Wetlands and Biodiversity Baseline Report for Nile Egypt

Nile Transboundary Environmental Action Project

NILE BASIN INITIATIVE

2009

Preface

The documentation of this baseline was made possible with the financial support from the Canadian International Development Agency and The Netherlands Government, provided through the Nile Basin Trust Fund, managed by the World Bank. NTEAP would like to take this opportunity to thank all development partners for their continued support."

This is a compilation of the information known about the Wetlands and Biodiversity of the Nile Egypt and has been undertaken by the Nile Transboundary Environmental Action Project in cooperation with the Nature Conservation Sector NCS of the Egyptian Environmental Affairs Agency EEAA and the Ministry of State for Environmental Affairs.

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Wetlands and Biodiversity Baseline Report for Egypt

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Foreword

The Nile Transboundary Environmental Action Project NTEAP was officially launched in May 2004 as one of the eight projects under the Nile Basin Initiative shared Vision Program (SVP). It was a five-year project hosted by Sudan and located in Khartoum.

The main objective of the project was to provide a strategic environmental framework for the management of the transboundary waters and environment challenges in the Nile river basin. One way NTEAP achieve this objective was through undertaking baseline using national experts to document what is known about the wetlands and biodiversity in each country with aim of improving the understanding of wetlands by providing information that can enhance sustainable development and management at selected transboundary wetlands sites.

Wetlands and biodiversity component of NTEAP made several achievements in Egypt. There exist a national working group representation at regional level; 6 trained staff from the Egyptian Environmental Affairs Agency on wetland management and biodiversity conservation internationally, formulated the National Supreme Committee for wetlands and Biodiversity that brings senior officials from the different agencies and ministries of concern together.

This report is documenting baseline information to improve the understanding of wetlands and biodiversity in the Nile basin area of Egypt. Experts from various fields of specializations prepared sections based mainly on desktop studies and literature surveys which were presented and discussed at national meetings in Egypt.

This report provides for the Nile Basin the starting point on what is known about wetlands and biodiversity and presents to large extent a proper package into the various identified themes of the target component.

The report will enhance the understanding of the biodiversity and wetlands areas in Egypt and the Nile Basin and can be used to enrich literature for awareness, teaching and preparation of awareness materials that can be used by environmental practitioners and decision makers in the Nile Basin Regions.

Gedion Asfaw
Regional Project Mnager
Nile Transboundary Environmental Action Project

EXECUTIVE SUMMARY

The first chapter of this report presents the state of the River Nile in Egypt and its associated Wetlands in terms of water resources, catchment areas, wetlands of the Nile Delta, geology and geomorphology, climate soil and hydrology. Some figures about the

regional and global freshwater wetland areas and the largest river basins of the world have been also presented.

Chapter 2 gives the fish importance in Egypt, and highlights the fish biodiversity and its important environment in the River Nile stem, the Nile islands and Lake Nasser in Egypt. The representative families, with scientific and Arabic names and status have been listed. The threats to the fish biodiversity was highlighted.

A comprehensive description of the higher plants of the River Nile part of Egypt has been described in chapter 3. The physical settings, natural vegetation, environmental characteristics, species and life forms, main habitats and their vegetation and the plant communities, have been provided and explained for the Nile system and the Deltaic part on the Mediterranean coast with the spots on the Nile islands, Lake Nasser, Lake Manzala and the Irrigation and drainage networks of the delta.

The available information about the Arachnids of Egypt in the most northern part of the Nile has mentioned in chapter 4 and the expected discoveries, with the available expertise and recommended actions have been included in this chapter.

The status and conservation needs of the most significant reptiles of the Nile and associated habitats have been elaborated in chapter 5. Recent distribution maps for those species have been provided for each.

The birds of the Nile River are significantly treated in chapter 6 of this report. The land use, threats, and the related bird communities have been introduced for the most important bird sites around the Nile system such as Lake Manzala and Lake Burullus as representatives to the Nile Delta; Lake Nasser and Aswan area as representatives for the Upper Egypt part of the Nile were introduced.

The Mammals community of the River Nile area in Egypt was reported with emphasis on the Nile Valley and Delta. The order, family and scientific and English names of the related mammal community were introduced for the Nile Valley, Delta and wetland areas in Egypt. A detailed key species account about the most important mammal species was also provided.

The microbiology of the River Nile and Delta has elaborated through hints on the Nile pollution sources from agricultural, industrial and domestic activities in chapter 8. The microbial diversity and their occurrence in the River Nile in terms of Fungi, Bacteria and Actinomycetes have been presented.

A comprehensive and detailed agro-biodiversity was introduced in chapter 9. The history and role of agro-biodiversity, the economic resources constraints of the Valley and Delta, the agro-biological zones in Egypt (on basis of climate, physiography, soil and water characteristics), the biodiversity of crops and crop rotations, biodiversity of farm animals, the biodiversity of pollinators, the biodiversity of birds and wild animals in agricultural areas and the value of agricultural biodiversity in Egyptian National economy were thoroughly introduced. The production of agro-biodiversity items, the threats to environment and biodiversity, the national efforts for conservation of agricultural genetic resources, and the national legislation on biodiversity conservation were also well described. Some applied technologies of eco-farming in Egypt were proposed at the end of this chapter.

Chapter 10 of this report has showed the infestation of the Nile River and its environments and tributaries with the invasive species. Three case studies for invasion by weeds and Schistosoma and weed control experience in Egypt have been introduced.

GLOSSARY

Alluvial soil

Soil transported and recently deposited with little or no modification, such as the soil left by

floodwaters.

Annual

A plant whose natural term of life is 1 year or 1 season; especially, any plant that grows from seed, blooms, fruits, and dies in the course of the same year

Biennial

A plant that requires 2 seasons of growth to produce its flowers and fruit, growing leaves the first year, flowering, fruiting, and going to seed, and dying the next

Biodiversity

The variety of all living things; a contraction of biological diversity. Biodiversity can be measured on many biological levels ranging from genetic diversity within a species to the variety of ecosystems on Earth, but the term most commonly refers to the number of different species in a defined area

BOD

Biochemical Oxygen Demands

Bulrush

The popular name for large, rushlike plants growing in marshes. The bulrush of Egypt is the *Cyperus Papyrus*

Chamephytes

Plants with buds on persistent shoots near the ground – woody plants with perennating buds borne close to the ground, no more than 25 cms above soil surface, e.g. bilberry and periwinkle.

Climate

The meteorological conditions, including temperature, precipitation, and wind, that characteristically prevail in a particular region.

COD

Chemical Oxygen Demand

Cryptophytes

Plants exist below ground or under water - with resting buds lying either beneath the surface of the ground as a rhizome, bulb, corm, etc., or a resting bud submerged under water

Ephemeral

Ephemeral things (from Greek-*ephemeros*, literally "lasting only one day") are transitory, existing only briefly. Typically the term is used to describe objects found in nature, although it can describe a wide range of things

Floodplains

A floodplain, or flood plain, is flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current

Geophytes

Plants resting in dry ground, e.g. crocus, tulip. May be further subdivided into rhizome, stem-tuber, root-tuber, bulb and root geophyte

Germplasm

A germplasm is a collection of genetic resources for an organism. For plants, the germplasm may be stored as a seed collection or, for trees, in a nursery

Helophytes

Plants resting in marshy ground, e.g. reedmace, marsh-marigold

Hemicryptophytes

Plants with their buds at or near the soil surface , e.g. daisy, dandelion

Hydrology

Hydrology (from Greek: Υδωρ, *hydōr*, "water"; and λόγος, *logos*, "study") is the study of the movement, distribution, and quality of water throughout the Earth, and thus addresses both the hydrologic cycle and water resources

Hydrophytes

Plants resting by being submerged under water, e.g. water-lily, frogbit

Meadow

A meadow is a field vegetated primarily by grass and other non-woody plants (grassland). It may be cut for hay or grazed by livestock such as cattle, sheep or goats

Parasite

An organism that grows in or on another plant or animal, getting all or part of its nutrients from it, and usually showing a degree of adaptive structural modification

Perennial

Plant that dies back seasonally, but produces new growth from a persisting part, as a perennial herb.

Phytoplankton

Phytoplankton obtain energy through the process of photosynthesis and must therefore live in the well-lit surface layer (termed the euphotic zone) of an ocean, sea, lake, or other body

of water. Phytoplankton account for half of all photosynthetic activity on Earth

Shrub

A shrub or bush is a horticultural rather than strictly botanical category of woody plant, distinguished from a tree by its multiple stems and lower height, usually less than 5-6 m (15-20 ft) tall. A large number of plants can be either shrubs or trees, depending on the growing conditions they experience. Small, low shrubs such as lavender, periwinkle and thyme are often termed sub-shrubs.

TDS

Total Dissolved Salts

Therophytes

Annual plants which survive the unfavourable season in the form of seeds and completes its life-cycle during favourable seasons. Annual species are therophytes. Many desert plants are by necessity therophytes.

Wetlands

A wetland is an area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes, and bogs, among others. The water found in wetlands can be saltwater, freshwater, or brackish

Xerophytes

A plant adapted structurally to living and growing with limited water by means that limit transpiration or provide water storage, for example, cactus and succulents

Zooplankton

Zooplankton is a broad categorisation spanning a range of organism sizes that includes both small protozoans and large metazoans. It includes holoplanktonic organisms whose complete life cycle lies within the plankton, and meroplanktonic organisms that spend part of their life cycle in the plankton before graduating to either the nekton or a sessile, benthic existence

CHAPTER 1
GENERAL SITUATION OF THE WETLANDS AND BIODIVERSITY IN THE NILE, EGYPT.

By

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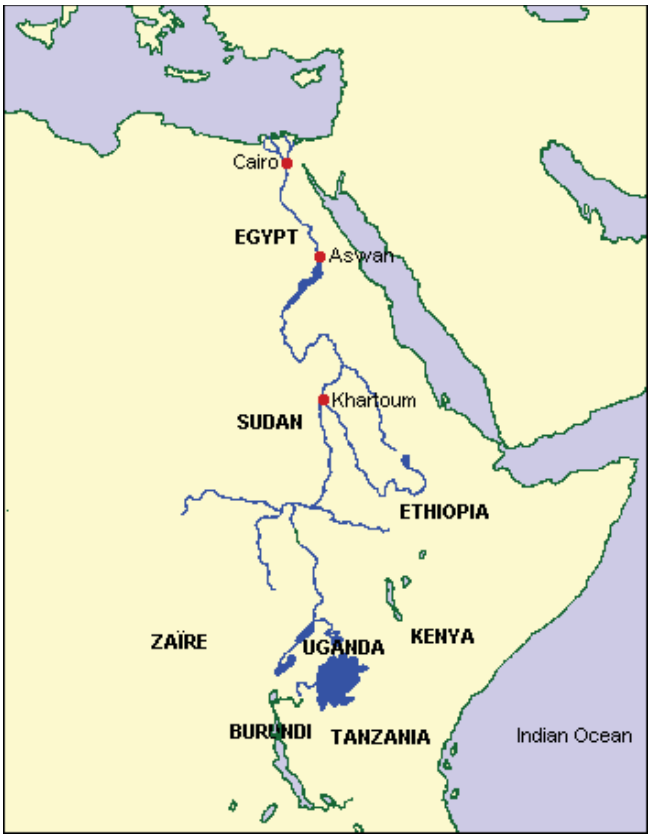
1. INTRODUCTION

The River Nile is one of the largest rivers in Africa and is the longest river in the world. It is about 6825 km long from following from Southeast to the North of Africa with latitude extending from 4° S to 31° N (Frasser & Keddy 2005).

The basin is stretching over different geographical, climatological and topographical regions. Besides the two plateaus in Ethiopia and around the equatorial lakes (Victoria, Albert, Kyoga, Edward), the Nile Basin can be considered as a large flat plain, in particular the White Nile sub-basin (Mohamed *et al*, 2005).



The River Nile basin is a part of a larger area that is associated with this great natural system, including substantial parts of Egypt, Sudan, Ethiopia, Kenya, Uganda, Tanzania, Rwanda, Congo (Kinshasa), Central Africa and Chad. The territories embraced by this definition include catchments areas of tributaries that no longer contribute to the water of the principal channel, and include upstream rivulets of other river systems. The Nile is not merely a river flowing across some 34° of latitude, but also a complex system including various forms of water bodies (lakes, marshes, streams, canals, drains, etc.) and landforms (highlands, plains, valleys, etc.). These territories represent a great variety of

climate, vegetation and land-use and also a number of bio-geographical regions. (Zahran, 2008).

Although the downstream part of the Nile crossing an extremely arid region without any significant water gains, Tackholm (1976) describes the Egyptian landscape of the Nile valley in the ancient past as an area (during the Neolithic and also the Pharaonic times) that had the character of the Sudd region of the present Sudan, a river with marshy shores where huge papyrus thickets offered a splendid abode for hippopotami and crocodiles, for birds and other animals. Her description was based on plant remains found in Pharaonic tombs, ancient drawings and records written on papyrus (Frasser & Keddy 2005).

The Nile meanders through a watershed that is more than 30% arid. The longer of two branches, the White Nile, extends from the mountains east of Lake Tanganyika, through Lake Victoria, to the Nile delta at the Mediterranean Sea in Egypt. The shorter branch, the Blue Nile, springs from the Ethiopian Highlands, joining the longer branch in central Sudan, and contributes the majority of water entering Egypt. Most of the population of Egypt and all of its cities, with the exception of those near the coast, lie along those parts of the Nile valley north of Aswan; and nearly all the cultural and historical sites of Ancient Egypt are found along the banks of the river (Wong, *et al* 2007).

Nile Basin Countries
Sudan, Ethiopia, Egypt, Uganda, Tanzania, Kenya, Rwanda, Burundi, Democratic Republic of Congo, Eritrea

Nile Basin Size
3,254,853 km^2

Key species
Loggerhead turtles lay eggs in the Nile Delta. The Nile watershed has 129 fish species, of which 26 are unique. Five areas along the Nile support birds found nowhere else in the world. (1).

Zahran (2008) reported that the Nile obtained most of its prominent features during the Pleistocene period through three phases: (a) Protonile, about 600,000 years BP with a more westerly course than the present river; (b) Prenile, about 500,000–125,000 years BP when the course of the Nile was still west of its present one, but east of the Protonile; and (c) Neonile, about 30,000 years BP during which most of the Nile sediments in Nubia were deposited and the Nile Valley attained its present form.

Of the total course of the River Nile only the terminal 1530 km lie within the borders of Egypt. Throughout this part of its course, and except for the dry wadis of the Eastern Desert (Chapter 4), the River Nile receives not a single tributary. The annual discharge in the main Nile reaching Egypt is 94 billion m^3, of which 58 billion m^3 are contributed by the Blue Nile, 24 billion m^3 by the White Nile and 12 billion m^3 by the Atbara River in the Sudan (Hurst, 1952).

People have been farming intensively in the Nile river basin for more than 5,000 years. The Nile delta is home to virtually all of Egypt's 78 million people, where the average population density ranges from 1,000 person/Km^2 to much higher in major cities, such as Cairo. Although the water supply per person is currently ample, the Nile is 1 of 6 river basins in the world with a projected population exceeding 10 million that is predicted to face water scarcity by 2025 (Wong *et al* 2007)

The Nile Basin experiences rising demands for its (limited) water resources. As a result, there is increasing pressure to augment river discharge by reducing the non-beneficial evaporation losses from the Upper Nile swamps. In the Sudd, the Nile evaporates more than half of its local flow, i.e. around 29Gm^3/yr out of the long-term mean of 49 Gm^3/yr (Mean of 1961–1983) (Mohamed *et al* 2005).

Constructing Aswan High Dam across the Nile at Aswan is obviously has some effect on the aquatic macrophyte. It provided routes for some aquatic weed species to the system where they had been previously absent, or they caused permanent elimination for some of them within Lake Nasser, Aswan reservoir, Nile River and waterways (canals sand drains). (El-Shinnawy *et al* 2000).

Table (1.1.) Estimates of Regional and Global Freshwater Wetland Area (millions of hectares)

Region (regionalization scheme differs between GRoWI and UNEP-WCMC sources)	GRoWI compilation of national wetland inventories[1]	Previous regional and global estimates[1]	UNEP-WCMC (1998) map[2]
Africa	111.6-112.2[3]	34.5-35.6[5]	132.4
Asia	207.4[4]	> 120[4]	343.6
Europe	227.8[3]	0.7[5]	35.8
Neotropics	414.9[4]	153.8[5]	156
North America	241.6[4]	167.3[4]	–[6]
Oceania	35.8[4]	No data	20.5
Total	1,236.5	> 474.5-475.6	> 688.3

Sources: [1] Finlayson & Spiers (1999) and its global and regional reports; [2] UNEP-WCMC (1998)

Notes: [3] 'inland' and 'human-made' wetland types only; [4] all wetlands; [5] freshwater wetlands only; [6] area estimate not available — shown on map as percentage of area covered by wetlands.

2. WATER RESOURCES & THE CATCHEMENT AREAS

The catchments area of the Nile is more than 3 million square kilometers with a mean annual rainfall of about 600 mm at present. A large part of the water carried by the Nile originates in Ethiopia and is due to the summer monsoons. The rest comes from as far south as Rwanda. Egypt receives about 55 billions m^3 of water entering the Nile per year. A number of huge lakes serve as reservoirs, evening out the flow of the White Nile.

The Nile region comprises the land under the influence of the river Nile and its canals and mostly of cultivated lands as soil fertility occurs. Its area is about 3 % of the total area of the country. It forms Nile delta in Lower Egypt by dividing into two branches after 20 km of Cairo which are Rosetta and Damietta branches. Nile derives its supply from tropical rainfall region. Area of cultivated lands of the Nile region is about 8,118,353 feddans (1929)

Table (1.2.) Twenty Largest River Basins of the World (by drainage area)

River/ Lake Basin	Basin Area[a] (km^2)	River Length (km)	Countries Sharing the Basin (Number)	Virgin Mean Annual Discharge (m^3/s)
Amazon	6,145,186	6280 - 6570	7	200,000
Congo	3,730,881	4370 - 4700	9	41,000
Nile	3,254,853	6484 - 6670	10	~3,000
Mississippi	3,202,185	5970 - 6019	2	18,400
Ob	2,972,493	3180 - 5570	4	12,800
Parana	2,582,704	4700 - 4880	4	21,000
Yenisey	2,554,388	3490 - 5870	2	20,000
Lake Chad	2,497,738	1400 - 1450 (Chari River)	8	1,200
Lena	2,306,743	4270 - 4400	1	18,900
Niger	2,261,741	4030 - 4200	10	6,100
Amur	1,929,955	2820 - 5780	3	10,900
Yangtze	1,722,193	5520 - 6300	1	29,460
Mackenzie	1,706,388	4240 - 4250	1	9,910
Volga	1,410,951	3350 - 3688	2	8,050
Zambezi	1,332,412	2650 - 3500	8	7,070
Tarim	1,152,448	2000	2	650
Nelson	1,093,141	2575 - 2600	2	2,830
Indus	1,081,718	2880 - 3180	4	–
Murray	1,050,116	2570 - 3750	1	–
St. Lawrence	1,049,636	3060 - 4000	2	10,800

Note: [a] Basin area was digitally derived from elevation data using a Geographic Information System, and areas may differ from other published sources.

Sources: Basin area and number of countries sharing the basin from WRI (2000); river length from Gleick (1993); virgin mean annual discharge from Dynesius and Nilsson (1994) and Revenga et al. (2000).

(After Reyenga & Kura 2003)

- The main source of water in Egypt is surface water available from the Nile. *This source of water is totally consumed; being mainly confined to the Nile valley and delta.*
- The second source of water is groundwater in the Nubian sandstone. The aquifer extends over 79% of the country physical area; however, groundwater in such formation is almost non-renewable.
- Other sources of fresh water include rain and flash flood which together amount about 1.5 billion cubic meters per year if properly harvested and conserved.
- Groundwater in the Nile valley and delta can not be considered a resource in itself since the aquifer is recharged as a result of activities based on the Nile water.

Table (1.3.) The volume of water resources during the year 2004/2005

Resources	million m^3/year	Rate
Nile water	55.5	%85
Rain and floods	1.0	%9.5
Groundwater "not profound" and the Delta valley	6.5	%5.5

Lake Nasser & Lake Nubia

Located to the south of Aswan, a huge man-made reservoir; Lake Nasser, flooded the whole Nubian Nile valley and deeply penetrated inside the desert. The areas of the Nubian valley were cultivated mainly with date palms and human settlements were located on the edge of the desert to escape the seasonal river flood. It was reported that the wetland areas formed by the reservoir lake have provided habitats for rich fauna – particularly birds, insects and reptiles (Frasser & Keddy 2005).

Springuel (1991) reported that Lake Nasser is a large impoundment of the River Nile in Upper Egypt between the latitudes of 22 ° 00' N and 23 ° 58' N. It extends southwards as Lake Nubia into Sudan, nearly to 20°N. The Lake as a whole is mostly surrounded by rocky terrain, chiefly piedmonts and peneplains of sandstone (Raheja 1973). Variations in the size and shape of the Lake are obviously affected by the annual and over-year policy for the release of water from the Dam. This results in an annual variation in the water level of probably 5 to 10 m, over-year fluctuation can be as much as 30 m (Abu-Zeid 1987).

The lake is 495.8 km long (at above 180 m sea level) and narrow in shape with an undulating shoreline determined by the surrounding topography. About 26 % of the capacity is dead storage; about 11 % of the reservoir water lost by evaporation annually (Frasser & Keddy 2005).

The First Cataract Islands

Downstream of the Aswan High Dam, the wetlands on the shores of the first cataract islands in Aswan are the only remains of swamps and natural floodplains vegetation, while north of Aswan every piece of land in the Egyptian Nile valley is now cultivated.

3. WETLANDS OF THE NILE DELTA

The Nile delta in Egypt covers an area of over 20,000 km^2, and includes both freshwater and saline wetland ecosystems. Reduction of seasonal fluctuations in the Nile due to the Aswan High Dam has led to substantial changes in the mosaic of floodplain wetlands. Annual flooding once replenished water, sediment, and nutrients on the floodplain, and wetland ecosystems included braided river channels, papyrus swamps, coastal wetlands, and other wetland environments dependent on fluctuations in River Nile flow.

Wetlands in the delta today include the two channels of the River Nile, numerous lakes within old river channels, and marshland, lakes and lagoons along the coast. Vegetation consists of reeds, bulrushes, sea rushes and other aquatic plants adapted to freshwater and saline environments.

Despite significant changes in floodplain wetland ecosystems over the past 50 years (1), the Nile delta remains one of the world's most important bird habitats. Wetlands within the delta are important stopover sites for the millions of birds that migrate every year between European and African habitats, while numerous waterbirds winter in the delta itself. These over-wintering species include the world's largest concentrations of little gull and whiskered tern. In addition, wetland habitats in the delta support one endemic frog (*Bufo kassasii*) and aquatic reptiles, including two endangered species of marine turtles (loggerhead and green turtle) that may breed at Lake Burullus. The delta supports

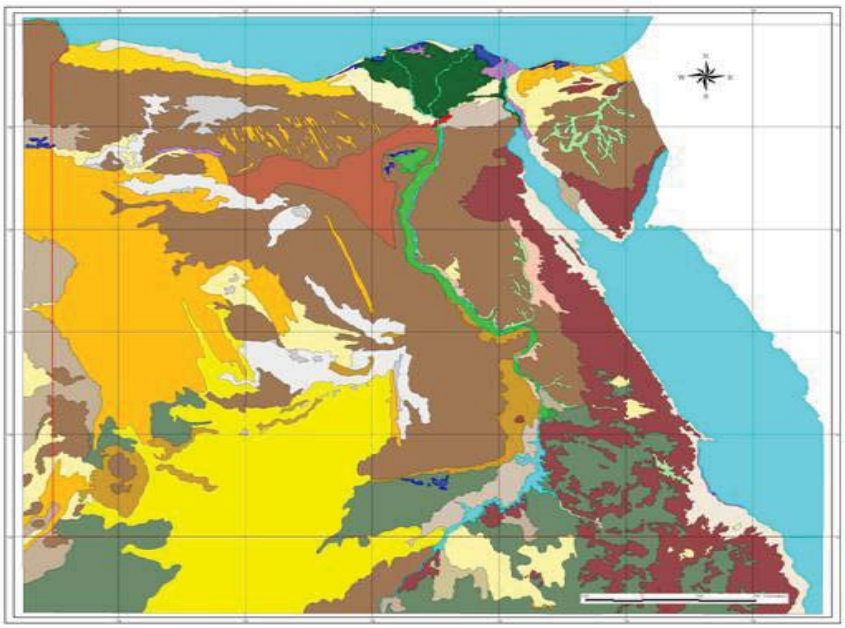
marine fish as well as economically important species found in the lakes and lagoons, such as tilapia and catfish.

Completion of the Aswan High Dam and elimination of the annual Nile flood downstream of the dam led to increased agricultural development of the floodplain and reduction of most wetland habitats. Nonetheless, some wetland habitat remains, including Lakes Manzala and Burullus, which are connected to the Mediterranean Sea, however, the later is one of Egypt's two Ramsar sites.

4. GEOLOGY & GEOMORPHOLOGY (after Zahran, 2008)

Nile Delta and valley consists of alluvial deposits (gravel, sand and Nile mud). Fayoum depression is of lacustrin deposits and Nile mud. The thickness of different layers changes as high dam constructed.

Geomorphological map of Egypt.



Legend :

- Alluvial Fan
- Delta
- Valley
- Coastal plain
- Dessected Plateau
- Footslope
- Hill
- lake
- Major deprssion
- Minor deprssion
- Mountainous area
- Gravelly plain
- Sandy plain with Rock out Crop
- Plateau
- Mud salty plain
- River terrraces of deltaic origin
- Rocky land
- Sand dune
- Sand flat
- Sandy Plain
- Pediment
- Wadies
- Water bodies
- Urban Area

From the Sudan to Egypt at Wadi Halfa, the Nile flows for more than 300 km in a narrow valley bordered by abrupt cliffs of sandstone and granite before reaching the First Cataract which starts about 7 km upstream of Aswan. Narrow strips of alluvial land could, until recently, be cultivated on both banks of the Nile in many parts of the Wadi Halfa-Aswan reach, but these, together with other features below the 180 m contour, are now drowned, being located in the area of the High Dam Lake. Downstream of the cataract, the valley begins to broaden, and flat strips of cultivated land between the river and the cliffs gradually increase in width northward. The total area of Upper Egypt (the Nile Valley) is about 12,000 km^2, stretching over a distance of more than 1000 km.

Lower Egypt (the Nile Delta) is twice the area of Upper Egypt. Beside the apex it spreads in a plain studded with an intricate network of canals and drains; the former lie along the higher tongues of land, the latter in the hollows. According to Said (1981), seven major branches of the delta are mentioned by various historical documents and in ancient maps. These branches are: Canopic Branch (the present Rosetta Branch), Bolbitinic Branch, Sebennitic Branch, Fatmetic ranch (the present Damietta Branch), Mendisy Branch, Tanitic branch and the Pelusiac Branch. Five of these branches generated and silted up in the course of time whereas two branches; Rosetta (about 239 km) and Damietta (about 245 km), are still running. The whole mesh loses itself in a coastal marsh belt of wastelands (Berari), punctuated with a number of coastal and inland lagoons.

The delta of the Nile appears as a triangle broader at the base than the sides. The length of the delta from south (20 km north of Cairo at the Delta Barrages) to north (the Mediterranean Sea) is 170 km and from east to west its breadth is 220 km. The area of the delta is about 22,000 km^2 and thus it comprises about 63% of Egypt's fertile land. The northern coast of the Nile Delta close to the Mediterranean Sea is characterized by three shallow lakes: Manzala (in the east), Burullus (in the middle) and Idku (in the west). These lakes receive the main bulk of the drainage water from the Nile Delta land.

Formerly all the lands of the Nile Valley and Nile Delta were watered by inundation of the basin system. The silt of the water, before the construction of Aswan High Dam, gave an annual increase in sediment. There was an increment in the thickness of mud of 1 m every 1000 years. The silts carried by the Nile water formed the fine fertile land of black or reddish color in layers with sand between. Nowadays, no silt reaches the Egyptian lands.

Geomorphic units of the Nile Valley in Egypt (after Hegazi & El-Bagouri, 2002)

The following geomorphic units could be distinguished for the Nile Valley system (from the Mediterranean shores of the Nile Delta to the North till Aswan in the south over an area extending from 22 – 32 latitude North):

A- Rubble Terraces: these are the remnants of the piedmont alluvial plains, built up by gravelly or coarser soil material brought down from the slopes of the high lands. Subsequent uplifts of the land in relation to the level of the sea have resulted in a number of terrace levels which are distinguished according to their relative age.

B- River Terraces: These are the remnants of the old Nile deposits in the desert fringe areas. There exist three or sometimes four different levels.

C- Alluvial fans: These are the accumulations of debris at the feet of the escarpments, brought down from the desert plateau by steep tributary streams descending through ravines thus the transported materials spread out in the shape of a fan. The fans usually consist of coarse gravelly and sandy fragments which are neither well – sorted nor rounded. Sands are washed down and deposited at the base of the fan. These deposits cover narrower areas between higher ground and they are described as out wash plain.

D- Wadis**:** are depressions, large or small, which may or may not have been formed by stream erosion, and may carry a flow of water on occasions. The term is commonly used for natural lines of drainage, but also for any gully or elongated depression however deeply incised.

E- Wind-blown sand: given rise to such distinct geomorphic units as large sand dune areas, ripple dunes, and sand sheets of varying thickness located in the fringes of the Nile Valley.

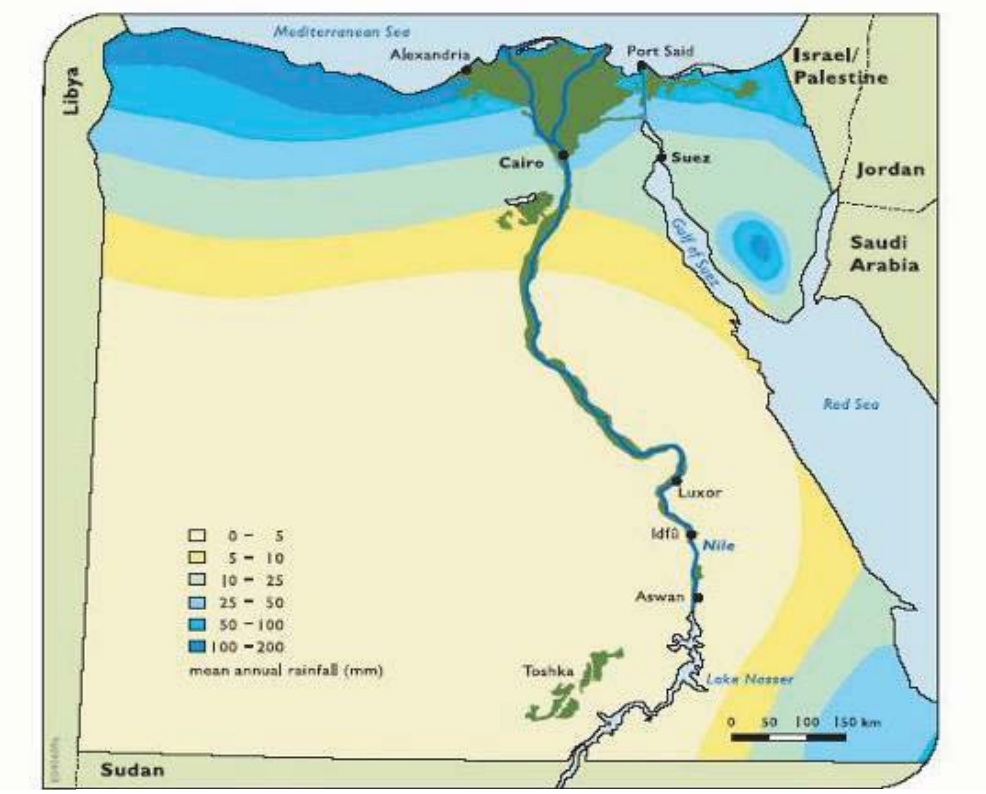
5. CLIMATE

An extremely arid climate prevails in the Nile Valley: high temperature, low relative humidity, high evaporation and negligible rainfall (1.4 mm–5.3 mm/year).

Climatic aridity gradually decreases northwards. At the Delta Barrages and Tanta the annual rainfall is 20.8 mm and 45.5 mm respectively. The climate of the deltaic coastal belt of Egypt is an extension of that of the western Mediterranean coast. The annual rainfall is about 160 mm in Rosetta and 102 mm in Damietta. Winds are generally light but violent dust storms and sand pillars are not rare. El-Khamasin winds blow occasionally for about 50 days during spring and summer.

The El-Fayoum Depression is in the arid part of Egypt with annual rainfall of about 14 mm, mean annual maximum and minimum temperatures are 29.5°C and 14.5°C respectively, mean annual evaporation is 6.9 mm/day (Piche) and mean annual relative humidity is 66%, 32% and 51% at 6 a.m., noon and 6 p.m. respectively.

Fayoum Province is one of the depressions of the Western Desert of Egypt. Being the nearest to the Nile Valley and after being connected with the River Nile by a large irrigation canal (Bahr Yusuf), the Fayoum Depression is considered as a part of the Nile Region. The lowest part of the depression is occupied by a shallow saline lake Qaroun Lake – which is about 4.5 m below sea level and about 200 km2 in area. The depression has a total area of about 1700 km^2. Its floor just above the lake level is about 23 m above sea level (Ball, 1939).



Average Annual rain fall in Egypt

6. SOIL

The agricultural soils of the Nile valley and the Delta are classified into loam, clay and sand, with several intermediate types between these great classes. Loamy soils are mainly composed of silt deposited by the Nile, and heavy or light loams form the bulk of the Egyptian soils. Clay soils may occur in small patches, while sandy soils are principally found skirting the edges of the desert (Aladjem , 1930 & Linton, 1908).

Salt soils are found in the Delta and the Fayoum province. Alkali land lies in a fringe around the lower edge of the delta from Alexandria in the west to beyond the Suez Canal in the east, and also in some districts of Upper Egypt where lands have been changed from basin to perennial irrigation, and canals not completed. Seepage near the bank of high level canals is another cause of such soils (Hume, 1925).

7. HYDROLOGY

The Nile basin has two types of climates. In the northern part, the part where the Sudan and Egypt lie, has virtually no rainfall in the summer (the rainfall is not actually measured). In contrast the southern portion, which encompasses the Ethiopian Plateau, has heavy rains during the summer months. During the season between October and May both regions are relatively dry due to the presence of the northeast trade winds.

There are parts of the East African lakes region and southwestern Ethiopia that have more tropical climates. Rainfall occurs throughout the year in these regions. Temperatures vary between 60 to 80^{o} F, with relative humidity averaging around 80 percent. The southernmost part of The Sudan has a similar climate, with as much as 50 inches of rain during the rainy season.

North of this tropical region there is a shorter rainy season occurring from July to August. There is less rainfall. In the central region of Sudan, the seasons start with a cool, dry winter (December to February). This changes in March to hot, dry weather with temperatures averaging 105 degrees F. Finally in July the rains come and the conditions are hot and rainy. Rainfall in this region varies from 10 to 21 inches annually. As one continues north of Khartoum the annual rainfall is 5 inches.

The remaining area in the north is characterized as having a desert climate. This area includes northern Sudan and the Egyptian desert. It is arid and extremely hot. In June the average temperature is 117^{o} F. In Egypt's desert there is a winter season with cooler temperatures and rainfall varies from one inch in the south and increases up to 8 inches as it reaches the coastal area. In these desert areas sandstorms can occur during the spring months. These sandstorms can last for three or four days and end with a "blue sun", a desert phenomenon.

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CHAPTER 2
FISH

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1. INTRODUCTION

Water cover about 71% of the Earth's surface, and containing more than 150 thousand types of aquatic organisms and more than 70 million tons of algae and seaweed. Fish are 1/6 from human consumption of animal protein (Shehata, 2003). Fish are widespread in all water bodies and play a key role in the food people. In Egypt, both marine and fresh water fish are of considerable importance as a source of meat (Hamed, *et al*, 1999)

Fish are a major source of food in various parts of the world and a major source of protein for more than half a billion people. Fish is also important as a source of employment and income, and 95% of those who rely on fish in their lives live in developing countries. Analysts expect that the demand for fish will continue to increase with population growth and rising income and the evolution of the food.

2. FISH IMPORTANCE

1. Play a key role in the diet of many nations and peoples especially the poorer ones, as they constitute about 30% of animal protein in meat of some African countries such as Ghana and Malawi.
2. Common of many popular dishes in view of its low price.
3. Contain non-saturated fatty acids work to reduce the proportion of cholesterol in the blood.
4. Easy to digest in view of the low white tissue.
5. The use of fish in the sports fishing and recreation.
6. Act as biological resistance.

Egypt has a long coastline (2500 km) together with a continuous continental shelf (53000 km^2) bordering the country on the north along the Mediterranean coast (970 km) and to the east along the Red Sea (The Red Sea coastal land of Egypt extends from Suez (Lat. 30 °N) to Mersa Halaib (Lat. 22 °N) at the Sudano-Egyptian border for 1100 km), with the Suez and Aqaba Gulfs. Moreover, Egypt has various inland resources, include the Nile River with many irrigation canals, six northern coastal lagoons opening to the Mediterranean Sea (Maruit, Idku, Burollus, Manzala, Port Fouad and Bardawil) and two openings to the Suez Canal (Timsah and Bitter Lakes), with two closed lakes (Qaroun and Wadi El-Rayan), and the great reservoir behind the Aswan High Dam (Lake Nasser). Recently, some small water bodies in the western desert have been redeveloped for fish production the Nile is truly the River of Life and has been revered in Egypt since ancient times.

3. FISH BIODIVERSITY

Fish is a major source of animal protein in human diet. The total fisheries area in Egypt is about 13.2 million feddans (IS 56,000 km^2) of which the Mediterranean and the Red Sea represent 24% while the internal lakes, lagoons and inland water represents 67%. The catch increased annually, from 244 750 tones in 1996 to 257 000 tones in 2001 and in 2007 the Nile river produced about 9.6% from total fishing products of Egypt (Published by General Authority for Fishes Resources Development, GAFRD, 2007).

Fisheries involve the greater proportion of fish production, most fishing in the Mediterranean and Red Seas is carried out by small fishing boats skippered by individualistic captains, each trying to make the best living he can. The fishing trade is hazardous because of dangers of harvesting and perishes ability of the commodity whose consumers demand that it should be fresh.

Fishermen are traditionally conservative community and inherited the traditions and cannot easily accept newcomers. They are organized in cooperatives, which work under the large umbrella of fisheries and fish farming cooperatives. The fishermen sell their catch to traders who in turn operate in the open market.

The Mediterranean and Red Sea are the main source of sardine and shrimps. However, the problems associated with water pollution in the Mediterranean Sea, Red Sea and inland waters are real threat for development plans which needs a collaborative efforts of the countries benefiting form both sources to develop their productivity. They are characterized by low yield per unit because much of the equipment is primitive and catch techniques are inefficient. They are monopolized by middlemen who gain most of the profit. The economic level of artisan fisheries is a main factor of their isolation.

Fish farming, production of seafood via agriculture of fish farming accounts for 16% of the seafood consumed in 1997. The total production from aquaculture showed a steady annual increase in quantities produced.

The increase in production of fish in Egypt has been achieved through a set of measures which have been implemented by ministry of agriculture, these measures include:

- Prohibiting drying of internal lakes and lagoons.
- Improving and development of the natural inland resources
- Encourage the fishermen cooperatives formation and provide them with fishing.
- Equipment through soft loans.
- Issuing a decree to guarantee a non polluted water media.

4. THE DIFFERENT ENVIRONMENTS IN THE NILE RIVER IMPORTANT TO FISH

1. Nile River stem

During the last ten years, the recorded catch of the Nile River Basin in Egypt increased annually from 40,000 tons in 1992 to 110,000 tons in 2001, comprising mainly Tilapia

and Catfish from the artisan fishing sector. The catch increase is statistical rather than actual, and reflects the extension of catch recording to additional landing sites.

2. Nile Islands

144 Island along the main course of the Nile from Aswan to the Delta are spreaded over the Egypt's governorates (Aswan - Qena – Sohag – Assuit – Menya - Beni Sewaif – Giza – Cairo - Qalyoubia – Monofia – Gharbia – Kafr El Sheikh – Dakahlia - Damietta). These isles were declared as the Natural Nile Isles Protected Area in 1989 by the Prime Minister's Declaration No. 1969. Nile River Islands are of great importances for fish, as they are represent a good environment for raising young hatch and away from predators and strong currents.

3. Lake Nasser

At the beginning of the 20th century, a more than 82 fish species inhabited Egyptian Nile Water. After the construction of High Dam, about 58 fish species were recorded in Lake Nasser. Currently, there are about 22 common Nile species and about 49 rare species.

The most economically important species are tilapia species (*Oreochromis niloticus*, *O. aureus*, *Sarotherodon galilaeus*, *Tilapia zillii*) and freshwater species (*Bagrus bayad*, *Lates niloticus*, *Barbus spp*., *Clarias spp*. and *Mugil spp*.) caught usually by trammel, cast and gillnets. The catch increased annually, from 244,750 tones in 1996 to 257,000 tones in 2001. These include the River Nile, irrigation canals, Lake Nasser, and some western desert water bodies.

5. THREATS

1. No statistical data is available on touristic use of the Nile (Hotels, number of boats which used for transportation of goods and people), but the increasing tourism industry is a threat to the fishery.
2. Hotels and floating restaurants contribute to pollution of the Nile.
3. The Nile is also used for transportation, but there is no detailed information on the. Transportation related pollution also poses pressure on Nile waters.
4. Urban waste which dumping into water drains.
5. Industrial draining waste.
6. Agricultural draining waste.
7. Invasive Species.
8. Increase the Fishing Effort in the Nile River.
9. Noncompliance with Fishing stopping in the Spawning Periods for Fishes.
10. Use non selective fishing gears.

Table 2.1.A. Fresh water fish species and their distribution in the Egyptian water bodies

Family	Latin Name	Arabic Name	Distribution
Protopteridae	*Protopterus aethiopicus*	دبيب الحوت	LN
Ploypteridae	*Polypterus bichir*	أبو بشير	LN
Characidae	Hydrocynus forskalii	كلب السمك - كلب البحر	N & LN
	Hydrocynus vittatus	كلب السمك - كلب البحر المخطط	LN
	Hydrocynus brevis	كلب السمك - كلب البحر بريفز	LN
	Alestes dentex	راي أبو أسنان	UEN & LN
	Alestes baremoze	رشالة - راي - ملوحة	UEN & LN
	Brycinus nurse	راي سردينة نورس	UEN & LN
Distichodontidae	Distichodus niloticus	لفاش نيلي - لسان البقر	UEN & LN
Mormyridae	*Mormyrops anguilloides*	قموم ثعباني	UEN & LN
	Petrocephalus ban	أرمنيا - حجر	UEN & LN
	Pollimyrus isidori	أنومة إيزيدور	UEN & LN
	Gnathonemus cyprinoides	أنومة أم شفه	RN & LN
	Morymyrus kannume	أنومة أم بويز	RN
	Morymyrus caschive	أنومة قشوة - كاشيف	UEN & LN
	Hyperopisus bebe	قلمية - بابية	LN
Gymnarchidae	*Gyimnarchus niloticus*	ريه نيلية	LN
Anguillidae	*Anguilla anguilla*	الحنشان	LEN & CL
Clupeidae	*Alosa fallax*	رنجة الصابوغة - سردين	RNC
	Labeo niloticus	لبيس نيلي ابيض	RN & LN
	Labo horie	لبيس أسود هوري	RN & LN
	Labo coubei	لبيس أسود كوبي	UEN & LN
	Labo victorianus	لبيس حجري فيكتوريا	RN & LN
	Garra dembeensis	أبو قرص فينسيجرا	LN
	Barbus bynni	بني أصيل	RN & LN
	Barbus perince	بني برنس - فهده	RN & LN
	Barbus neglectus	بني نجلكتس	UEN & LN
	Barbus werneri	بني فرنر	UEN & LN
	Barbus anema	بني أنيما	UEN & LN
	Leptocypris nioticus	بيبي - مرجان نيلي	UEN & LN
	Raiamas loati	مرجان لوتي	UEN & LN

	Chelaethiops bibie	بيبيه كليتوبس	UEN & LN
	Cyprinus carpio	*مبروك عادي	RN
	Hypophthalmichthys molitrix	*مبروك فضي	RN
	Ctenophyaryngodon idella	*مبروك الحشائش	RN
	Aristichthys nobilis	*مبروك كبير الرأس	RN
	Mylopharyngodon piceus	*مبروك أسود	RN
Citharinidae	*Citharinus citharus*	قمره	UEN & LN
	Citharinus latus	قمره لاتس	UEN & LN
Bagridae	*Bagrus bajad*	بياض - بقر	RN & LN
	Bagrus docmak	بقر دقماق	RN & LN
	Bagrus degeni	بقر دوجيني	UEN & LN
	Chrysichthys auratus	أبو ريله فضي	RN & LN
	Chrysichthys rueppelli	أبو ريله روبل - كركور شامي	RN & LN
	Clarotes laticeps	أبو مسيكه	RN
	Auchenoglanis biscutatus	حلوف - كرفش شال	LEN & LN
	Auchenoglanis occidentalis	حلوف - كرفش حمار الحوت	RN & LN
Schilbekdae	*Schilbe (Eutropius) niloticus*	شلبه - ذريه نيلي	RN & LN
	Schilbe (Schilbe) mystus	شلبه أصلي	RN
	Schilbe (Schilbe) uranoscopus	شلبه عربي	UEN & LN
	Siluranodon auritus	شلبة ودنة أصلي	RN
Clariidae	*Clarias anguillaris*	حوت - قرموط زفلوط	UEN & LN
	Clarias gariepinus	حوت - قرموط لازير	RN & LN
	Heterebranchus bidorsalis	كركور حالا - قرموط	UEN & LN
	Heterebranchus longifilis	كركور أصلي - قرموط	UEN & LN
Malapteruridae	*Malapterurus electricus*	رعاش أفريقي - رعاد	UEN & LN
Mochokidae	*Synodontis schall*	قرقور شال - شيلان	RN & LN
	Synodontis serratus	شال - قرقور قواقيه	RN & LN

	Synodontis clarias	شيلان - قرقور قرموطي	LEN & LN
	Mochocus niloticus	مقومقس نيلي	UEN & LN
	Chiloglanis niloticus	كيلوجلانس نيلي	UEN & LN
Cyprinodontidae	*Aphanius fasciatus*	بطريق	ND & CL
Centropomidse	*Lates (Lates) niloticus*	ساموس - قشر بياض	RN & LN
Cichlidae	*Hemichromis bimaculatus*	هيمكرومس مخطط	ND & CL
	Haplochromis bloyeti	هابلوكرومس قزم	ND & CL
	Tilapia zilii	بلطي أخضر	CL & QL
	Oreochromis niloticus	بلطي نيلي - أبيض - سلطاني	CL & LN
	Oreochromis aureus	بلطي أزرق - حساني	ND, CL
	Sarotherodon galilaeus	بلطي مولاي - جاليلي	CL & LN
	Oreochromis mossambicus	*بلطي موزامبيقي	RN
	Oreochromis spilurus	*بلطي سبيلورس	RN
	Red Tilapia	*بلطي أحمر	RN
Moronidae	*Dicentrarchus labrax*	قاروص	ND & CL
	Dicentrarchus punctatus	قاروص منقط	ND & CL
Mugilidae	*Mugil cephalus*	بوري أصيل	LEN & CL
	Liza ramada	طوبارة	LEN & CL
	Liza aurata	جران	LEN & CL
Atherinidae	*Atherina boyeri*	بساريا	CL
Tetrodontidae	*Tetrodon linneatus*	فهقة - حمار البحر	UEN & LN
Poecilidae	*Gambusia affinis*	جامبوزيا - آكل الناموس	CL

LN: Lake Nasser; UEN: Upper Egypt Nile; RN: the whole River Nile; LEN: Lower Egypt Nile; CL: Coastal Lakes; ND: Nile Delta; RNC: River Nile in Cairo; QL: Qaroun lake;

*: introduced to the River Nile habitat.

Table 2.1.B. The Common Freshwater Fishes in the Nile River:

Family	Species	Arabic Name	Distribution
Mormyridae	Morymyrus kannume	أنومة أم بويز	RN
Anguillidae	Anguilla anguilla	الحنشان	LEN & CL
Cyprinidae	Labeo niloticus	لبيس نيلي ابيض	RN & LN
	Barbus bynni	بني أصيل	RN & LN
	Barbus perince	بني برنس - فهده	RN & LN
Characidae	Hydrocynus forskalii	كلب السمك - كلب البحر فورسكال	RN & LN
	Brycinus nurse	راي سردينة نورس	UEN & LN
Bagridae	Bagrus bajad	بياض - بقر	RN & LN
	Bagrus docmak	بقر دقماق	RN & LN
	Chrysichthys auratus	أبو رياله فضي	RN & LN
Schilbekdae	Schilbe (Schilbe) mystus	شلبه أصلي	RN
Clariidae	Clarias gariepinus	حوت - قرموط لازير	RN & LN
Malapteruridae	Synodontis schall	قرقور شال - شيلان	RN & LN
Centropomidse	Lates (Lates) niloticus	ساموس - قشر بياض	RN & LN
Cichlidae	Tilapia zilii	بلطي أخضر	RN, CL & QL
	Oreochromis niloticus	بلطي نيلي - أبيض - سلطاني	RN, CL & LN
	Oreochromis aureus	بلطي أزرق - حساني	ND & CL
	Sarotherodon galilaeus	بلطي مولاي - جاليلي	RN, CL & LN
Mugilidae	Mugil cephalus	بوري أصيل	LEN & CL
	Liza ramada	طوبارة	LEN & CL
	Liza aurata	جران	LEN & CL

LN: Lake Nasser; UEN: Upper Egypt Nile; RN: the whole River Nile; LEN: Lower Egypt Nile; CL: Coastal Lakes; ND: Nile Delta; RNC: River Nile in Cairo; QL: Qaroun lake;

Table 2.1.C. The Rare Freshwater Fishes in the Nile River

Family	Species	Arabic Name	Distribution
Protopteridae	Protopterus aethiopicus	دبيب الحوت	LN
Polypteridae	Polypterus bichir	أبو بشير	LN
Mormyridae	Mormyrops anguilloides	قموم ثعباني	UEN & LN
	Petrocephalus bane	أرمنيا - حجر	UEN & LN
	Pollimyrus isidori	أنومة إيزيدور	UEN & LN
	Gnathonemus cyprinoides	أنومة أم شفه	RN & LN
	M. caschive	أنومة قشوة - كاشيف	UEN & LN
	Hyperopisus bebe	قلمية - بابية	LN
Gymnarchidae	Gymmarchus niloticus	ريه نيلية	LN
Clupeidae	Alosa fallax	رنجة الصابوغة - سردين	ND & RN
Cyprinidae	Labo horie	لبيس أسود هوري	RN & LN
	L. coubei	لبيس أسود كوبي	UEN & LN
	L. victorianus	لبيس حجري فيكتوريا	RN & LN
	Garra dembeensis	أبو قرص فينسيجرا	LN
	Barbus neglectus	بني نجلكتس	UEN & LN
	Barbus werneri	بني فرنر	UEN & LN
	Barbus anema	بني أنيما	UEN & LN
	Leptocypris nioticus	بيبي - مرجان نيلي	UEN & LN
	Raiamas loati	مرجان لوتي	UEN & LN
	Chelaethiops bibie	بيبيه كليتوبس	UEN & LN
Characidae	Hydrocynus vittatus	كلب السمك - كلب البحر المخطط	LN
	Hydrocynus brevis	كلب السمك - كلب البحر بريفز	LN
	Alestes dentex	راي أبو أسنان	UEN & LN
	Alestes baremoze	رشالة - راي - ملوحة	UEN & LN
Distichodontidae	Distichodus niloticus	لفاش نيلي - لسان البقر	UEN & LN
Citharinidae	Citharinus citharus	قمره	UEN & LN
	Citharinus latus	قمره لاتس	UEN & LN
Bagridae	Bagrus degeni	بقر دوجيني	UEN & LN
	Chrysichthys rueppelli	أبو ريله روبل - كركور شامي	RN& LN
	Clarotes laticeps	أبو مسيكه	RN
	Auchenoglanis biscutatus	حلوف - كرفش شال	LEN & LN
	Auchenoglanis occidentalis	حلوف - كرفش حمار الحوت	RN & LN
Schilbekdae	Schilbe (Eutropius) niloticus	شلبه - ذريه نيلي	RN& LN

	S. (S.) uranoscopus	شلبه عربي	UEN & LN
	Siluranodon auritus	شلبة ودنة أصلي	RN Nile
Clariidae	Clarias anguillaris	حوت - قرموط زفلوط	UEN & LN
	Heterebranchus bidorsalis	كركور حالا - قرموط	UEN & LN
	Heterebranchus longifilis	كركور أصلي - قرموط	UEN & LN
Malapteruridae	Malapterurus electricus	رعاش أفريقي - رعاد	UEN & LN
Mochokidae	Synodontis serratus	شال - قرقور قواقيه	RN & LN
	Synodontis clarias	شيلان - قرقور قرموطي	LEN & LN
	Mochocus niloticus	مقومقس نيلي	UEN & LN
	Chiloglanis niloticus	كيلوجلانس نيلي	UEN & LN
Cyprinodontidae	Aphanius fasciatus	بطريق	ND & Some CL
Cichlidae	Hemichromis bimaculatus	هيمكرومس مخطط	ND & CL
	Haplochromis bloyeti	هابلوكرومس قزم	ND & CL
Moronidae	Dicentrarchus labrax	قاروص	ND & Some CL
	Dicentrarchus punctatus	قاروص منقط	ND & Some CL
Tetrodontidae	Tetrodon linneatus	فهقة - حمار البحر	UEN & LN

Table 2.1.D. The Extinct Fishes in the Nile River

Family	Species	Arabic Name
Mormyridae	Petrocephalus bovie	بونة بوفي
	Mormyrus hasselquistii	أنومة هاسكويست
	M. niloticus	أنومة نيلية
Osteoglossidae	Heterotis niloticus	نواق نيلي - جرافش
Characidae	Brycinus macrolepidotus	رايرصفصفة - كامبوت
	Micralestes acutidens	ميكرالستس – حاد الأسنان
	Ichthyoborus besse	اكتيوبور – بسه
Distichodontidae	Distichodus rostratus	لفاش ببوز
	Distichodus engycephalus	لفاش حراشا – لسان
	Nannocharax niloticus	ملخ نيلي – سمك الملك
Mochokidae	Brachysynodontis batensoda	قرقور جمل – شال بطن سوده
	Hemisynodotis membranaceus	قرقور غشائي
Cyprinodontidae	Aplocheilichthys schoelleri	بطحيش شولوري

6. RECOMMENDATIONS

1- Statistical data about Nile River touristic hotels and vessels is urgently needed.

2- Urban drainage water treatment is a must.

3- Prevent the industrial drainage wastes in Nile River.

4- Stop the compliance fishing at the Spawning Periods.

5- Prevent the illegal fishing gears.

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CHAPTER 3
PLANTS

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1. PHYSICAL SETTINGS

Egypt comprises five sub-regions namely: a) Upper Egypt or the Nile Valley, b) Lower Egypt or the Delta, c) Eastern Desert, d) Sinai and e) the Western Desert, Drar (1953).

The concern will be for a) the upper Nile and b) the lower Nile or the Delta.

1.1.Upper Egypt (the Nile Valley)

It is a narrow valley, in which the cultivated area bordering on the Nile becomes narrower as we proceed southward, until it disappears north of Aswan Dam. South of the Dam the course of the Nile is merely a deep-cut trench bound on the eastern side by precipitous cliffs and on the western side by a lower escarpment. Increase of cultivation by water lifting is already established in certain more populated centers such as El-Dekka, El Dirr, etc. Drar (1953).

North of the Dam there are about one million feddans (1 feddan = 1.038 acres) under basin irrigation. Along the desert side of the basin irrigated land and of the land already transferred from basin to perennial irrigation, there are considerable areas of higher ground that can also be cultivated if provided with water. Increased cultivation by the use of water from subterranean wells has been achieved, to a small extent in the basin land, Drar (1953).

1.2.Lower Egypt (Nile Delta)

It begins north of Cairo and the cultivated areas are now totally under perennial irrigation. Nearly half of the Delta is occupied by lakes, swamps and desert arable lands still awaiting reclamation.

Water storage is at present effected in Egypt by the Aswan Dam. Raising the water level for the feeding of canals is primarily carried out through the barrages of Esna, Nag'a Hammadi and Assiut in Upper Egypt, and Mohamed Ali, Zefta and Idfina in Lower Egypt. Drar (1953).

2. NATURAL VEGETATION

Essentially, almost all the vegetation is xerophytic. Aquatic plants are well represented in the Delta. Reed and swamp types occupy a considerable area of the northern lakes. Salt marsh plants are prominent than in any other part of the country.

Winter annuals constitute the bulk of the vegetation. Summer annuals are restricted number, except where summer crops are grown.

Vegetation of Nile region is represented by 543 species without algae which represents

29.9 % of the total number of species of the country. The Nile valley includes 149 species while the Delta and Fayoum depression contain 291 and 64 species respectively.
The life-form spectra in the area indicate that the majority of species are therophytes (59.4 %), hydrophytes and helophytes (9.8 %), hemicryptophytes (8 %), chamephytes (7.6 %), geophytes (6.4 %) and parasites (2.6 %). Hydrophytes and helophytes percentage is higher in Nile region than other regions. Therophytes percentage is relatively higher than other life-forms because they are more easily distributed by cultivation. The majority of weeds in the Nile region are therophytes, flower in spring or in early summer. Perennial weeds are rare.
The most represented families among the weeds are Leguminosae, Compositae, Cruciferae, Graminae and Amarantaceae. The abundance of weeds depends upon the type of crop.

2.1. DELTAIC SECTION OF THE RIVER NILE (Zahran & Willis 1992)

2.1.1. Ecological Characteristics

Three shallow lakes occupying the northern part of the delta characterize the geomorphology of the deltaic section: Lake Manzala (east), Lake Borollus (middle) and Lake Idku (west). Many areas around lakes are covered with water as a result of flooding from these lakes and inland canals. Some areas are salt flats and others are marshes.
Ecologically, the vegetation of the coastal Mediterranean area is by far the richest among the phytogegraphical regions of Egypt. Its flora represents more than 50 % of the total flora of Egypt (Hassib 1951; Takholm 1974). The middle section of the Mediterranean coast of Egypt extends between Abu Qir and Port Said for 180 km. (Zahran *et al*, 1990)

2.1.2. Species and Life Form

The most frequent life form in the middle section is therophytes followed by Cryptophytes, Chamaephytes, Hemicryptophytes and Nanophytes.
The Mediterranean Deltaic coast of Egypt consists of five distinct communities which are dominated by *Zygophyllum aegyptium, Arthrocnemum macrostachyum, Halocnemum strobilaceum, Juncus acutus* and *Juncus rigdus.* The associated species are *Juncus sublatus* and *Tamarix nilotica* as perennial, *Lotus halophilus, Salsola kali* and *Polypogon viridus* as annuals.
Soil fertility, salinity and moisture available are the most effective factors controlling species distribution.

2.1.3. Main Habitats and Natural Vegetation

The delta section of the Mediterranean coast of Egypt can be divided ecologically into four main habitats: salt marsh, sand formation, reed swamp and fertile non-cultivated land. In each habitat, vegetation types can be distinguished based on the dominance of single species. The salt marsh habitat comprises five such communities dominated by: *Zygophyllum aegyptium*, *Inula crithmoides*, *Arthrocnemum macrostachyum*, *Juncus acutus* and *Halocnemum strobilaceum*. The vegetation of the sand formation includes 11 communities dominated by: *Elymus farctus* ssp. *farctus*, *Alhagi graecorum*, *Cynodon dactylon*, *Heliotropium curassavicum*, *Stipagrostis lanata*, *Thymelaea hirsuta*, *Moltkiopsis ciliata*, *Asparagus stipularis* and *Pancratium maritimum* (sand dunes),

Cressa *cretica* and *Phragmites australis* (sand flats). The reed swamp habitat is dominated by *Typha domingensis*. In the fertile non-cultivated land *Alhagi graecorum*, *Cynodon dactylon* and *Heliotropium curassavicum* are the dominants.

Sand dunes

The sand formations comprise the low and small sandy mounds that form low sand bars along the shore-line. In this habitat *Zygophyllum aegyptium* predominates with no associate species and with very thin cover. Also, there are the huge of mobile sand dunes of Abu-Madi (60 m high) which are barren except for a very few plants of *Phragmites australis.* The partially stabilized sand dunes are dominant by the pioneer psammophytes *Stipagrostis ciliata* and *Elymus farctus* with abundant presence of *Alhagi maurorum, Astragalus tomentosus Silene succulenta, Erucaria uncata, Senecio desfontainei* and *Echinops spinosissimus.* Stabilized dunes are dominated by *Asparagus stipularis, Thymelaca hirsuta, Lycium europaeum* and *Lygos raetam.* The cultivated sand dunes at Baltim, Qalabshu and Zaiaan are characterized by shrubs of figs *(Ficus carica),* grapes *(Vitis sp.)* palm trees *(Phoenix dactylifera)* together with some vegetable cultivations e. g. tomato and watermelons. The flora of these dunes includes *Erucaria ancata, Launaca angustifolia* and *Bromus aegyptiacus.*

Salt marshes

The halophytic vegetation of these salt marshes is organized into community type dominated by *Arthrocnemum macrostachyum, Halimione portulacoides, Halocnemum strobilaceum, Juncus rigidus, Limoniastrum monopetalum, Suaeda vera, Tamarix tetragyna, Zygophyllum aegyptium, Inula crithmoides* and *Juncus acutus.*
Certain patches of these salt affected lands are covered with sand sheets. On these patches mixture of halophytes and xerophytes are present e.g. *Sporobolus virginicus* and *Senecio desfontainei.*

Swampy habitats

Typha domingensis predominates these swamps with *Phragmities australis* as abundant associate species. Other species are *Cyperas articulatus* and *C. lavigatas.* On the other saline fringes of these swamps many halophytes are growing e.g. *Juncus rigidus, J. acutus* and *Tamarix tetragyna.*

The fertile non cultivated lands

They are found on the well drained less saline soils. The most common species are mainly weeds as *Amaranthus gracizans, A. ascendens, Cakile maritima, Senecio desfontainei, Launaca angustifolia* and *Euphorbia peplis.*

2.2. THE DELTAIC MEDITERRANEAN COAST (Zahran, 2008)

The deltaic Mediterranean coast is a narrow belt influenced greatly by the sea. It is the coastal area between Abu Qir eastward to Port Said: 180 km from west to east and about 15 km from sea landward.

Four main types of habitat can be recognized in the deltaic Mediterranean coast of Egypt: sand formations, salt marshes, swamps and potentially cultivated lands. The sand formations comprise the low and small sandy mounds that form low sand bars along the shore-line. In this habitat *Zygophyllum aegyptium* predominates with no associate species and with very thin cover. Also, there are the huge mobile sand dunes of Abu Madi (60 m high) which are barren except for a very few plants of *Phragmites australis* which may be an indicator of a previously swampy habitat.

The partially stabilized sand dunes are dominated by the pioneer psammophytes *Stipagrostis ciliata* and *Elymus farctus* with abundant presence of *Alhagi maurorum* and *Echinops spinosissimus* etc. Stabilized dunes are dominated by *Asparagus stipularis, Echinops spinosissimus, Lycium europaeum, Silene succulenta* and *Thymelaea hirsuta*. The semi-wild *Phoenix dactylifera* is also a characteristic feature of the sand dune vegetation of this coastal belt.

The vegetation of the salt marsh habitat is of communities dominated or co-dominated by *Arthrocnemum macrostachyum* (widespread), *Halimione portulacoides, Halocnemum strobilaceum, Inula crithmoides, Juncus acutus, J. rigidus, Limoniastrum monopetalum, Suaeda vera, Tamarix tetragyna* and *Zygophyllum aegyptium*.

The frequent swampy habitats are usually in low areas of the landward zones where the water seeping from the lakes and/or drained from cultivated lands accumulates. *Typha domingensis* dominates in these swamps with the common presence *of Phragmites australis*. In the saline-saturated fringes of these swamps, rushes, e.g. *Juncus acutus* and *J. rigidus*, sedges, e.g. *Carex extensa, Cyperus laevigatus* and *Scirpus tuberosus*, grow.

The potentially cultivated land occupies the most landward areas of this coastal belt. Being less saline, this habitat supports the growth of annual weeds. The most abundant weed is *Cakile maritima*; common ones include *Amaranthus ascendens, Launaea angustifolia* and *Senecio desfontainei*.

2.3. NILE SYSTEM (Zahran, 2008)

The Nile system, encompasses the lands affected mainly by the water of the River Nile in Egypt and this includes: the Nile Valley between Aswan in the south northward to the Delta Barrages, the man-made lakes south of Aswan to the Sudano-Egyptian border, the Nile Delta between the Delta Barrages northwards to the inland border of the Mediterranean coastal belt, and the Nile Fayoum at about 60 km southwest of Cairo in the Western Desert. The vegetation types of the different habitats of these two sub-regions are described.

The plants of the Nile system of Egypt (about 553 species) (The number now known is higher and may reach >600 (Täckholm, 1974)) represent about 29.9% of the total flora of Egypt (Hassib, 1951). About 126 species are not recorded elsewhere in Egypt. Apart from *Opuntia ficus-indica* (Cactaceae), usually cultivated as a fence plant and for its edible fruits, no stem succulents are present in the Nile system flora. Megaphanerophytes, mesophanerophytes and epiphytes are also absent. The percentage of hydrophytes and helophytes (9.8%) is, however, higher than in other regions of Egypt.

The Nile system of Egypt includes a number of habitats formed and/or greatly influenced by the water of the River Nile. These are: 1) The aquatic habitat, 2) The swampy habitat, 3) The canal bank habitat, 4) The cultivated lands, 5) The northern lakes, 6) The artificial lakes, 7) The Nile Islands.

2.3.1. Aquatic Habitats

The hydrophytes of the River Nile and its irrigation and drainage systems are greatly developed in Egypt due to several reasons: 1) the warm climate on the most of the year, 2) the establishment of the Aswan High Dam with its associated and followed effects such as change in fertilization behavior, control the water flow and dredging which removes large quantities of seeds and perennating organs of water plants (Zahran, 2008).

The aquatic weeds of the Nile system of Egypt are some 35 species of 19 genera of 15 families (Täckholm, 1974). The plants are either entirely submerged, free- floating or their roots may penetrate the soil at the bottom of the stream. Some of these bottom-rooting plants have floating leaves. Recently, Zahran and Willis (2003) stated that the aquatic vegetation of the River Nile system of Egypt comprises 36 communities dominated by 8 submerged, 9 floating and 19 emerged species. An account of these aquatic weeds follows. The important aquatic community was family identified (Zahran, 2008):

Araceae: represented by the free floating species *Pistia stratiotes*. Its presence in Egypt is recorded in a limited area of the northern section of the Nile Delta, in calm and stagnant canals of Faraskur.

Ceratophyllaceae: two are rare (C. *submersum* and *C. muricatum*) and the third is common (C. *demersum*).

Haloragidaceae: *Myriophyllum spicatum* has been fairly recently recorded invading the River Nile and its system.

Hydrocharitaceae: Three submerged perennial fresh-water weeds of this family – *Elodea canadensis, Ottelia alismoides* and *Vallisneria spiralis* – are all rare in Egypt.

Lemnaceae: six species of three genera – *Spirodela, Lemna* and *Wolffi* are present. *Spirodela punctata* is common in the Nile Delta whereas S. *polyrrhiza* is common in the stagnant water of the Nile system. *Lemna gibba* is the most common and widely present species of this family. *L. perpusilla* and *L. minor* are rare in the Nile Delta. *Wolffi a hyalina* is common in the stagnant fresh and brackish waters.

Lentibulariaceae: only one genus, *Utricularia*, of this family occurs.

Marsileaceae: *Marsilea* is the only genus of this family present in Egypt.

Najadaceae: *N. pectinata, N. minor* and *N. graminea* are rare in the Nile Delta, and absent from other parts of the Nile system. *N. armata*, however, is a common annual weed of the channels of the Nile Delta and Fayoum (Täckholm, 1974).

Nymphaeaceae: Two species have been recorded in the Nile system: *N. coerulea* and *N. lotus*. Both are common in the Nile Delta but rare in or absent from the Nile Valley.

Onagraceae: *Jussiaea repens* is a rare hydrophyte in the Nile Delta and absent from other areas of the Nile system.

Pontederiaceae: The genus *Eichhornia* includes two species of free-floating plants that occur in Egypt: *E. crassipes* (the worst water invasive plant in Egypt) and *E. azurea*

Potamogetonaceae: *Potamogeton* is the only genus of this family in Egypt and is represented by a group of submerged plants (pondweeds). Five *Potamogeton* species and one variety known to occur in Egypt: *P. natans, P. natans* v. *serotinum, P. lucens, P. crispus, P. pusillus* and *P. pectinatus*.

Ranunculaceae: Four annual hydrophytes of the genus *Ranunculus* have been identifi ed in the Nile system of Egypt: *R. rionii, R. saniculifolius, R. sphaerospermus* and *R. trichophyllus*. All of these species are either rare in the Nile Delta or absent from Upper Egypt.

Ruppiaceae: The single genus *Ruppia* is represented in Egypt by one perennial submerged species, *R. maritima*, which occurs in two varieties: v. *spiralis* and v. *rostrata*. The first is very rare in the salt water of the Mediterranean coastal area whereas the second is very common in all types of water in Egypt.

Zannichelliaceae: *Zannichellia* is a genus of submerged perennial hydrophytes that grows in fresh, brackish and salt water in Egypt. *Z. palustris* is a very common weed, present in three varieties: v. *genuina*, v. *pedicellata* and v. *major.*

2.3.2. Swampy Habitats

In the swampy parts of Egypt reeds grow near water usually with their root system and lower parts of their shoot system below the water level.

Some of these plants are rooted at the normal water level and their stems and branches spread out over the water: e.g. *Agrostis semiverticillata, Alternanthera achyranthoides, Diplachne fusca, Echinochloa stagnina* and *Jussiaea repens*.

Others spread from the bank in a similar manner but their strong stems may develop from submerged creeping systems, some only from rather shallow water, e.g. *Cyperus alopecuroides* and *Typha domingensis*.

A third type of swamp plant grows in relatively deep water, e.g. *Cyperus articulatus* and *Phragmites australis*.

The swampy habitat may has the important plant communities: *Phragmites australis, Echinochloa stagnina, Echinochloa crus-galli, Diplachne fusca, Typha domingensis, Jussiaea repens, Polygonum salicifolium, Polygonum senegalense, Paspalidium geminatum, Polypogon semiverticillatus, Alternanthera repens, Veronica anagallis-aquatica.*

Besides the species mentioned above, other plants of the swampy habitats of Egypt include *Alisma gramineum, A. plantago-aquatica, Bacopa monnieri, Carex divisa, Cyperus articulatus, C. difformis, C. longus, C. mundtii, C. polystachyos, Damasonium alisma, Eleocharis caribaea, E. palustris, Fuirena ciliaris, Juncus acutus, J. subulatus, Limosella aquatica, Scirpus litoralis* and S. *supinus*.

2.3.3. Canal Bank Habitats

The plants of the canal bank habitat may be categorized into three types: (a) bank retainers; (b) "aggressive" species (smotherers); and (c) sand controllers.

The bank retainers are plants having bankholding qualities, e.g. cultivated trees and shrubs: *Acacia nilotica, Ficus sycomorus, Melia azedarach, Morus alba, M. nigra, Parkinsonian aculeata, Salix safsaf, Tamarix arborea* and *Ziziphus spina-christi*, and undershrubs, herbs and grasses e.g. *Alhagi maurorum, Arthrocnemum glaucum, Arundo donax, Chenopodium ambrosioides, Conyza dioscoridis, Cynodon dactylon, Desmostachya bipinnata, Imperata cylindrica, Panicum maximum* and *Suaeda vermiculata*.

"Aggressive" species (smotherers) are those which make such rapid and robust growth that they prevent many smaller and more slow-growing plants, including weed species, from establishment. Quick growing species, which form mats, either perennials, e.g. *Cyperus laevigatus* and *Lippia nodifl ora*, or annuals, e.g. *Trifolium resupinatum*. Apart from the previously mentioned species, *Canna indica, Inula crithmoides, Saccharum spontaneum* v. *aegyptiacum, Silybum marianum* and *Sphaeranthus suaveolens* are also vigorous and dense growing plants on salt soils.

The sand controllers are plants that can tolerate and at least partly stabilize drift sand. The efficient windbreak trees, shrubs and other perennials include *Arundo donax, Casuarina equisetifolia, Dalbergia sisso. Eucalyptus citriodora, E. rostrata, Parkinsonia aculeata, Ricinus communis, Salix babylonica, S. safsaf* and *Tamarix aphylla*. Some plants of this group spread when once established, either by seeds, e.g. *Dalbergia sisso* and *Ricinus communis*, or by a creeping underground system, e.g. *Arundo donax*. Some species are especially useful in trapping sand in salt marsh areas, e.g. *Arthrocnemum glaucum, Halimione portulacoides, Inula crithmoides, Juncus rigidus, Nitraria retusa* and *Sporobolus spicatus. Opuntia fi cus-indica*, a fence plant, is also a sand controller.

The flora of the canal banks may also include *Ambrosia maritima, Andropogon annulatus, Coronopus niloticus, Eclipta alba, Ethulia conyzoides, Glinus lotoides, Gnaphalium pulvinatum, Potentilla supina, Urospermum picroides, Bassia indica* and *Verbena supina*.

2.3.4. Cultivated Lands & weed vegetation

The weeds of the cultivated lands of Egypt are mainly short-lived (ephemerals, annuals and biennials) herbs. Perennial herbs, under-shrubs and shrubs may also be present in certain neglected areas where the soil is affected by salt (with halophytes), is swampy (with helophytes) or is dry (with xerophytes).

The most common crop in permanently irrigated land during winter is wheat (*Triticum vulgare*). Other important crops include broad beans (*Vicia faba*) and Egyptian clover (*Trifolium alexandrinum*). The coastal land along the western Mediterranean coast is characterized by the rain-fed cultivation of barley (*Hordeum vulgare*). During summer the main local cereal crop is maize (*Zea mays*). This is replaced in the southern provinces of Upper Egypt and the oases by the warmth requiring millet (*Sorghum durra*). It is customary to have an associate crop in the same field, namely cow-pea (*Vigna sinensis*).

Cotton (*Gossypium barbadense*) is cultivated on a larger scale in the delta and in the northern provinces of the Nile Valley. Rice (*Oryza sativa*) is cultivated on a large scale in

Lower Egypt whereas sugar cane (*Saccharum offi cinarum*) is widely cultivated in Upper Egypt for the production of sugar.

Weeds of very common occurrence in the cultivated lands of winter crops in all regions of Egypt are *Anagallis arvensis, Brassica nigra, Chenopodium album, C. murale, Convolvulus arvensis, Cynodon dactylon, Melilotus indica, Polypogon monspeliensis, Sonchus oleraceus* and *Trifolium resupinatum*. Most of these species are natives of the Mediterranean region, whereas *Cynodon, Sonchus* and *Chenopodium album* are often found in the warm temperate regions of the world. These three weeds tend to continue their growth during the summer. New seedlings of *Sonchus* and *Chenopodium* appear during early summer whereas *Cynodon* persists throughout the whole year.

The very common weeds in summer crops include *Amaranthus angustifolius, A. ascendens, Convolvulus arvensis, Corchorus olitorius, Cynodon dactylon, Portulaca oleracea, Solanum nigrum* and *Sonchus oleraceus. Cynodon, Convolvulus, Solanum* and *Sonchus* may also be present in the winter months, although less common. The others are obligate summer weeds.

Among the, winter weeds, *Silene rubella* is rare, but there are more rare summer weeds, e.g. *Amaranthus chlorostachys, Ammi majus, Avena fatua, Beta vulgaris, Brassica nigra, Lolium perenne, Lotus corniculatus, Malva parvifl ora, Panicum repens, Plantago lagopus, Polypogon monspeliensis, Reichardia orientalis, Rumex dentatus* and *Xanthium spinosum*. Three of these weeds, *Amaranthus, Panicum* and *Xanthium*, are obligate summer weeds.

During winter, a group of plants may be recognized as characteristic of the barley cultivation of the Western Mediterranean coastal area; these include *Achillea santolina, Adonis dentata, Anacyclus glomerata, Bupleurum subovatum, Carduus getulus, Centaurea alexandrina, Cutandia dichotoma, Echium sericeum, Eryngium creticum, Filago spathulata, Herniaria hemistemon, Koeleria phleoides, Lathyrus pseudocicera, Linaria haelava, Onobrychis crista-galli, Peganum harmala, Plantago albicans, Reseda decursiva, Roemeria hybrida, Salvia lanigera, Scorzonera alexandrina* and *Trigonella maritima*.

The weeds of the cultivated lands of the western Mediterranean coastal belt include a group of halophytes and helophytes which also occur in similar habitats within other regions, e.g. Nile Fayoum and Oases. These plants include *Aeluropus lagopoides, Centaurium pulchellum, Cressa cretica, Cyperus laevigatus, Diplachne malabarica, Imperata cylindrica, Kochia indica, Phragmites australis, Schang-inia baccata, Scirpus tuberosus, Spergularia marina* and *Typha domingensis*.

The Nile Delta is the site of a few species not known in other parts of Egypt. *Melilotus siculus, Senecio aegyptius*, and *Setaria verticillata* are recorded for the winter.

The weed flora of the cultivated lands in the oases is a mixture of xerophytes, mesophytes, halophytes and helophytes, e.g. *Aeluropus lagopoides, Asphodelus tenuifolius, Bassia muricata, Boerhavia diandra, Citrullus colocynthis, Corchorus tridens, Cressa cretica, Fagonia indica, Haplophyllum longifolium, Heliotropium supinum, Hyoscyamus muticus, Kochia indica, Lagonychium farctum, Launaea cassiniana, Linaria aegyptiaca, Pulicaria arabiea, Salsola baryosma, Sckouwia thebaica,*

Scirpus tuberosus, Sporobolus spicatus, Tribulus longipetalus, Typha domingensis and *Withania somnifera*.

Weeds of general occurrence in all phyto-geographical regions of Egypt must have spread to the remote oases through the continuous introduction of new crops; such weeds as *Lathyrus hirsutus, Thesium humile* and *Trachynia distachya* are common to both the Mediterranean coastal area and the oases. This may be attributed to the introduction of barley from the Mariut district to the oases, e.g. Siwa Oasis. This group includes also *Astragalus corrugatus, Erodium malacoides, Phalaris paradoxa, Plantago pumila, Silene nocturna, S. villosa* and *Vaccaria pyramidata*.

2.3.5. Northern Lakes

The northern lakes of the Nile Delta, namely Lake Manzala, Lake Burullus and Lake Idku are very close to the Mediterranean Sea and separated from it by strips of land that are very narrow in several places and are connected with the sea through narrow outlets (straits).

Lake Manzala

Environmental Characteristics

Lake Manzala is the largest of the northern deltaic lakes of Egypt. According to location it serves five provinces, namely: Damietta, Port Said, Ismailia, Sharkiya and Dakahlia. Lake Manzala is not of maritime origin, having no relation to the Mediterranean Sea in its formation. It is characterized by a large number (1022) of islands. The water of Lake Manzala was less saline than that of the sea and was used for drinking during times of flood. But now and after the establishment of the Aswan High Dam (1965) no flooding occurs and the salinity of the lake is increased.

The climate affecting Lake Manzala is generally arid. The absolute minimum temperature ranges between 10°C in January and 23.7°C in August whereas the absolute maximum temperature ranges between 19°C in January and 33.3°C in August. Relative humidity is very similar throughout the year, the air being humid all the year round; relative humidity is rarely less than 70% or more than 80%. The rainfall of Lake Manzala ranges between 47 mm/year and 88 mm/year.

Vegetation

The ecology of the lake is reported by Montasir (1937), who states that the vegetation of Lake Manzala includes halophytic and helophytic species growing mainly on shores and islands of the lake. Included are 27 species as follows: *Arthrocnemum glaucum (A. macrostachyum), Arundo donax, Atriplex farinosa, Cistanche phelypaea, Cressa cretica, Cyperus laevigatus, Halimione portulacoides, Halocnemum strobilaceum, Halopeplis perfoliata. Inula crithmoides, Juncus acutus, J. rigidus, Limoniastrum monopetalum, Limonium delicatulum, Phragmites australis, Salicornia fruticosa, S. herbacea, Salsola kali, S. longifolia, Sporobolus spicatus, Suaeda pruinosa, S. salsa, S. vera, S. vermiculata, Tamarix aphylla, Typha domingensis* and *Zygophyllum aegyptium*. Ten of these species were dominants; these are *P. australis, A. macrostachyum, C. cretica, H. strobilaceum, H. portulacoides, I. crithmoides, J. acutus, J. rigidus, S. fruticosa* and Z. *aegyptium*.

According to Zahran *et al*. (1989), i.e. more than 50 years after the records of Montasir (1937), seven of these species listed are still dominant. *I. crithmoides* and *C. cretica* are nowadays recorded as common associates but S. *fruticosa* is absent. Further, five species, *Atriplex farinosa, Halopeplis perfoliata, Limoniastrum monopetalum, Salicornia herbacea* and *Suaeda vermiculata*, which were included in the floristic list of Montasir (1937), are absent.

According to Montasir (1937), the hydrophytes commonly growing in the water of Lake Manzala include *Ceratophyllum demersum, Eichhornia crasssipes, Lemna* spp. and *Potamogeton crispus*. However Khedr (1989) states that apart from the dominant "reeds" (*Phragmites australis* and *Typha domingensis*), the water habitat of Lake Manzala is characterized by fi ve dominant hydrophytes (*Eichhornia crassipes, Jussiaea repens, Najas armata, Potamogeton pectinatus* and *Ruppia maritima*) and four associates (*Ceratophyllum demersum, Lemna gibba, L. minor* and *Potamogeton crispus*). *Chara* sp. is also commonly present.

Plant communities

The vegetation of Lake Manzala islands, essentially halophytic, is described in seven communities dominated by *Phragmites australis, Juncus acutus, J. rigidus, Arthrocnemum macrostachyum, Atriplex portulacoides, Halocnemum strobilaceum* and *Zygophyllum aegyptium*.

***Phragmites australis* community**

It is widespread and its community occurs in all islands where it forms dense thickets along shore-lines with surface deposits of sand and silt with cover ranges between 50% and 100%. The common associate species were *Inula crithmoides* and *Arthrocnemum macrostachyum*

***Juncus acutus* community**

Common on all islands and its community usually occupies the first, low-level, zone of the sedge-meadow habitat, close to the reed zone, where the soil is wet, dark and slippery with thin salt crusts on the surface. The common associates are *A. macrostachyum, I. crithmoides, J. rigidus* and *P. australis*. Other associates include *Atriplex portulacoides, Cressa cretica, Conyza dioscoridis, Cyperus laevigatus, Juncus bufonius, Paspalidium geminatum, Scirpus tuberosus, Suaeda pruinosa, S. salsa* and *Tamarix nilotica*.

***Juncus rigidus* community**

Dominates a widespread community in the second landward zone of the sedge-meadow with a relatively low moisture content. The common associates were *Phragmites australis* and *Arthrocnemum macrostachyum.*

***Arthrocnemum macrostachyum* community**

A common succulent halophyte and its community is a prominent feature of the vegetation of Lake Manzala Islands. It grows in patches covering the high sandy habitat amidst low areas where seeped water is accumulated. Common associates were *A. portulacoides, H. strobilaceum, I. crithmoides, J. rigidus* and *P. australis*. Other associates include *Cressa cretica, Cyperus laevigatus, Frankenia hirsuta, Juncus acutus, Scirpus tuberosus, Suaeda pruinosa, S. salsa* and *Tamarix nilotica*

***Atriplex portulacoides* community**

Occurs on the dry parts of the salt lands next to that of *Arthrocnemum* with cover ranging between 50% and 90%. Common associates *A. macrostachyum* is closely associated and may be considered as co-dominant in some stands. *P. australis* and *I. crithmoides* are common associates.

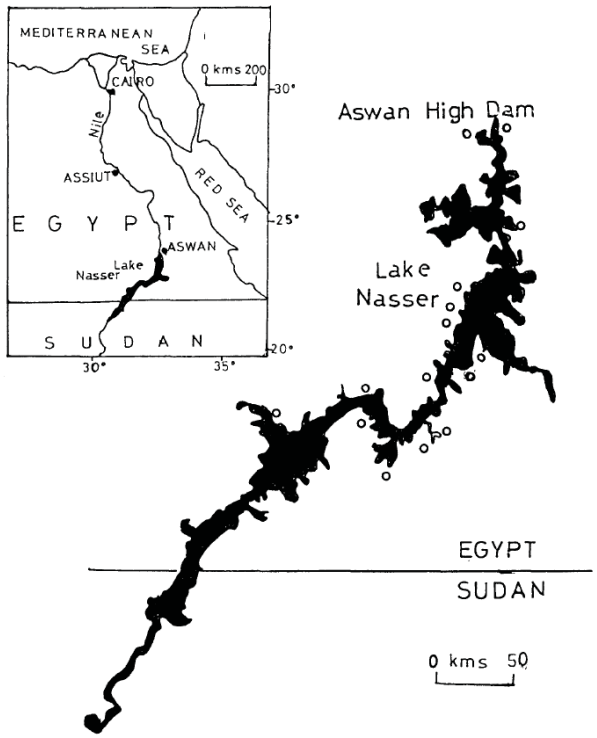
2.3.6. The artificial lakes

The valley upstream of the First Cataract has been converted into a reservoir by the construction of the first Aswan Dam (1902) across the Nile at the head of the cataract. The construction of the Aswan High Dam during the period 1959–1965 resulted in the formation of a great artificial lake and bounded the old reservoir between the two dams (Figs. 6.5 and 6.6). Accordingly, the River Nile in the most southern part of Egypt is characterized by two artificial lakes (reservoirs): (I) High Dam Lake and (II) Reservoir bounded by the two dams.

Lake Nasser (Springuel, et. al. 1991)

A fragile plant cover has developed during the last two decades along the shores of Lake Nasser, **then** largest impoundment of the River Nile. Development of this vegetation has been influenced by the prevailing environmental factors.

The Lake as a whole is mostly surrounded by rocky terrain, chiefly piedmonts and peneplains of sandstone (Raheja 1973). Variations in **the** size and shape of the Lake are obviously affected by the annual and over-year policy for the release of water from the Dam. This results in an annual variation in the water level of probably 5 to 10 m, over-year fluctuation can be as much as 30 m (Abu-Zeid 1987).



If we start with the lower part of the slope representing the wet end on the moisture gradient, the following zones of vegetation can be recognized:

1. Sparsely distributed seedlings of annuals *Crypsis schoenoides, Amaranthus lividus, Echium rauwolfii.*

2. A dense growth of annuals dominated by *Glinus lotoides* and *Heliotropium supinum;* associated species: *Hyoscyamus muticus* and *Portulaca oleracea.*

3. Zone of perennials dominated by *Tamarix nnilotica,* associated species: *Phragmites australis.* Annuals *(Rumex dentatus)* appeared after flooding, but dry individuals remained in the ground for a few years.

Transitional zone between zones 1-2 and zones 2-3, is inhabited by a sparse growth of annuals: *Eragrostis aegyptiaca, Cyperus pygmaeus, Senecio aegyptius* and *Fimbristylis bis-umbellata.* The desert perennials *(Salsola baryosma* and *Pulicaria crispa)* have a special position out of the recognized moisture gradient. They are indigenous plants in the desert around the Lake and their growth seems to depend on the seed bank rather than on other factors. Along the shores of the lake both plants are present only in isolated locations and do not form a continuous zone.

Vegetation Types of Lake Nasser (Zahran, 2008)

The vegetation types associated with the High Dam Lake are presented here under two main topics: a. vegetation of the khors and b. shore-line vegetation.

Vegetation of the Khors

Khor El-Amberkab and Khor Rahma

Located on the eastern side of the lake, 40 km and 50 km south of Aswan High Dam respectively. On the steep rocky slopes the perennial species frequently present are *Hyoscyamus muticus, Phragmites australis* and *Tamarix nilotica*. Less common and rare perennials include *Cynodon dactylon, Imperata cylindrica, Pulicaria undulata* and *Salsola baryosma. Glinus lotoides* is the abundant annual which, with some other annuals, grows in the crevices between the rocks and along the low banks near the water. These include *Amaranthus blitoides, Chenopodium album, Crypsis aculeata, Heliotropium ovalifolium, H. supinum* and *Rumex dentatus. Najas armata* and *N. minor* are abundant hydrophytes in the shallow water of these khors. Other aquatics are *Potamogeton nodosus* and *P. trichoides* (Springuel, 1985a).

Khor Kalabsha

The largest on the west side of the lake. Its shoreline is less rocky than shores of the eastern side. The silt and sand deposits form a fertile layer along the shore-line and could be used for cultivation. In this khor, 29 species are recorded: 22 terrestrial along the shore-line and seven aquatic in the shallow water.

Hyoscyamus muticus, Phragmites australis and *Tamarix nilotica* are frequent perennials whereas *Glinus lotoides* and *Heliotropium supinus* are frequent annuals. *Calotropis procera, Crypsis alopecuroides* and *Leptadenia arborea* are recorded onlym from Khor Kalabsha. Other associates include *Astragalus vogelii, Chenopodium album, Crypsis aculeata, Echium rauwolfi i, Imperata cylindrica, Portulaca oleracea, Rumex dentatus, R. vesicarius*, and *Salsola baryosma*. In the shallow water *Najas armata, N. minor* and *Potamogeton trichoides* are abundant. Four submerged hydrophytes (*Potamogeton crispus, P. nodosus, Vallisneria spiralis* and *Zannichellia palustris*) have scattered distribution.

Khor Allaqi

About 150 km south of Aswan High Dam, penetrates the Eastern Desert for about 80 km. It has a wide mouth and narrows towards its extremity. The flora of its shore-lines includes 28 species: 25 terrestrial and three aquatic growing in the shallow water near the banks. *Hyoscyamus muticus* and *Tamarix nilotica* are abundant perennials on the steep rock slopes. Abundant annuals – *Glinus lotoides, Heliotropium supinum, Portulaca oleracea* and *Rumex dentatus* – form a narrow belt on the low banks near the water. Less frequent species of Khor Allaqi are *Amaranthus lividus, Chenopodium album, Citrullus colocynthis, Crypsis aculeata, C. schoenoides* (absent from the other khors), *Cynodon dactylon, Cyperus michelianus, Diplotaxis harra, Fagonia arabica, Fimbristylis bis-umbellata, Heliotropium ovalifolium, Oligomeris linifolia, Rumex vesicarius, Salsola baryosma* and *Senecio aegyptius*.

The aquatic plants are *Najas armata, N. minor* and *Potamogeton trichoides*. Further south on the west side of the lake at Khors El-Madiq, El-Malki, Eneiba and Tushka (Fig. 6.5), the shore-line vegetation shows much the same floristic diversity. *Hyoscyamus muticus* and *Tamarix nilotica* are the abundant perennials and *Glinus lotoides* is the frequent annual. *Fagonia arabica* and *Salsola baryosma* are present in Khors El-Madiq and El-Malki, but are absent from Khors Eneiba and Tushka. Other plants recorded in these

khors are *Citrullus colocynthis, Crypsis aculeata, Echium rauwolfi i, Francoeuria crispa, Heliotropium ovalifolium, H. supinum, Phragmites australis, Portulaca oleracea, Rumex dentatus and R. vesicarius. Najas armata* and *N. minor* occur in the four khors whereas *Potamogeton trichoides* occurs only in Khors Eneiba and Tushka

Shore-Line Vegetation

According to water supply, deposition processes and the pattern of plant cover, six habitats may be recognized in the shore-line of the Aswan High Dam Lake (Springuel, 1985b).

Habitat 1: Steep Banks of the Lake and Central Elevated Parts of the Islands

This type of habitat provides suitable conditions for *Tamarix nilotica* whereas the dry remains of *Hyoscyamus* and *Phragmites* are conspicuous in the area. Annuals are infrequent and appear for only a short period after the annual high floods. The flora of this habitat includes *Citrullus colocynthis, Fagonia arabica, Francoeuria crispa* and *Salsola baryosma* (perennials) and *Echium rauwolfii, Glinus lotoides, Heliotropium supinum, Oligomeris linifolia, Portulaca oleracea* and *Rumex dentatus* (annuals).

Habitat 2: Areas at the Edge of Rocky Slopes and Low Banks

Suitable habitat for perennials such as *Hyoscyamus, Phragmites* and *Tamarix*. The vegetation of this habitat includes the species of habitat 1 in addition to *Calotropis procera, Morettia philaena, Pulicaria undulata* and *Senecio aegyptius*.

Habitat 3: The Low Banks Submerged During Certain Periods

Phragmites is very frequently found near the water. Dense carpets are formed, with 100% cover in some stands by *Glinus lotoides* and *Heliotropium supinum*. This is followed by a narrow belt of *Crypsis aculeata, C. alopecuroides* and *C. schoenoides-Chenopodium album, Portulaca oleracea, Rumex dentatus* and *R. vesicarius* and other annuals seldom occur far from the water. Numerous seedlings of *Tamarix nilotica* grow on low banks but most of the seedlings do not survive the prolonged fl ooding. *Cynodon dactylon, Echium rauwolfii, Francoeuria crispa, Heliotropium ovalifolium, Morettia philaena, Oligomeris linifolia* and *Salsola baryosma* are occasional in this habitat.

Habitat 4: Embankments Covered by Gravel

Perennials normally do not live beyond the seedling stage in this habitat (except *Hyoscyamus muticus*). Annuals such as *Glinus lotoides* and *Amaranthus* sp. are abundant; other plants present are *Crypsis* spp., *Heliotropium ovalifolium, H. supinum, Phragmites australis, Portulaca oleracea, Salsola baryosma* and *Tamarix nilotica*.

Habitat 5: Small Islets Close to the Water Level

Favourable habitats for pioneer plants such as *Hyoscyamus muticus, Glinus lotoides* and *Rumex dentatus. Tamarix nilotica* is restricted to the central parts of these islets where softer soil accumulates and where some seedlings are able to survive the long inundation.

The flora of this habitat includes the species of habitat 4 as well as *Echium rauwolfii, Oligomeris linifolia* and *Rumex vesicarius*.

Habitat 6: Shallow Waters Along the Shore-Line and Islands

Potamogeton trichoides, Najas minor and *N. armata* are abundant species with common presence of *Potamogeton nodosus* and *Zannichellia palustris*

Bishai *et al*. (2000) reported eleven submerged fl owering and non-flowering species in the water of Lake Nasser. These are: *Najas marina* subsp. *armata, N. horrida, Vallisneria spiralis, Zannichellia palustris, Potamogeton lucens (= P. schweinfurthii), P. crispus, P. Pectinatus, P. trichoides, P. perfoliatus*, and *Myriophyllum spicatum* (flowering plants) in addition to the macro-algae *Nitella hyaline*.

The Nile islands (Zahran, 2008)

Group I: Aswan area

Environmental *characteristics*

The Nile at Aswan, north of the High Dam, is interrupted by about 30 islands of varied size and structure. Most of these are small uninhabited granite islets which support natural vegetation believed to be the only remains of the original plant cover of the Nile Valley that survived after the establishment of the Aswan Dam (1902–1930) and the High Dam (1960–1965). The vegetation of these islands represents a relict of woodland growth that became scarce (El-Hadidi and Springuel, 1978).

First Cataract, which is about 7 km south of Aswan with a length of 12 km. The First Cataract forms the least obstacle in the course of the river on its way north (Abu Al-Izz, 1971). North of the first cataract located are small islands in the Nile dividing it into sectors. The most famous of these are Suluga Island and Aswan Island. The latter was known during the Roman era as Elephantine Island (Springuel, 1981). The Aswan area represents one of the extremely dry areas of the world, almost rainless (average 1.0 mm/year).

Habitat and vegetation types

Five main habitats have been recognized in the rocky islands of the River Nile in the Aswan area: submerged land, partly submerged land, seasonally submerged land, occasionally submerged land and dry land (Springuel, 1981).

Submerged Land

Includes shallow areas along the banks of the Nile, around the islands and areas between the islands where the water current is slow. The ground is mostly sandy and occasionally muddy. In areas where the current is strong the bottom is mostly covered by gravel and aquatic plants are absent. The aquatic vegetation of this habitat is co-dominated by *Ceratophyllum demersum* and *Potamogeton crispus* with a cover from 10% to 100%. The water depth ranges from 80 cm to 250 cm for *C. demersum* and *P. crispus* (dominants), *P. perfoliatus* and *Zannichellia palustris* (perennial associates) and *Najas armata* and *N. pectinata* (annual associates). Rarely *Typha domingensis* has been recorded in the shallow parts of the fringes of this habitat.

Partly Submerged Land

This habitat is dominated by *Polygonum senegalense* which is an aquatic/terrestrial, tall glabrous plant with thick, swollen horizontal stolons, just above the soil surface, up to 3 m long and with vertical stems reaching 1.5 m.

The vegetation of this habitat includes 17 species in addition to the dominant. *Phragmites australis* is abundant. Common are *Cyperus longus, Mimosa pigra, Oxystelma esculentum, Panicum repens, Salix* spp., *Tamarix nilotica* and *Typha domingensis*. Other associates are *Conyza dioscoridis, Cynodon dactylon, Cyperus mundtii, C. rotundus, Leptadenia heterophylla, Ricinus communis, Sesbania sesban* and, *Veronica anagallis-aquatica* (perennials) and *Avena fatua* (annual).

Seasonally Submerged Land

Low Bank Meadow

The main characteristic of the meadow grasses is their capacity for vegetative spread which tends to exclude colonization by new species and provides a suffi ciently large population to withstand fl ooding. This habitat is generally dominated by *Cynodon dactylon* and *Panicum repens* which form a narrow belt (2–5 m) on the low banks of the islands.

The phytocoenosis of the *Cyperus-Panicum* meadow (cover 70–100%) of these islands shows considerable fl oristic richness. A total of 46 species has been recorded: 11 trees and shrubs, 16 perennial herbs and 19 annuals. The flora of this meadow includes *Cyperus mundtii* and *Lotus arabicus* (abundant), and *Cajanus cajan, Cyperus rotundus* and *Sesbania sesban* (common). Less common associates are *Cyperus longus, Leptadenia heterophylla, Polygonum senegalense, Senecio aegyptius* and *Tamarix nilotica*. Other associates include *Acacia nilotica, A. raddiana, A. seyal, Avena fatua, Brassica arabica, Chenopodium album, Conyza dioscoridis, Crypsis schoenoides, Digitaria nodosa, Eclipta alba, Eremopogon foveolatus, Francoeuria crispa, Heliotropium ovalifolium. H. supinum, Hemarthria altissima, Imperata cylindrica, Medicago sativa, Mimosa pigra, Oxystelma esculentum, Ricinus communis, Saccharum spontaneum, Salix subserrata, Solanum nigrum, Sonchus oleraceus*, and *Veronica anagallis-aquatica*.

Low Rocky Habitat

This habitat is also seasonally submerged and is characterized by the presence of a large number of species, with different pioneer plants on the low rocky areas, randomly distributed along the banks of the islands. This rocky habitat supports a rich flora (49 species): 15 trees and shrubs, 17 perennial herbs and 17 annuals. In spite of such high floristic diversity, the vegetation is fairly open with a low cover (but up to 70%).

The most frequent shrubs (*Leptadenia heterophylla* and *Tamarix nilotica*) are those with very low cover values and hence do not much infl uence the physiognomy of the vegetation. The plants with high cover are *Cynodon dactylon, Francoeuria crispa* and *Panicum repens* (perennials) and the annual *Lotus arabicus*. Common plants with low cover include *Conyza dioscoridis, Mimosa pigra, Oxystelma esculentum* and *Sesbania sesban* (shrubs), *Cajanus cajan, Cyperus longus, C. mundtii, Imperata cylindrica* and *Polygonum senegalense* (perennials) and *Conyza aurita, Heliotropium* spp., *Senecio aegyptius* and *Trigonella hamosa* (annuals).

Occasionally Submerged Land

This habitat is characterized by recent, mobile and deep sand deposits. It consists of flat terraces at the water level from 80 to 150 cm high which are occasionally flooded (once

every few years). On the other hand, the large difference in day and night temperatures promotes the condensation of water at night which is sufficient for some annual species.

The vegetation of the occasionally submerged land is an open type dominated by two species with broad ecological tolerance to these conditions of moisture and soil– *Tamarix nilotica* and *Leptadenia heterophylla.* The phytocoenosis of this habitat shows low diversity. Eighteen species are recorded: 6 trees and shrubs, 9 perennial herbs and 3 annuals. The plant cover is heterogeneous, ranging from 5% to 80%, but is usually less than 40%, the main contributors to the cover being the canopy of *Acacia albida, Leptadenia heterophylla* and *Tamarix nilotica*. Species such as *Acacia raddiana, A. seyal, Cynodon dactylon, Eragrostis aegyptiaca, Francoeuria crispa* and *Vahlia dichotoma*, though common, make little contribution to the cover. Other species in this habitat include *Acacia nilotica, Conyza aurita, Cyperus mundtii, C. rotundas, Fimbristylis bisumbellato, Imperata cylindrica, Lotus arabicus, Panicum repens, Saccharum spontaneum* and *Tephrosia apollinea*.

Dry Land

The dry land of the Nile islands at Aswan may be divided into (a) silty habitats and (b) high rocky habitats.

Silty Habitats

A characteristic feature of this habitat is that the vegetation has four layers. The upper layer is formed by *Acacia* trees, the second is a shrub layer of *Tamarix nilotica*, the third is of under-shrubs, and the fourth is the ground layer formed by some perennials, e.g. *Cynodon*, and annuals, e.g. *Sonchus*.

In Egypt there are 13 species of *Acacia* (Täckholm, 1974), six of these – *A. albida, A. arabica, A. laeta*, *A. nilotica*, *A. raddiana* and *A. seyal* – being present in the silt habitat of Aswan Island.

The vegetation in the low deposit area is clearly layered. The uppermost, tree layer (3–5 m high) is represented by the common trees *Acacia nilotica* and *A. seyal* as well as the rare *A. arabica, A. laeta* and *A. raddiana*. The shrub layer (150–300 cm high) comprises *Tamarix* and A *albida* which also grows as shrubs. The undershrub layer includes *Cajanus cajan, Desmostachya bipinnata, Hyoscyamus muticus, Imperata cylindrica, Francoeuria crispa* and *Tephrosia apollinea*. The ground layer includes *Cynodon dactylon* and *Cyperus mundtii, C. rotundus* and *Panicum repens* (perennials), *Conyza aurita, Lotus arabicus, Schoenefeldia gracilis* and *Senecio aegyptius* (annuals).

The vegetation cover of the low silt deposits area ranges between 10% and 100%. The plants grow in groups differing in size and diversity. Between these groups is usually a thin shrub layer of *Tamarix nilotica* (1–1.5 m high) associated with *Francoeuria crispa* and with *Leptadenia heterophylla* which twines around *Tamarix* and covers *Francoeuria* or grows on the bare surface of the silt. *Acacia albida, A. nilotica* and *A. seyal* usually form thickets. Some stands of *A. albida* are very dense and impassable thickets interwoven with *Leptadenia*. In these thickets, *A. seyal* is present either in tree form with an umbrella-shaped crown or as a shrub if the main trunk has been cut. *A. laeta* and *A. raddiana* usually grow on the slopes of the silt terraces and form groups with open

canopies together with other *Acacia* trees. *T. nilotica* grows between the groups of trees and usually forms a shrub layer not more than 1.5 m high, with an open canopy.

The vegetation of the deep silt deposits is an open one with maximum cover of 50%. It is of low diversity. The most common species are *Acacia nilotica* (tree), *Leptadenia* (twiner) and *Tamarix* (shrub). Less common ones include *A. albida, A. seyal, Calotropis procera, Desmostachya bipinnata, Francoeuria crispa, Imperata cylindrica* and *Ziziphus spina-christi*.

High Rocky Habitat

The high rocky habitat of the dry land of the Nile Islands at Aswan is of granitic rocks which are different in size and height and represent the base for deposits of soil-forming material brought by the river water around them. The best adapted plants for such dry conditions are *Francoeuria crispa* and *Leptadenia heterophylla*. Both have a high tolerance to drought and undemanding soil requirements. The plant cover ranges from 5% to 20%. Common associates are *Acacia raddiana. A. seyal* and *Tamarix nilotica*. Less common species include A. *albida, A. laeta, Calotropis procera, Desmostachya bipinnata, Imperata cylindrica, Ziziphus spina-christi* and the annual *Ceruana pratensis*.

Group II Minia Area

The plant life of 43 islands of the middle section of the main stream of the River Nile in Minia Area was studied by Mohamed and Hassan (1998). Most of these islands (34) are cultivated and the rest (9) are uncultivated, their areas ranged between 0.005 km^2 and 1.046 km^2.

Four habitat types are recognized in these islands, namely: wet, canal bank, cultivated lands and inhabited areas. The hydrophytes and helophytes inhabiting the wet habitat include: *Ceratophyllum demersum, Cyperus articulatus, Ludwigia stolonifera, Persicaria lapathifolia, P. salicifolia, Phragmites australis, Potamogeton nodosus*, and *Typha domingensis*

The canal bank habitat is organized into 2 terraces. The fi rst (lower) terrace is subjected sometimes to water flooding due to the fluctuation of water level of the Nile. The floristic assemblage of this terrace comprises hydrophytes, e.g. *Cyperus* spp., *Phragmites australis, Saccharum spontanum* and *Typha domingensis* and mesophytes, e.g. *Cynodon dactylon, Aster squamatus, Fibristylis bisumbellata, Alternanthera sessilis, Conyza bonariensis, Pluchea dioscoridis, Sencio aegyptius* and *Potentilla supine*. The second higher levelled terrace and its slope are characterized by the growth of *Sesbania sesban, Acacia nilotica, Cynanchum acutum, Ricinus communis, Imperata cylindrica, Desomstachya bipinnata, Cynodon dactylon, Alhagi graecorum, Tamarix nilotica* and *Cyperus* spp. A group of therophytes were recorded in this terrace, e.g. *Polypogon monspeliensis, Solanum nigrum, Phyla nodflora, Glinus lotoides, Eclipta alba, Chenopodium album, C. murale, Gnaphalium luteo-album, Ammi majus, Amaranthus lividus* and *Senecio aegyptius*.

The cultivated areas of these islands are characterized by weed plants associated with fi eld crops and vegetables. The main aggresstal weeds (inside the fi elds) are: *Solanum nigrum, Malva parvifl ora, Melilotus indicus, Orobanche ramosa, Euphorbia peplus,*

Trifolium ruspinatum, Trigonella glabra, Brassica tournefortii, Spergularia marina, Beta vulgaris, Chenopodium album, C. mural, Cyperus rotundus, Convolvulus arvensis, Sonchus oleraceaus, Ammi majus, Cynodon dactylon, Echinochloa colona, Polypogon monspeliensis, Leptochloa fusca, Setaria verticillata, Rumex dentatus, Protulaca oleraceae, Cuscuta pedicllata and *Amaranthus lividus*. The radial weeds (outside the cultivated plots) include: *Cyperus articulatus, C. alopecaroides, Desmostachya bipinnata, Juncus hypridus, Sphaeranthus suaveolens, Pluchea dioscoridis* and *Tamarix nilotica*.

The areas inhabited by the farmers contain some of the shade trees and shrubs e.g. *Ficus retusa, Eucalyptus rostrata, Ricinus communis, Delbergia sisso* and *Phoenix dactylifera*.

2.4. HYDROPHYTIC VEGETATION IN THE IRRIGATION AND DRAINAGE CANALS (Mashaly & El-Ameir 2007)

Eighty sampled stands were selected in the study area representing various water ways, namely, drainage canals, irrigation canals, northern lakes (Manzala, Borollus and Idku), Damietta branch, Rosetta branch and main stream of the River Nile. (Mashaly & El-Ameir 2007)

70 plant species recorded in 80 sampled stands led to recognition of six vegetation groups dominated by *Phragmites australis*, *Eichhornia crassipes*, *Typha domingensis*, *Arthrocnemum macrostachyum* and *Echinochloa stagnina*

In Egypt, the total length of canals and drains is approximately 4700 km (Van der Bliek, 1982). These canals and drains are infested by different aquatic weeds. The degree of infestation is affected by environmental factors, including water transparency, depth of water, physico-chemical properties, water quality, water currents and air temperature (El-Gharably, 1982).

The different life forms of hydrophytes were recognized as well as the aquatic vegetation groups were defined in different parts of Egypt by many authors (Springuel, *et al*. 1990; Zahran & Willis, 2003).

Species

Alhagi graecorum
Alternanthera sessilis
Amaranthus lividus
Arthrocnemum macrostachyum
Arundo donax
Aster squamatus
Atriplex canescens
Atriplex prostrata
Bassia indica
Bidens Pilosa
Cakile maritima subsp. maritima
Carthamus tenuis
Ceratophyllum demersum
Chenopodium album
Chenopodium ficifolium
Chenopodium murale
Conyza aegyptiaca
Conyza bonariensis
Cynodon dactylon
Cyperus alopecuroides
Cyperus articulatus
Cyperus difformis
Cyperus laevigatus
Cyperus rotundus
Echinochloa stagnina
Eclipta alba
Eichhornia crassipes
Elodea canadensis
Ethulia conyzoides
Halocnemum strobilaceum
Heliotropium lasiocarpum
Imperata cylindrica
Ipomoea carnea
Juncus acutus
Juncus rigidus
Juncus subulatus
Lemna gibba
Lemna minor
Leersia hexandra
Limbarda crithmoides
Ludwigia stolonifera
Marsilea aegptiaca
Mesembryanthemum crystallinum
Mesembryanthemum nodiflorum
Myriophyllum spicatum
Najas minor
Nymphaea lotus
Panicum repens
Persicaria lapathifolia
Persicaria salicifolia
Phragmites australis
Pistia stratiotes
Pluchea dioscoridis
Potamogeton crispus
Potamogeton nodous
Potamogeton pectinatus
Ranunculus sceleratus
Rumex dentatus
Saccharum spontaneum
Salsola kali
Scirpus maritimus
Senecio glaucus
Solanum nigrum
Spergularia marina
Suaeda pruinosa
Tamarix nilotica
Typha domingensis
Veronica anagallis-aquatica
Vigna luteola
Zygophyllum aegyptium

(Mashaly & El-Ameir 2007)

3. RECOMMENDATIONS

1. Strengthen the implementation of the global strategy for plant conservation in Egypt to protect the plant diversity in the country

2. Promote and strengthen the research programs related to the important plant areas in Egypt

3. Implement the national strategy for conservation of medicinal plants in Egypt

4. Implement the national wetland strategy for sustainable management and protection of the important wetland sites in Egypt

5. Promote the public awareness and education programs identifying the importance of plant resources

6. Training and capacity building for those who work in the plant conservation field (protected areas of Egypt)

7. Promote and encourage the funds and projects working on the plant species and habitat conservation

8. Enhance the regular monitoring and conservation programs inside the protected areas and important plant areas

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CHAPTER 4
INVERTEBRATES

By
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1. ARACHNIDS OF EGYPT, THE MOST NORTHERN PART OF NILE BASIN

Egypt, the most northern part of Nile basin has a rich fauna of different orders of Arachnida. There are eight of the eleven known arachnid orders recorded from Egypt until now. Egypt lies in a transitional zone between three major bio-geographic units, i.e. the Palaearctic, the Afrotropical and the Oriental Realms. The arachnids (except ticks and mites) are poorly studied in Egypt. There are scattered publications since the second half of the 18th century until now. The first collective work on Egyptian arachnids was published in 1825 by French scientists who accompanied Napoleon's expedition. The second one was published in 2002(!). The numbers of arachnid species of Egypt increased since that time as follows: Order Araneae (Spiders) from 81 to 386, Order Scorpions (Scorpions) from 3 to 26, Order Pseudoscorpions (Pseudoscorpions) from 3 to 18, Order Solifugae (Sun-spiders) from 4 to 26, and Order Opiliones (Harvestmen) from 3 to 6 species. Two species of micro whip-scorpions (Order Palpigradi) were recorded from Egypt for the first, and last, time in 1951. In 2002, one species of Order Amblypygi (Whip spiders) was recorded from Egypt to increase the recorded arachnid orders to eight ones. This discovery and the most recent discovery of the scorpion genus *Microbuthus* in 2007 from Egypt mean that there are many other unknown arachnid species in this country. These species need a good survey of Egypt to be discovered. These species may become extinct under human and industrial impacts before scientists can discover them. There is only one Egyptian taxonomist and one collection of Arachnida in Egypt. The lack of a natural history museum in Egypt, and the absence of supporting funds for arachnological studies make this field of studies "endangered".

Ancient Egyptians recognized several kinds of animals and deified some of them. Scorpion was one of those animals. This may be due to its capability to sting and to kill using its fatal venom. We have nothing about other arachnids in the ancient Egyptian mythology.

2. AVAILABLE INFORMATION

Table 4.1. Number of recorded arachnide species in Egypt and the world

Order	Number of recorded species in	
	The World	Egypt
Araneida	40 462*	386
Scorpionida	1 454	26
Pseudoscorpionida	3 266	18

Solpugida	**1 090**	**26**
Opilionida	**6 125**	**6**
Palpigradida	**79**	**2**
Amblypygida	**159**	**1**
Acarida	**38 861**	**>1100**
Uropygida	**106**	**Not yet recorded from Egypt**
Schizomida	**236**	
Ricinuleida	**57**	

3. DISCOVERIES EXPECTED

The record of whip spiders (Amblypygi) in 2002 for the first time from Egypt increased the recorded arachnid orders to eight ones. This discovery and the most recent discovery of the scorpion genus *Microbuthus* in 2007 from Egypt suggest that there are many other unknown arachnid species in Egypt. There is a lot of new species preserved in the Arachnid Collection of Egypt. Several hundreds of new species are possibly hidden in the Egyptian deserts and the Nile valley.

4. AVAILABLE EXPERTISE

Only one arachnid taxonomist, one arachnological bulletin (*Serket*), and one arachnid collection (The Arachnid Collection of Egypt - ACE), and both *Serket* and ACE depend on this man and they will mostly stop and vanish with him.

5. RECOMMENDED ACTIONS

a. Thorough survey should be conducted to obtain satisfactory information on the arachnids of Egypt.

This requires:

i. generous funding,

ii. training of more specialists to help the only arachnid taxonomist in Egypt.

b. Since human and industrial activities are affecting wildlife, including arachnids, it is recommended that necessary measures should be taken to protect them.

c. It is necessary to support the establishment of the Egyptian Natural History Museum to include different collections, especially private ones. The Arachnid Collection of Egypt will find secure shelter in this museum.

d. To get a real assessment of the arachnids of Egypt, it is necessary to survey all arachnid species living in Egypt, to study them, and to conduct studies on their venoms and silk to get benefit of them.

CHAPTER 5
HERPS

By
Basem Rabea

Environmental Researcher, Zaranik Protected Area, Nature Conservation Sector, EEAA

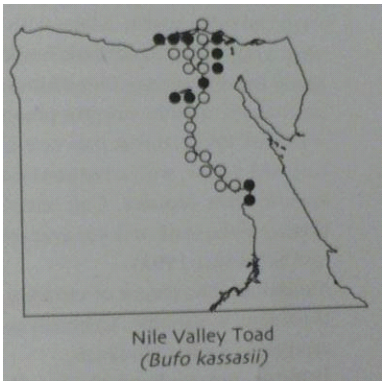
There are about 106 species of Reptilia and Amphibia in Egypt; six are endemic and one, the Egyptian Tortoise, is endangered.

The most numerous reptiles are the 49 species of lizards; of these the largest group is the Gekkonidae. Among the 36 snake species, nine are poisonous and a further nine are rear-fanged snakes that are also poisonous although they are less of a risk for humans due to the necessity of getting part of the victim to the back of their jaws in order to inject venom.

The five species of sea turtles found in Egyptian waters are all globally endangered. The Green Turtle and the Hawksbill both nest on Egypt's shores or on Egyptian islands. Five species of Bufonidae (toads), of which one is endemic, are joined by one tree frog and two other species of frogs. The impressive Nile Crocodile, once common along the Nile, is now found only in Lake Nasser, together with the large Nile Monitor and the Nile Soft-shelled Turtle.

In spite of being illegal, commercial trade in sea turtles appear in many CITES party countries one of which is Egypt. Turtles are continued to be exploited in Egypt since pharaonic time. Pharaohs were collecting turtles (Shetyw, Shetw, Sheta in Egyptian) for their shells and meat; they were using their shells as shields when hunting. Now sea turtles trade In Egypt appears along the Mediterranean coast from Sinai peninsula to the Libyan border. Sea turtles are sold for their meat in the fish markets. They are also traditionally consumed in Alexandria fish markets for their blood. The native people of Alexandria believe that blood of sea turtle can increase fertility and give power.

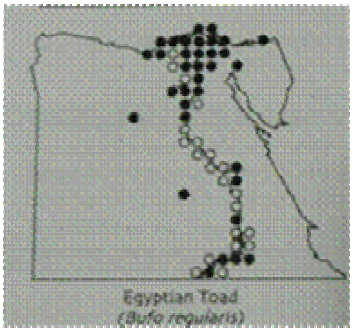
The Status and conservation needs of the most important reptiles with their distribution maps were identified as follows: (Bahaa El-Din, 2006)

Status and conservation needs of the most important reptiles	Distribution Map
Bufo kassasii Common but localized. Classified as least concern by IUCN. (2004)	

Bufo regularis

Fairly Common and wide spread.

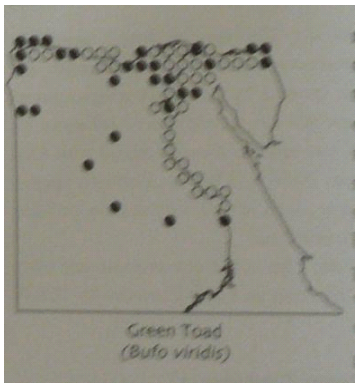
Classified as least concern by IUCN. (2004)



Bufo viridis

Common and wide spread.

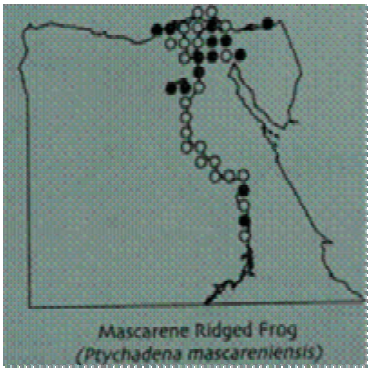
Classified as least concern by IUCN. (2004)



Ptychadena mascarreniensis

Fairly Common and wide spread.

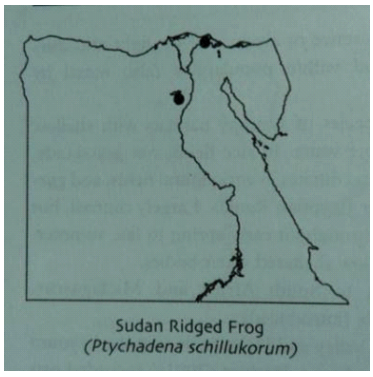
Classified as least concern by IUCN. (2004)



Ptycchadena schillukorum

Not well known. Apparently localized and rare

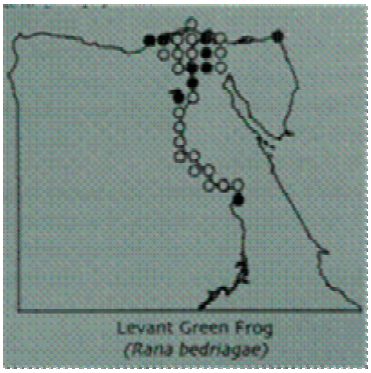
Classified as least concern by IUCN. (2004)



rana bedriagae

Common and wide spread.

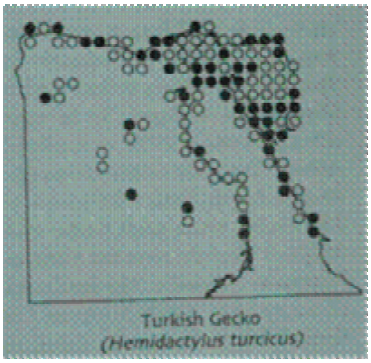
Classified as least concern by IUCN. (2004)



Hemidactylus turcicus

very Common and wide spread.

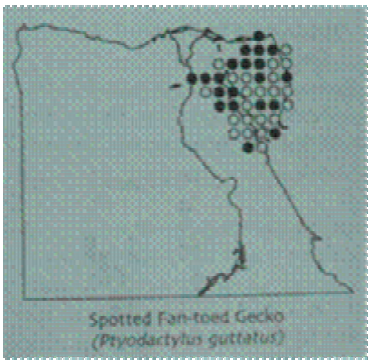
Classified as least concern by IUCN. (2005)



Ptyodactylus guttatus

Common throughout egyptian range.

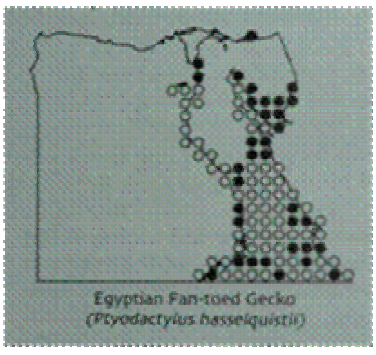
Classified as least concern by IUCN. (2005)



Ptyodactylus hasselquistii

Common

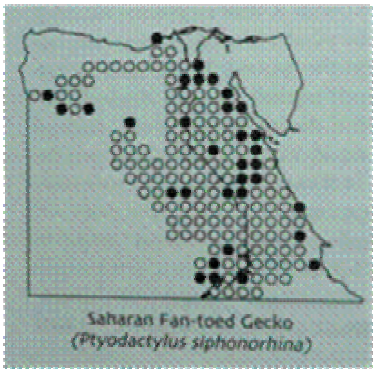
Classified as least concern by IUCN. (2005)



Ptyodactylus siphonorhina

Fairly Common and wide spread.

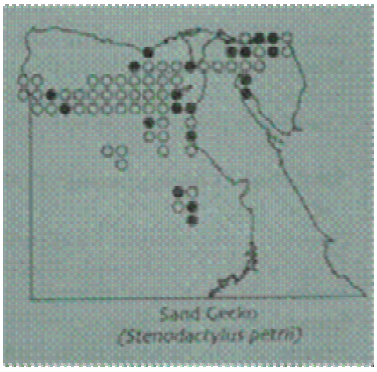
not listed by iucn. (2005)



Stendactylus petrii

Fairly Common

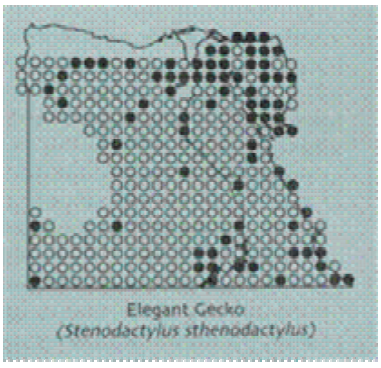
Classified as least concern by IUCN. (2004)



Stendactylus Stendactylus

One of the most widespread reptiles of Egypt.

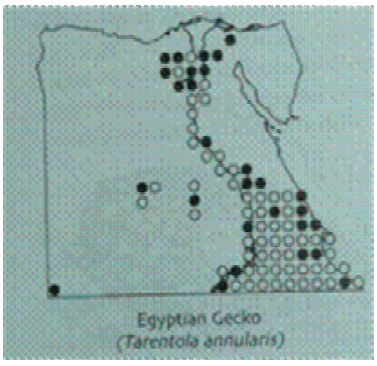
Classified as least concern by IUCN. (2005)



Tarentola annularuis

Subject to intensive collection by pet trader. For the export market.

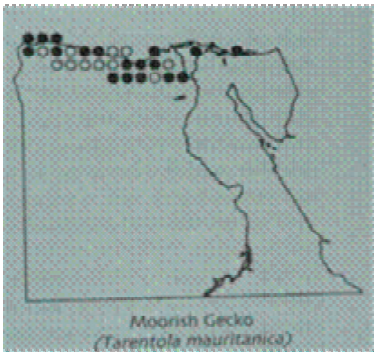
Classified as least concern by IUCN. (2005)



Tarentola mauritancia

Thousands are collected and exported every year.

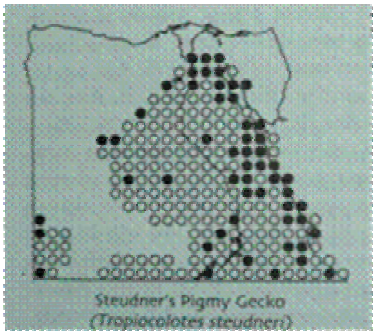
Classified as least concern by IUCN. (2005)



Tropiocolotes steudneri

Common

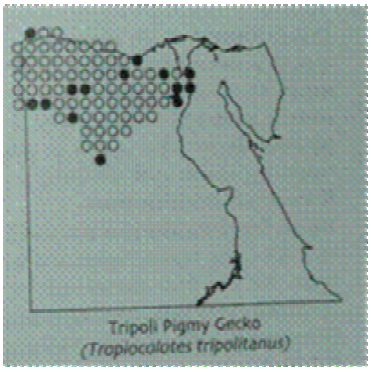
Classified as least concern by IUCN. (2004)



Tropiocolotes tripolitanus

less widespread.

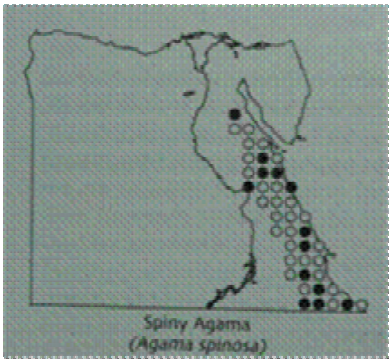
Classified as least concern by IUCN. (2005)



Agama spinosa

More Common and wide spread.

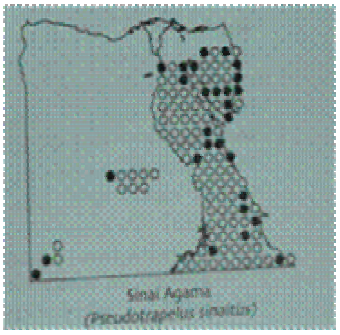
Classified as least concern by IUCN. (2005)



Pseudotrapelus sinaitus

Uncommon and wide spread.

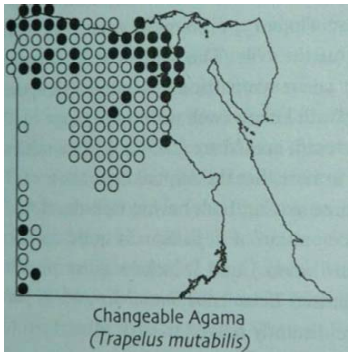
Classified as least concern by IUCN. (2005)



Trapelus mutabilis

Common and wide spread.

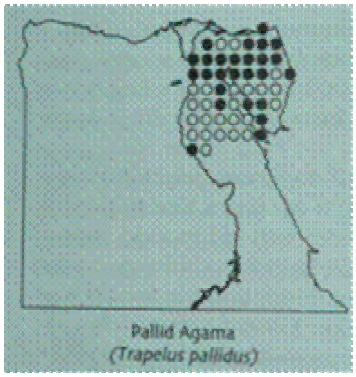
Classified as least concern by IUCN. (2005)



Trapelus pallidus

Fairly Common and wide spread.

Classified as least concern by IUCN. (2005)

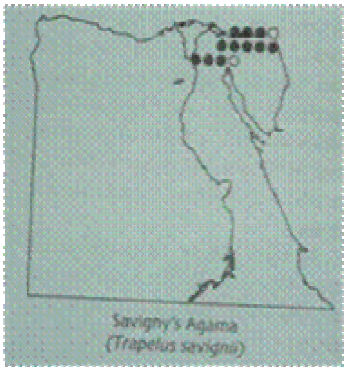


Trapelus savignii

Locally Common but declining.

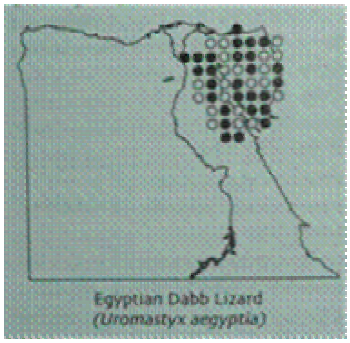
The species is practically endemic to Egypt

Classified as least concern by IUCN. (2004)



Uromastyx aegyptia

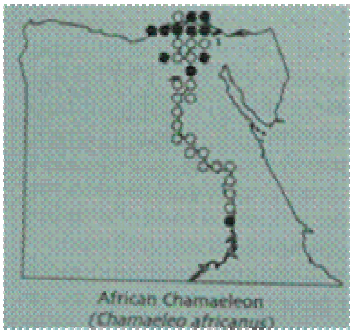
Classified as near threatened by IUCN. (2005)



Chamaeleon Africanus

Fairly Common in the northern delta

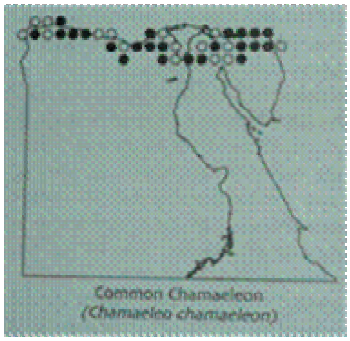
Classified as least concern by IUCN. (2005)



Chamaeleon chamaeleon

Fairly Common and wide spread.

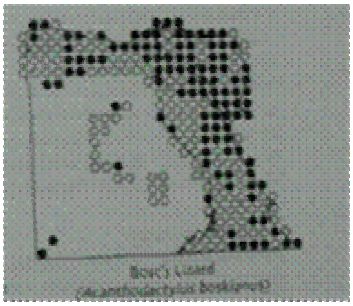
Classified as least concern by IUCN. (2005)



Acanthodactylus boskianus

Locally Common and wide spread.

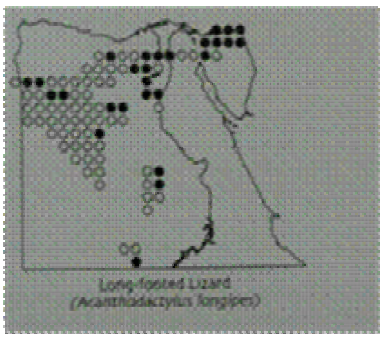
Classified as least concern by IUCN. (2005)



Acanthodactylus longipes

Common and wide spread.

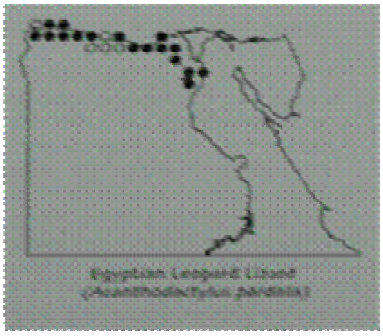
Classified as least concern by IUCN. (2005)



Acanthodactylus pardalis

One of Egypt's most threatened reptiles.

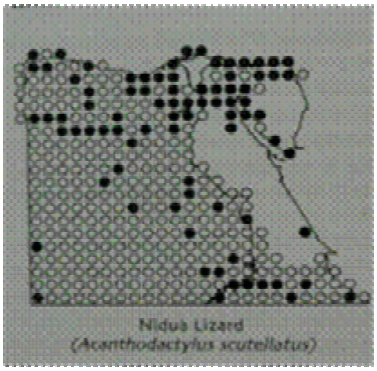
Classified as vulnerable IUCN. (2005)



Acanthodactylus scutellatus

Common and wide spread.

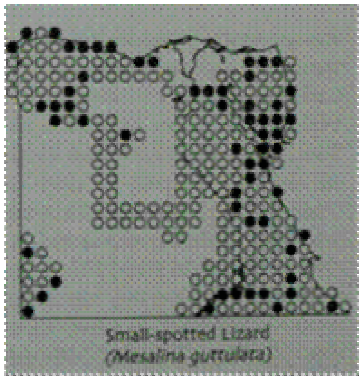
Classified as least concern by IUCN. (2005)



Meslina guttulata

Fairly Common and wide spread.

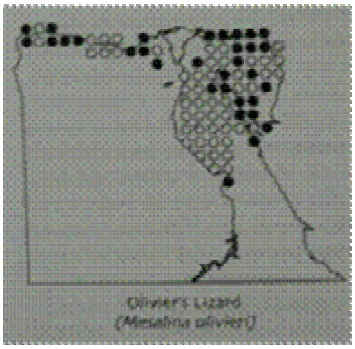
Classified as least concern by IUCN. (2005)



Meslina olivieri

Locally Common.

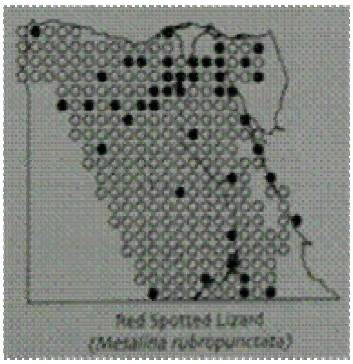
Classified as least concern by IUCN. (2005)



Meslina rubropunctata

Uncommon but widespread.

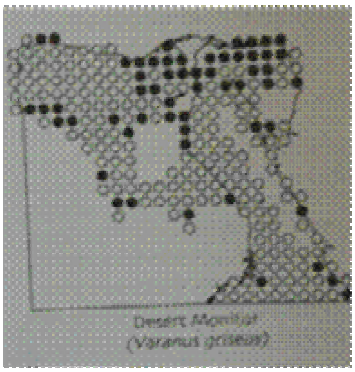
Classified as least concern by IUCN. (2004)



Varanus griseus

Fairly Common and wide spread.

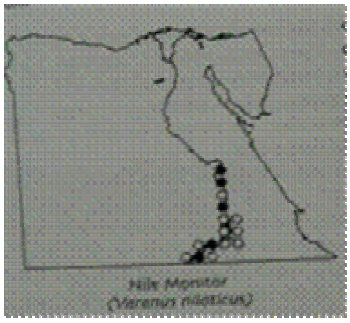
Classified as least concern by IUCN. (2005)



Varanus niloticus

Common in lake Nasser but declining in the Nile valley.

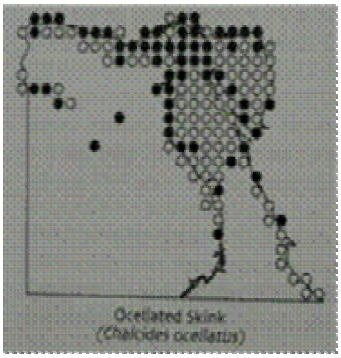
Classified as least concern by IUCN. (2005)



Chalcides ocellatus

Common and wide spread.

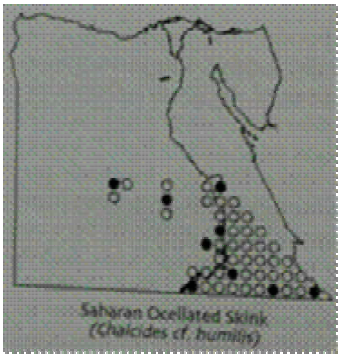
Classified as least concern by IUCN. (2005)



Chalcides cf. humilis

Common and wide spread.

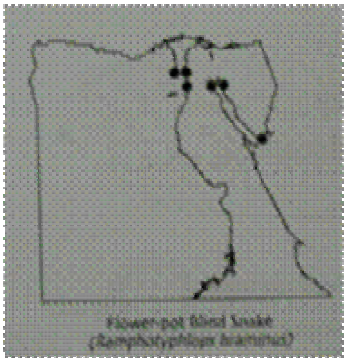
not listed by IUCN. (2004)



Ramphotyphlops braminus

Fairly Common and wide spread.

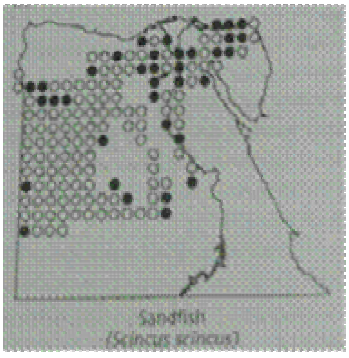
Classified as least concern by IUCN. (2004)



Scincus scincus

Common and wide spread.

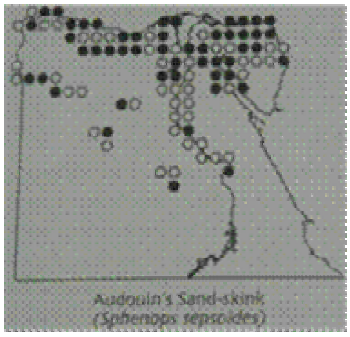
not listed by IUCN. (2005)



Sphenops sepsoides

Fairly Common and wide spread.

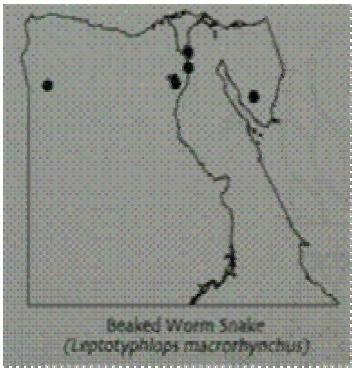
Classified as least concern by IUCN. (2005)



Leptotyphlops macrohynchus

Fairly Common and wide spread.

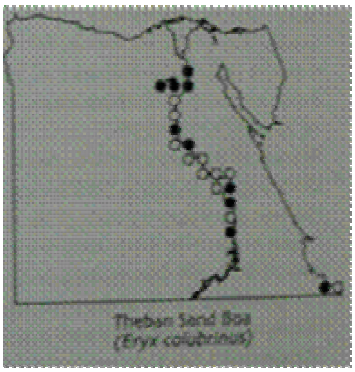
Classified as least concern by IUCN. (2005)



Eryx colubrinus

Uncommon.

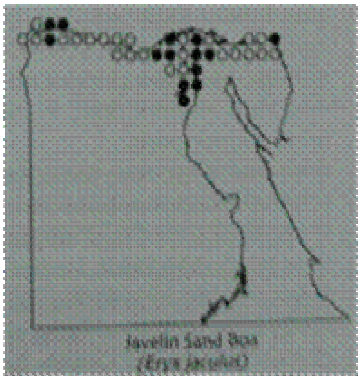
Classified as least concern by IUCN. (2005)



Eryx jaculus

Rare and localized.

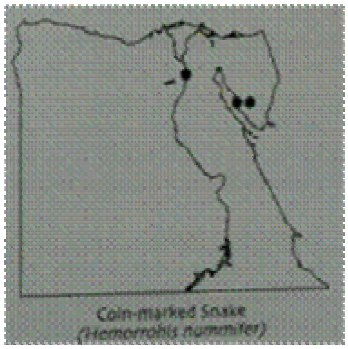
Classified as least concern by IUCN. (2004)



Hemorrohis nummifer

Rare and localized.

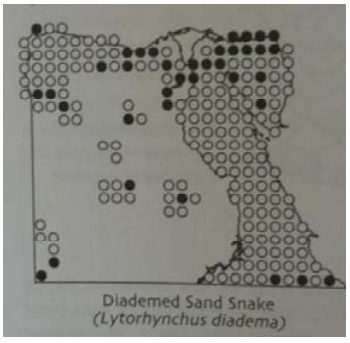
Classified as least concern by IUCN. (2005)



Lytorhynchus diadema

Fairly Common and wide spread.

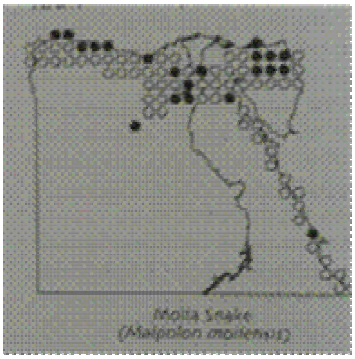
Classified as least concern by IUCN. (2005)



Malpolon moilensis

Uncommon but widespread.

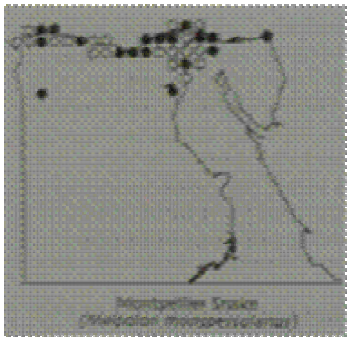
Classified as least concern by IUCN. (2005)



Malpolon monspessulanus

Common and wide spread.

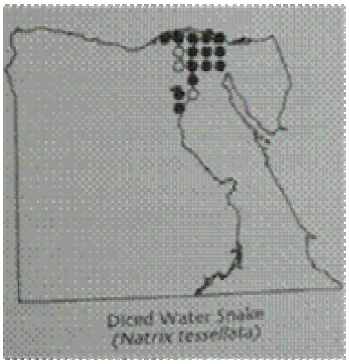
Classified as least concern by IUCN. (2005)



Natrix tessellate

Common and wide spread.

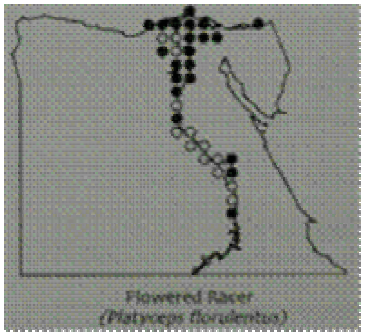
Classified as least concern by IUCN. (2005)



Platyceps florulentus

Fairly Common and wide spread.

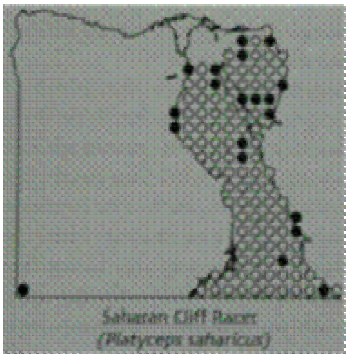
Classified as least concern by IUCN. (2005)



Platyceps saharicus

uncommon but widespread.

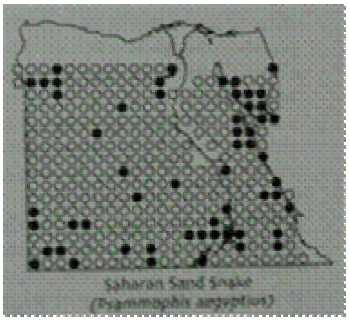
Classified as least concern by IUCN. (2005)



Psammophis aegyptius

Common and wide spread.

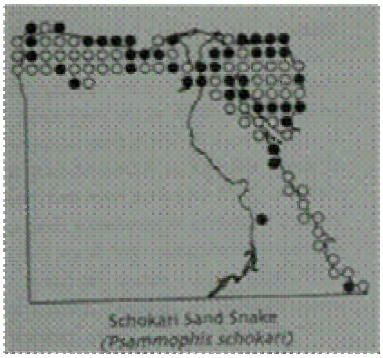
Classified as least concern by IUCN. (2005)



Psammophis schokari

One of the commonest and most widespread snakes in Egypt.

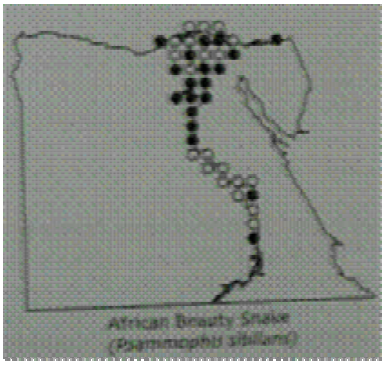
Common in the pet trade



Psammophis sibilans

Common and wide spread.

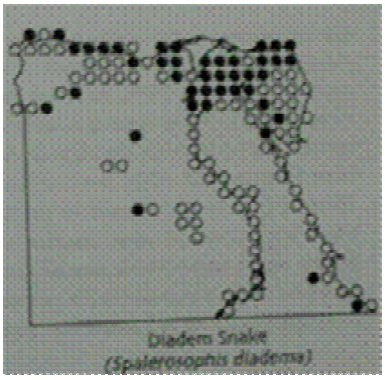
Classified as least concern by IUCN. (2005)



Spalerosophis diadema

Common and wide spread.

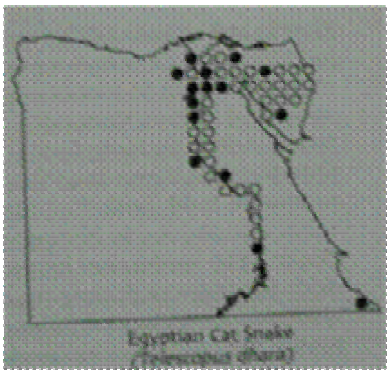
Classified as least concern by IUCN. (2005)



Telescopus dhara

uncommon and localized.

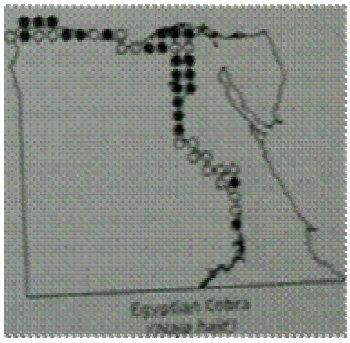
Classified as least concern by IUCN. (2004)



Naja haja

Fairly Common and wide spread.

Classified as least concern by IUCN. (2005)

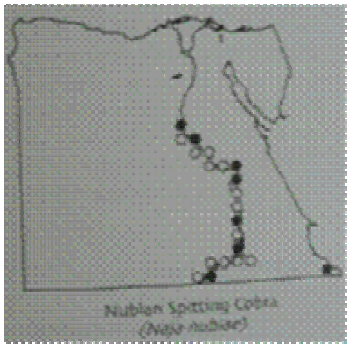


Naja nubiae

Uncommon and wide spread.

In Egypt is near threatened.

Classified as least concern by IUCN. (2005)

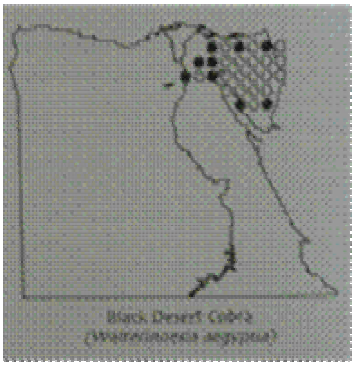


Walterinnesia aegyptia

Rather rare but widespread.

In Egypt is near threatened

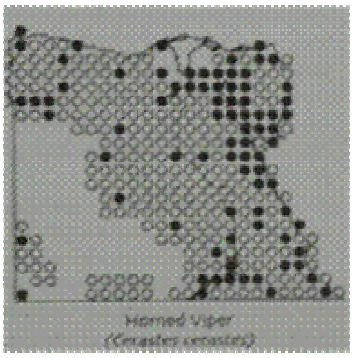
Classified as least concern by IUCN. (2005)



Cerastes cerastes

Common and wide spread.

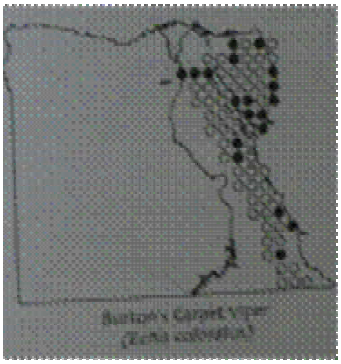
Classified as least concern by IUCN. (2005)



Echis coloratus

Fairly Common and wide spread.

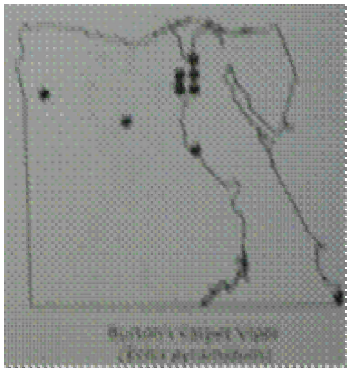
Classified as least concern by IUCN. (2005)



Echis pyramidum

Fairly Common and widespread.

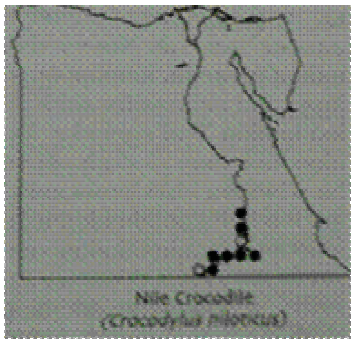
Classified as least concern by IUCN. (2005)



Crocodylus niloticus

In Egypt it is rather uncommon and localized. In Egypt it is vulnerable

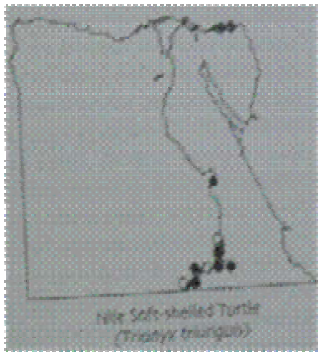
Classified as least concern by IUCN. (2004)



Trionyx triunguis

uncommon in Lake Nasser, rare and localized.

Classified as least concern by IUCN. (2004)



RECOMMENDATIONS

1. Strengthen the enforcement of CITES in Egypt against illegal trade in reptile species.
2. Apply the national public awareness strategy for reptiles species conservation in Egypt.
3. Enhance the capacity building for Egypt's protected areas staff.
4. Encourage the funds and projects supporting the reptiles species conservation such as turtles.
5. Enhance and develop captive breeding centers especially those inside protected areas.
6. Implementing the suitable and available conservation practices such as those initiated by Darwin initiative in Egypt (e.g. hatchery within the bounds of Zaranik protected area).

REFERENCES

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http://www.biomapegypt.org/biodiversity/WildLife/Reptiles.html

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Mostafa A. Saleh 1997, Amphibians and Reptiles of Egypt. Egyptian Environmental Affairs Agency, pp.234.