been dug.

Conservation Status: Unprotected.

Wetland Name: The Qattara Depression

Country: Egypt

Coordinates: 28°35 ' -30°25 'N/26°20 ' -29°04'E

Area: 1 700 000 ha (below sea level)

Altitude: 133 m bsl to 300 m asl

Nearest Towns: Cairo (220 km E); Alexandria (150 km NE)

General: This depression, oriented SW-NE, is 285 km long and reaches a maximum width of 135 km. It is bounded by a steep, and in places precipitous, escarpment, along the northwestern and northern sides, which rises to heights of over 300 m, and a few kilometres away from the escarpment edge, to over 500 m. By contrast the southern and eastern sides of the depression rise more gradually to the plateau of the Western Desert. Saline marshes/deserts, up to 30 km wide and over 150 km long, are situated under the escarpment along the northern side of the depression, and other marshes extend out into the southern central part of the basin, occupying a total of about 300 000 ha. Wind blown sands have intruded into the depression along the southern margins and are encroaching upon the marshes in the central and extreme southern areas. Elsewhere on the south side, the floor of the depression comprises black gravels or bare broken rock, or there are rock/salt plateaux, and in the far south there is a hard clay pan. There are four semi-permanent saline lakes, one, Lake el Maghra (30°14'N/28°53'E), at the extreme northeastern end of the depression, and three along the most southerly margin, on a gravel plain at the edge of the sand sea. These are situated at 28°39'N/26°41'E; 28°40'N/ 26°27'E (Lake el Bahrein); and 28°43'N/26°56'E (Lake Sitra). Each covers several hundred hectares. Lakes el Maghra and Sitra (the largest) are below sea level, while the other two are just above it. There are springs at Ain Tibaghbagh (29°05'N/26°23'E), el Araq (28°57'N/ 26°30'E) and el Watya (28°51'N/26°43'E) along the southern edge.

Flora & Fauna: *Chara* occurs in the lakes, and the saltmarshes contain species listed in the regional introduction. A number of invertebrate species have been recorded from the lakes and there is an abundant birdlife. Mammals present include *Felis caracal*, *F. lybica*, some rodents and *Vulpes rupellii*.

Human Impact & Utilisation: Not permanently inhabited and at present virtually unutilised. However, consideration is currently being given to a proposal to flood the depression with sea water, thus creating the world's largest manmade lake. This would raise the water table in the surrounding desert and water evaporated from the lake might condense over the Western Desert with beneficial effects for projected agriculture.

Conservation Status: Unprotected.

Wetland Name: Wadi el Natrun

Country: Egypt

Coordinates: 30°19'-30°30'N/30°02'-30°30'E

Area: 30 000 ha (total depression)

Altitude: 10 m bsl

Nearest Towns: Cairo (75 km ESE); Alexandria (80 km N)

General: The wadi is situated in an area of undulating sand with sparse scrub vegetation 47 km west of the Nile Delta, but there are hard packed gravel soils along the northern wadi margin. The lowest part of the Wadi is a depression below sea level, 50 km long and up to 8.5 km wide, oriented NW-SE, which contains a string of small saline lakes surrounded by saline desert marsh vegetation. The principal lakes are, from NW-SE, el Ga'ar, el Beida, el Hamrah, el Rummya, um Risha and el Fisoa. There are deposits of salt and soda crystals on parts of the wadi floor, which may occasionally be inundated by discharges from the dozen temporary watercourses that enter the depression along its southern margin.

Flora & Fauna: Flora and fauna as described in the regional introduction. There are however, comparatively few birds.

Human Impact & Utilisation: Little used.

Conservation Status: Unprotected.

Wetland Name: Lake Qarun

Country: Egypt

Coordinates: 29°24'-29°32'N/30°24'-30°49'E

Area: 23 500 ha

Altitude: 44 m bsl (lake surface)

Nearest Towns: Cairo (65 km NE); El Faiyilm (13 km S)

General: Lake Qarun is situated in a depression 71 km long and 20 km wide, which descends to 44 m below sea level at the mean surface level of the lake. The lake has a mean depth of 4.2 m and a maximum depth of 8.5 m in the western basin. A cluster of small natural lakes is situated near El Gharaq el Sultani (29°08'N/30°42'E), some 13 km south of the Qarun Depression, and some artificial lakes have been created in the Wadi Ruwayan, 12 km southwest of the depression.

Hydrology & Water Quality: Lake Qarun is endorheic and was in the past artificially fed by water from the Nile, but now, with modern agricultural practices, it receives only the run-off from the irrigated peripheral lands. This enters the lake via two canals at the eastern end, and the mean annual influx is estimated at 390 million m³. Mean annual precipitation over the lake is estimated at 9 mm, relative humidity ranges from 49% in June to 75% in December, and Class A Pan evaporation is estimated at 1750-1900 mm. The lake is becoming increasingly saline. At the turn of the century salinity was measured as 13‰, but this had risen to over 34‰ in some parts of the lake by 1976. Salinity is highest in the western basin and lowest in the vicinity of the influx canals. Secchi depths of 2-3 m are obtained in the western basin, but only 60 cm near the mouths of the canals.

Flora & Fauna: There is a rich plankton and an invertebrate benthos dominated by the mollusc *Cerastoderma glaucunz* which produces an average standing crop of 288.5g dry weight/m², and comprises 70% of the total benthic biomass. The benthic fauna is

characterised by the presence of several euryhaline marine species, e.g. *Nereis diversicolor*, and there are marine elements in the plankton, believed to be imported with fish fry with which the lake is stocked each year. The most important species of fish are *Mugil capita*, *M. cephalus*, *Solea vulgaris* and *Tilapia zillii*. All of these were first introduced in 1928 and are now restocked annually. The lake supports large numbers of water birds among which *Alias clypeata* (11 000), *Aythya fuligula* (6000), *Fulica atra* (19 000+), *Podiceps cristatus* (4000) and *P. nigricollis* (11 000) are the most abundant.

Human Impact & Utilisation: The rate of salification has increased since the closure of the high dam at Aswan. Artificial fertilisers are used to replace the nutrients formerly provided by the sediment deposited during the annual flood, and these raise the concentration of salts in the waters entering the lake. There is a flourishing fishery on the lake.

Conservation Status: Unprotected.

THE 'NEW VALLEY' OASES

In the days of the Pharaohs the oases west of Luxor (25°41'N/32°24'E) were among the most fertile areas of Egypt and are believed to have supported a population of 8 million people. Today the oasis at El Farafra (26°55'-27°30'N/27°50'-28°20'E) has no surface water, while there are now only springs and wells at Dakhla (25°10'-25°50'N/ 28°50'-29°25'E) and at the Great Oasis of El Khirga (24°32'-25°49'N/30°23'-30°43'E). However, artesian water is available at these places and vast irrigation projects are underway to 'reclaim' these oases. At Dakhla, a depression, less than 200 m asl, lies in a NW-SE oriented trough in the plateau at 500 m. On the southwestern side, the plateau slopes gradually down to the floor of the trough, but on the northeastern side it rises abruptly from the depression in a 300 m escarpment. A series of wells and springs occurs several kilometres out into the depression below the foot of this escarpment. At El Khirga there is a depression, less than 100 m asl, oriented roughly N-S and parallel with the Nile. It is 135 km long and up to 40 km wide.

Wetland Name: Lake Nasser/Nubia

Country: Egypt

Coordinates: 20°27'-23°58'N/30°07'-33°15'E

Area: 685 000 ha (581000 ha in Egypt)

Altitude: 183 m asl (at capacity)

Nearest Towns: Aswan (at dam); Cairo (700 km NNW)

General: In the past the Nile flooded its lower valley and delta each year, depositing a fertile layer of silt on which crops could be grown. The highest flood on record was in 1879 and the lowest in 1913. During successive dry years, water for irrigation was in very short supply and agricultural production was greatly reduced. Each year water flowed into the Mediterranean without having been used for irrigation or power generation. However, since the construction of the High Dam at Aswan, 7 km below the old Aswan Dam, the Nile no longer overtops its banks in Egypt and river flow is controlled to provide water for hydroelectric power and year round irrigation. The dam is rock-filled, 111 m high at its crest, 980 m wide at its base and 40 m wide at the top. It has an impervious core, a grout curtain extending 180 m under the core to meet the bedrock, and a horizontal upstream impervious blanket. It is 3600 m long, 520 m lying between the banks of the Nile with the remaining 3080 m stretching outward in the form

of two wings on both sides of the river. The irregular shoreline of the lake is approximately 7900 km long, and is presently unprotected.

The lake can be divided into three sectors. The northern sector is fully lacustrine and extends south from the dam to Tushka. The middle sector is semi-riverine and comprises the southern part of Lake Nasser and the northern part of Lake Nubia, up to Daweishat. It is characterised by riverine properties during the flood season but by lacustrine properties during the rest of the year. The southern sector has riverine characteristics all year round. The irregular shoreline is some 7900 km long.

Hydrology & Water Quality: The dam holds back 161 billion m³ of water at capacity, comprising a dead volume of 31 billion m³, below which the generators will not operate, a live capacity of 90 billion m³, and a flood control capacity of 41 billion m³. Maximum depth is 98 m. It is anticipated that it will take 500 years for the dead capacity to be filled by silt. There is a diversion system on the east bank, used during dam construction, which can accommodate the full flood capacity of the river, while on the west bank there is a tunnel which can accommodate the passage of surplus water when the lake is full. This has a carrying capacity of 9400 m³/sec. In the case of successive high flood years occurring, water can be sent 40 km from Aswan to the Talkha Dam, constructed across a depression in the Western Desert.

When the annual flood enters the southern part of the lake it destroys stratification in the lake and the turbid floods push lake water, with relatively high conductivity, ahead of them. Secchi depths at the high dam range from 3.4 m in winter to 1.5 m in summer, and from 2.3 m in winter to 80 cm in summer at Tushka. It is estimated that 134 million tonnes of suspended matter enter the lake each year. Chloride ion concentrations have increased since impoundment and are now 8.83-9.83 mg/l, while sulphates range from 5-10 mg/l, the highest concentrations being in bottom water. Sulphide ion concentration increases sharply close to the bottom, sometimes exceeding 400 mg/l at depths below 90 m. The principal cation concentrations are 8.2-27.8 mg/l for sodium, 2-8 mg/l for potassium, 14-27.5 mg/l for calcium and 4.5-12.5 mg/l for magnesium. Carbonate and bicarbonate concentrations have fallen since the lake was first filled and carbonate concentrations at the surface are now in the range of 0 -1 mg/l. The waters have become more alkaline since impoundment and current pH values are 8-8.85, with some seasonal variations, increasing in winter. The highest surface water temperatures are recorded in August and range from 29.3-31.8°C, while the lowest surface water temperature of 16°C was recorded during winter 1970/71. In winter the water column is oxygenated from top to bottom with concentrations of 6.7-11 mg/l at the surface and 5.4-8.7 mg/l at the bottom, but in the summer bottom water may become deoxygenated. Surface water oxygen concentrations in summer range from 5.2-10.1 mg/l.

Flora & Fauna: The lake is set in the desert. It has a bluish-green colour due to the presence of blue-green algae which are particularly abundant in early summer. *Volvox* comprises the bulk of the phytoplankton, while cladocerans (*Daphnia*) and copepods (*Cyclops*) provide the bulk of the zooplankton. Primary production ranged from 10.7-16.4 g carbon/m²/day in 1979. Most of the Nile fishes, referred to in the regional introduction, have been recorded from the lake, but the lacustrine and riverine sectors have these species in different proportions so that their fish faunas are distinct. For example, *Eutropius niloticus*, *Schilbe nyzistus* and *S. uranoscopus* thrive where riverine conditions predominate and are most common at the southern end of Lake Nubia, while *Alestes nurse* and *Hydrocynus forskalii* are most common in the clear waters of northern Lake Nasser under lacustrine conditions. The importance of the lake to birds has not yet been properly ascertained.

Human Impact & Utilisation: The power station has a generating capacity of 2.1 MW, producing 10 billion KW/hours/yr. Annual catches from the fishery which has developed on the lake have increased from 645 tonnes in 1966 to 33 933 tonnes in 1981. The principal species landed are *Bagrus bayad*, *B. docinac*, *Clarias* spp., *Eutropius niloticus*, *Labeo* spp., *Lates niloticus*, *Oreochromis galilaeus*, *O. niloticus* and *Synodontis* spp. The two cichlids are by far the most important species, having formed 27 % of the catch in 1968 but 90% in 1981. Gill and trammel nets are commonly used for fishing in the lake. Gill nets are about 2 m deep and mainly catch *Alestes* and *Hydrocynus*. The other species are generally caught in trammel nets. Fish are usually iced, and then frozen or processed in some other way. A small proportion of the catch, say 6%, is salted. Some 8960 fishermen operate on the lake, using mainly two-man canoes or traditional Nile boats manned by 4-5 men. Few of the craft are motorised. Signs of fishing stress, seen in decreasing fish sizes, have begun to appear at certain centres in recent years. References and a good introductory account of the fishery are given by Latif (1984). The high dam has had a deleterious effect upon the Nile below it, in that the number of species of fish in the river has decreased from 71 to 31. Despite this the annual production of the lower Nile fishery has increased since the dam, but chiefly because of intensified effort. The coastal fishery, and in particular the sardine fishery, has however, declined. The Egyptian catch from the Mediterranean fell from 38 000 tonnes in 1962 to 7000 tonnes in 1969, but recovered to 20 000 tonnes in 1979. Sardines, which once formed 37% of the annual catch now constitutes only 9%.