2014

EGYPT'S FIFTH NATIONAL REPORT TO THE CONVENTION ON BIOLOGICAL DIVERSITY

EGYPT


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Mediterranean Sea
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SYRIA
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HEIGHTS
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Bani Suwayf
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Al Bawiti
Al Minya
Ra's
Gharib
Gulf of Suez
Al Tur
Gulf of Aqaba
Sharm ash
Shaykh
Asyut
Al Ghardaqah
EGYPT
Bur Safajah
Suhaj
Qina
Al Qusayr
Luxor
Mut
Al Kharijah
Marsa
al 'Alam
Red
Sea
Idfu
Baris
Aswan
Baranis
Lake
Nasser
Abu Sunbul
Hala'ib
Lake Nubia
Wadi Halfa'
SUDAN
Dunqunab
Egypt
International Boundary
Governorate Boundary
Buffer Zones/Treaty Lines
Road
River
National Capital
Governorate Capital
City or Town
0 50 100 150 KM
0 50 100 150 Miles
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Executive Summary

With its unique geographic location midway between Africa and Asia, Egypt is home to a wide variety of ecosystems and terrestrial and aquatic life. Many plant and animal species in Egypt represent tropical and Mediterranean environments, some of which go back millions of years. Egypt has unique biodiversity that contributes to the economy and supports human wellbeing.

Egypt is a home to over 2,145 species and 220 infra-specific taxa of native and naturalized vascular plants, 175 species and subspecies of mosses, 13 hepatics, 111 mammals (40 threatened with extinction), 480 birds (26 threatened with extinction), 109 reptiles (27 threatened with extinction), 9 amphibians, more than 1,000 fish species, 800 Mollusca, 1,000 Crustacean, more than 325 species of coral reefs, 10,000 – 15,000 species of insects (including 63 butterflies), 2,420 species of fungi, in addition to thousands of algae, bacteria and viruses. A significant part of these species are found in nationally designated protected areas (Abdel-Azeem and Salem, 2013; Shaltout and Eid, 2010).However, few of Egypt's described species have been assessed to determine their conservation status.

A significant portion of Egypt's Gross Domestic Product (GDP) is directly linked to the use of biological resources. In 2012, total agriculture production accounted for 13.2% of Egypt's GDP (81.3 billion Egyptian pounds) and employed 32% of the total work force (more than 6 million jobs in agriculture and fisheries) (ADB, 2012). In 2011 over 1.3 million tons, having a value of EGP 18 billion, were produced from marine and inland capture fisheries and brackish and freshwater aquacultures. The tourism sector, which heavily depends on natural resources, contributed more than EGP 96.8billion (5.6% of total GDP) in 2013, and is forecast to rise by 1.9% in 2014, and to rise by 4.9% per annum, from 2014-2024, to EGP158.6billion (5.5% of total GDP) in 2024. Travel & Tourism directly supported 1,251,000 jobs (5.1% of total employment) in 2013 and this is expected to rise by 2.4% in 2014 and rise by 2.5% per annum to 1,648,000 jobs (5.2% of total employment) in 2024 (WTTC Travel and Tourism Economic Impact 2014).

Biodiversity also provides regulating and supporting services. The protection of Red Sea coastal areas from erosion by coral reefs and mangroves was valued at 80 million EGP per km^2 and the yearly loss of Egyptian economy resulting from pollinator numbers decline due to the use of pesticides was estimated at 13.5 billion EGP.

Despite these obvious economic gains from biodiversity, trends from available indicators suggest that the state of biodiversity is declining and the pressures upon it are increasing, despite the many national efforts taken to conserve biodiversity and use it sustainably. Biodiversity in Egypt is deteriorating at the level of ecosystems, species and populations; and, genetic diversity is also declining. The losses are due to a range of threats including habitat loss and fragmentation, overexploitation and unsustainable use of natural resources, pollution, invasive species and climate change. Limited human and financial resources have also contributed to the loss of biodiversity. These pressures are continuing to increase and are themselves driven by a range of socio-economic drivers, mainly the growing population and limited human and financial resources. Climate change will act synergistically with other threats with serious consequences for biodiversity.

Direct habitat loss is a major threat to terrestrial, marine and coastal ecosystems; and, freshwater ecosystems are particularly severely affected by fragmentation. Land reclamation, urbanization and industrial activities destroy and alter critical natural habitats along with their plant and animal life.

Overgrazing and over-fishing contribute to biodiversity degradation. Wildlife utilization is, for the most part, unregulated in Egypt and excessive hunting is endangering a number of wild animals as well as several species of resident and migratory birds. Major exploited groups include medicinal plants, mammals for wild meat and recreational hunting, birds for food and the pet trade, and amphibians for traditional medicine and food.

Pollution causes deterioration of critical habitats and species loss. A concrete example is the Delta wetlands. Excessive use and misapplication of pesticides also causes loss of rare species including those that act as pollinators and natural biological control agents.

Invasive species continue to be a major threat to all types of ecosystems and species in Egypt. Currently available information about invasive species in Egypt is still insufficient or is not readily available. Exerted efforts to control and eradicate existing invasive species and to prevent the introduction of new ones still limited in spite of the fact that invasive species represent real threat to Egyptian ecosystems, the economy and human health. Combating invasive species is beyond the country's current potential in terms of human, financial and technical resources, and requires participation of all concerned agencies.

Climate change is likely to exacerbate many of the risks associated with above mentioned stressors and reducing the choices open to individuals and policy makers. Systematic quantitative assessments are needed to determine how changes in biodiversity would impact the provision of ecosystem services, or how the production of ecosystem services has impacted on biodiversity.

Wetlands which are some of Egypt's most important habitats in terms of biodiversity (second only to the Red Sea's coral reefs), supporting both the greatest diversity and density of bird species, are subject to a variety of human induced threats leading to the degradation of this valuable national resource. Most Egyptian wetlands and river systems have been degraded drastically during the past 50 years as a result of multiple pressures. One of the major threats to wetlands, in the northern coastal lakes in particular is the drainage of water bodies for their conversion into agricultural and settlement developments, ultimately destroying habitat and reducing their areas. Other threats to wetlands include water withdrawal for irrigation, coastal erosion, invasive species, water pollution and overfishing.

River systems have also been degraded drastically during the past 50 years. They are being significantly affected by water withdrawals, leaving some small rivers nearly or completely dry, thereby reducing biodiversity. The construction of renaissance dam in Ethiopia definitely exacerbates the situation.

The Egyptian coastal and marine environment is distinguished by specific habitats, namely coral reefs and mangroves. The Red Sea is renowned for its coral reefs and mangroves where the greatest known species diversity of any marine ecosystem is found. Coastal habitats have come under pressure from many forms of development including tourism, urban infrastructure and port facilities. Major threats to marine ecosystems are unregulated tourism, exploitation of marine resources, overfishing and fishing in illegal areas (e.g. breeding grounds) and coastal pollution. At present, 20% of Egyptians live in coastal areas, which are also visited annually by 11 million tourists. In addition, more than 40% of industrial activity occurs in the coastal zone.

The main threats to desert biodiversity are habitat loss and land degradation due to overgrazing, where grasslands have been converted to accommodate seasonal agriculture. Other causes of habitat loss and degradation are air and water erosion, poor land management, limited and ineffective popular participation by locals in conserving the land and the establishment of several developmental projects.

The loss of biodiversity in mountainous areas is attributed to human activities, such as hunting, logging, trafficking in species, urban development, invasive alien species, climate change and natural disasters (mainly flooding).

Agricultural cropland habitats have also been declining since the late 1980s. These declines are thought to be related to changes in land use and agricultural practices. Agricultural land continues to be lost to human settlements. It is estimated that some 47,700 feddans (1 feddan = 1.038 ha) are lost every year. The intensification of crop and livestock production, along with the abandonment of rural areas for urban ones, has caused the loss of genetic diversity. This loss in genetic diversity may have serious implications on food security; especially given Egypt's dependency on four crops (wheat, corn, rice and potato) for 50% of its vegetarian food and 14 mammal and bird species for 90% of animal proteins.

Species diversity is also in decline and continues to be threatened by the same threats observed on the ecosystem level: habitat destruction, unsustainable use of natural resources, pollution, invasive species and overexploitation. Few of Egypt's described taxonomic groups or species have been assessed to determine their conservation status. The distribution of threatened species in freshwater habitats in Egypt is poorly known, but regional assessments from the Mediterranean Basin indicate that freshwater species are, in general, at much greater risk of extinction than terrestrial taxa (Smith and Darwall, 2006 and Stein *et al*., 2000).

By the end of 2013, 364 species of the over 22,000 species described in Egypt had been assessed and the conservation status of only the following taxonomic groups is available: mammals (111 species), insects (mainly butterflies: 63 species and Odonata: 40 species), four plant families (*Apocyanaceae*: 22 species, *Euphorbiaceae*: 51 species, *Primulaceae*: 9 species and *Amaranthaceae*: 25 species) and birds (43 species), which indicate a continuing increase in the risk of extinction. Major efforts are needed to assess taxonomic groups or species that have not been assessed to determine their conservation status including crop genetic diversity and animal genetic resources.

Of the assessed 364 species, 41 % (152 species) are considered threatened with extinction, although this varies among taxonomic groups. Among selected mammals, insects and plant groups, between 70% and 25% of species are currently threatened with extinction, with the *Euphorbiaceae* plant family facing the greatest risk.

On the other hand, the rate of loss of ecosystems and genetic diversity is poorly known and exerted efforts are still limited, but a good example of the loss of genetic diversity in Egypt is that of cotton, having lost its varieties greatly onwards from the 1950s. Genetic diversity is being lost in natural ecosystems and in systems of crop and livestock production due partly to the intensification of production, and also partly to the abandonment rural areas for larger cities and urban areas. The continued loss of genetic diversity of such crops and livestock may have major implications on food security. Currently, Egypt depends on four crops (wheat, corn, rice and potato) for 50% of its vegetarian food and 14 mammal and bird species for 90% of animal proteins.

The loss of biodiversity will ultimately impact the ecosystems functions and their ability to deliver essential goods and services. As a result, serious social, economic, cultural and ecological implications are expected. The continuing decline of biodiversity puts these crucial ecosystem services at stake, ultimately affecting the well-being of Egyptians.

National responses to the continuing loss of biodiversity are varied and threats to biodiversity are addressed through a number of activities with varied degrees of success. Some of the most significant with varied degrees of success are achieved in support of the implementation of the National Biodiversity Strategy and Action Plan, relevant International and Regional Agreements and Strategies for Cooperation, national legislation, institutional support and capacity building to protect biodiversity, protected area based conservation, *ex-situ* based conservation (breeding, propagation and rehabilitation), managing invasive species, managing wildlife trade and use, sustainable agriculture, local community empowerment, regulating access and benefit sharing of genetic resources and associated traditional knowledge, recognizing the value of cultural diversity and traditional knowledge, managing the impacts of climate change on biodiversity through mitigation and adaptation, communication, education and public awareness.

Egypt had prepared a National Biodiversity Strategy and Action Plan (NBSAP) in 1998 spanning the years 1998 to 2017 through a consultative process. The NBSAP 1998-2017 had six main goals and a national action plan composed of 11 programmes categorized into enabling and supporting, applied research and monitoring projects.

Progress towards implementing of the main goals and programmes of the National Biodiversity Strategy and Action Plan 1998-2017 and the CBD 2010 Targets is mixed, with significant progress in a number of areas (e.g. those related to PA establishment and management and the NCS/EEAA capacity development), and limited progress in many others (notably the introduction of biodiversity concerns and priorities into the mainstream of the Egyptian socio-economic landscape). Most significant results are achieved in the development of legislation that regulates many aspects of biodiversity conservation, establishment and development of PAs network, establishment of the NCS as the institutional structure responsible for the coordination of implementing the nation's biodiversity agenda in general, PAs management and raising public awareness in particular. The implementation of the Convention and the NBSAP has shed light on some valuable insights for Egypt. The role of biodiversity in the supply of ecosystem goods and services is gaining recognition in Egypt although identifying economic values of biodiversity goods and services is relatively new.

Protected areas have been Egypt's most important and effective tool to conserve its biodiversity, preventing the potential loss of species and habitats, as well as fulfilling its international commitments. By the year 2013, Egypt had established 30 protected areas, covering over 146,000 km^2 or about 14.6 % of the total surface area. However, the coverage did not meet the CBD 2020 Aichi target (Aichi Target 11: "at least 17% of terrestrial and inland water areas and

10% of coastal and marine areas"). In spite of numerous efforts made in the establishment of the protected areas network, critical problems and risks still exist, including the inability to retain trained staff, under-funding and lost opportunities to generate substantial revenues. The performance of protected areas in maintaining populations of their key species is poorly documented. There is a need to assess the completeness of coverage and status of the existing protected area network and identify additional sites which make important contributions towards the comprehensiveness and proportional representatives of the PAs network.

Outside protected areas, limited complementary *ex-situ* conservation measures were undertaken for genetic resources for food and agriculture and for selected animal and plant species. Limited efforts have also been undertaken to rehabilitate some endemic flora and fauna species to increase their numbers in their natural habitats to protect them from extinction. Sustainable agriculture has been garnering more attention lately.

Although local communities are not excluded from protected areas, none of the existing protected areas is being managed by local communities. They are encouraged to actively participate through partnership arrangements, as in the case of the medicinal plants project in St. Katherine PA. A number of important poverty alleviation and community development programs have been initiated, and presented opportunities for improving natural resource management and employment for local communities and linking biodiversity and social development.

The absence of legal and administrative mechanisms to regulate access to Egypt's genetic resources and to set conditions for benefit-sharing is a key constraint towards achieving a meaningful access and benefit sharing framework. It is hoped that the draft law on the regulation of access to genetic resources and related traditional knowledge and the equitable sharing of benefits from their use that has been finalized will be soon approved by the Egyptian Government. Relatively few initiatives have been taken to maintain, protect, document and promote traditional knowledge as it relates to natural resource management and on mechanisms to promote access and benefit-sharing of genetic resources.

The absence of legal and administrative mechanisms to implement the Cartagena Protocol on Biosafety is a key constraint towards the safe transfer, use and transboundary movement of GMOs. It is hoped that the draft national biosafety law will be soon approved by the Egyptian Government.

Some of the major factors affecting Egypt's implementation of the NBSAP and achieving CBD global targets include the lack of financial and human resources, inadequate coordination between government agencies, lax enforcement of environmental laws and policies and the insufficient mainstreaming of biodiversity into other sectors. There is still limited evidence of biodiversity concerns being reflected in a serious way in the policies, legislation and regulations governing most of the productive sectors in the country, and it is not reflected in the nation's development agenda in many significant ways.

The impact of conservation interventions on the risk of ecosystem loss or degradation, extinction of species and genetic diversity cannot be assessed due to the lack of monitoring programs over a certain period of time. Some examples of the impacts of major threats on biodiversity and associated effects on ecosystem services and human well-being are available. Major efforts are still needed to conserve genetic diversity of animal genetic resources. Without enforcing environmental regulations in regard to land use and new development activities to save the natural habitat and preserve the monuments of Egypt, loss of biodiversity and nature-derived benefits will continue decline. Mainstreaming of biodiversity into key economic sectors should be a priority.

Although the NBSAP stimulated conservation action at the national level and contributed to a better understanding of biodiversity, its value and management have not been fully effective in addressing the main drivers of biodiversity loss or mainstreaming biodiversity and ecosystem services in development activities. Many of the policies and NBSAP plans have not been finalized and/or implemented due to lack of both financial and human resources. Government's fiscal difficulties over the last few years have impacted significantly on resource availability. National responses to the continuing loss of biodiversity are varied and responses so far have not been adequate to address the scale of biodiversity loss or reduce the pressures.

In 2014, Egypt, as a Party to the CBD, has revised its NBSAP in line with the new CBD Strategic Plan for Biodiversity 2011–2020, through another wide participatory process. After initial stocktaking and appraisal of the current status of national biodiversity and the underlying causes of biodiversity loss, 6 strategic goals were identified to address the decline in biodiversity and achieving the Aichi Targets. The updated NBSAP, leading up to 2020, sets the framework for implementing the three objectives of the Convention and achieving the Aichi targets. The NBSAP makes a significant contribution towards the global biodiversity agenda and the Millennium Development Goals (MDGs). In addition, the NBSAP sets clear national biodiversity targets and priorities and aims for the integration of biodiversity concerns into relevant sectors.

In the light of Egypt's commitment to achieve the targets of the Millennium Development Goals (MDGs) by 2015, several national committees were established (sustainable development, integrated management of coastal zones, climate change, wetlands and conservation of biodiversity) to achieve harmonization between policies, strategies and national action plans of development, by executing specific indicators to determine implementation efficiency in different fields, such as environmental sustainability, reduction of poverty pressure, enabling women, improving the quality of health and education. Egypt prepared many strategies and specialized programs addressing the conservation of wetlands in 2005, ecotourism in 2006 and medicinal plants conservation in 2007. The eight MDGs are integrated in the National Development Plan 2008-2011 under the different key areas. This shows the government's commitment to achieving the MDGs.

In conclusion, despite a significant increase in conservation efforts and expenditures (as clearly indicated by the expansion of the PA network and the substantial investment in biodiversity focused projects in Egypt), trends of biodiversity status in Egypt are in a down turn and are not meeting the CBD 2010 global targets. Successes have been mainly in short and medium term achievements, with limited impact on policy level processes and root causes (despite multiple efforts), particularly those outside the environmental realm and in the mainstream economic sectors. Many of the policies and plans have not been finalized and/or implemented due to lack of both financial and human resources. Government's fiscal difficulties over the last few years have impacted significantly on resource availability. There are several areas that need improvement and effectiveness, particularly in regards to coordination and cooperation between government agencies; the mainstreaming of biodiversity; wetland, coastal, marine and arid land biodiversity management; invasive alien species; biosafety; and access and benefit sharing. Without enforcing environmental regulations in regard to land use and new development activities to save the natural habitat and preserve the monuments of Egypt, loss of biodiversity and nature-derived benefits will continue decline.

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List of Abbreviations

ABS	Access and Benefit Sharing
ADB	African Development Bank
ARC	Agricultural Research Center
BioMAP	Biodiversity and Assessment Project
BI	BirdLife International
CBD	Convention on Biological Diversity
CEPA	Communication, Education and Public Awareness Strategy
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COP	Conference of the Parties to the CBD
CR	Critically Endangered
DD	Data Deficient
EEAA	Egyptian Environmental Affairs Agency
EGP	Egyptian Pound
EN	Endangered
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GMOs	Genetically Modified Organisms
GDP	Gross Domestic Product
GAFRD	General Authority for Fish Research and Development
Ha	Hectare
IBAs	Important Bird Areas
IUCN	International Union for Conservation of Nature
IUCN-USAID	IUCN – U.S. Agency for International Development
LC	Least Concerned
MDGs	Millennium Development Goals
MCP	Minimum Convex Polygon
NBSAP	National Biodiversity Strategy and Action Plan
NEAP	National Environmental Action Plan
NGB	National Gene Bank
NCS	Nature Conservation Sector
NGOs	Nongovernmental Organizations
NE	Not Evaluated
NT	Near Threatened
OECD	Organization for Economic Co-operation and Development
PERSGA	Regional Organization for the Conservation of the Environment in Red Sea and the Gulf of Aden
PERSGA/GEF	PERSGA/Global Environment Fund
PA	Protected Area
RAMSAR	Convention on Wetlands of International Importance Especially as

	Waterfowl Habitat
SOE	State of the Environment Report
TDA	Tourism Development Authority
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNEP/MAP	UNEPMediterranean Action Plan
UNEP/MAP/MED POL	UNEP/MAP Programme for the Assessment and Control of Marine Pollution in the Mediterranean
UNEP/ MAP//RACSPA	UNEP/ MAP/ Regional Activity Centre for Specially Protected Areas
UNEP-WCMC	UNEP-World Conservation Monitoring Centre
VU	Vulnerable
WB	World Bank
WDPA	World Database on Protected Areas
WPIS	World Program of Invasive Species
WRI	World Resources Institute
WWF	Worldwide Fund for Nature
WTTC	World Travel & Tourism Council

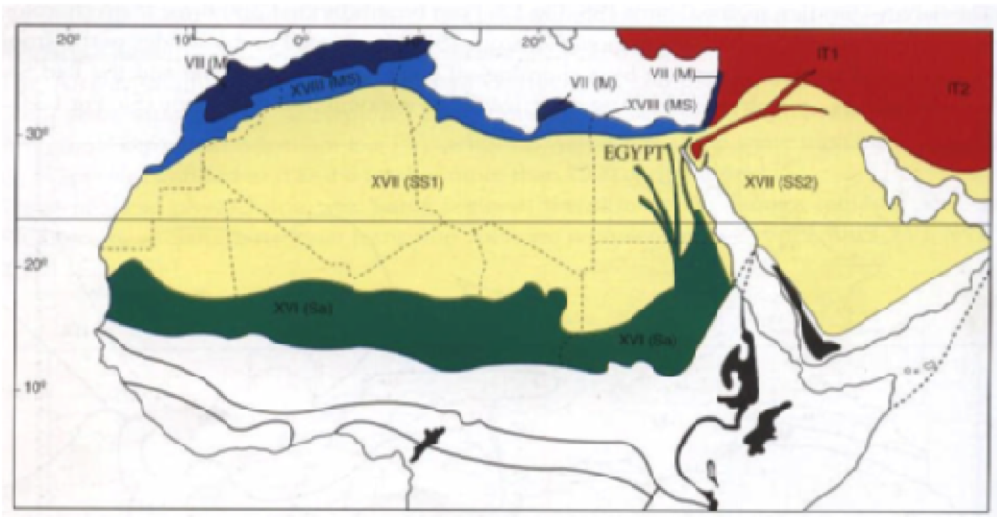
1 Biodiversity Profile of Egypt

Biodiversity comprises much of the renewable natural capital on which livelihoods and development are grounded. Policies relating to issues such as land degradation and desertification, trade, transport, development, climate change, security, health care and education all have impacts on biodiversity. Despite the critical need for more effective conservation and sustainable use, the trends from available indicators suggest that the state of biodiversity is declining, the pressures upon it are increasing and the benefits derived by humans from biodiversity are diminishing. The losses are due to a range of pressures driven by a range of socio-economic drivers. Climate change will act synergistically with other threats having serious consequences for biodiversity. Despite the many efforts taken around the world to conserve biodiversity and use it sustainably, responses so far have not been adequate to address the scale of biodiversity loss or reduce the pressures upon it.

Egypt is uniquely positioned midway between Africa and Asia, with its long coasts of the Mediterranean Sea in the north (c. 970 km) and the Red Sea in the east (c. 1,100 km). The county covers an area of about one million square kilometers and can be divided into four physiographic regions: the Nile Valley and Nile Delta, Western Desert, Eastern Desert, and Sinai. The country can also be divided into 4 bioclimatic zones: the eastern desert, which is hyper arid with mild winters, hot summers and extremely rare rainfall; the southern Sinai region which is also hyper arid but has cool winters, hot summers, and less than 30 mm/year of rainfall; the coastal belt along the Mediterranean Sea; and the sub-coastal belt and the wetlands (Nile Valley, Nile Delta).

Egypt is the meeting point of biotic elements belonging to four bio-geographical regions: i) the Mediterranean-Sahara regional transition zone (MS-XVIII), which occupies a small area along the Mediterranean coast; ii) the Sahara- Sindian regional zone (SS-XVII), which encompasses the vast desert occupying the greater part of Egypt; iii) the Irano-Turanian regional center of endemism (IT), which occupies a small area in the Sinai highlands and some enclave areas in the Eastern Desert (e.g. Galala Mountains); and iv) the Sahel regional transition zone (Sa-XVI), which comprises the Afrotropical Gebel Elba mountainous region in the southeast of Egypt (Figure 1-1).

Figure 1-1 Phytochoria in North Africa and Southwest Asia



The arid desert covers 92% of the country's surface area, with the remaining 8% of arable land being restricted to the Nile Valley, the Nile Delta and a few oases scattered in the Western Desert. Given the country's physiography, Egypt's population is unevenly distributed, where 99% of Egyptians live on less than 4% of the land.

Egypt has a rich and diverse biota. The country is home to a wide range of habitats with microclimates (e.g. mangroves, coral reefs, mountains, sand dunes, oasis, and wadis) that host many plant and animal species and communities representing both tropical and Mediterranean environments. Some dating back millions of years ago, such as the skeletons of whales in the Western Desert (a Natural World Heritage Site in Wadi Al-Rayan Protected Area), while other sites represent the Stone Age, about 10,000 years ago. Some animal and plant species represent relicts of a once flourishing growth in ancient periods when the environment was less severe. As conditions became decidedly arid, a limited number of these species remained in the natural refugee sites. For example, small populations of gymnospermus trees of *Juniperus phoenicea* still exist in a few hilly sites in N. Sinai (e.g. Gebel El-Maghara, Yelleg, Labni and El-Halal). Similarly, a few individual cheetahs (*Acinonyx jubatus*) can be found in the Qattara Depression of the Western Desert, but they are on the brink of extinction.

In terms of terrestrial habitats, Egypt can be classified into only two of the major habitats of Africa; desert and riverine vegetation (albeit greatly modified by man). Therefore, terrestrial habitat diversity is low overall. Habitats with the greatest floral and faunal species diversity, or informally "the biodiversity hot spots" of Egypt, are roughly the mountains of South Sinai, the Gebel Elba region, and the Mediterranean littoral and coastal desert west of Alexandria. The fog deposition in Gebel Elba produces the only Egyptian example of an officially WWF endangered habitat, a Red Sea Fog Woodland. In addition, the Nile River itself and the Delta lakes support a considerable number of species.

Marine and coastal habitats are confined to the Mediterranean and Red Sea. Marine biodiversity in Egypt benefits from having two completely independent elements, the Mediterranean and the

Red Sea. Its Mediterranean fauna and flora are modest and shared with most of the countries of that region. Its very rich Red Sea equivalents are also probably shared with most of the countries bordering the Red Sea. Endemics are largely or wholly limited to Red Sea habitats, where Egypt has the most northerly coral and mangrove habitats of the world – possibly rendering them more important as climate changes occur. The shallow waters of the Suez Gulf are important areas for marine biodiversity and the contrast with the abyssal depths of the Gulf of Aqaba create a very important set of habitats.

Each of these habitats has its unique fauna and flora and more than 22,000 species of flora and fauna have been identified in Egypt's diverse ecosystems and many more remain to be further investigated. These range from well known-species of plants, mammals, reptiles, amphibians, fish and birds to less visible but equally important aquatic and terrestrial invertebrates, fungi and bacteria. Levels of endemicity are reasonably high as a result of the drying of North Africa over the last 5,000 years, which caused the fragmentation and isolation of fauna and flora, allowing the evolution of many unique forms of life. Isolated pockets of biodiversity exist in the oases of the Western Desert and on the mountaintops of Sinai. The relatively rich biodiversity of Gebel Elba harbors many endemic forms, however, more research is required to assess their uniqueness relative to other Red Sea fog woodlands further south in the Sudan.

Despite being dominated by desert and drought, Egypt comprises over 2,145 species and 220 infra-specific taxa of native and naturalized vascular plants, in addition to 175 species and subspecies of mosses and 13 of hepatics, 111 mammals (40 threatened with extinction), 480 birds (26 threatened with extinction), 109 reptiles (27 threatened with extinction), 9 amphibians, more than 1,000 fish species, 800 Mollusca, 1,000 Crustacean, more than 325 species of coral reefs, 10,000 – 15,000 species of insects (including 63 butterflies), 2,420 species of fungi, in addition to thousands of algae, bacteria and viruses. A significant part of these species are found in nationally designated protected areas (Abdel-Azeem and Salem, 2013; Shaltout and Eid, 2010).

Substantial part of this diversity is confined to wetter regions, namely the Mediterranean, Sinai Peninsula and Gebel Elba. The Western Desert holds the lowest plant diversity in Egypt (El Hadidi and Hosni, 1996 and Boulos, 1999-2005). The flora and fauna of Egypt is well documented in many reference books, theses, scientific papers and reports since the mid of the 20th Century. However, there is no checklist for the algal and agricultural flora in Egypt. However, as a rough estimate, the algal diversity approximates 1,500 species; while the agrobiodiversity approximates 2100 species in addition to ca 1000 species of ornamental cultivated species. Therefore, it must be a priority to concentrate future studies on algal and agrobiodiversity in order to prepare accessible verified check lists for both groups of plants.

Despite relatively well documented biodiversity, to date, there are still no concrete statistics quantifying the rate of biodiversity loss in Egypt.

2 Importance of Biodiversity to National Socio-economic Development

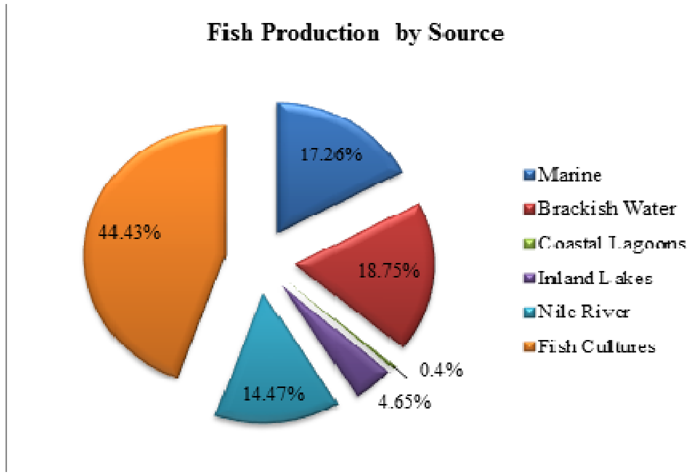
Biodiversity is essential for healthy ecosystems, human health, prosperity, security and wellbeing. Identifying economic values of biodiversity in terms of the goods and services that it provides is relatively new and slowly gaining recognition in Egypt. Since ancient times, Egypt has relied on the wealth of its natural resources to sustain its civilization. Contributions of biodiversity to the national economy are substantial. Much of the country's economy is built on a natural resource base. Biodiversity forms the basis of agriculture, fisheries and enables the production of foods, both wild and cultivated, which contributes to the overall well-being of Egyptian people. In addition, biodiversity supports the development of many new industries (e.g. nature-based tourism and recreational activities), which provide high economic returns on national, regional and local scales. Genetic resources have enabled past and current crop and livestock improvements, enabling them to adapt to changing environmental conditions, such as climate change.

A significant portion of Egypt's Gross Domestic Product (GDP) is directly linked to the use of biological resources. In 2012, total agriculture production accounted for 13.2% of Egypt's GDP (81.3 billion Egyptian pounds) and employed 32% of the total work force (more than 6 million jobs in agriculture and fisheries) (1 USD = 5.95 Egyptian pounds). Agricultural exports constitute about 20% of total export activities (African Development Bank, 2012).

The aquatic resource base in Egypt is extensive. It consists of marine, fresh water, and brackish water. Marine resources come mainly from the Mediterranean and Red Sea, the Suez Canal and the Great Bitter Lakes. Fresh water resources include the Nile River with its canals and Lake Nasser in Upper Egypt. Brackish water resources include lakes Manzala, Burullus, Edku, and Maryout, the Bardawil and Port Fouad lagoons located to the East of the Delta. Furthermore, brackish water resources include three important drainage basins that are present in the Fayoum Region, namely Lake Qaroun and Wadi El-Ryan Depressions (I) and (III) and various smaller lakes that are scattered around the country plus fish farms.

Fisheries provide a major source of food, revenues and employment. Egyptian total fish production in 2001 from all sources totaled 771,515 tons. The marine fisheries produced a total of 133,173 tons (17.26 %), the northern four brackish water lakes produced a total of 144,710 tons (18.75 %), the coastal lagoons 3,308 tons (0.4%), inland lakes 35,854 tons (4.65 %), the Nile River system with its canals 111,606 tons (14.47 %) and fish culture employing various systems, a total of 342,864 tons (44.43 %) (Figure 2-1). In cumulative terms, capture fisheries in 2001 produced a total of 428,651 tons or 55.6 % of the total, while aquaculture contributed the balance of 342,864 tons.

Figure 2-1 Fish Production by Source



According to the annual report issued by the General Authority for Development of Fish Resources (GAFRD, 2012; Rothuis *et al*., 2013), fish production in 2010 amounted to 971,000 tons of which fish farming contributed 61% and natural resources (Nile River, Red Sea, and Mediterranean) 38% of total fish production.

In 2011 over 1.3 million tons, having a value of 18 billion Egyptian pounds, were produced from marine and inland capture fisheries and brackish and freshwater aquacultures. Of these, the natural resources (Nile River, Red Sea, and Mediterranean) provided 375,354 tons (18.5% of total production) of which marine fish production amounted to 122,303 tons (12.5% from total production) andthe aquaculture sector produced 986,820 tons (81.5% of total production) with a total production value of approximately US $ 2 billion or just below 1% of the GDP. In addition, fish hatcheries produced more than 270 million fish fries (sea bream, sea bass, soles, shrimps, tilapias and carp) that are used in developing fish production in some lakes and fish cultures. Fish production in Egypt by sector in 1993 and 2009 is shown in Figure 2-2 below (Abdel Rahman, 2011).

Figure 2-2 Fish Production in 1993 and 2009

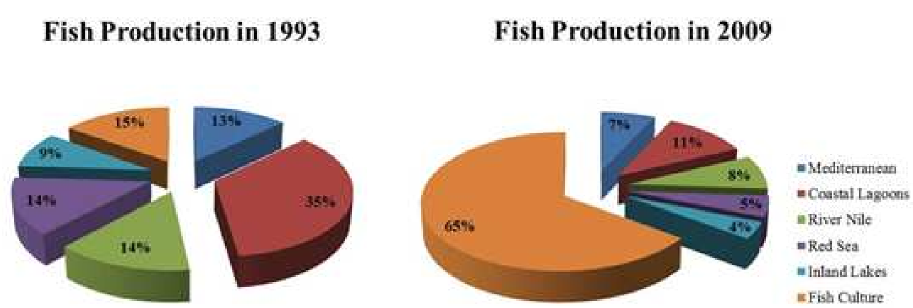
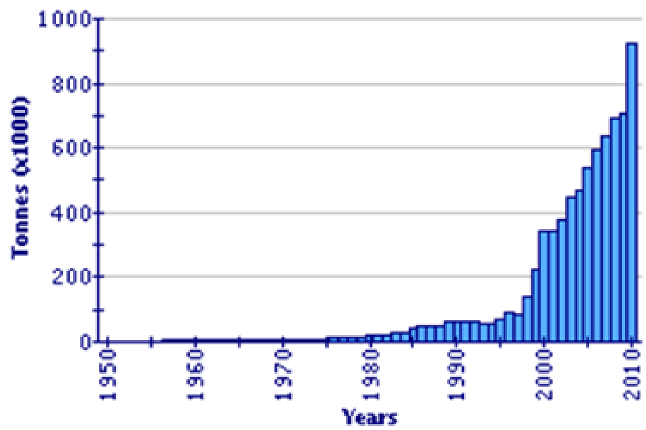


Figure 2-3 shows total aquaculture production in Egypt from 1950 to 2010 according to FAO statistics.

Figure 2-3 Reported Aquaculture Production in Egypt from 1950 to 2010



The generated income from nature-based tourism is also substantial. Nature-based tourism developments aid in maintaining the natural environment and promote the improvement and development of facilities required to protect and regenerate environmental resources that benefit both residents and tourists alike. Tourism continues to be a main source of hard currency for the country, playing an important role in the balance of payments. The industry used to rank second among Egypt's major sources of foreign currency. More growth is expected in the tourism industry in the coming years as foreign investments continue to increase.

The tourism sector has grown from 1.4 million visitors in 1982 to 14.7 million visitors in 2010, with an annual growth rate of 16.5%. The economic importance of tourism represents 11.3% of GDP, 19.2% of foreign exchange earnings and 12.6% of employment. There is a clear shift in the demand for tourism destinations, shifting from historical (e.g. Luxor) to nature-based sites (around 50% in the Red Sea and Sinai). Protected areas receive approximately 5 million visitors annually (2010 estimate), where potential for nature-based tourism is very high. Nature-based tourism allows visitors to engage in activities such as diving, trekking, desert safaris, bird watching, visiting unique landscapes, geological features and numerous cultural sites.

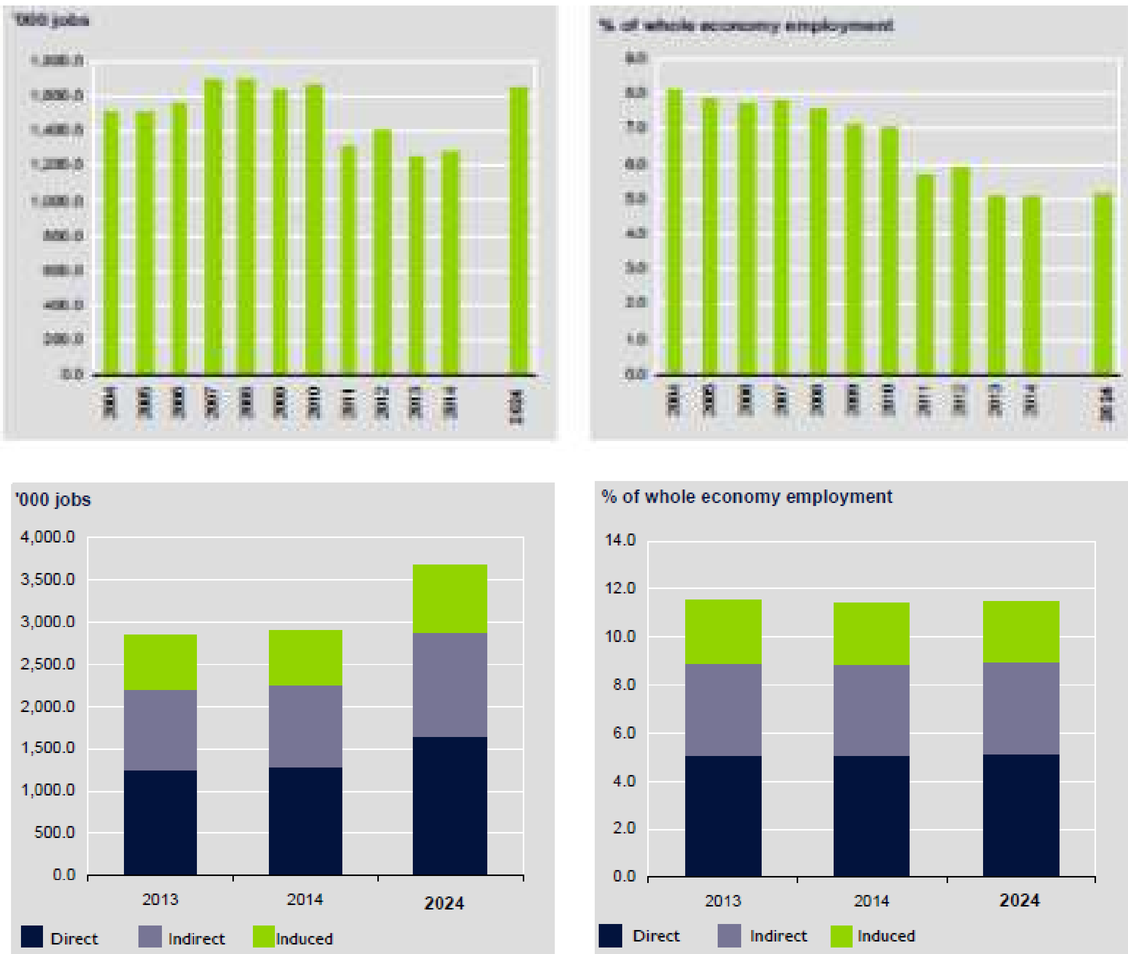
The direct contribution of travel and tourism to GDP and employment in the period 2004-2024 is presented in Figure 2-4 and Figure 2-5, respectively (World Travel & Tourism Council, 2014).

The direct contribution of Travel & Tourism to GDP was EGP96.8bn (5.6% of total GDP) in 2013, and is forecast to rise by 1.9% in 2014, and to rise by 4.9% pa, from 2014-2024, to EGP158.6bn (5.5% of total GDP) in 2024 (in constant 2011 prices). The total contribution of Travel & Tourism to GDP was EGP217.1bn (12.6% of GDP) in 2013, and is forecast to rise by 1.1% in 2014, and to rise by 4.9% pa to EGP353.2bn (12.2% of GDP) in 2024.

In 2013 Travel & Tourism directly supported 1,251,000 jobs (5.1% of total employment). This is expected to rise by 2.4% in 2014 and rise by 2.5% per annum to 1,648,000 jobs (5.2% of total employment) in 2024. The total contribution of Travel & Tourism to employment in 2013, including jobs indirectly supported by the industry, was 11.5% of total employment (2,848,000 jobs). This is expected to rise by 1.6% in 2014 to 2,892,000 jobs and rise by 2.4% pa to 3,673,000 jobs in 2024 (11.5% of total).

Figure 2-4 Direct Contribution of Travel and Tourism to GDP 2004-2024

Figure 2-5 Direct Contribution of Travel and Tourism to Employment 2004-2024



Visitor exports were a key component of the direct contribution of travel and tourism in 2013. Egypt generated EGP 46.0 billion in visitor exports (Figure 2-6). By 2024, international tourist arrivals are forecast to total 11.3 million, generating expenditure of EGP 77.2 billion, an increase of 4.9% per annum (World Travel & Tourism Council, 2014).

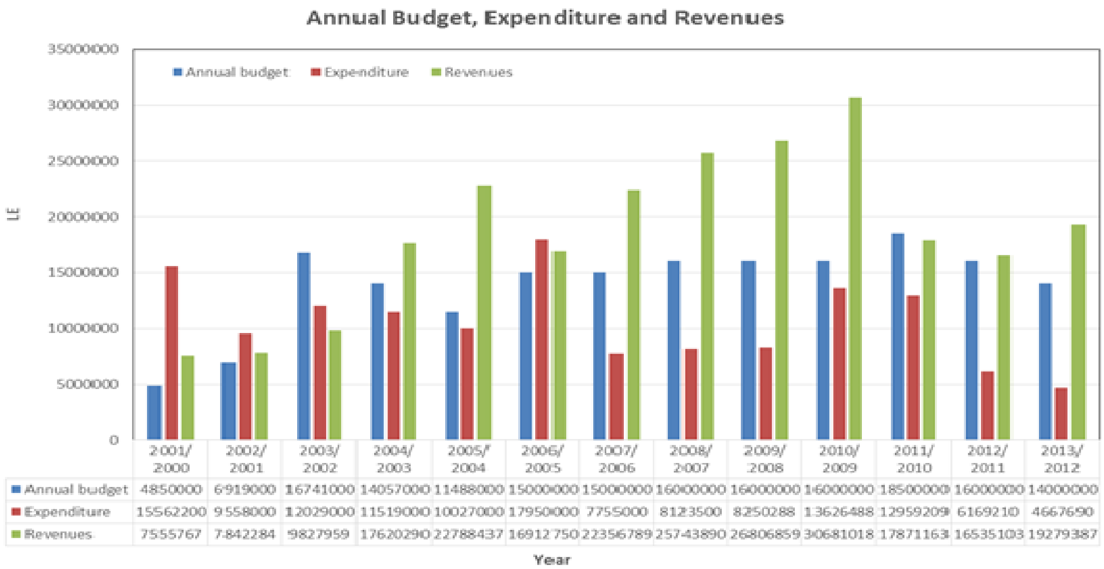
Figure 2-6 Foreign Visitor exports and International Arrivals

The revenues of marine activities related to biodiversity, especially tourism, were estimated at more than 20 billion Egyptian pounds annually (NCS, 2007). The economic benefits of coastal marine tourism in Egypt go well beyond the direct revenue generated by diving centers. Although hotels and resorts benefit greatly from diver-related tourism, other service industries, such as food and beverage, recreation, transportation and entertainment, also benefit greatly from coastal marine tourism. Therefore, calculating the total economic benefits of coral reefs from the tourism industry involves much more than simply adding up the number of reef-related tourists and the value added from the diving industry (Herman, 2003). Additionally, it is important to account for the indirect benefits provided through ecosystem services (Costanza *et al*., 1997).

Despite there being obvious economic gains from biodiversity, there have been no studies showing the indirect benefits derived from biodiversity, biodiversity such as natural materials produced by coral reefs or plants used in the treatment of many diseases. In addition, the usage of microorganisms in biotechnology has not yet been fully investigated. Many local communities, particularly in Sinai and the northwestern Mediterranean coast, depend on the sustainable harvesting of biological resources for their subsistence as this harvesting provides a large portion of their food, medicines and income. Local communities have also, over thousands of years, developed an intimate cultural and spiritual relationship with nature. Therefore, it is safe to say that biodiversity in Egypt should not be taken at face value.

Besides the provisional services that biodiversity provides, it also provides regulating and supporting services, such as bacteria and microbes that transform waste into usable products, insects that pollinate crops and flowers and coral reefs and mangroves that protect coastal areas from erosion. The continuing decline of biodiversity puts these crucial ecosystem services at stake, ultimately affecting the well-being of Egyptians. Egypt has experienced first-hand how the loss of biodiversity can impact its economy; 13.5 billion Egyptian pounds are lost yearly as pollinator numbers decline due to the use of pesticides. The protection of Red Sea coastal areas from erosion by coral reefs and mangroves was valued at 80 million Egyptian pounds per km^2. The annual expenditure and income from PAs is presented in Figure 2-7.

Figure 2-7 Annual Expenditure and Income from Protected Areas in Egypt



	2001/ 2000	2002/ 2001	2003/ 2002	2004/ 2003	2005/' 2004	2006/ 2005	2007/ 2006	2008/ 2007	2009/ 2008	2010/ 2009	2011/ 2010	2012/ 2011	2013/ 2012
Annual budget	4850000	6919000	16741000	14057000	11488000	15000000	15000000	16000000	16000000	16000000	18500000	16000000	14000000
Expenditure	15562200	9558000	12029000	11519000	10027000	17950000	7755000	8123500	8250288	13626488	12959209	6169210	4667690
Revenues	7555767	7842284	9827959	17620290	22788437	16912750	22356789	25743890	26806859	30681018	17871163	16535103	19279387

3 Overview of Egypt's Biodiversity Status and Trends

Most of the information in this chapter has been summarized from National SOE reports, National Biodiversity Reports to CBD, published literature, and data and information available at the National Conservation Sector (NCS) and Egyptian Environmental Affairs Agency (EEAA).

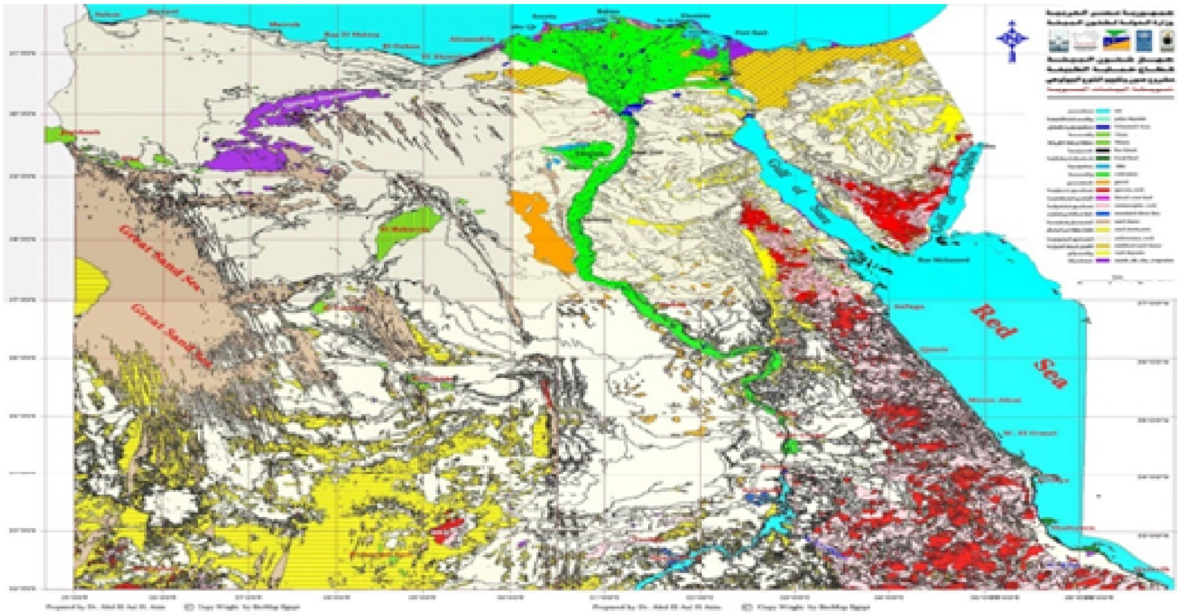
Trends from available indicators suggest that the state of biodiversity is declining and the pressures upon it are increasing, despite the many national efforts taken to conserve biodiversity and use it sustainably. The losses are due to a range of threats including habitat loss and fragmentation, overuse of natural resources, pollution, invasive species and tourism driven by a range of socio-economic drivers. Climate change will act synergistically with other threats with serious consequences for biodiversity. Although the country's species diversity is relatively low owing to its general aridity, many species are endemic and/or narrowly distributed or highly localized with limited geographical distribution to certain areas (Oasis, Elba Mountain and Sinai Mountains), making habitat conservation crucial.

3.1 Status and Trends of Terrestrial and Aquatic Ecosystems

The natural habitats of Egypt can be broadly divided into; i) desert habitats; ii) arable and urban landscapes; iii) wetland habitats; and iv) coastal and marine habitat. Egypt's first national assessment of the status of biodiversity at the ecosystem level was carried out between 1996 and 1998 as part of assessing the status and coverage of existing protected areas (PAs), as the main vehicle for biodiversity conservation. The objective was to systematically identify geographical priority areas for the development of a network PAs in Egypt.

The map showing habitats in Egypt (Figure 3-1), interpreted according to available satellite data, includes 22 main groups of natural habitats such as urban areas, islands, oases, dunes, metamorphic and sedimentary rocks, open water, fresh water channels, warm springs (El Ain El Sokhna – Oyon Mousa), coral reefs, and mangrove trees. Every habitat has been subdivided into divisions, depending on morphological characteristics and important groups of fauna and flora that inhabit it.

Figure 3-1 Natural Habitats of Egypt



3.1.1 Desert Ecosystems

Dry and sub-humid habitats (Figure 3-2) cover over 90% of Egypt's territory, combining different ecosystems. The Mediterranean coastal desert receives the highest rain fall in the country (up to 200 mm annually) and has a fair amount of vegetation cover and the greatest national floral diversity. The influence of coastal rains extends up to 60 km inland.

Figure 3-2 General View of Arid Lands (SOE, 2007)

About 1,775 plant species have been recorded in desert ecosystems: 279 in North Sinai, 472 in South Sinai, 328 in North Coast, 66 in Halayeb, 250 in the Western Desert and 280 in the Eastern Desert. Most of recorded plants are associated with traditional knowledge in Sinai, the North Coast and the Eastern and Western deserts.

The Western Desert which occupies about two-thirds of the country's area (681 thousand km^2) is a harsh environment for plant growth because of the hot summers (sometimes above 50 °C), extreme daily temperature fluctuations in the winter (from above 30 °C in the day to below zero at night) and rare rainfall. Oases are the most prominent features of the Western Desert and are the only source of water and vegetation over much of this desert. Over a long history of human settlement, the local biota was severely affected by humans. Inside oases land was transformed into cultivated fields and orchards. As a result, it is difficult to ascertain what natural vegetation had been there before human interference. However, a total of 233 plant species (116 annuals and 103 perennials), belonging to 151 genera and 44 families, were recorded in the western Mediterranean sand dunes. Of these, some 30 species are known to be endemic to the Mediterranean. Additionally, a total of 219 plant species (116 annuals and 103 perennials), belonging to 154 genera and 47 families, were recorded in the Sallum area.

In contrast, the desert bordering the Red Sea is very dry and the vegetation is typical of that of the Eastern Desert (223 thousand km^2), being largely restricted to mouths of larger wades and along the coast where saltmarsh vegetation grows. As for the Sinai Peninsula (61 thousand km^2), it is considered to be a huge mass of basic formation with high rough peaks (St. Catharine Mountain), valleys and some oases. Wades and mountains are characteristic of the landscape of much of the Eastern Desert and Sinai.

Biological diversity recorded in El Omayed, a deserts protectorate, includes251 plant species (1 endemic, 11 threatened, 17 endangered of extinction), 324 animal species including 39 bird species (4 endemic, 1 globally endangered, 19 rare); 10 mammals (1 endemic, 2 endangered of extinction, 4 rare); 33 reptiles (3 endangered with extinction, 12 under environmental threats); and242 insect species (2 endangered with extinction).

In the Wadi AllaqiPAbiodiversity is represented by139 plant species (98 of them became extinct between 2000 and 2006 and 6 species are deteriorating due to over and random grazing);15 mammal species (including The Barbary Sheep (*Ammotragus lervia*), Gazelle, Heyena, Sand Cat, fox, Mountain Rabbit, Ibn Awa, and Wild Donkey);and100 bird species.

Biological diversity reported in the Siwa PAincluded53 plant species,28 wild mammals including 8 rare species threatened with extinction (namely cheetah, Striped Hyena, Egyptian Gazelle, White Gazelle, Red Fox, Wild Cat and Fennec fox), 32 reptile species**,** 164 bird species and36 insects and a large number of invertebrates.

In Wadi El Gemal and Hamata, 140 plant species, including 32 used in traditional medicine, 24 mammal species, 29 species of reptiles and amphibians and 45 bird species were recorded.

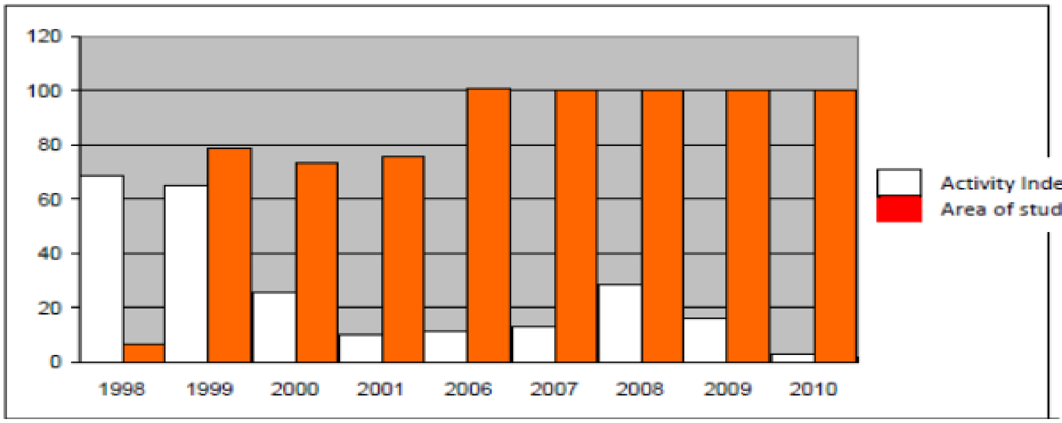
There are several indicators used to assess the loss of biodiversity in desert ecosystems. One of these indicators is the loss of 40% of the plant species in the last 20 years in the Wadi Allaqi PA due to extreme dryness and overgrazing. Another indicator would be the disappearance of the Cheetah, which has not been seen in the Western Desert in the past two decades. In addition, the Egyptian desert was home to 6 species Antelopes until the mid-1940s: Mountain Gazelle (*Gazella gazelle*), Dorcas Gazelle (*Gazelle dorcas*), Scimitar Horned Oryx (*Oryx dammah*), Rhim Gazelle (*Gazelle leptoceros*), Addax (*Addax nasomaculatus)* andAfrican Wild Ass (*Equus asinus*). As a result of hunting activities and drought, the Mountain Gazelle, Scimitar Horned Oryx, Addax and African Wild Ass have disappeared completely. Only the Dorcas Gazelle (*Gazelle dorcas*) and Rhim Gazelle (*Gazelle leptoceros*) are still present today, however, threatened with extinction. The Dorcas Gazelle is relatively widely distributed compared to the Rhim Gazelle, which had been monitored in limited areas of the Western Desert close to Siwa.

3.1.2 Indicators of State of Desert Ecosystems

The Dorcas Gazelle (Gazelle dorcas dorcas) (Figure 3-3), being capable of adapting to harsh desert conditions, is considered to be one of the indicators of the state of biodiversity in Egyptian desert ecosystems. According to an activity index (Figure 3-4) for the Dorcas Gazelle in the period between 1996 and 2010 in the South Sinai, there has been a significant decline gazelle activity in the area of study in 2010 compared to previous years, especially in northern areas which were considered important habitat for the gazelle.

Figure 3-3 Dorcas Gazelle (*Gazelle dorcas dorcas*)

Figure 3-4 Activity Index for the Dorcas Gazelle in South Sinai from 1996 to 2010 (SOE, 2010)



3.1.3 Mountain Ecosystems

Mountainous areas are concentrated in three regions in Egypt: South Sinai, El Owaynat, and Elba in the Red Sea. They cover 0.7 % of Egypt's territory and are characterized by unique biodiversity given the variety of habitats found within their ranges, such as mountain peaks, rifts, mountain slopes, desert valleys, mountain valleys and caves.

More than 600 plant species have been documented in Egypt's mountains. Of these plant species, 70 (indigenous and endangered species in Elba and St. Katherine Mountains) are said to have been lost. To date, the different taxonomic groups recorded in mountain ecosystems include: 472 plant species (including 30 endemic - 50 % of the endemic species found in Egypt - and 140 medicinal plants), 85 moss taxa (48% of taxa recorded in Egypt, including two the endemic *Tortula kneuckeri* and *Grimmia anodon*). There also exists one species of hepatics (*Riccia* *cavernosa*). In St. Katherine there are 41 mammal species, 36 reptile species, 50 bird species and 33 butterfly species. In the Eastern Desert, mountains are home to 361 plant species, including the diversity found in Elba, which comprises of 458 plant species (3 endemic), 36 mammal species, 38 reptile and amphibian species and 60 bird species. In Hamata, there are 150 plant species, In El Owaynat there are 71plant species (40 species became extinct in the last 20 years), 12 mammal species, 12 reptile species, 30 bird species and 24 invertebrate species. The Gelf Elkebir is home to 64 plant species. The most common mountain mammals include the Slender horned gazelle (*Gazella leptoceros*), Nubian ibex (*Capra nubiana*), Wild cat (*Felis silvestris),* Swamp cat (*Felis chaus),* Caracal *(Caracal caracal),* and Rock hyrax (*Procavia capensis).*

3.1.4 Agricultural Ecosystems

Agricultural cropland habitatshave been declining since the late 1980s. These declines are thought to be related to changes in land use and agricultural practices. Agricultural land continues to be lost to human settlements.About 286,000 feddans (1 feddan = 1.038 ha) were lost from 1990 to 1996; it is estimated that some 47,700 feddans are lost every year. In addition, the introduction of high yielding varieties and their wide use led to the neglect and disappearance of traditional varieties and the erosion of crop plant genetic diversity. Currently, Egypt depends on four crops (wheat, corn, rice and potato) for 50% of its vegetarian food and 14 mammal and bird species for 90% of animal proteins.

Invasive species such as palm weevil and invasive weeds are also of great concern and the excessive use of fertilizers and pesticides has led to the disappearance of important agricultural biodiversity such as owls, kites, and pollinators. Fertilizer use increased from 707,400 tons in 2001 to 996,000 tons in 2003 and 4000,000 tons in 2005.

The Egyptian economy's losses were estimated at about EGP 13.5 billion /year due to usage of pesticides, which contributes to the loss of pollinators. Most of Egyptian botanical crops depend completely or partially upon insect pollination in its production.

3.1.5 Wetland Ecosystems

There are six major inland wetland areas in Egypt: the Nile River, Lake Nasser, Bitter Lakes, Wadi El Natrun, Lake Qarun, and Wadi El Rayan. In addition, there are many smaller wetlands scattered across the Nile delta and valley, and in oases located in the Western Desert. Oases are the only source of water over much of the western desert, the principal ones being Maghra, Siwa, Wadi El Rayan, Bahariya, Farafra, Dakhla, Kharga, Kurkur and Dungul. There are also six major coastal lagoons on the Mediterranean: Bardawil, Port- Fouad (Mallaha), Manzala, Burullus, Edku and Maryout. The Red Sea coastal habitats and wetlands include mudflats, reefs, mangroves and marine islands.

Wetlands and river ecosystems in Egypt are poorly protected and most Egyptian wetlands and river systems have been degraded drastically during the past 50 years as a result of multiple pressures. Although species diversity was recorded for many inland water wetlands (Nile River, Lake Nasser and Northern Delta lakes such as Lake Burullus and Lake Bardawil), there is a need for regular assessments and evaluations to identify priorities for conservation.

3.1.5.1 Nile River and Lake Nasser

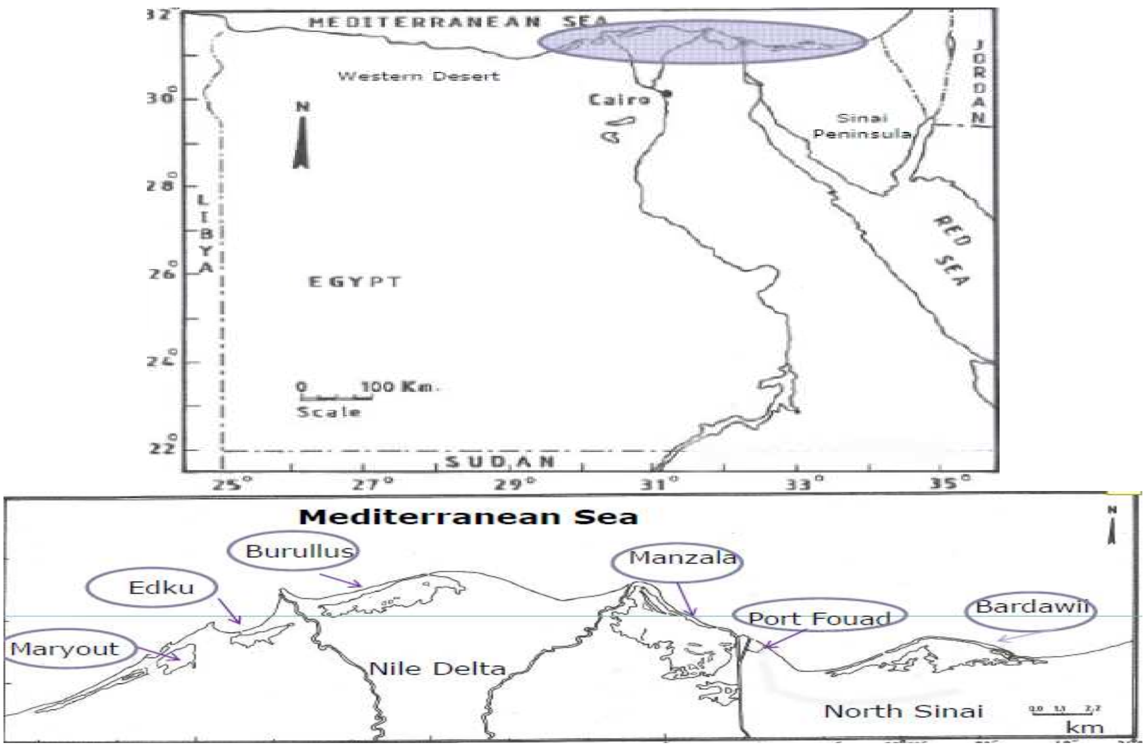
The Nile River (6,650 km) runs 1,530 km in Egypt. The Nile supports most of the country's wetlands, which are some of Egypt's most important habitats supporting the greatest diversity and density of bird species. The Nile's water quality is relatively good from Aswan to Cairo but declines in quality in the Delta. Species diversity recorded includes 87 aquatic weeds, 100 zooplankton and 80 phytoplankton species (algae). At the beginning of the 20th century, a total of 82 fish species were recorded. After erection of the high dam and establishment of Lake Nasser only 58 species were recorded; today 22 species of these (*Tilapia spp*) are widely spread and 36 species are less spread or rarely found. Additionally, 31 amphibian species and reptiles previously recorded in the river including the Nile crocodile (*Crocodylus niloticus*) and Nile Chelonia (*Trionyx triunguis*) are now found only in Lake Nasser. Presently, mammals are not well represented in Nile River; 37 species were previously recorded and the Nile Rhino (*Ceratotherium cottoni*) was observed only up to the year1800 (Fisher and Khalifa, 2003). The most commonly found mammals are small ones, such as rats and bats. Less common mammals include mongoose, red fox, jungle cat and the Egyptian Jackal (*Canis aureus lupaster*) that are found mainly in cultivated Nile valley and Delta lands.

Eleven macrophytic aquatic plants have been recorded in Lake Nasser in the Egyptian Nubia, before and after the completion of the Aswan High Dam. Two euhydrophytic species disappeared after the filling of Lake Nasser. Of the other nine species, three Potamogeton spp. (i.e. *P. crispus, P. trichoides, P. pectinatus*) which were recorded during the seventies and early eighties have no longer been observed in recent years. For bird species, 122 species were recorded in the Nile River and its islands. In Lake Nasser, more than 200,000 bird species were recorded.

3.1.5.2 Mediterranean Coast Lakes

The six Egyptian Mediterranean brackish water coast lakes or lagoons (Figure 3-5) are situated along the Nile delta coast (Manzala, Borollus, Edku and Maryout) and to the east of the Suez Canal (Port-Fouad and Bardawil). All of them, with the exception of Lake Maryout, are directly connected to the sea.

Figure 3-5 Number and Distribution of Coastal Lagoons in Egypt



The aquatic fauna of the Northern Delta lakes (Figure 3-6) is a mix of freshwater and marine species. The freshwater fauna is dominated by tilapia species which make the majority of fish catch. Many Nile species also inhabit these lakes, such as *Hydrocynus forskalii*, *Lates niloticus*, *Cyprinus carpio*, *Barbus bynni*, *Clarias lazara*, *C. gariepinus*, *Bagrus bayad* and *Lates niloticus*. Several freshwater tolerant marine species are also found in the Delta lakes, including mullets, soles, seabream, seabass, meager, eels and shrimp. In recent years many of the fish species having originated from marine ecosystems have disappeared from these lakes.

Figure 3-6 Northern Delta Lakes

Different taxonomic groups were recorded in Lake Burullus and Lake Bardawil ecosystems. A total of 887 species have been recorded in Lake Burullus: 274 species of vascular plants (137 annuals and 97 perennials), 11 species of aquatic reeds (*Phragmites australis*), 276 species of phytoplankton (145 of diatoms, 50 species of blue algae, 10 species related to other groups), 90 species of zooplankton, 33 species of benthic animals, 127 species of land invertebrates (screwworms, molluscs, arthropods), 33 species of fish (but only 25 were recorded recently), 23 species of reptiles, 112 species of birds and 18 species of mammals.

During the 1970s, 33 species of fish were recorded in Lake Burullus, but at the beginning of this century 52 species were recorded (most of them fresh water fish and migratory fish) while 8 species of marine fish disappeared. This serves as biological evidence of agricultural sewage impacting the lakes salinity. In spite of increasing primary productivity of the lake, the quality of fish (mostly freshwater fish) value has decreased dramatically.

In Lake Bradawil, a total of 2,111 species have been recorded: 203 species of vascular plants (83 annuals and 120 perennials), 241 phytoplancton and 59 zooplankton species), 72 species of invertebrates including field worms, crustacea (shrimps), molluscs and echinoderms, 55 spiders, 202 species of insects, 45 fish species (bream and mullets), 23 species of reptiles, 241 species of birds (more than 50% of recorded species in Egypt) and 21 species of mammals. A remarkable change was observed over the past 30 years, namely the dominance of bream fish during the 1980s, then *Mugilidae* family in the 1990s and now crustacea (shrimps) amounts to 50% of lake production.

Biodiversity status of Lake Bradawil according to the red lists described by IUCN includes 6 plant species threatened with extinction, 2 of them are endangered, one is unidentified, and one is rare. In addition to that, 5 species are considered to be limited in distribution. One of the most famous threatened animal species in Lake Bardawil is the Egyptian tortoise (3 species), the wild Egyptian turtle in addition to corn crake which has increased greatly in the last few years. Lake mammals like Greater Gerbeoa, Fennec Fox (*Vulpes zerda*), wild cat, and sand cat are threatened species.

3.1.5.3 Indicators of State of Wetland Habitats

By looking at different state and pressure indicators, such as changes in lake area, pollution, eutrophication, fish landings and fish species diversity, it is evident that these wetlands are being degraded and that there is inadequate law enforcement with regards to land use.

A) Change in Lake Areas

Changes in the areas of the four Nile Delta lakes are shown in Table 3-1 and Figure 3-7. Additional information on the changes in area for lakes Maryout and Manzala are provided in Tables 3-2 and 3-3, Figures 3-8 and 3-9. Similar information for lakes Edku and Burullus is not currently available. As early as 1977, prior to the dramatic increase in private fish farming enclosures, lake surface areas lost to land reclamation were already at 60% in Lake Maryout, 29% in Lake Edku and 11% in Lake Manzala. By 1988, losses had risen to 30 percent in Manzala and 62% in Edku. Today, Manzala's surface area is a mere one third of its original expanse of 327,000 feddans and Lake Edku has been reduced to less than half its original size. Similarly, Lake Burullus has lost an estimated 37% of its open-water area and 85% of its marsh area in the past 40 years, largely as a result of ongoing drainage and land reclamation. The situation is compounded by the fact that the water quality in what remains of these lakes has been seriously compromised through the systematic discharge of waste into them.

Table 3-1 Changes in Lake Area for the Four Nile Delta Lakes (2008)

Lake	Area in 2008 (Feddan)	Area Prior to 1950 (Feddan)	Mean production (Ton)
Manzala	90,000	350,000	62,000
Burullus	70,000	220,000	48,000
Edku	10,000	45,000	9,000
Maryout	16,000	66,000	5,000

Figure 3-7 Changes in Lake Area for the Four Nile Delta Lakes (prior to 1950 to 2008)

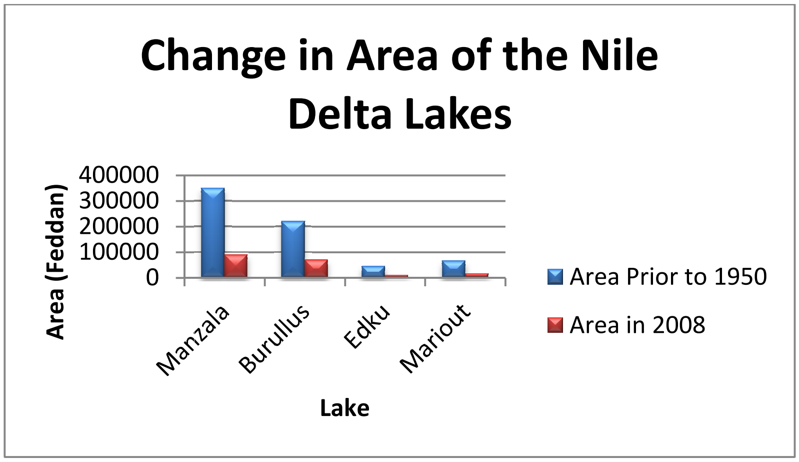


Table 3-2 Changes in Lake Maryout Area

Year	Area (1000 Feddans)	Area (km^2)	Percentage of 1889	Comments
6000 years ago	571, 315	2,400	950%	Lake and Valley
1889	60	252	100%	10.5% of original
1920	41	172.2	68.3%	31.7% decrease in area within 30 years
1952	39.6	159.6	63.3%	7.3% decrease in area within 32 years
1965	38	136.9	54.3%	14.2% decrease in area within 13 years
2001		50	19.8%	63.5 decrease in area within 63 years

Figure 3-8 Changes in Lake Maryout Area

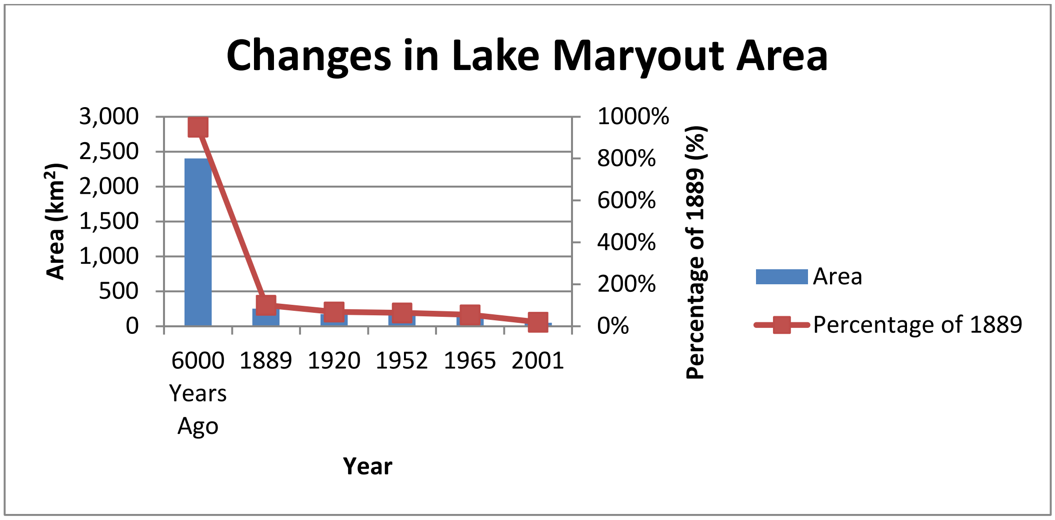
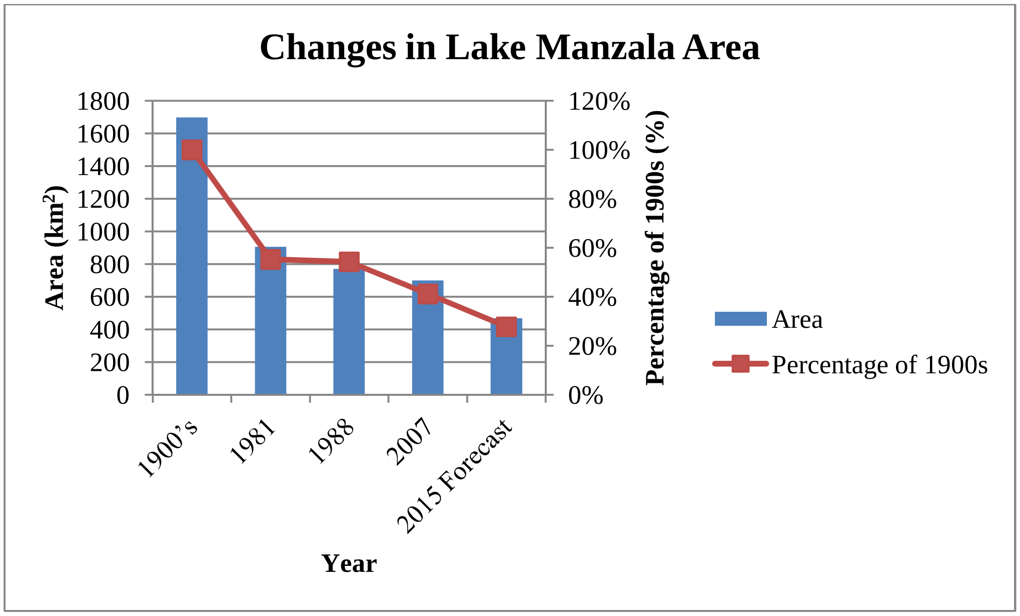


Table 3-3 Changes in Lake Manzala Area

Year	Area (km^2)	Percentage of 1900's	Comments
1900s	1698	100%	
1981	905	55.3%	46.7% decrease in area within 81 years
1988	770	54.3%	14.9% decrease in area within 7 7 years
2007*	700	41.2%	% decrease in area within 19 years
2015 forecast	469	27.8%	% decrease in area within 8 years

*Assuit University www.aun.edu.eg/abstract_th.php?R_ID=4058

Figure 3-9 Changes in Lake Manzala Area



B) Eutrophication

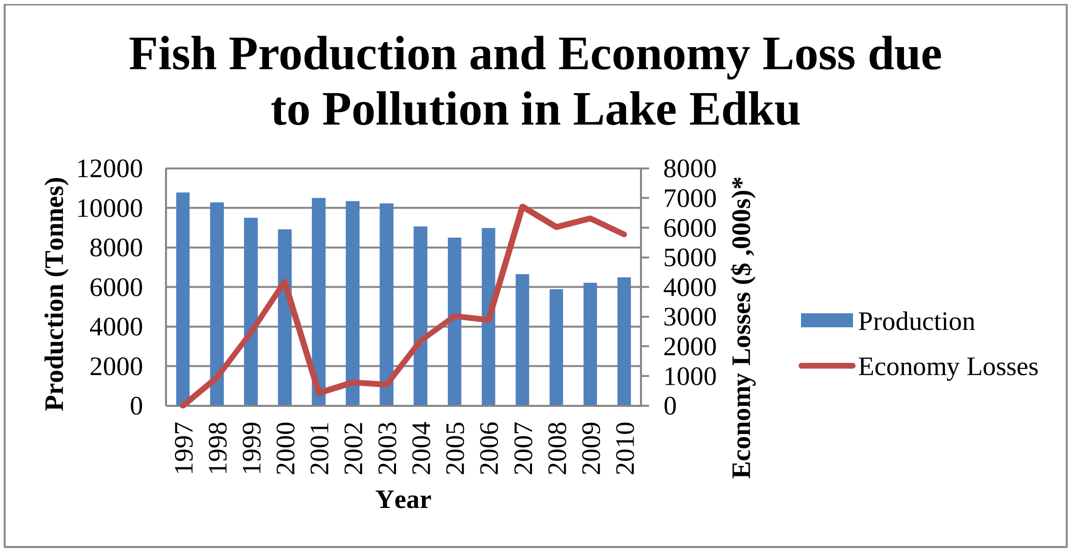
In the last two decades several studies have been carried out to explore the extent of pollution in the northern Delta lakes. According to studies conducted by Gamil and El-Karyony (1994) and El-Tantawy (2012), phosphorus, nitrogen and trends in fish catch are used as indicators of Lake Eutrophication. There are studies that have concluded that the highly eutrophic lakes in the northern Delta are a result of agricultural runoff and domestic wastewater, discharging high levels of nitrogen and phosphorus. As a consequence, lakes have become increasingly rich in plant biomass, especially algae, causing the depletion of dissolved oxygen and often causing high species mortality, which in turn affects species assemblages and causes the decline of aquatic flora and fauna diversity.

Although most of these studies are concerned with the technical component of that pollution, i.e., toxicity, water quality and effect on biological conditions, very few studies were concerned with the economic aspects of such pollution as in the case of Lake Edku (Table 3-4, Figure 3-10).

Table 3-4 National Welfare Losses due to Lake Edku Pollution

Year	Production (Tons)	Deviation from base year (Tons)	Economy Losses Value ($1,000)
1997	10784	-	-
1998	10280	504	949
1999	9494	1290	2457
2000	8922	1862	4173
2001	10510	174	428
2002	10336	448	780
2003	10230	554	710
2004	9056	1728	2191
2005	8490	2294	3019
2006	8986	1798	2886
2007	6645	4139	6709
2008	5886	4898	6020
2009	6206	4578	6308
2010	6493	4291	5776

Figure 3-10 Fish Production and Economy Losses due to Pollution in Lake Edku from 1997 to 2010



C) Pollution with Pesticides and Heavy Metals

Pesticides and the relatively higher levels of heavy metals are severely damaging fish habitat, threatening species survival and affecting water quality in wetland areas. Pollution caused some fish species to go extinct and others to significantly decline in numbers. According to surveys of fish carried out in the 1980s, over 60% of fish sampled in the four Delta lakes contained DDT and benzene chloride. Numerous other investigations in the four lakes had shown high levels of heavy metals, pesticides and PCBs in fish.

D) Fish Landing

The four northern Delta lakes (Manzala, Burullus, Edku and Mariout) were among the richest and most diverse ecosystems in Egypt until 40 years ago. Production levels are already endangered by developments in other sectors, such as land reclamation in Lake Manzala and hyper-salinization in Lake Qarun. The four northern Delta lakes provided 35% of Egypt's fish catch during the 1970s. They now account for only 17% of the catch. The dwindling catch is attributed to pollution and improper resource management, among other factors. The production in Lake Maryout and Lake Manzala, both of which are adjacent to large urban populations, is on the order of half of the production in Lakes Edku and Burullus, which are adjacent to lower-density agricultural communities, and are consequently less affected by domestic and industrial pollution and fishing pressure.

The relative areas and fish production for the four lakes are shown in Table 3-5 and Figure 3-11. The development of fish catch in Lake Maryout from 1920 to 2010 is presented in Figures 3-12 and 3-13. The development of fish catch for Lake Edku from 1997 to 2010 is presented in Figure 3-14.

Table 3-5 Relative Areas and Fish Production in the Four Delta Lakes

Lake	Maryout	Edku	Burullus	Manzala
Landings (t)	3,500	8,209	59,200	59,600
Area (ha)	6,800	7,100	48,000	80,500
Production (t/ha)	0.5	1.1	1.2	0.7

Figure 3-10 Area and Landings in the Four Nile Delta Lakes

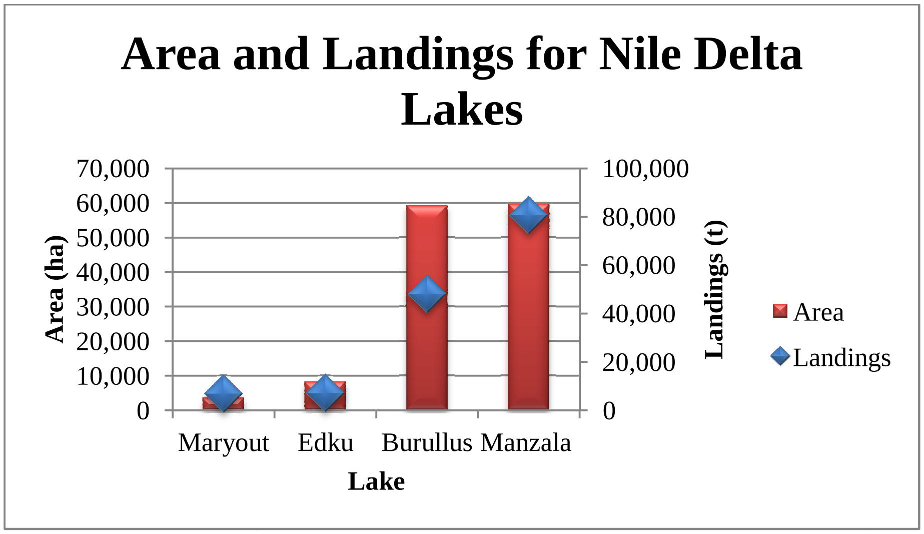


Figure 3-11 Development of Fish Catch in Lake Maryout from 1974 to 2005

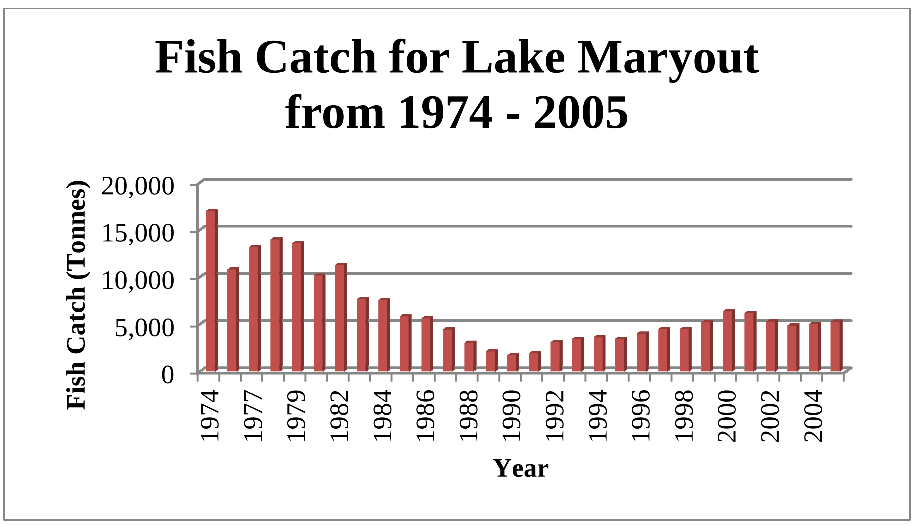


Figure 3-12 Development of Fish Catch in Lake Maryout from 1920 to 2010

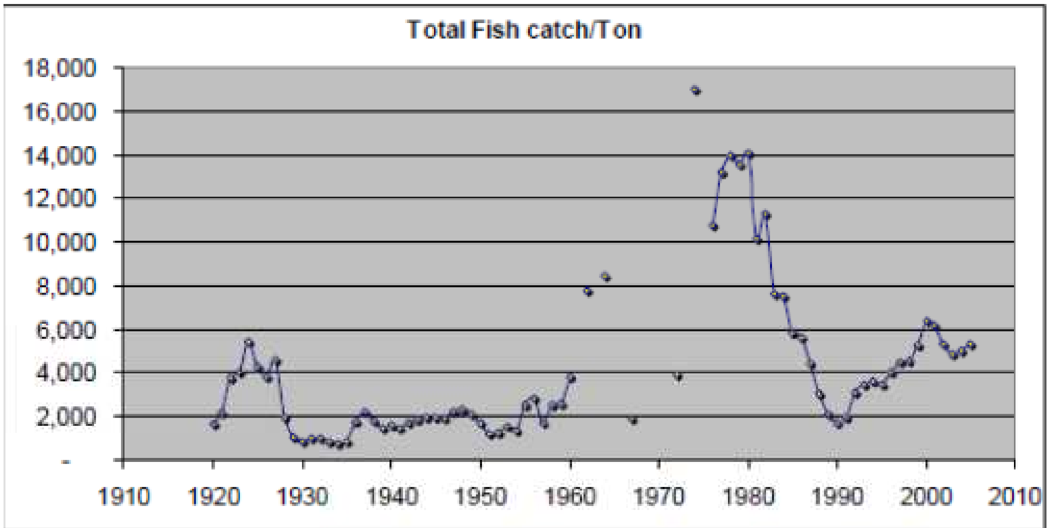
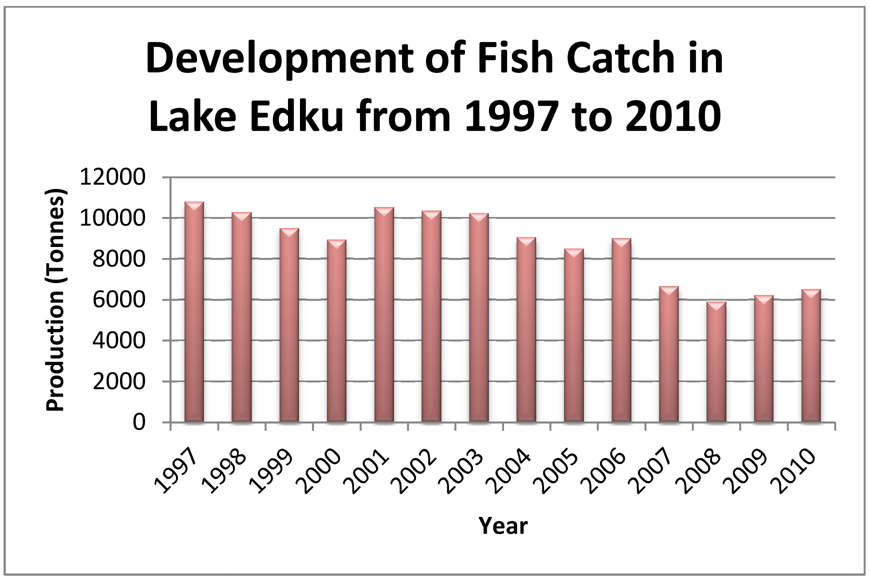


Figure 3-13 Development of Fish Catch in Lake Edku from 1997 to 2010



E) Fish Diversity and Density

Fish serve as good indicators of trends in aquatic biodiversity as their variety easily reflects a wide range of environmental conditions. Fish also have a major impact on the distribution and abundance of other organisms in the waters which they inhabit.

As a result of wastewater discharge into Lake Maryout since 1988 and excessive fishing pressure, most of the less tolerant high-valued fish such as *Mugil cephalus*, *Labeo niloticus*, *Bagrus bajad*, *Lates niloticus* and *Barbus bynni* have decreased in numbers and/or completely disappeared from the lake while *Tilapia spp*. flourished, representing about 90 % of the total yield in recent years. The mullet catch in Lake Maryout has been reduced from 3.6% of the catch in the late1970s to less than 1% in the early 1990s. The eel catch is in danger of disappearing completely. The fish catch of major and minor species from Lake Maryout from 1962 to 2005 is shown in Figures 3-15 and 3-16.

Figure 3-14 Fish Catch of Major Species from Lake Maryount from 1962 to 2005

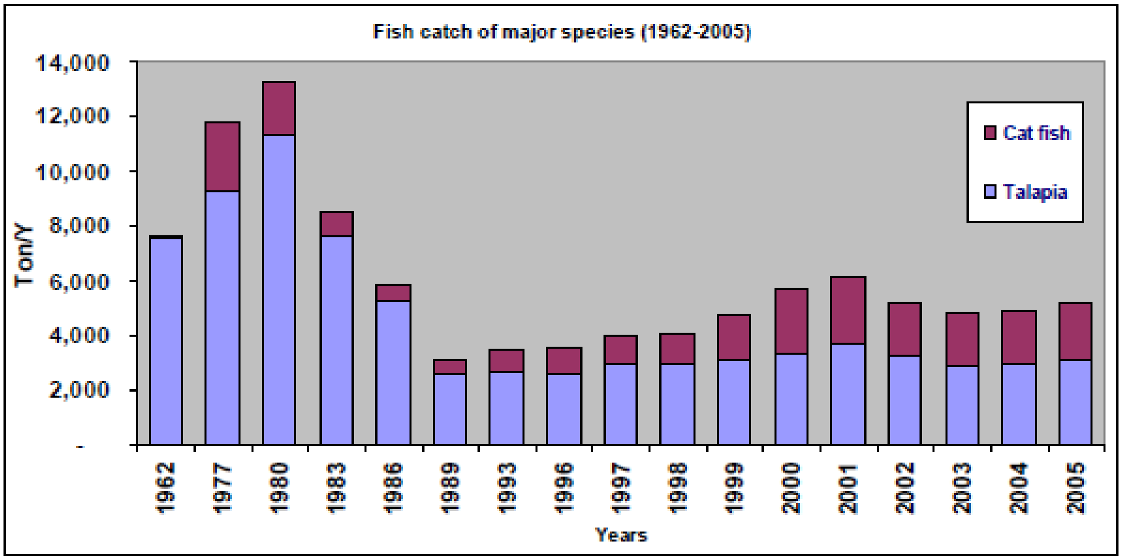
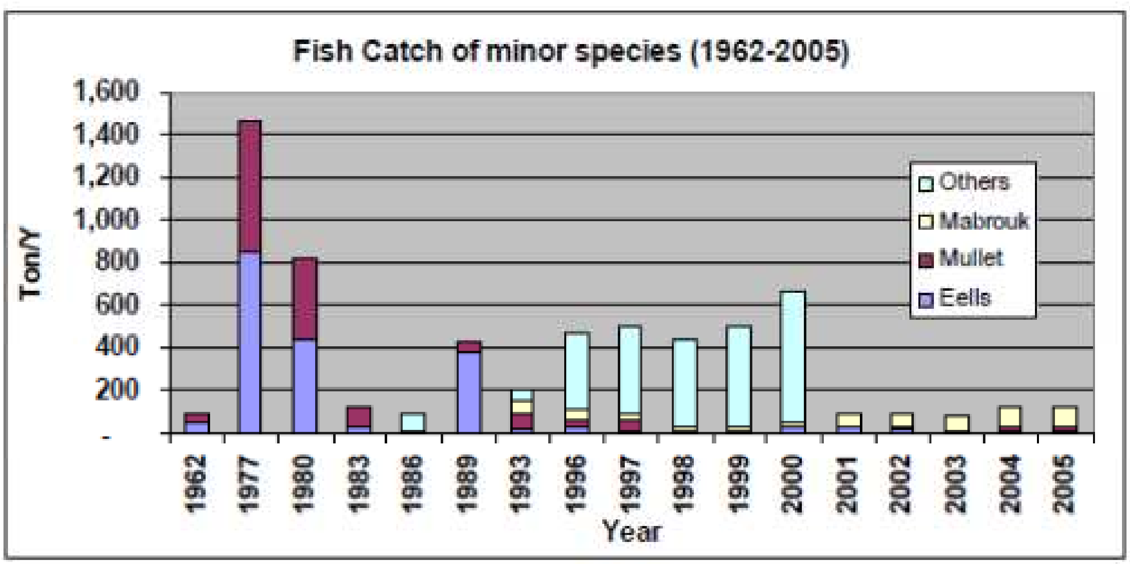


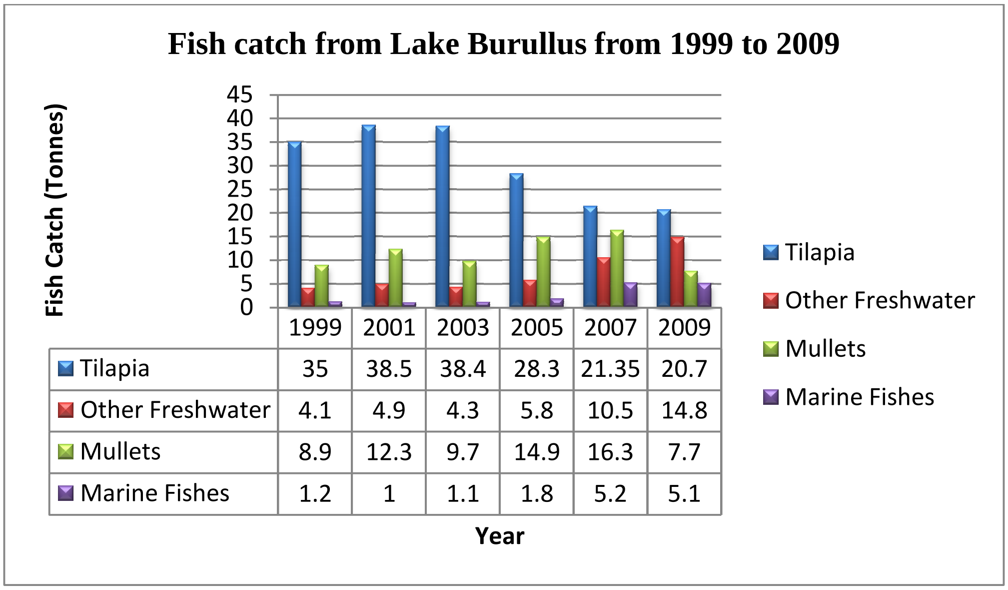
Figure 3-15 Fish Catch of Minor Species from Lake Maryout from 1962 to 2005



In Lake Manzala, there has been a substantial reduction over the last few decades in both fish and bird species.

In Lake Burullus, the fish composition of the lake has changed over the years (Figure 3-17) due to changes in the environmental condition of the lake.

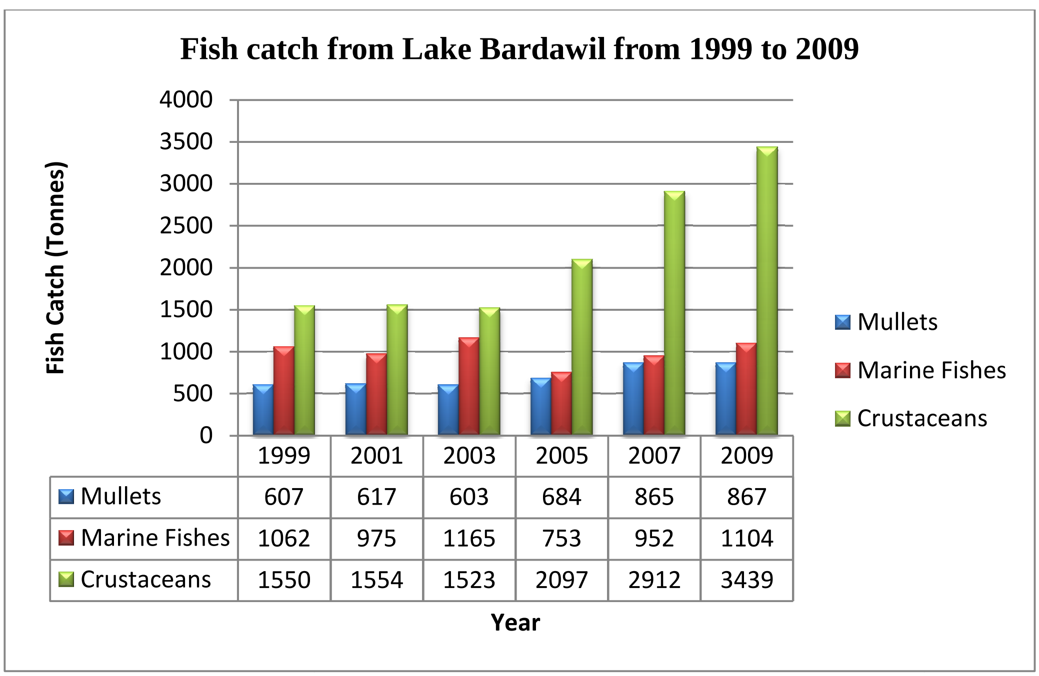
Figure 3-16 Fish Catch from Lake Burullus from 1999 to 2009 (Abdel Rahman, 2011)



	1999	2001	2003	2005	2007	2009
Tilapia	35	38.5	38.4	28.3	21.35	20.7
Other Freshwater	4.1	4.9	4.3	5.8	10.5	14.8
Mullets	8.9	12.3	9.7	14.9	16.3	7.7
Marine Fishes	1.2	1	1.1	1.8	5.2	5.1

In Lake Bardawil, fisheries catch composition has changed since 1999 (Figure 3-18) and the contribution of the most economic species, such as the sea bream and sea bass, has sharply declined from 56.5 % in the period between 1982 and 1988, to about 7.5 % in 2007.

Figure 3-17 Catch from Lake Bardawil from 1999 to 2009 (Abdel Rahman, 2011)



	1999	2001	2003	2005	2007	2009
Mullets	607	617	603	684	865	867
Marine Fishes	1062	975	1165	753	952	1104
Crustaceans	1550	1554	1523	2097	2912	3439

The changes in macrobenthic invertebrate diversity in Lake Bardawil from 1984 to 2007 are shown in Figures 3-19 – 3-21 (Khalil *et al.*, 2013).

Figure 3-18 Annual Macrobenthos Density of Lake Bardawil from 1984 to 2007

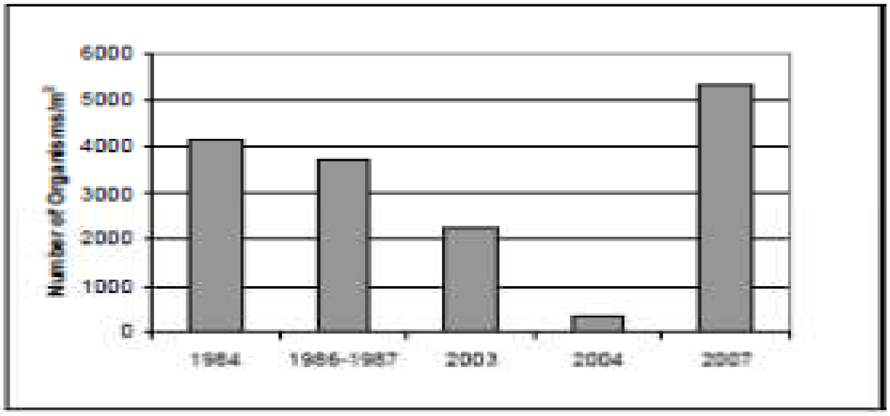


Figure 3-19 Percentage composition of macrobenthos groups of Lake Bardawil from 1984 to 2007

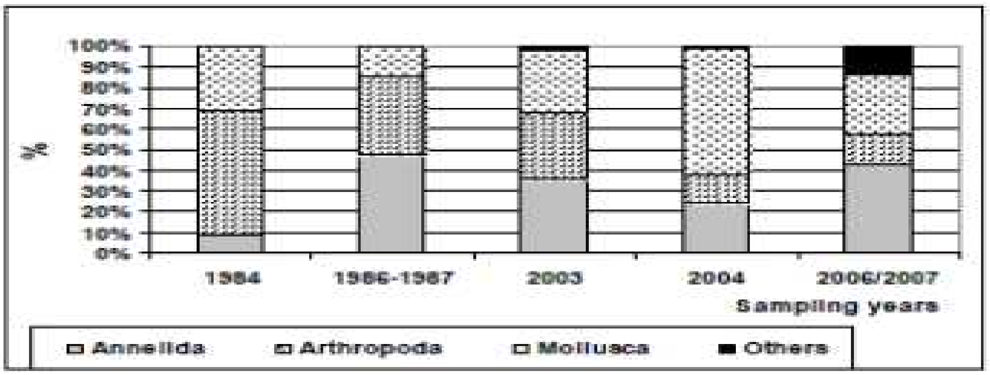
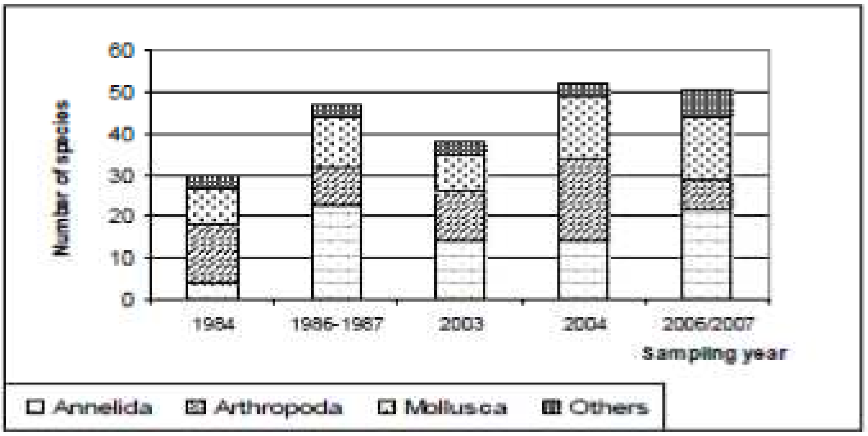
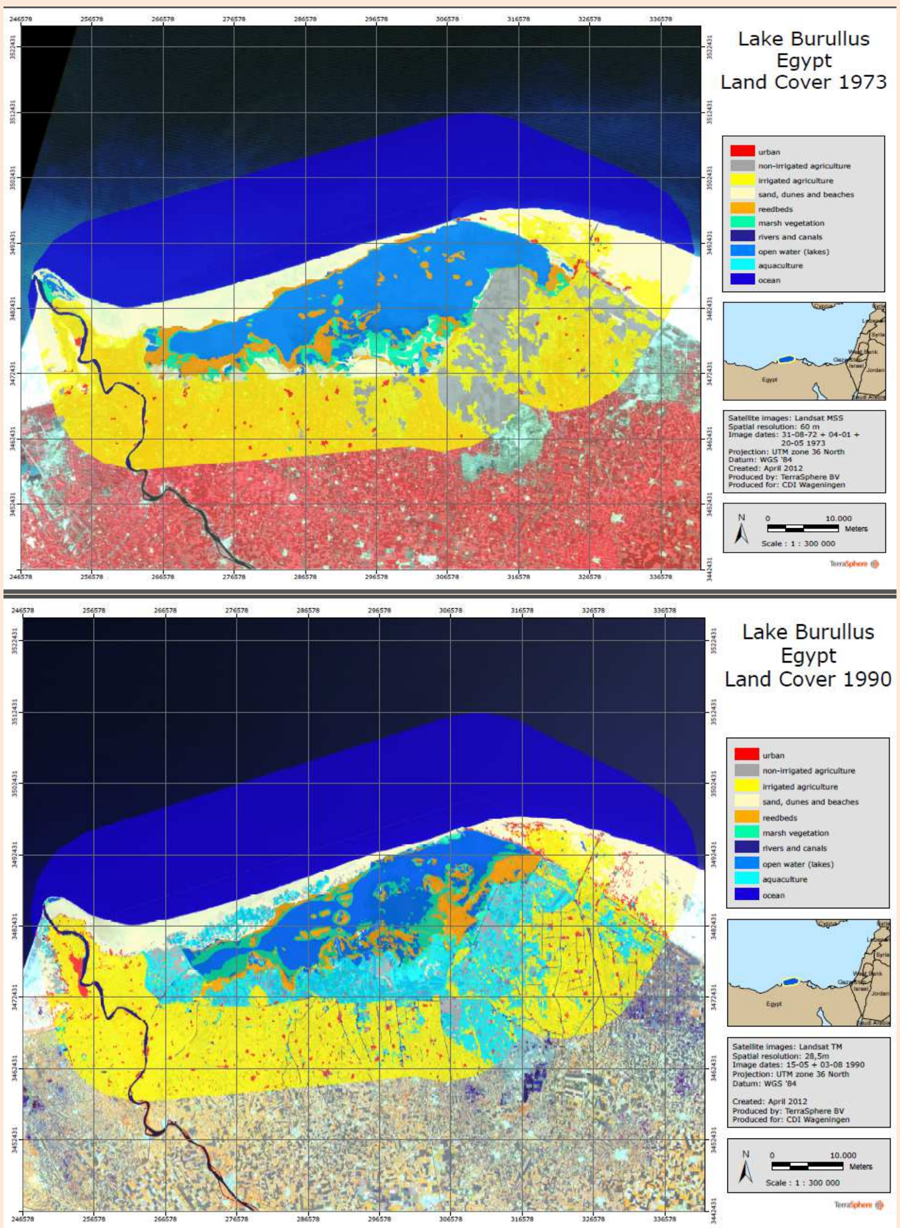


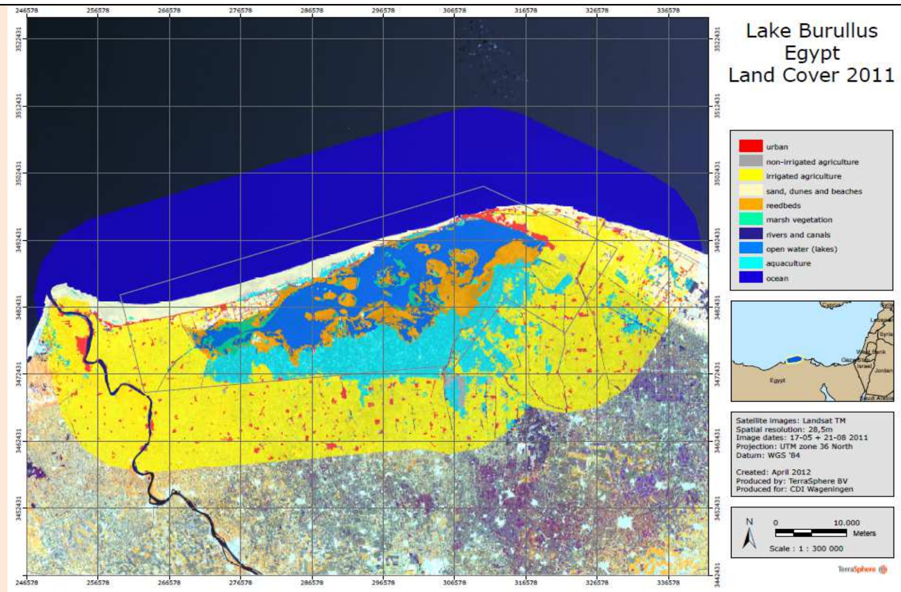
Figure 3-20 Macrobenthos Diversity of Lake Bardawil from 1984 to 2007



Changes in Land Use in Lake Burullus

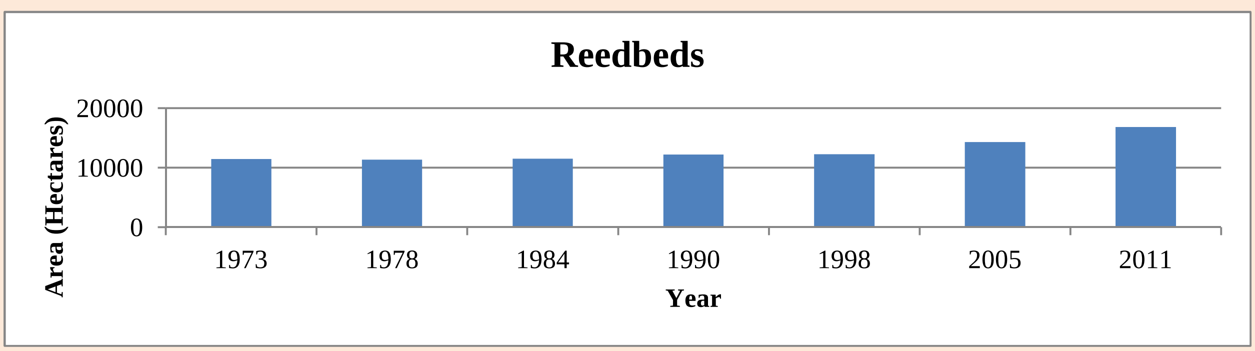
Lake Burulus is an important coastal wetland and RAMSAR site on the northern coast of Egypt. Despite the status of Protectorate under Egyptian legislation, the environmental condition of Lake Burullus has dramatically changed over the past 40 years. Three processes can be held accountable; the unprecedented growth of aqua culture ponds (from close to 0 hectares in 1978 to over 40,000 hectares 12 years later in 1990), the expansion of urban area from nearly 2,000 hectares in 1973 to 8,500 hectares in 2011, and loss of open water from over 45,000 hectares in 1973 to about 25,000 hectares in 2011.





The aqua culture ponds have predominantly been built in the fringes of the Lake at the account of shore line vegetation (marsh vegetation and reed) and non-irrigated agricultural lands. The loss of marsh land (from 8,000 hectares in 1978 to a bit more than 3,000 hectares in 2011) in the fringes of the Lake due to the construction of aqua ponds is partly compensated by the development of new marsh land vegetation in the Lake. The surface of reed vegetation increased even despite the fact that reed vegetation along the shore lines was massively replaced by aqua culture ponds; due to the inflow of nutrients from upstream agricultural lands and untreated waste water from the new urban areas reed invaded the open water. As a result the surface of reed beds increased from nearly 11,000 hectares in 1978 to nearly 17,000 hectares in 2011 (Figure 3-22).

Figure 3-21 Reedbed Areas from 1973 to 2011



Active management (mowing and removal of detritus) has prevented further encroachment of reed and greater loss of open water.

The loss of open water, combined with the deteriorating water quality has had a damaging impact on the biodiversity (seven valuable fish species disappeared) and the livelihoods of about 50,000 fishermen living around the Lake.

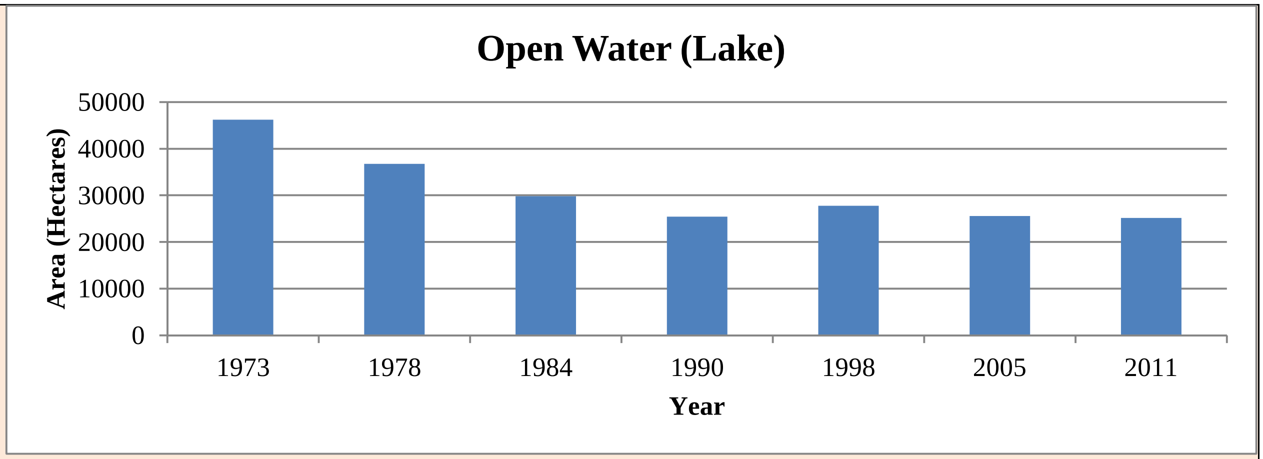


Figure 3-22 Loss of Open Water (Lakes) from 1973 to 2011

As indicated earlier (Figure 3-18), the fish composition of Lake Burullus has also changed over the years due to the change in the environmental conditions of the lake.

3.1.6 Coastal and Marine Ecosystems

Egypt is bounded from the north by the Mediterranean Sea with about 995 km and from the east by the Red Sea with about 1,941 km. The Egyptian coastal and marine environment is distinguished by specific habitats, namely coral reefs and mangroves where the greatest known species diversity of any marine ecosystem is found. Coastal habitats have come under pressure from many forms of development including tourism and urban infrastructure and port facilities.

3.1.6.1 State of Mediterranean Sea Biodiversity

The majority of the Mediterranean Basin biodiversity is threatened by a range of human activities. Among the most endangered marine vertebrate species are the Mediterranean monk seal; common bottlenose dolphin, short-beaked common dolphin, striped dolphin, sperm whale, green turtle, leatherback turtle, loggerhead turtle, and cartilaginous fishes (sharks, rays, and chimaeras) (UNEP/MAP/MED POL 2005).

Seabirds of conservation concern nest in the Western and Eastern Mediterranean. In the Eastern Mediterranean, seabirds are threatened by habitat loss due to drainage, water diversion, changes in annual water regime, eutrophication, reed cutting, landfills, chemical pollution and hunting (UNEP/MAP 2012).

3.1.6.2 State of Red Sea Coral Reefs

Egypt is a home to over 1,800 km of diverse coral reef habitats along the western Red Sea coast and in the Gulfs of Suez and Aqaba. The Red Sea contains some of the world's unique coastal and marine environments. The most notable among them is the extraordinary system of coral reefs and their associated animals and plants. This environment supports rich biological communities and representatives of several endangered species. Reef-building corals are living animals which produce coral reefs by secreting a hard skeleton made of aragonite, a form of calcium carbonate (limestone). This external skeleton then creates a 3D framework that forms a complex habitat, increasing species abundance and total productivity. Such limestone structures may reach 1.3 km thick and up to 2,000 km long.

Coral reefs rank as the most diverse and productive natural ecosystems, their high productivity stemming from the efficient biological recycling, their high retention of nutrients and their structure complexity, which provides habitat and food for vast numbers of organisms. The world conservation strategy (IUCN/UNEP, 1985) declared the coral reef as "one of the essential life support systems" necessary for food production, health and other aspects of human survival and sustainable development. Following their shapes, they are classified according to their relationship with land as fringing reefs (parallel to the coastline at a distance < 1 km from shore and often form a shallow lagoon between the beach and the main body of the reef), barrier reefs (parallel to the coastline at a distance > 5 km from shore), atoll reefs (a ring-shaped coral reef including a coral rim that encircles a lagoon partially or completely and there may be coral islands/cays on the coral rim) or patch reefs (outcrops of coral usually lie within a lagoon). The corals build these massive structures form a thin layer of living coral polyps or colonies (1 mm thick). It is estimated that coral polyps need about 10,000 years to form a reef and 100,000 to 30 million years to build a fully mature reef. Polyps are only able to build a reef with the help of single-celled Zooxanthellae algae.

Egypt's coastline possesses a significant proportion and considerable range of the coral reefs found in the Red Sea with about 3,800 km^2 of reef area (Spalding *et al*. 2001) and 1,800 km long (PERSGA, 2010). The Red Sea is home to approximately 300 species of hard coral and 125 species of soft coral. Of the 300 hard coral species found in the Red Sea, two thirds are found in the Egyptian Red Sea, including some endemic species (Kotb *et al*. 2008). These numbers are higher than those recorded in the Caribbean and equal to the Indian Ocean. Egyptian reefs are fringing reefs alongside the coastline. The reefs extend in the North to the gulfs of Suez and Aqaba and to Ras Hedarba in the South at the border of Sudan. They are, however, not continuous because of the periodic flooding from wades creating gaps between reef systems. The northern part of the Red Sea has the highest coral diversity (Table 3-6) and number of islands while the south has the highest terrestrial biodiversity for the whole country (Shaalan, 2005).

Table 3-6 Number of Genera and Species of Reef-building Corals in Egypt's Red Sea (Abu Zaid, 2000)

Region	Genera	Species
Gulf of Aqaba	47	120
Gulf of Suez	25	47
North Red Sea	45	128
Central Red Sea	49	143
South Red Sea	31	74

Live coral cover of Egyptian reefs averages 48%. Fish found in abundance in and around coral reefs include the butterflyfish (Chaetodontidae) (Table 3-7).

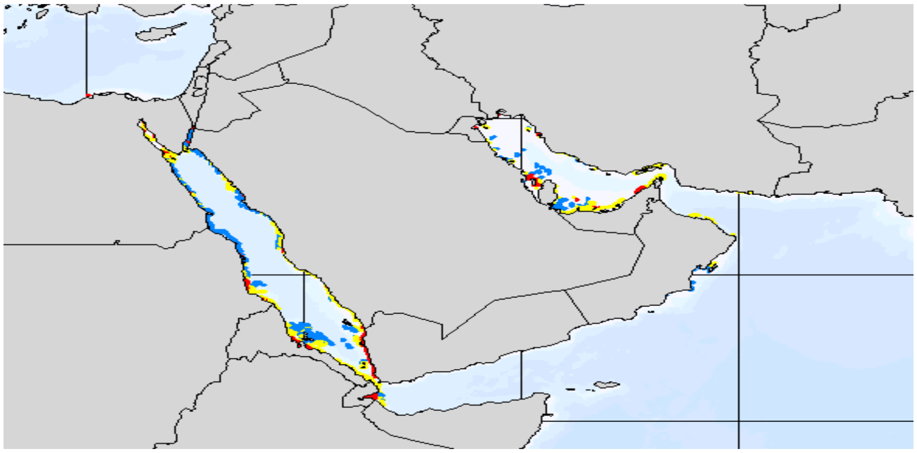
Table 3-7 Key Coral Reef Indicator Species Abundance in 2002 and 2008 (PERSGA, 2010)

Abundance (fish number per 100 m^2 reef)	**2002**	**2008**
Butterfly fish	8.6 ±0.36	6.10 ±0.07
Sea urchin (*Diadema*)	< 5	< 1
Giant clam	2.2 ± 2	3.0 ±1.4
Grouper	0.77 ±1	0.74 ±0.03
Lobster	0.02 ±0.08	-
Parrotfish	2 ±1.6	2 ±0.4
Sea cucumber	< 1	Nearly 0
Snapper	5 ±5	11 ±10
Sweetlips	0.4 ±0.1	0.8 ±0.05
Triton	<1	-

In addition to coral diversity, the Red Sea and Gulf of Aqaba are also home to a diversity of flora and fauna. Different taxonomic groups recorded in Red Sea coral reef ecosystems include more than 1,000 fish species, 500 species of crustaceans, 400 Mollusca species and hundreds of species of other organisms. There are 13 species of marine mammals, 4 marine reptiles and 2 species of mangroves. The dugong (Dugong dugon) and different marine turtle species (hawksbill, green turtle, leatherback and logger-head) are present in different areas across the Red Sea (Tiran Islands, Nabq and Abu Galum Park in the North). In the Gulf of Aqaba, 49 species of invertebrates were found living in the sea grass bed, of which about 70% were molluscs. There are 325 species of reef fish in the Egyptian Red Sea, of which 17% are endemic species. Butterfly Fish have declined in numbers in the Red Sea from an average of 9.7 per 100 m^2 to 5.2 per 100 m^2 2002, and Sweetlips populations have dropped by 69% (Hassan et al. 2002). In addition, the abundances of groupers and parrotfish in the Egyptian Red Sea have also decreased and this has been attributed to the lack of law enforcement where poaching in the no take zones is high (Hassan *et al*., 2002). It has also been established that the southern reefs house a greater diversity of fish species than northern reefs (Abu Zaid, 2000). Exposed reefs contain higher fish diversity than sheltered reefs, which has been attributed to a lower incidence of SCUBA divers and fishermen in exposed areas (Pilcher and Abu Zaid, 2000). In areas with higher diving activity, mostly in the north, an average of 55 species can be found in and around non-degraded reefs of Hurghada and Sharm El Sheikh. In contrast, a little further down the coast in Marsa Alam, where the number of tourists and developments are considerably less, average fish diversity increases to 70 species in and around non-degraded reefs (Abu Zaid, 2001). There was a positive correlation between the number of Butterfly Fish and live coral cover (Abu Zaid *et al*., 2002).

About 60% of Red Sea coral reefs were assessed as at risk primarily due to coastal development, overfishing and the potential threat of oil spills in the heavily trafficked Arabian Gulf and southern end of the Red Sea (Figure 3-24). Within the Gulf of Aqaba, reefs were estimated to be approximately 70% under low threat and 30% under high threat, largely from coastal development. This is regarded as a potential underestimate due to the threats posed by tourism and shipping. In some of the once most pristine reef areas, poorly managed diving tourism operations (causing damage from anchors and recreational scuba divers) has also taken its predictable toll on the reefs. Diving areas represent 60% of coral reef areas (the remaining areas are inaccessible and protected). The number of dives and snorkeling activities ranged in every region between several thousands to more than 70,000 dives a year (SOE, 2010).

Figure 3-23 Estimated Threat to Red Sea Coral Reefs
Low (blue), Medium (yellow), High (red)



Ras Mohammed National Park, a marine protectorate containing miles of healthy fringing reefs, was established in 1983 to help alleviate some of these problems. Coral reefs within protected areas have shown to be relatively healthier than their counterparts in non-protected areas. Since 2001, coral reefs' status in Egypt has been monitored in more than 120 sites in the Red Sea and Gulf of Aqaba, using environmental indicators (living vs. nonliving coral reefs, number of species and other indicators such as fish and vertebrates). Studies conducted in 17 dive sites (8 dive sites around Hurghada, 2 sites in Safaga, 4 sites Marsa Alam, and 3 sites in Wadi El Gemal area) from 2001 to 2011 using photo permanent quadrate methods (Figure 3-25-3-27) revealed that sites farther away from human activities witnessed a 15% increase in coral reef coral when compared to corals exposed to human activities (5-7%), where soft corals have increased at the cost of hard ones (Attalla, 2013).

Figure 3-24 Change in Coral Cover in Hurghada, 2001-2011

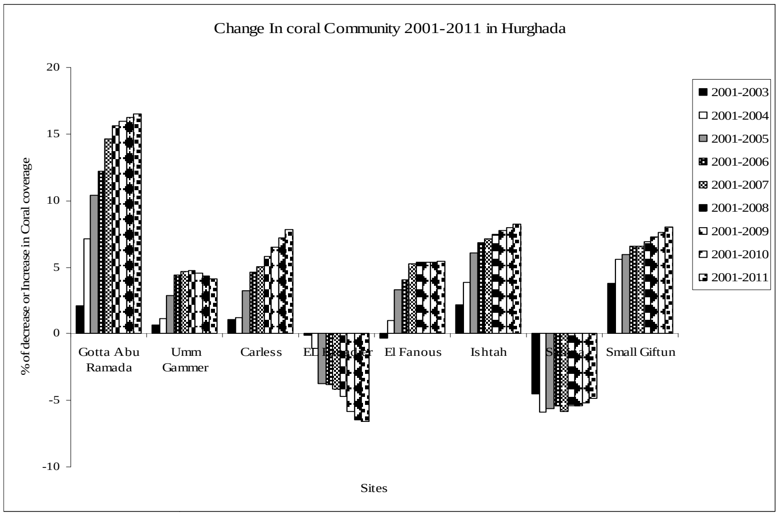


Figure 3-25 Change in Coral Cover in Southern Sites, 2001-2011

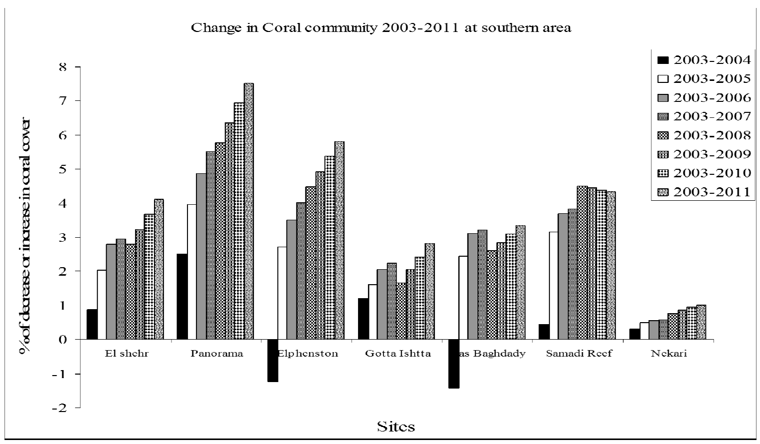
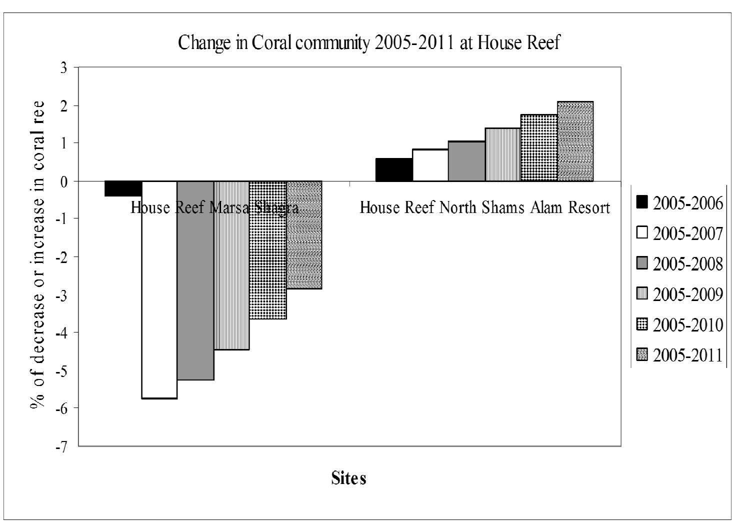


Figure 3-26 Change in Coral Cover in Southern House Reefs, 2001-2011



The effects of patrolling and diving pressure on coral reefs in 15 sites in the Red Sea (eight in the Hurghada area & seven in the Southern area) were also monitored (Figure 3-28). The good patrolling system adopted by Red Sea protectorates helped reduce damage to corals by swimming tourists and aided in the increase of coral cover. The presence and the continuous maintenance of the mooring system proved to be effective, as the number of coral colonies damaged by anchoring is significantly reduced.

Figure 3-27 Effects of Patrolling and Diving on Red Sea Coral Reefs (Hurghada and Southern Areas)

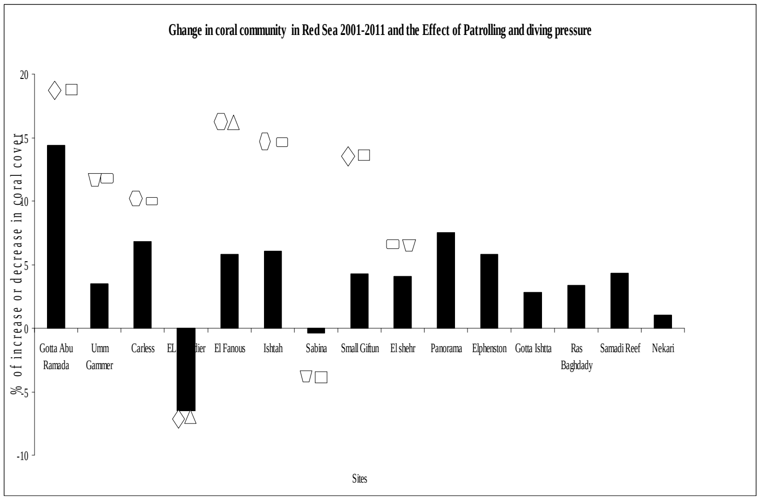


Figure 3-29 Dugong – A Popular Marine Mammal in the Red Sea (SOE, 2007, 2010)

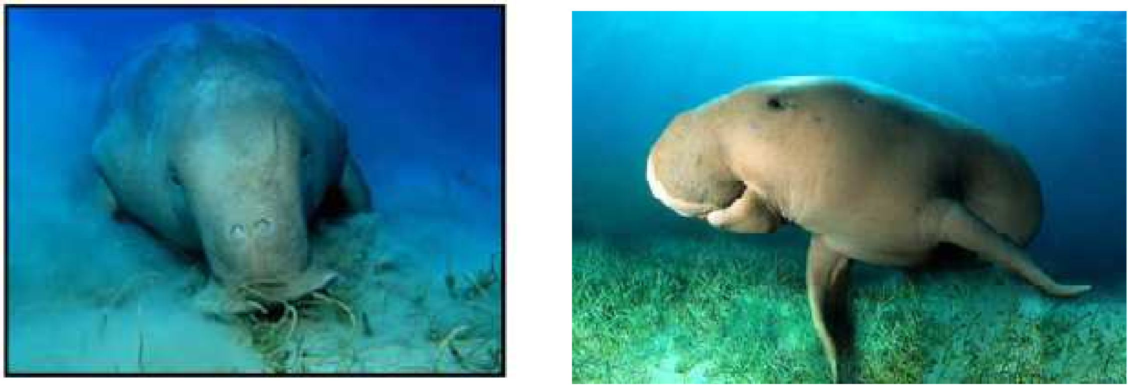
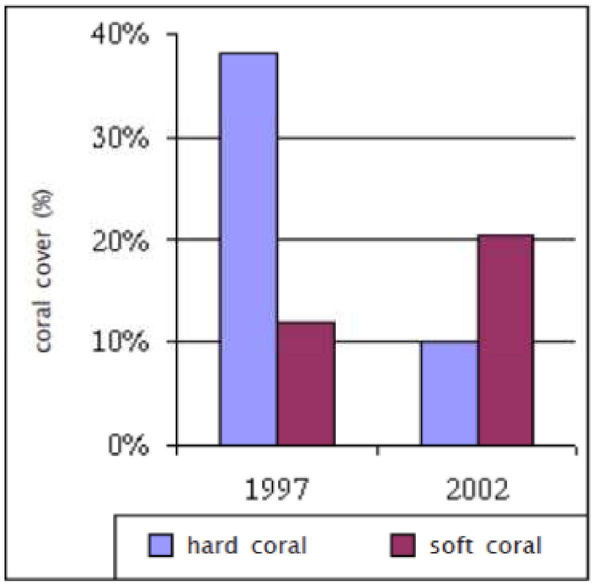


Figure 3-30 Marine Turtle (top left), Spinner Dolphins (top right) and a Whale Shark (bottom) (SOE, 2007)

Until recently, coral reefs in the Red Sea were considered healthy and free of major anthropogenic stresses, but the rapid development along the coast over the last few decades has resulted in a number of new anthropogenic threats to reefs. Threats include high sedimentation from land reclamation works for the construction of artificial beaches for tourism developments, dredging, sewage and nutrient loading from hotels, tourism and curio trading, oil spills and physical damage from recreational SCUBA diving. Regional surveys of coral reef ecosystems carried out from Hurghada to Shalateen between 1997 and 1999 in 130 reef sites revealed that the coral cover at many places has dropped by as much as 30% (Abu Zaid, 2000).

Figure 3-31 shows the decrease in coral cover in the period from 1997 to 2002 in Sharm El Sheikh, an area with high diving activity. Live hard coral cover fell from nearly 40% in 1997 to only 10% in 2002, mainly due to over development and tourism expansion (Wilkinson, 2002).

Figure 3-28 Change in Soft and Hard Coral Cover along the Sinai Coast



Diving Impacts on Coral Reefs

Tourism developments in the Red Sea region and South Sinai are generating new jobs and increasing Egypt's share of the global tourism market. However, failing to enforce environmental regulations on new developments to ensure the protection of its natural resources and monuments, would significantly impact the tourism industry's performance as it risks losing its main natural assets, and consequently face a decline in income from the tourism sector.

The carrying capacity of coral reefs was evaluated areas by studying their annual and monthly patterns of entertainment activities in more than 60 diving sites (Figure 3-32). Diving numbers have ranged from 10,000 to 60,000 dives annually, a figure higher than the international rate of 15,000 dives per year. An analytical study exploring the number of violations in coral reefs during the last 10 years concluded that there were 600 violations for hotels, other tourism establishments, ships and individuals. These violations have led to the destruction of coral reefs in many sites having a financial value of tens of billions of Egyptian pounds. Figure 3-33 shows diving impacts on coral reefs.

Figure 3-29 Diving Activities on Coral Reefs in Different Diving Areas during 2007

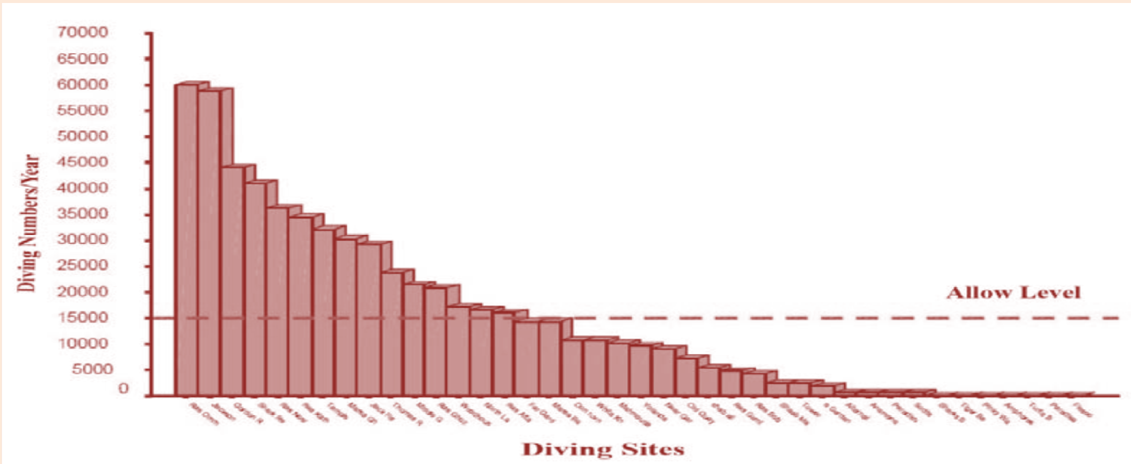
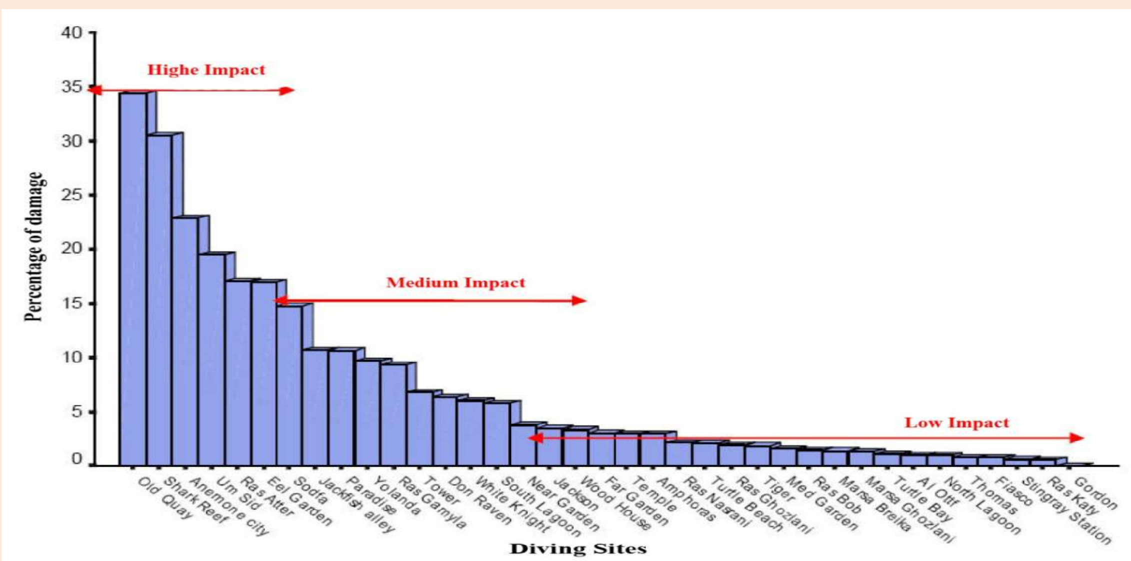


Figure 3-30 Diving Impacts on Coral Reefs (SOE, 1997)



3.1.6.3 State of Red Sea Mangroves

There are two types of mangroves in the Red Sea: *Avicennia marina* and *Rhisophora mucronata*. The *Avicennia marina* is the most abundant, where it was recorded in 28 areas along the coast and islands of the Red Sea and the Gulf of Aqaba in Ras Mohammed and Nabq PAs. The second type, *Rhisophora mucronata*, was recorded in the southern region only (in and around Shalateen) and beyond the Egyptian borders. The most important areas with mangroves are the islands of Monkar and Qaysom, Wadi El-Gemal, Hamata and the southern coast of Safaga.

Figure 3-31 Red Sea Mangroves

The mangroves provide habitat for a large number of faunal assemblages of marine organisms including a high diversity of fish, crustaceans, molluscs and echinoderms. Many terrestrial organisms and avifauna visit these mangroves for reproduction, food and shelter. Mangroves are surrounded by very rich habitats including coral reefs and sea grasses. They act as nurseries for juveniles of commercially important fish species. Different taxonomic groups so far recorded in Red Sea mangrove ecosystems include more than 22 fish species, 36 species of algae, 40 insect species, 82 crustacean species, 65 Mollusca species and 17 Echinodermata species (PERSGA, 2004; ITTO, 2012).

3.1.6.4 Indicators of State of Coastal and Marine Ecosystems

Monitoring programs have been established for sensitive ecosystems and regional surveys of coral reef ecosystems were conducted in 2002 and 2008 (PERSGA, 2010) using fish indicator species (Hudgson, 2006). The mean abundance of different indicator species per 100 m^2 recorded at different PERSGA countries during 2002 and 2008 surveys are presented in Figure 3-35 and Figures 3-36 to 3-46.

Figure 3-32 Abundance of Indicator Species in 2002 and 2008

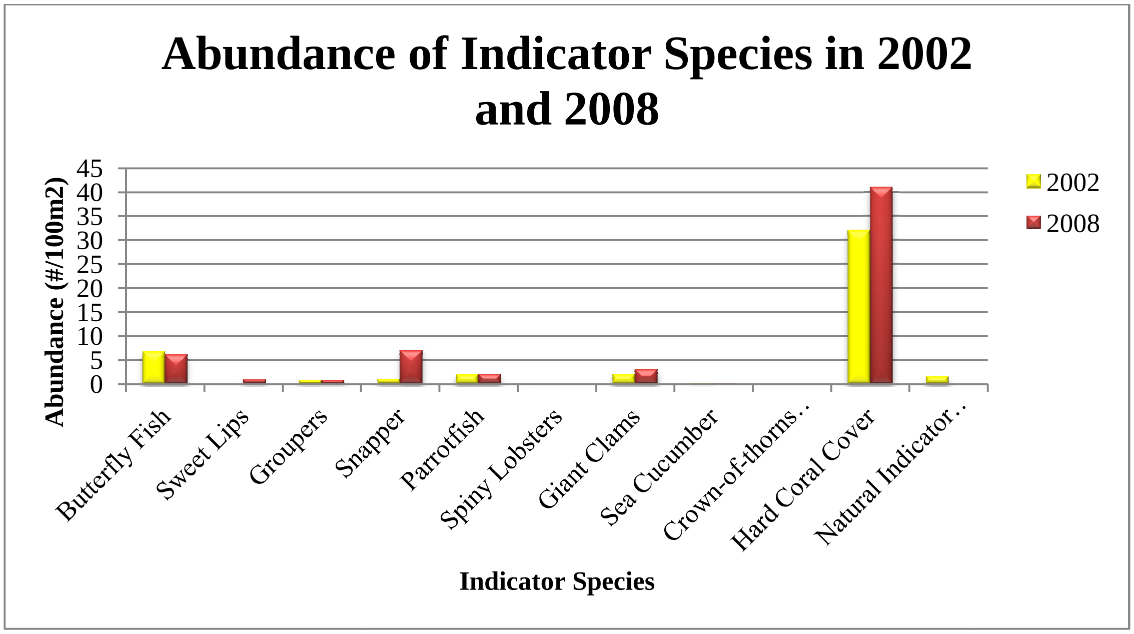


Figure 3-33 Butterfly Fish: Indicators of Ornamental Fish Trade and Overfishing

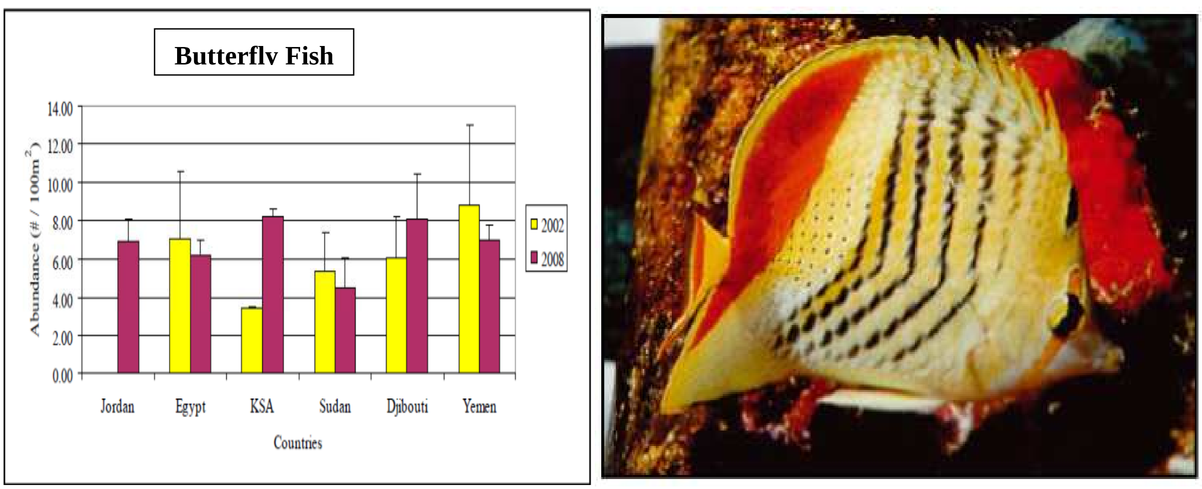


Figure 3-37 Sweetlips: Indicators of Overfishing by Line-fishing and Spear-fishing Close to Reef Areas

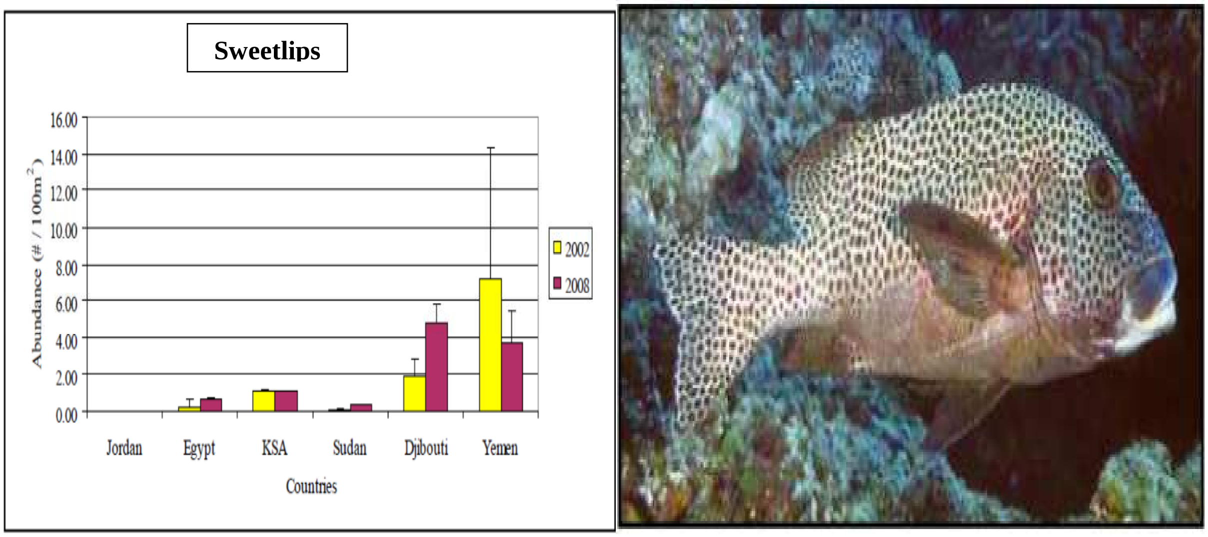


Figure 3-38 Groupers (larger than 30 cm): Indicators of Overfishing by Line-fishing and Spear-fishing Close to Reef Area

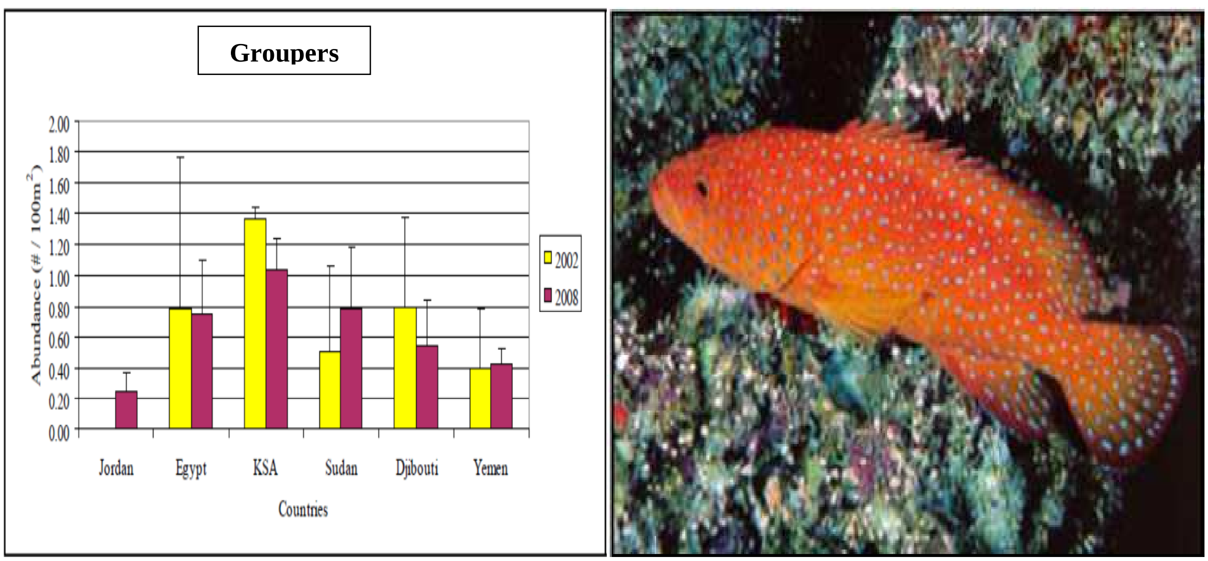


Figure 3-39 Snapper: Indicators of Overfishing

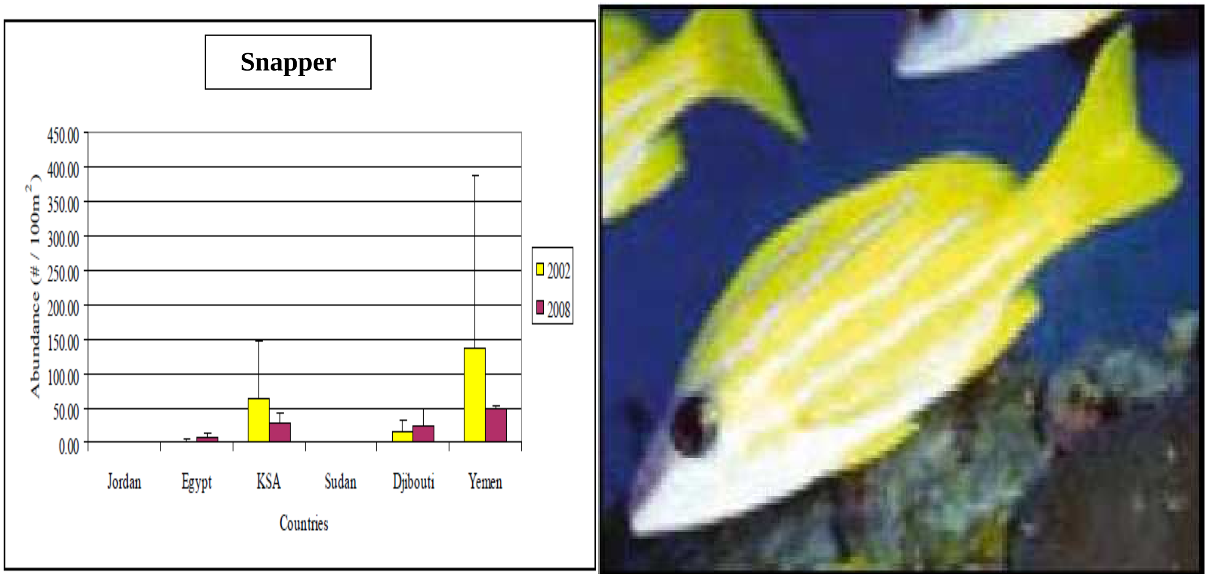


Figure 3-34 Parrotfish: Indicators of over fishing; Plays Important Role in Coral Reef Ecological Balance

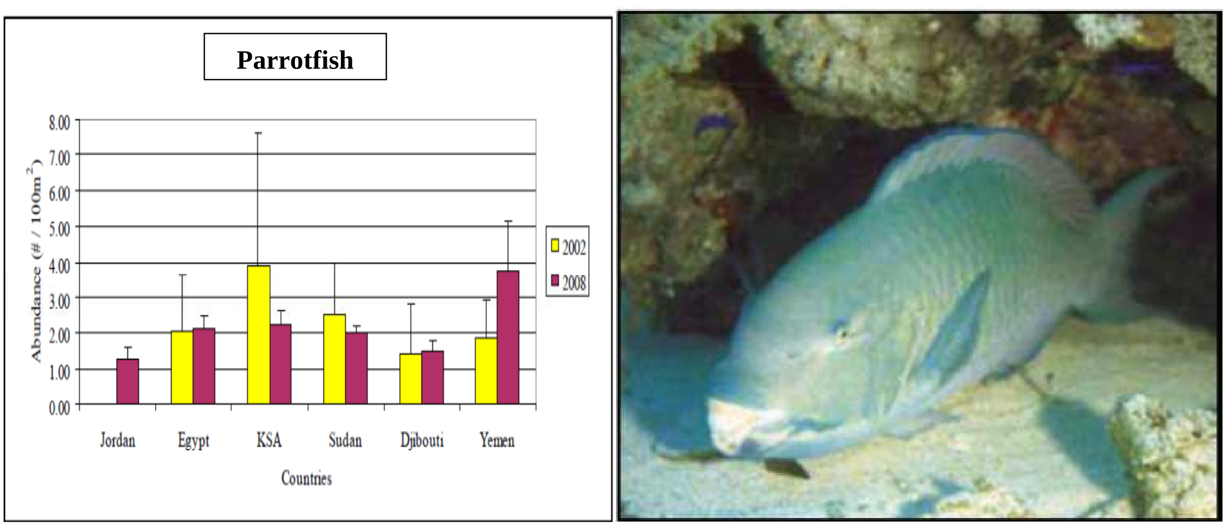
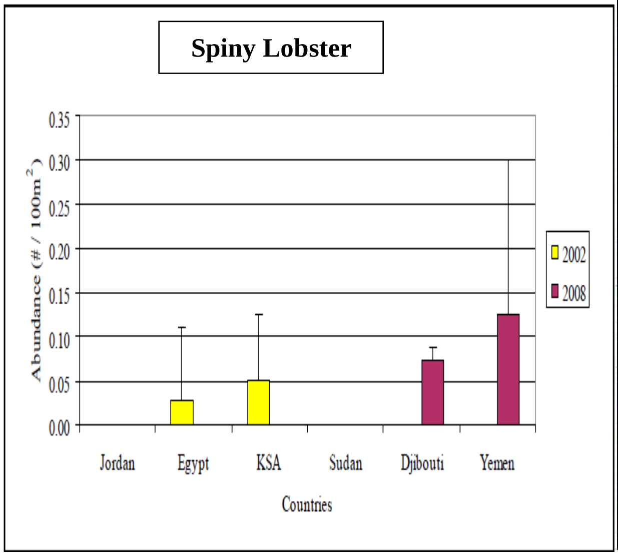


Figure 3-41 Spiny Lobsters: Indicator of Overfishing by Direct Collection from Reefs for Food (Universally Prized as Seafood)



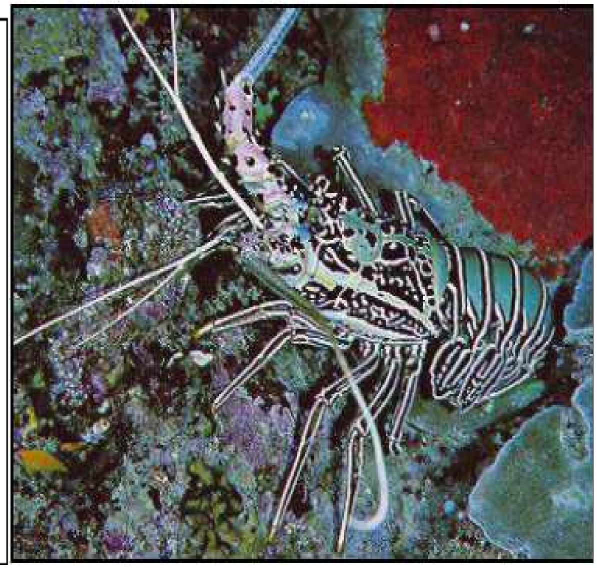


Figure 3-42 Giant Clams: Indicators of Overfishing by Direct Collection from Reefs for Food (Highly Prized Seafood)

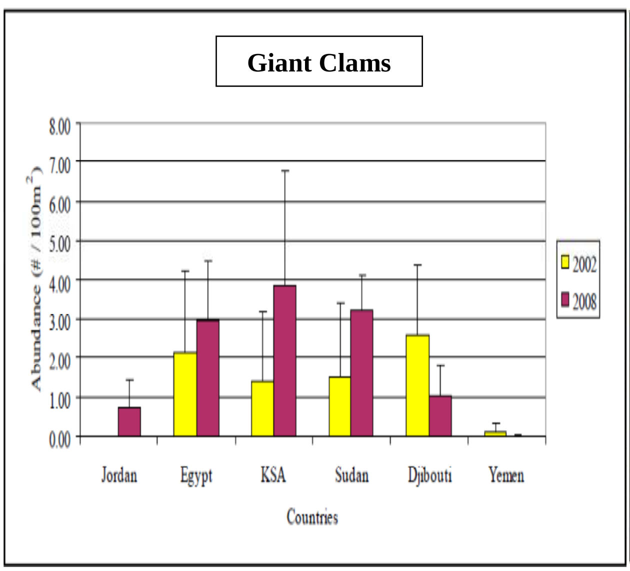


Figure 3-43 Sea Cucumber: Indicators of Direct Collection as Exported Food

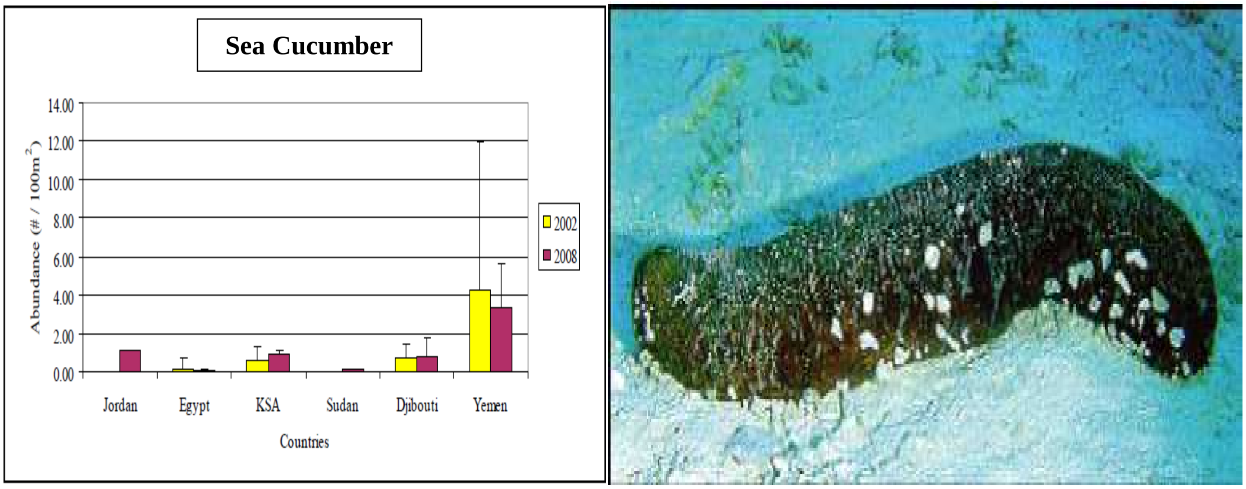


Figure 3-44 Crown-of-thorns Starfish: Can Cause Major Damage to Coral Reefs through Predation during Outbreak

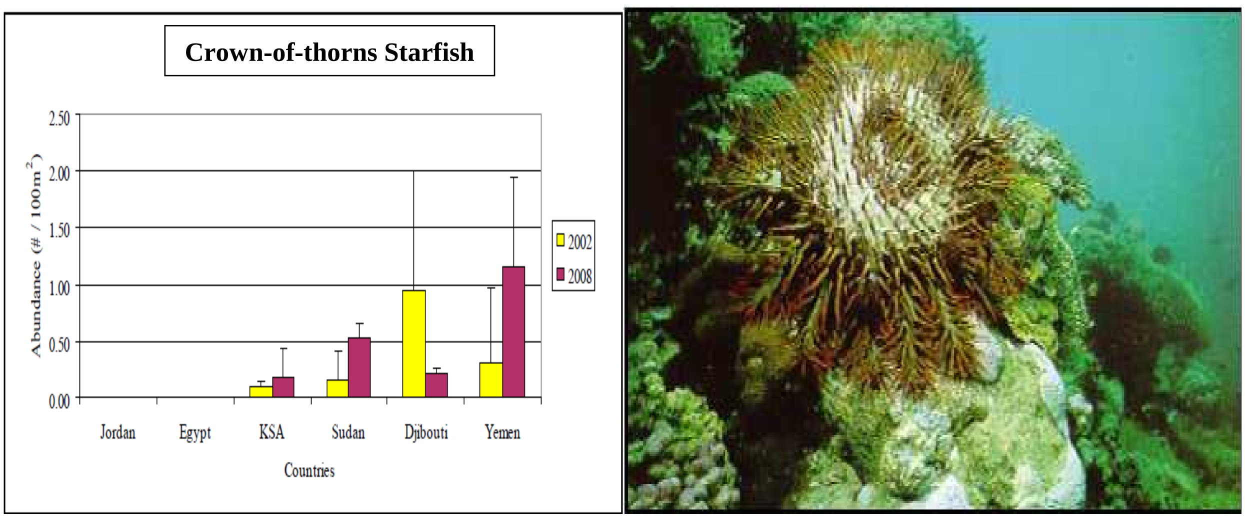


Figure 3-45 Hard Coral Cover: Indicators Greatly Affected by the Distribution of Hard Substratum on a Reef as well as by the Health of the Coral Living There

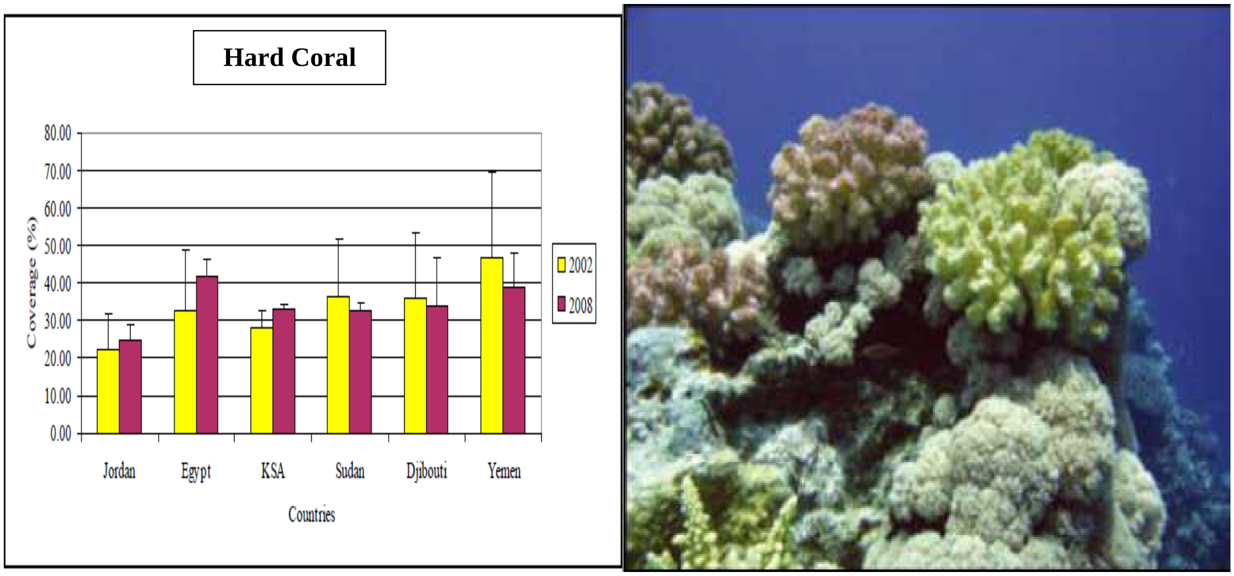
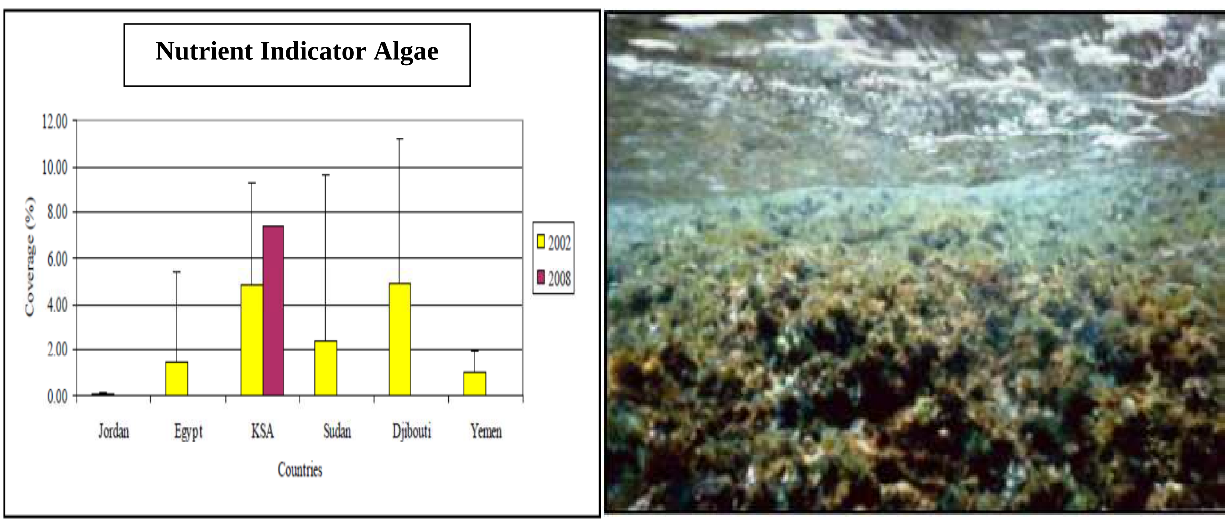
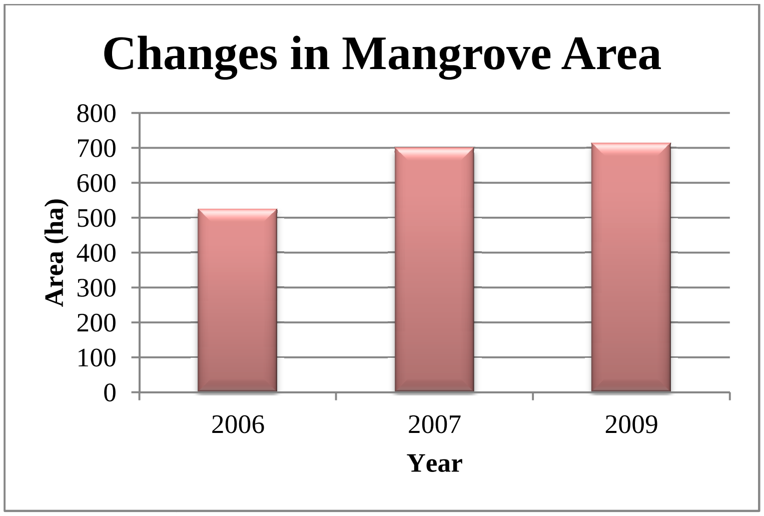


Figure 3-46 Nutrient Indicator Algae (NIA): Seaweed Algae an Indicator of High Nutrient Input from Land-based Sources such as Fertilizers and Sewage Pollution to the Sea



Other state and pressure indicators include the percentage of coastal and marine protected areas of total PAs, the number of marine species extinct or at risk of extinction as a result of environmental changes and degradation of marine and coastal environments and the status of threatened sensitive marine and coastal habitats (e.g. mangroves and coral reefs) (Figure 3-47).

Figure 3-47 Changes in Mangrove Area (ha) from 2006 to 2009



3.2 Status and Trends of Species Diversity

Few of Egypt's described taxonomic groups or species have been assessed to determine their conservation status.

3.2.1 Terrestrial Plant Species Diversity

The abundance classes of the flora of the different phyto-geographical regions of Egypt and their current status are presented in Table 3-8 (Khedr, 2006).

Table 3-8 Abundance Classes of Egyptian Flora

Region	Very rare	Rare	Common	Very Common	Endemics	Total
Nile Delta	102	167	194	167	2	630
Nile Valley	61	134	49	160	2	504
Nile Fayoum	18	49	109	131	1	307
Oases	63	125	143	163	4	494
Mediterranean West	212	329	298	206	13	1045
Mediterranean East	131	210	225	170	9	736
Eastern Desert North	72	164	147	157	10	540
Eastern Desert South	70	110	81	101	1	362
Isthmic desert	176	225	221	180	15	802
Western Desert	38	77	115	124	3	354
Red Sea Coast	63	105	54	81	2	303
Gebel Elba	199	142	48	54	3	443
Sinai	275	225	159	153	34	812

3.2.2 Freshwater Species Diversity

The distribution of threatened species in freshwater habitats in Egypt is poorly known, but regional assessments from the Mediterranean Basin indicate that freshwater species are, in general, at much greater risk of extinction than terrestrial taxa (Smith and Darwall, 2006 and Stein et al., 2000). The conservation status of 877 of North African freshwater species belonging to five taxonomic groups assessed in accordance with IUCN regional Red List guidelines showed that:

- Freshwater species are mainly concentrated in the Mediterranean Maghreb and the Nile River in Egypt;
- 247 (28.2%) North African freshwater species assessed are threatened with extinction at the regional level, with a further 9.5% as Near Threatened and 14.1% as Data Deficient;
- 18 (2%) of freshwater taxa, previously present within the region, are Extinct at the global level (one endemic fish: Salmo pallaryi and 17 molluscs), and a further 32 (4%) taxa are regionally Extinct (23 fish, 2 molluscs, 6 dragonflies and damselflies and 1 aquatic plant);
- The Nile River basin stands as the region where most North African freshwater species have gone extinct (28 species were recorded extinct or regionally extinct including 23 freshwater fish, 3 odonates, and 2 molluscs);
- Almost half of the 199 endemic species (94 taxa) are threatened with extinction; and
- The Nile River basin of Egypt, predominantly the Lower Nile, was identified as one of three areas having the highest number of freshwater species. It supports 13% of threatened species (32 species and subspecies), including 21 freshwater fish, 6 aquatic plants, 1 mollusc, and 4 odonates. A significant part of these areas are covered by the existing protected areas network.

3.2.3 Coastal and Marine Species Diversity

The Egyptian coastal and marine environment is distinguished by specific habitats and threatened species, such as marine mammals (17 species), marine turtles (4 species), sharks (more than 20 species), sea cucumber, special bivalves (clams), coral reefs, mangrove trees and many birds (white eyed gulls , sooty falcons, ospreys). This is in addition to great biodiversity (more than 5000 species), including 800 species of seaweeds and sea grasses, 209 species of coral reefs, more than 800 species of molluscs, 600 species of crustacea, 350 species of echinodermata, and many others yet to be discovered in the Exclusive Economic Zone in the Red Sea.

3.2.3.1 Status of Mediterranean Sea Local Species

The conservation status of species found in the Mediterranean Sea, between southern Europe and northern Africa is Critical/Endangered. A total of 19 species of cetaceans can be found in the Mediterranean, with eight of them consideredcommon to the Mediterranean (Fin Whale, Sperm Whale, Striped Dolphin, Risso's dolphin, Long Finned Pilot Whale, Bottlenose dolphin, Common dolphin, Cuvier's beaked whale), four considered occasional (Minke Whale, Killer Whale, False Killer Whale, Rough Toothed Dolphin) and 6 considered alien to the

Mediterranean, but have been occasionally sighted in the last 120 years (the Humpback Whale among them).

A few of the species that are endangered include the Mediterranean Monk Seal (Monachus monachus), Mediterranean Mussel (*Mytilus galloprovincialis*), Mullet (*Mugilidae*), Gilthead Sea Bream (*Sparus aurata*), Sea Bass (*Dicentrarchus labrax*) and the Greater Flamingo (*Phoenicopterus roseus*). Also found in this ecosystem are Loggerhead Sea Turtles (*Caretta caretta*), Green Sea Turtles (*Chelonia mydas*), and Leatherback Sea Turtles (*Dermochelys coriacea*).

Although the Mediterranean Basin is high in biodiversity, many of its species are threatened by a range of human activities. Among the most endangered marine vertebrate species are: the Mediterranean Monk Seal, Common Bottlenose Dolphin (*Tursiops truncates*), Short-beaked Common Dolphin (Delphinus delphis), and Striped Dolphin (*Stenella coeruleoalba*), Sperm Whale (*Physeter macrocephalus*), Green Turtle, Leatherback Turtle and Loggerhead Turtle and cartilaginous fishes (sharks, rays, and chimaeras) (UNEP/MAP/MED POL 2005). Sea turtles are vulnerable to human activities throughout their life cycle.

Loggerhead and Green Turtles have been listed as Endangered by the IUCN while the Leatherback Turtle is listed as Critically Endangered (UNEP/MAP 2012). While the Loggerhead remains relatively abundant, it seems to have almost deserted the Western Basin. The Leatherback and Green Turtle are becoming increasingly rare. Nesting sites for the herbivorous and migratory Green Turtle are in Cyprus, Turkey, Syria, Egypt, Lebanon and Israel. There are a total of only 2,000 nesting females at these sites, and this number is declining. Important nesting sites for the Loggerhead Turtle are on the coasts of Greece and Turkey, on a number of Mediterranean islands, and in Tunisia, Libya and Egypt along the North African coast. The Leatherback Turtle is rarer in the Mediterranean and has no permanent nesting sites, although there are some breeding records for Israel and Sicily.

Of all five sea turtle species found in the world's oceans, three frequent the Egyptian Mediterranean shores for foraging and wintering grounds. The most commonly-found turtle on this coast is the Loggerhead, followed by the Green and the Leatherback, the latter being just an occasional visitor. They nest in low numbers during the summer on the outer sandy Mediterranean shores of Lake Bardawil.

The Loggerhead has rarely been sighted in Lake Bardawil in North Sinai, a semi-enclosed water body listed among the RAMSAR Wetlands of International Importance.

However, recent changes in the biodiversity of the saline lake have led to growth in their numbers. Newer fishing practices, like bottom trawling, have reduced the sea bass population of Lake Bardawil, because fine mesh nets trap both adult and juvenile fish. This is despite the fact that by law, fishermen are forbidden to use nets with meshes smaller than 40 mm. In Bardawil, they fish with 8 mm nets. The declining sea bass population, combined with increased water salinity has attracted shrimps and crabs – the sea turtle's favorite food. Additionally, the Lake has become an attractive wintering ground for sea turtles. In order to gather fish and crustaceans in certain areas of the lake, some fishermen dump tires and other large objects into the water to create a sort of shelter for them and thus increase the populations of shrimp and crab. However, the turtles are found to frequent these shelters to feed on shrimp and crab, becoming a nuisance to fishermen.

In October 2012, over 90 sea turtles were found dead (Figure 3-48) and in various stages of decomposition on the shores of Lake Bardawil, suggesting that their deaths may have been occurring for several months (Sarant, 2012; Yahia, 2012). Lake Bardawil is one of the less polluted bodies of water in the country, so pollution seems improbable as a major source of mortality. In addition, the dead turtles were counted in a single small area and not found dead randomly across the lake. Of the 96 dead turtles found, only 74 could be clearly identified through photographic evidence. The vast majority found were Loggerheads. However, a few Green Sea Turtlesand one Leatherback were also identified. Four turtles had been decapitated and one died from a head trauma caused by a blunt object. The conclusion reached was that turtles interfered with the catch of fishermen, driving fishermen to eliminate their competition.

Figure 3-48 Turtle Mortality

The lack of a coordinated and integrated approach between environmental policies and fisheries policies to protect marine biodiversity further exacerbates the problem. The conflict witnessed in Lake Bardawil is an indication that the lake should be designated a marine protected area, with an integrated management approach to accommodate fishing activities, in order to ensure sea turtles' survival in the long term. Further research and field surveys should be conducted to fully document the of the wetland as a feeding, wintering and development habitat for sea turtles in the Mediterranean, their interaction with the lake's fisheries, as well as monitor mortality rates and causes.

3.2.3.2 Status of Red Sea Coral Reef Species

The greatest known species diversity of any marine ecosystem is found in coral reefs; their vertical growth and complexity provides numerous niches for different species to fill. Red Sea coral reefs are particularly well developed in the north and central portions (off the coasts of Egypt, Saudi Arabia, Sudan), with large sizable offshore reef complexes containing many islands, fringing reefs and other coral reef habitats. Further south, coral growth is somewhat inhibited by the influx of nutrient laden water where the Indian Ocean enters the Red Sea. In general, the marine biota of Red Sea coral reefs is characterized by high endemism. For example, of the 1,200 or so coral reef fish species recorded, about 10% are endemic. About 300 hard coral species have been recorded from the Red Sea as a whole. The Egyptian coast alone supports about 200 species of reef building corals belonging to almost 50 genera. This represents about four times the hard coral diversity found on Caribbean reefs, and is comparable to the coral diversity found in the Maldives and Seychelles in the Indian Ocean.

3.2.3.3 Status of Red Sea Mangrove Species

Biotic communities so far recorded in Red Sea mangrove ecosystems includes more than 22 fish species, 36 species of algae, 40 insect species, 82 Crustacea species, 65 Mollusca species and 17 Echinodermata species. However, the diversity of macroinvertebrate fauna (crustacea, molluscs and echinoderms species) reported in 2006 (27 genera) were lower than those recorded in 2002 (33 genera) while the coral cover in the fringing reefs adjacent to the mangrove did not change.

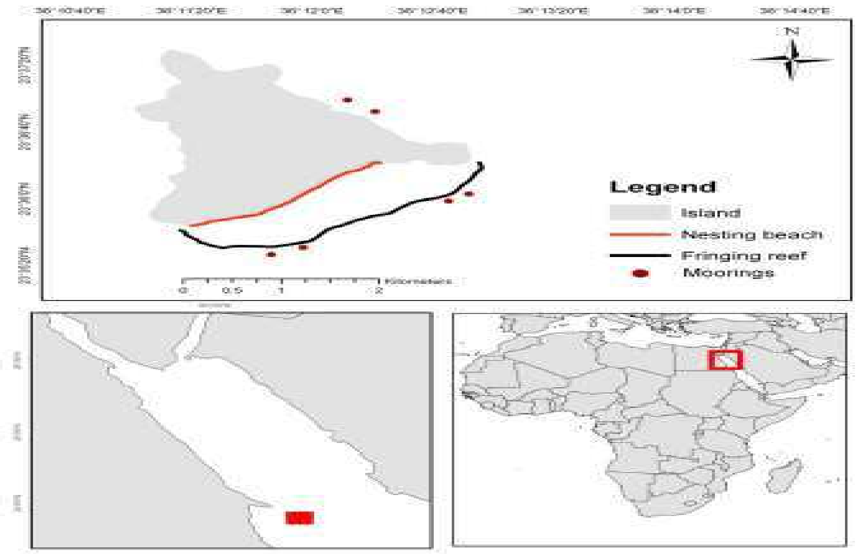
3.2.3.4 Status of Red Sea Green Turtles

Marine turtle monitoring in the Red Sea and Mediterranean is considered to be one of the most successful monitoring programs in large part due to the existence of specialists in this field for more than 10 years. The Red Sea is known to host nesting sites for the endangered Green Turtle, the most important ones being located in Saudia Arabia, Djibuti, Sudan and Egypt. Nesting activities along the Egyptian coast was described as low-density and scattered (Frazier et al. 1987) with three major concentrations: Tiran Island (Northern Red Sea), Wadi Gemal National Park (Southern Red Sea, in-shore) and Zabargad Island (Southern Red Sea, off-shore).

Figure 3-49 Red Sea Turtles

Available data on marine turtles nesting in the Egyptian Red Sea are scattered, and usually have been collected with different methods and by different teams over time. Zabargad Island is considered the most important nesting site for Green Turtles in the region. This is attributed to the absence of human activities in or in vicinity of Zabargad Island (SOE, 2007). The island is a part of the Gebel Elba Protected Area. It is located in the southern Egyptian Red Sea, approximately 37 nautical miles from the coastline (Figure 3-50). The island is mostly rocky but on the southern side there is a sandy beach of approximately 2.5 km long that is used by Green Turtles as a nesting site and another sandy beach on the eastern side of approximately 1.5 km. Estimates obtained from irregular surveys from 2001 to 2008 suggested that as many as 610 turtles could nest on the 3.5 km long beach on the island.

Figure 3-50 Zabargad Island



Four species of marine turtles have been recorded (Green, Loggerhead, Hawksbill and Leatherback) in 15 sites on the beach and islands (El-Sadek *et al*., 2013). They have been monitored with high percentage of nesting in Zabargad island (5,336 nests were found in 2007 in comparison with 438 in 2001). Such high nesting is probably over estimated as no effort was undertaken to differentiate true nests from false crawls and to estimate nesting success. Nesting success (NS) was calculated as the number of true nests divided by the total number of observed tracks. Recently, the total number of true nests on the island was estimated at 2,262.51±531.27 in 2009; 1,073.90±268.80 in 2010; and 1887.29±388.97 in 2012 (Figure 3-51) while the total number of true nests was 227 in 2009, 130 in 2010 and 510 in 2012 (Figure 3-52). The Nesting success was 10%, 12%, and 27% in 2009, 2010, and 2012 respectively (Figure 3-53).

Figure 3-51 Annual Total Number of Green Turtle Tracks on Zabargad Island

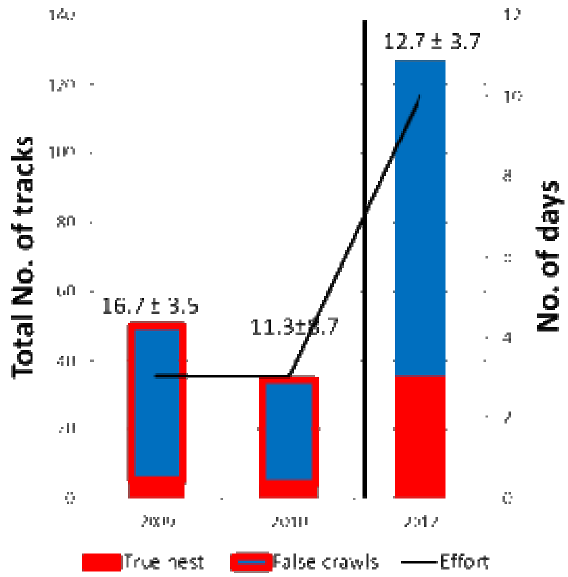


Figure 3-52 Annual Number of Green Turtle True Nests on Zabargad Island

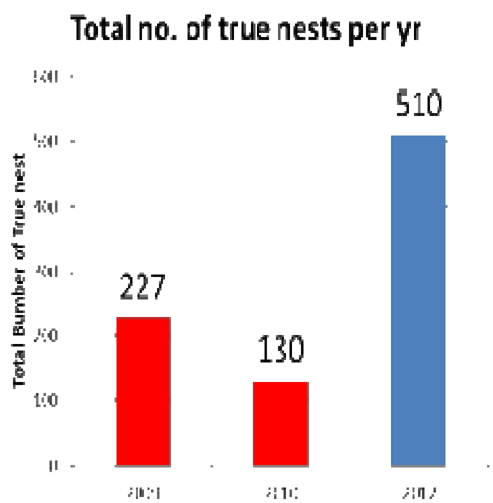
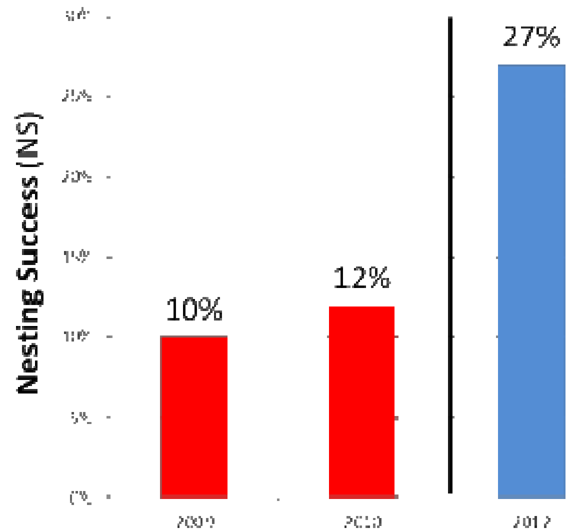


Figure 3-53 Annual Nesting Success of Female Green Turtles on Zabargad Island



The population of Green Turtles in the Red Sea is estimated to be around 450 nesting females per year (excluding Eritrea for which data are not available, PERSGA/GEF, 2004; El-Sadek et al., 2013). The annual estimates of Green Turtle nesting females on Zabargad Island are presented in Figures 3-54 and 3-55.

Figure 3-54 Annual Estimates of Green Turtle Nesting Females on Zabargad Island

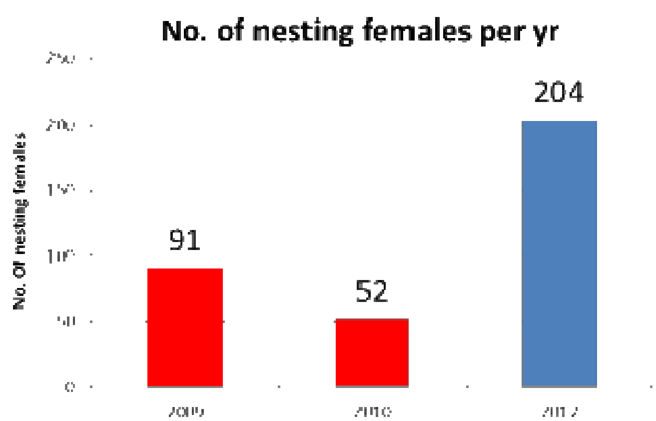
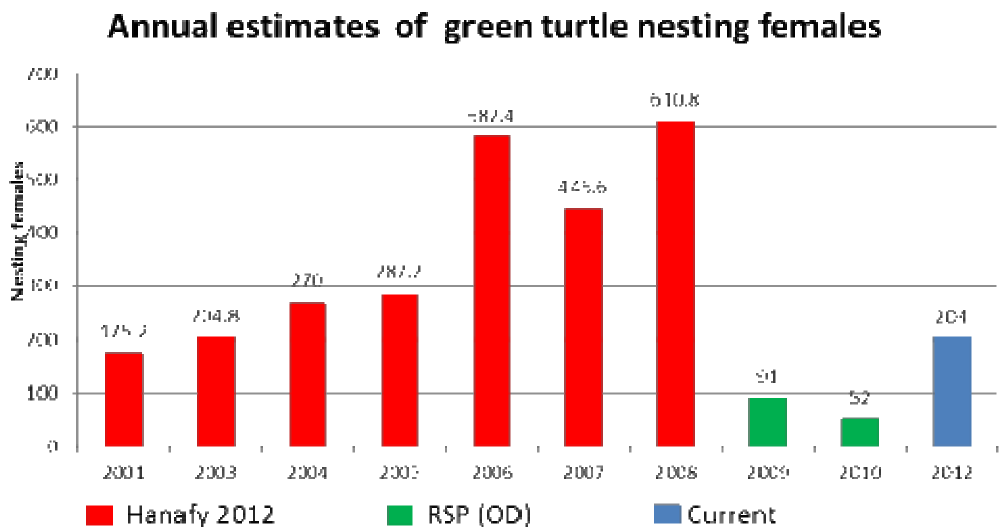


Figure 3-55 Annual Estimates of Green Turtle Females on Zabargad Island



The variation in the numbers generated from year to year may be a result of the various factors, such the amount of effort put into data collection, the timing of data collection and the availability of food in feeding grounds. In 2009 and 2010, floods may have affected some of the major known feeding grounds along the Egyptian Red Sea coast.

The nesting success on Zabargad Island compared to other countries or regions (Table 3-9) is lower than that reported for Oman and Mayotte populations, but similar to that found in Syria (Mediterranean population) and the Ascension Island (Atlantic Ocean population).

Table 3-9 Nesting Success (NS%) for Different Green Turtle Populations

Oman (AlGheiliani, 1996)	**Mayotte (Yemen)** (Bourjea *et al.* 2007)	**Syria** (Rees *et al.* 2008)	**Ascension Island** (Goldley *et al.* 2001)	**Zabargad Island**
66%	77%	33%	33%	27%

The low nesting success in Syria and Ascension Island may be related to the high density of crabs and nesting birds on the beach. However, further studies are necessary to prove this hypothesis. Although Zabargad Island might be of secondary nesting importance compared with nesting sites in Oman and Yemen, its Green Turtle population could be genetically unique as it is isolated from the other rookeries, and thus requires total protection. Genetic studies are currently under way to verify this hypothesis (El-Sadek *et al*., 2013).

Post-nesting Migration Routes of Red Sea Green Turtles

The Red Sea has been suggested to be an important nesting site for sea turtles despite the sea's small size and relative isolation from other marine waters (Frazier and Salas 1984). Five species of sea turtles have been recorded in the Red Sea, with only the Hawksbill (*Eretmochelys imbricate*) and the Green Turtle (*Chelonia mydas*) being regularly observed and known to nest (Frazier and Salas, 1984; Frazier *et al*., 1987; Hanafy, 2012).

Green turtles are a globally endangered species that have many natural history traits that make the species vulnerable to anthropogenic disturbance (Godley *et al*., 2008; IUCN, 2011). These include delayed sexual maturity, ontogenetic habitat use, and undertaking of long migrations that utilize spatially distant and different habitats (Musick and Limpus, 1997, Godley *et al*., 2008; Seminoff *et al*., 2008). In addition, the habitats of sandy beaches that are used as nesting grounds and sea grass beds that are utilized as feeding areas are commonly degraded, and the availability of these habitats is decreasing as a result of anthropogenic disturbances (Short *et al*., 2011).

Very little is known about the green turtle population or their ecology in the Red Sea, with the exception of the distribution of nesting sites (Frazier and Salas 1984; Frazier *et al*., 1987; Miller, 1989; Hanafy, 2012). The identification of post-nesting migration routes provides valuable information about the life history of sea turtles such as location of nesting sites, feeding grounds, migration routes between different habitats, how movement relates to political boundaries, and potential threats to turtles (Hays *et al*. 2002; Hamman *et al*. 2010; Maxwell 2011; Amorocho *et al*., 2012). Understanding the many factors that contribute to the use of dynamic seascapes is needed to make informed management decisions to assist in the conservation of sea turtles (Godley *et al*., 2008).

The post-nesting migration patterns of green turtles in the Red Sea were recently studied by Attum *et al*. (2014). They reported that the sea turtles moved along the coast as expected (Godley et al. 2008), and four geographically distinct migration paths and post nesting habitat were identified. The shortest migration was 140 km and the longest 940 km, with turtles migrating west, east, north, and south of the nesting sites (Table 3-10) and Figures 3-56 – Figure 3-59). The migrations and post nesting habitats encompassed the boundaries of four - Egypt, Sudan, Eritrea, and Saudi Arabia - of the seven Red Sea nations. The post nesting habitats encompassed shallow coastal habitat and were often near shore archipelagos. One turtle even appeared to use more than one feeding ground as part of her migration towards Saudi Arabia (Figure 3-58). Some sea turtles are known to not take the most direct route to their destination, but instead utilize long resting stops or multiple feeding grounds as part of their migration (Whiting et al., 2007).

Table 3-10 Migration Distances and Home Range Areas of Post-nesting Green Turtles in the Red Sea

Turtle	Minimum Migration Distance (km)	Kernel Area (km^2)		Minimum Convex Polygon Area (km^2)
		50%	95%	
Fahd	140	28.88	249.99	793.93
Nada 1	150	22.16	172.30	410.72
Nada 2	610	-	-	-
Sallam	940	113.98	1095.08	1381.69
Rasheeda	550	21.04	212.68	1560.61
Mean±SE	**404±173**	**46.52±22.6**	**432.5±212**	**1036.7±265**

Figure 3-56 Fahd's Home Range as Outlined by Minimum Convex Polygon (MCP), 95% Kernel Density, and 50% Kernel Density Estimates

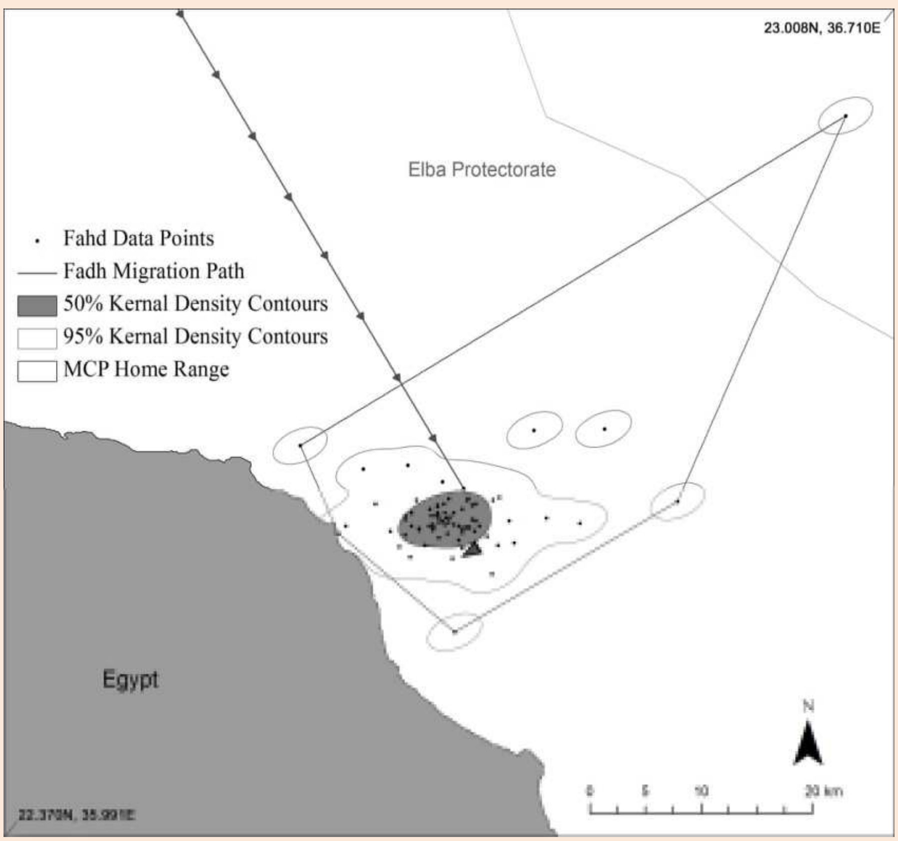


Figure 3-35 Nada's Home Range as Outlined by Minimum Convex Polygon (MCP), 95% Kernel Density, and 50% Kernel Density Estimates

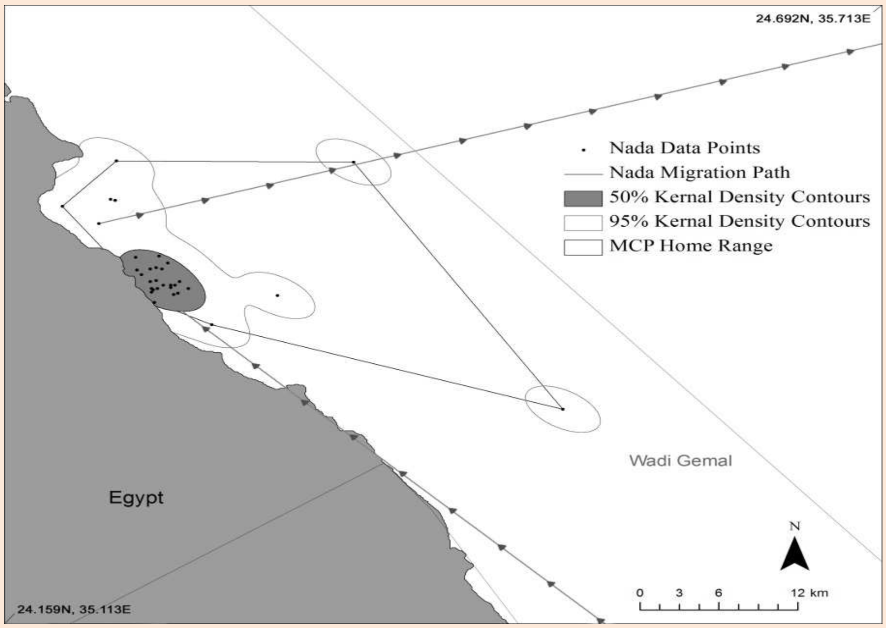


Figure 3-36 Sallam's First Home Range as Outlined by Minimum Convex Polygon (MCP), 95% Kernel Density, and 50% Kernel Density Estimates

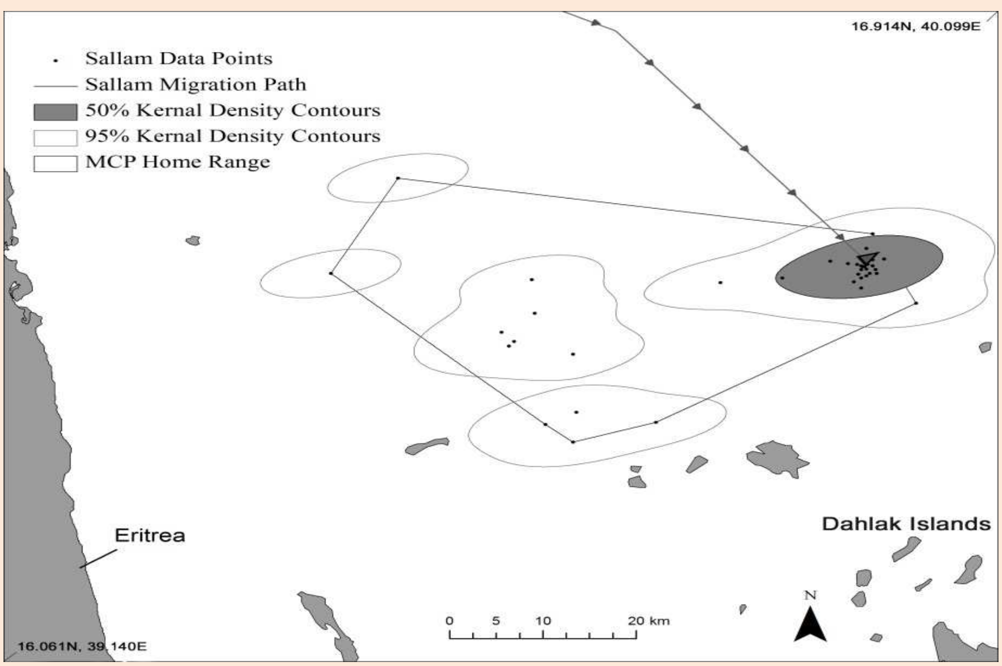
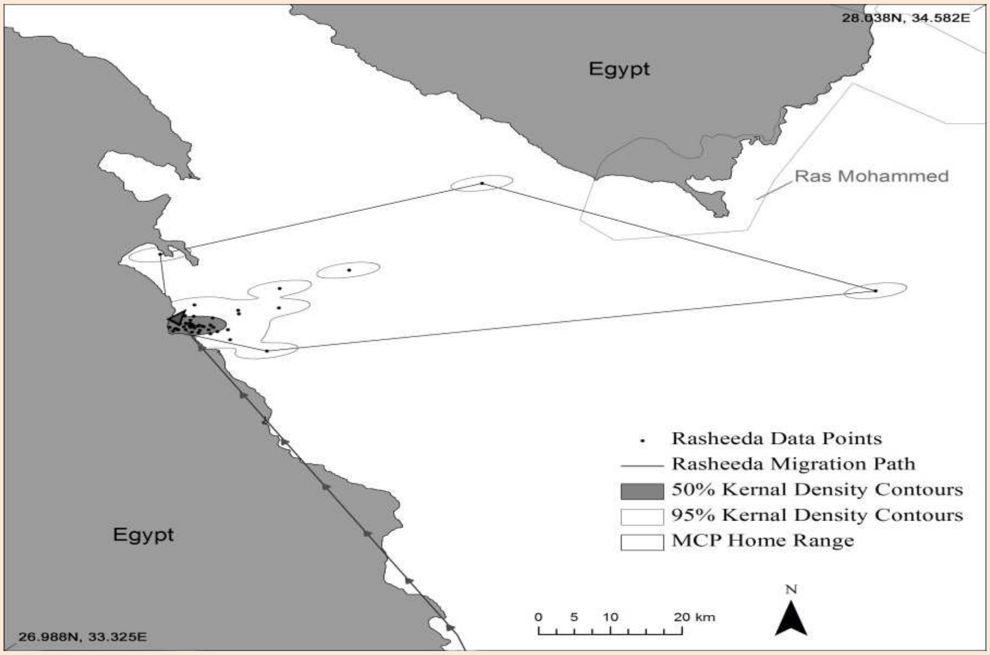


Figure 3-59 Rasheeda's First Home Range as Outlined by Minimum Convex Polygon (MCP), 95% Kernel Density, and 50% Kernel Density Estimates



The turtles moved past areas of suitable post nesting habitat that was occupied by other turtles, which suggests that these turtles may be exhibiting fidelity to certain feeding and nesting sites (Hays et al., 2002). For example, turtle Sallam (Figure 3-59) moved over 900 km south to the Dahlak archipelago passing numerous potential post nesting habitat utilized by other turtles in this study. In addition, this individual could have also travelled less than 100 km south to nest on any of the numerous beaches of Dahlak archipelago, a known nesting spot for green turtles in the Red Sea (Frazier *et al*., 1987). The variation and flexibility in foraging and nesting site selection could be the result of unknown disturbances to closer nesting or feeding sites or may simply be an evolutionary strategy to maintaining sea turtle populations over geologic time scales (Seminoff *et al*., 2008). This variation would be advantageous by allowing some sea turtles to escape catastrophic oceanographic events that affect nesting frequency and availability (Seminoff *et al*., 2008).

The results obtained corroborate past studies that suggest Zabaragad Island is an important nesting site for green turtles in Egypt and other nations of the Red Sea (Frazier and Salas, 1984; Hanafy, 2012). Islands typically represent important nesting habitat for sea turtles and other wildlife because offshore beaches are believed to have fewer natural predators and experience less anthropogenic disturbance than mainland nesting sites as a result of their isolation. The Red Sea islands in the territorial waters of Egypt are also afforded some protection as a result of their remoteness, falling within the boundaries of marine protected areas, and subjected to military control that limits visitor access (Hanafy, 2012).

From the study, it is concluded that:

i) Effective long-term management of green turtles will not be simple as there are numerous threats to the biodiversity of the Red Sea. Maintaining the connection between feeding grounds and nesting sites of the geographically distinct mainland beaches, near shore islands, archipelagos, and isolated islands should remain a priority to increase survival during different life history periods;

ii) Sea turtle protection within Egypt's marine protected areas is challenging as a result of a lack of institutional funding and staff and numerous challenges such as pollution, overuse of areas as recreational sites, illegal fishing, and unknown levels of sea turtle bycatch from local community fishermen (Frazier and Salas, 1984; Samy et al., 2011; Rouphael et al., 2013);

iii) The multinational spatial scale could potentially increase the difficulty in effectively conserving sea turtles in the Red Sea. The females that nested on Zabaragad Island utilized migration routes and post nesting habitats that include coastal areas and archipelagos of four Red Sea nations, all of which are known to have different levels of negative impacts on sea turtle populations (Frazier et al., 1987; Miller, 1989); and

iv) Regional and multi-national cooperation will be needed to protect sea turtles that nest on Zabaragad Island, a nesting site that is important for Egypt and other Red Sea nations.

3.2.4 Indicators of Threatened Taxonomic Groups and Species

A) IUCN Red List 2013

At the global level, a total of 71,576 species have been assessed by the IUCN in 2013. Of these, 21,286 species are threatened with extinction. The IUCN assigns a species to one of eight categories of threat based on whether or not they meet criteria linked to population trends, population size, structure and geographic range. Species listed as critically endangered, endangered or vulnerable are collectively described by the IUCN as threatened.

Table 3-11 shows the number of threatened species in Egypt according to the IUCN Red List 2013. The figures for these groups should be interpreted as the number of species known to be threatened within those species that have been assessed to date, and not as the overall total number of threatened species for each group.

Table 3-11 Threatened Species in Egypt by Taxonomic Group

Taxonomic group	Number of Threatened species
Mammals	18
Birds	10
Reptiles	12
Amphibians	0
Fishes	40
Molluscs	0
Other Invertebrates	53
Plants	2
Total	**135**

Source: BirdLife International (2014) Country profile: Egypt

Tables 3-12 and 3-13 show the total number of bird species recorded in Egypt and the number of threatened bird species, respectively, according to the IUCN Red List 2013. The numbers in brackets refer to the country's rank when compared to other countries and territories globally.

Table 3-12 Bird Species Recorded in Egypt

TOTAL	379 (97th)	Breeding Endemic	0
Landbirds	241	Seabirds	39
Migratory	299	Waterbirds	129

Source: BirdLife International (2014) Country profile: Egypt

Table 3-13 IUCN 2013 Red List of Bird Species

Extinct (EX)	0
Extinct in the Wild (EW)	0
Globally Threatened (VU, EN,CR)	10 (134th)
% threatened	3% (166th)

Critically Endangered (CR)	0
Endangered (EN)	2
Vulnerable (VU)	8
Near Threatened (NT)	16
Least Concern (LC)	353
Data Deficient (DD)	0

Source: BirdLife International (2014) Country profile: Egypt

B) National Red List

The national preliminary Red Data List of threatened species of various taxonomic groups in 2010 is shown in Table 3-14 (Fouda, 2013).

Table 3-14 Number and Percentage of Threatened Species of Various Taxonomic Groups in 2010

Taxonomic group	Known Species Number	Threatened Number and %
Mammals	111	72 (65.5%)
Birds	475	43 (9.6%)
Reptiles	112	47 (24.0%)
Amphibians	9	2 (22.2%)
Fish	1200	52 (04.3%)
Invertebrates	12000	205 (01.7%)
Vascular plants	2145	457 (20.0%)

At the national level, several attempts have been made to provide a conservation assessment for different taxonomic groups in Egypt and in its protected areas. By the end of 2013, the conservation status of only the following taxonomic groups is available: mammals (111 species), insects (mainly butterflies: 63 species and Odonata: 40 species), four plant families (Apocyanaceae: 22 species, Euphorbiaceae: 51 species, Primulaceaa: 9 species and Amaranthaceae: 25 species) and birds (43 species), which indicate a continuing increase in the risk of extinction. Figures 3-60 to 3-67 highlight the status and trends of the assessed taxonomic groups.

Figure 3-60 Red List of Mammals (111 species)

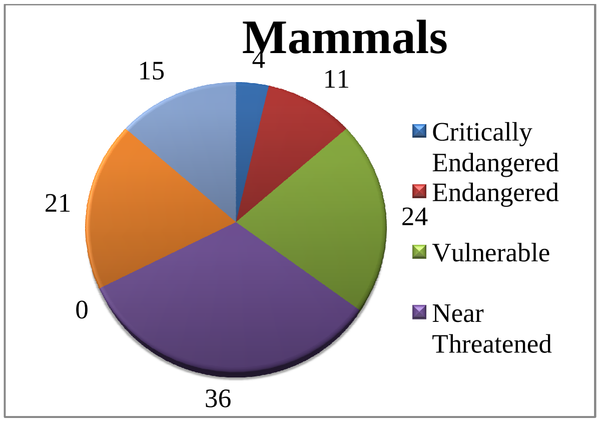


Figure 3-61 Red List of Butterflies (63 species)

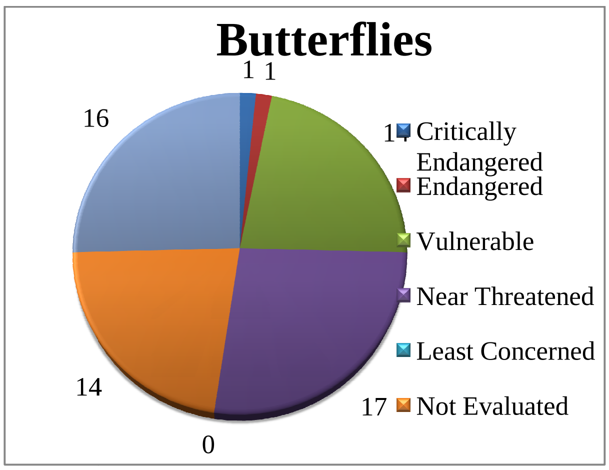


Figure 3-62 Red List of Odanata (40 species)

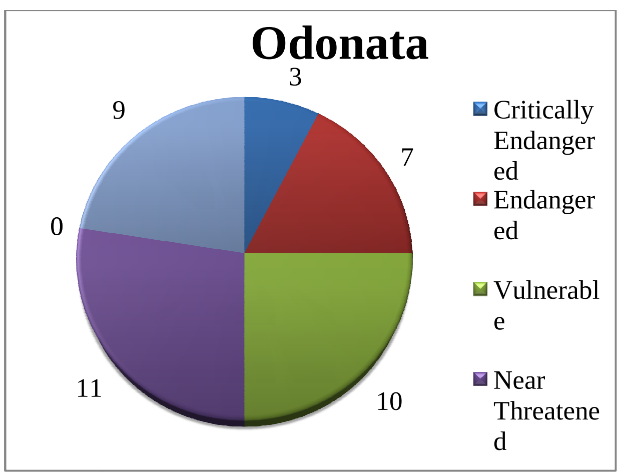


Figure 3-63 Red List of Birds (43 species)

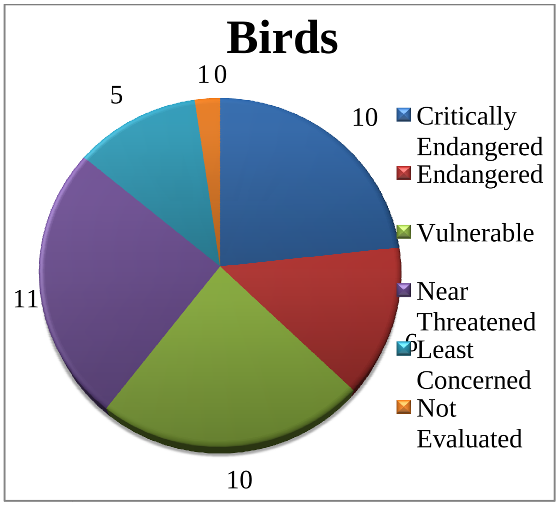


Figure 3-64 Red List of Apocynaceae Plant Family (22 species)

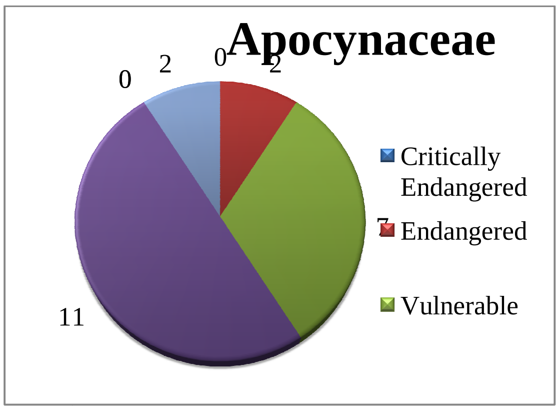


Figure 3-65 Red List of Euphorbiaceae Plant Family (51 species)

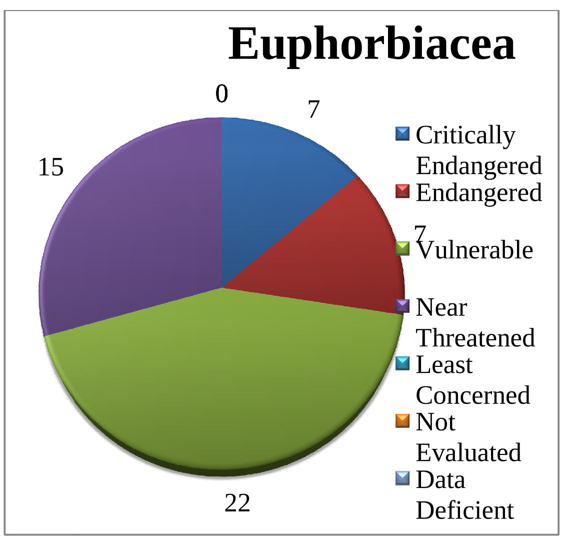


Figure 3-66 Red List of Primulceaa Plant Family (9 species)

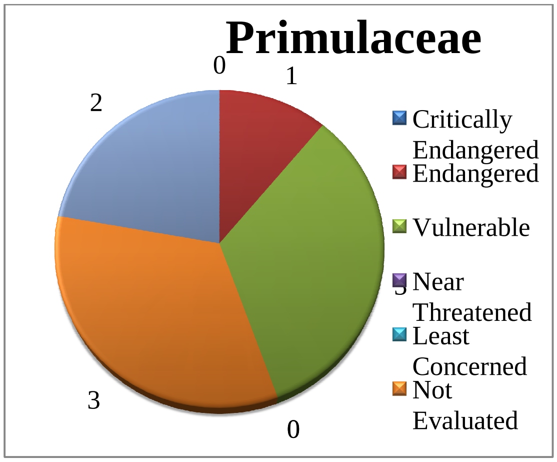
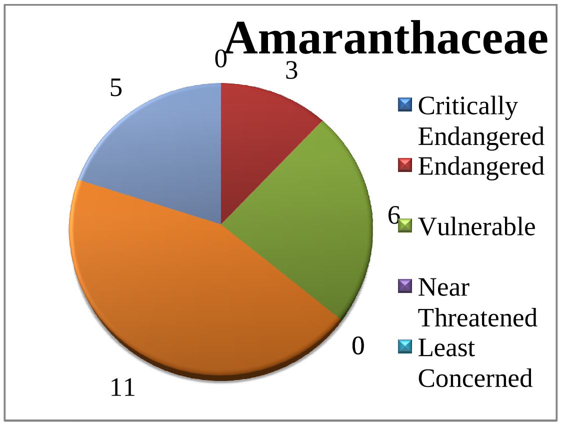


Figure 3-67 Red List of Amaranthaceae Plant Family (25 species)



As of 2010, 364 species of the over 22,000 species described in Egypt had been assessed (Table 3-15). This indicator shows the status ranking by taxonomic group. Of these 364 species, 41 % (152 species) are considered threatened with extinction, although this varies among taxonomic groups. Among selected mammals, insects and plant groups, between 70% and 25% of species are currently threatened with extinction, with the *Euphorbiacea* plant family facing the greatest risk.

Of the mammals, butterflies, insect odonata, birds, *Apocynaceae*, *Euphorbiacea*, *Primulaceaa* and *Amaranthaceae* plant species assessed, 31%, 25%, 50%, 60%, 40%, 70%, 44% and 36%, respectively, are threatened. Global environmental reports predict that about one quarter of the world's mammals will be endangered during the next 30 years. In Egypt, there are many species of desert mammals that had already gone extinct during first half of the 20 century.

Of the 111 mammal species recorded in Egypt (ca. 27 endemic) in 2010, 40 are included in the IUCN Red list, which represents about one third mammals found in Egypt. Global environment reports expected that about one quarter of world mammals will be endangered during next 30 years. In Egypt many species of desert mammals are already extinct during first half of the 20 century.

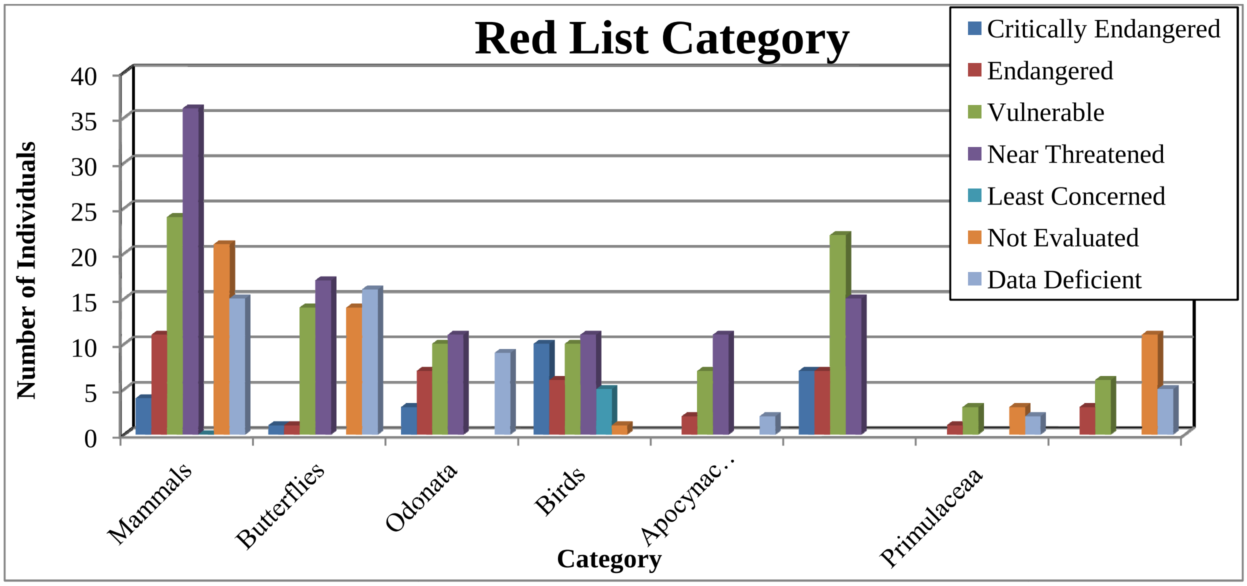
Table 3-15 Conservation Status of Assessed Animal and Plant Taxonomic Groups

Red list Category	Mammals	Butterflies	*Odonata*	Birds	*Apocynaceae*	*Euphorbiacea*	*Primulaceaa*	*Amaranthaceae*
CR	4	1	3	10		7		
EN	11	1	7	6	2	7	1	3
VU	24	14	10	10	7	22	3	6
NT	36	17	11	11	11	15		
LC				5				
NE	21	14		1			3	11
DD	15	16	9		2		2	5
Total	111 species	63species	40 species	43 species	22 species	51 species	9 species	25 species

CR: Critically Endangered EN: Endangered VU: Vulnerable NT: Near Threatened
LC: Least Concerned NE: Not Evaluated DD: Data Deficient

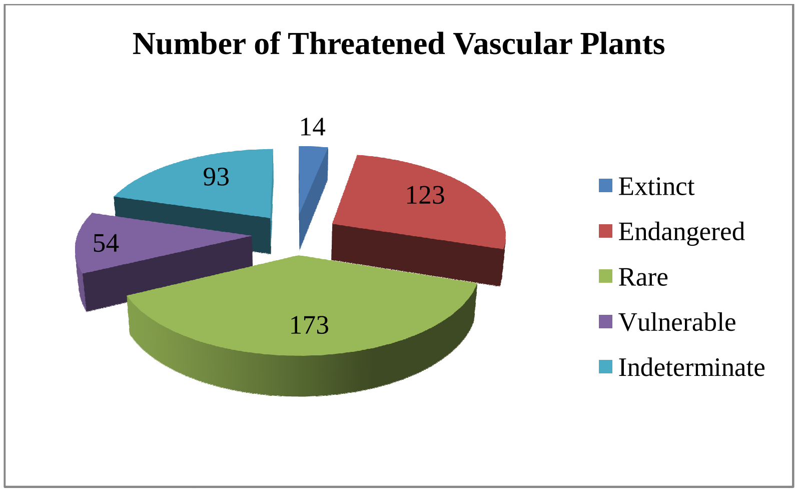
Figure 3-68 highlights the status and trends of selected animal and plant taxonomic groups. Those species that are classified as Critically Endangered, Endangered or Vulnerable are considered to be threatened.

Figure 3-37 Red List Categories of Assessed Animal and Plant Taxonomic Groups



The preliminary Red Data List of the vascular plants in Egypt includes 457 species (ca 20 % of the total flora) (El-Hadidi and Hosni, 2000). Following the Red List categories of IUCN (1994), these species are classified as 14 extinct, 123 endangered, 54 vulnerable, 173 rare and 93 indeterminate species (Figure 3-69). List of nationally threatened plant species and their distribution (Shaltout and Eid, 2010) is contained in Annex 1.

Figure 3-69 Threatened Vascular Plant Species in Egypt



However, the impact of conservation interventions on the risk of extinction for these species cannot be assed due to the lack of monitoring programs over a certain period of time.

Currently, efforts are carried on to identify the rest of the groups such as reptiles, as well as the remainder of plant species, insect species and other groups.

3.3 Status and Trends of Genetic Diversity

Egyptian ecosystems are rich in wild plants and landraces which survived for hundreds of years. These landraces and wild relatives are widely adapted to biotic and abiotic stresses, as well as harsh conditions prevailing in the areas in which they grow.

Genetic diversity is being lost in natural ecosystems and in systems of crop and livestock production due partly to the intensification of production, and also partly to the abandonment rural areas for larger cities and urban areas. The continued loss of genetic diversity of such crops and livestock may have major implications on food security. Currently, Egypt depends on four crops (wheat, corn, rice and potato) for 50% of its vegetarian food and 14 mammal and bird species for 90% of animal proteins.

3.3.1 Plant Genetic Resources for Food and Agriculture

The rate of loss of genetic diversity is poorly known, but a good example of the loss of genetic diversity in Egypt is that of cotton, having lost its varieties greatly onwards from the 1950s.

The Egyptian agriculture sector is facing many challenges, a major challenge being the limited cultivated areas and water supply required to provide food for the growing population which exceeded 86 million in 2013 and another being to the elimination of poverty in the agricultural population by increasing the national agricultural production.

Under the prevailing pressures including desertification, deforestation, erosion, climate change and the overuse of pesticides and other agrochemicals, many genetic resources are disappearing at an unprecedented rate. Furthermore, in the past 50 years new uniform crop varieties and hybrids have replaced many hundreds, if not thousands, of local varieties and landraces over large areas of production. These new varieties are selected from the same gene pool resulting in the increase of vulnerability to pests, diseases and the prevailing abiotic stressors.

Despite of the fact that Egyptian agriculture is a very intensive system and uses more than 450 thousand tons of true seeds from different field crops and more than 5,000 tons of vegetable seeds, excluding the seeds of vegetative propagated crops. There are some Egyptian farmers who still use the seeds of old local varieties in many rural areas in Egypt which are considered a very rich biodiversity source.

In Egypt today, important progress is being made to conserve plant genetic diversity, especially using ex situ banks. A number of programs have been set up to collect different genetic varieties for cataloguing and storage for possible future use. Plant genetic resources of field and horticulture crops stored in the National Gene Bank (NGB) conservation facility situated in the Agricultural Research Center in Cairo was estimated to hold more than 35,000 genetic origins in 2006, 500 of which are vegetables collected from breeding programs and international gene banks. However, the NGB capacity is estimated at 200,000 genetic origin samples. Classes and species of these genetic resources are shown in Table 3-16.

Table 3-16 Plant Genetic Resources Existing in the National Gene Bank

Crop	Number of Classes (Genera)		Number of Species	
	2006	**2007**	**2006**	**2007**
Field crops	48	58	111	115
Vegetable crops	45	51	56	76
Fruits	0	20	0	25
Medicinal and aromatic plants	133	183	173	252
Wild plants	141	165	227	232
Trees and shrubs	45	45	63	63
Total	**412**	**522**	**630**	**763**

Almost all plant collections in Egypt are kept in the herbaria of universities, research centers and botanical gardens (e.g. Aswan, Orman, Kobba Palace and Zohareya in Cairo; Montazah Palace and Antoniadis in Alexandria). Nine of these herbaria have been registered in the Index Herbarium of the New York Botanical Garden.

3.3.2 Animal Genetic Resources for Food and Agriculture

Major efforts are still needed to conserve genetic diversity of animal genetic resources.

4 Protected Areas Network

Egypt has declared a relatively good proportion of its land as PAs, and the ecological and social benefits offered by Egypt's PA system are high. Protected areas have been Egypt's most important and effective tool to conserve its biodiversity, preventing the potential loss of species and habitats, as well as fulfilling its international commitments. They have expanded over the past 30 years in both number and area (Figure 4-1 and Figure 4-2). By 2013, 30 protected areas were established, covering over 146,000 km^2 or about 14.6 % of the total surface area. They vary in size, from the largest, El Gelf El Kebeer PA, at about 48,500 km^2 to Saluga and Gazal, at about 0.5 km^2.

The nationally designated protected areas system contains a good representation of Egyptian habitats with high biological significance. It also represents other sites of importance, such as biodiversity hotspots, cultural heritage sites, geological formations, landscapes of outstanding natural beauty and Important Bird Areas (IBAs). The system appears to be equally important for most aspects of biodiversity conservation, i.e. representativeness, important species, full range of diversity, significant populations, etc.

However, the coverage did not meet the CBD 2020 Aichi target (Aichi Target 11: "at least 17% of terrestrial and inland water areas and 10% of coastal and marine areas"). Although the percentage of terrestrial and inland water areas meeting the 17% target has increased from 7.2% in 1994 to 14.7% in 2013, the percentage of marine ecoregions meeting the 10% target is only at about 1.7 %. Outside of protected areas, the proportion of sustainably managed production landscapes for agriculture, fisheries and aquaculture, amongst others, is limited.

Figure 4-1 Number of Protected Areas from 1993-2012

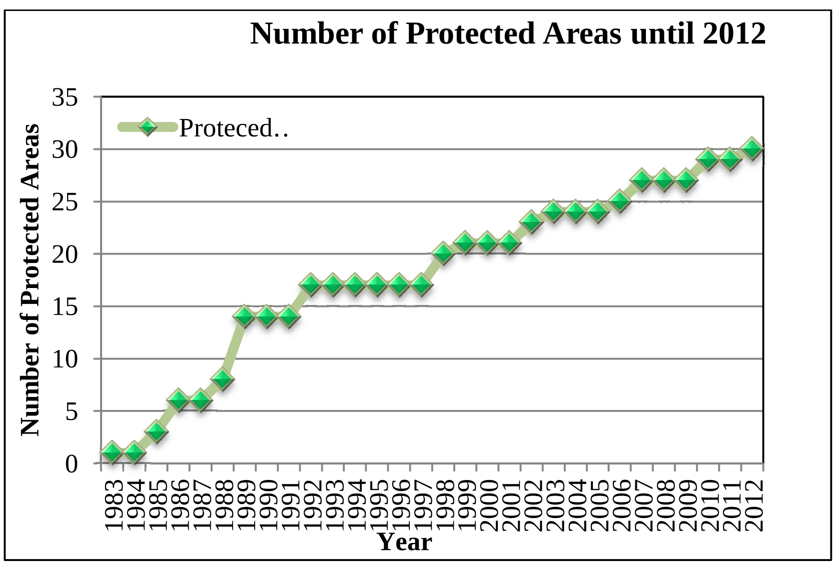
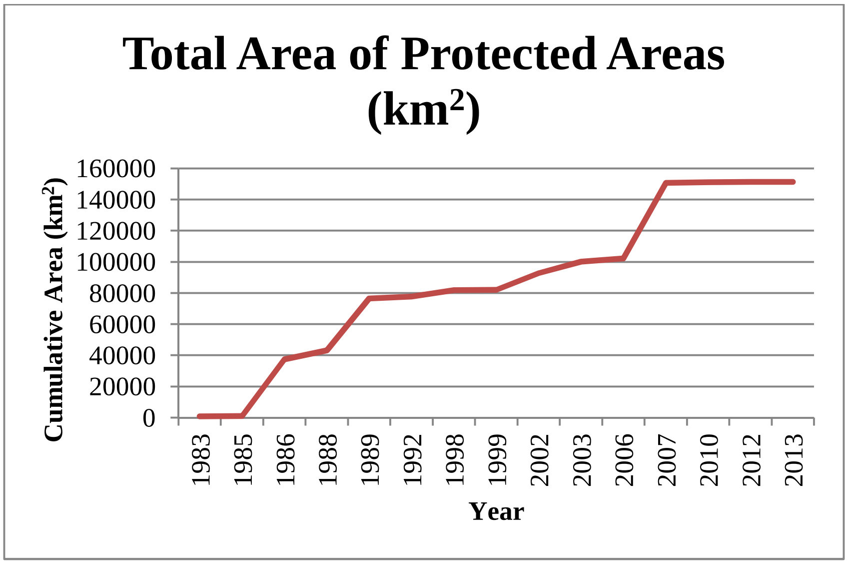


Figure 4-2 Total Area of Protected Areas in Egypt



4.1 Coastal and Marine Protected Areas

Egypt has seven coastal and Marine PAs (Figure 4-3) located in the Red Sea and Al-Aqaba Gulf zones, except El Sallum PA located in the Mediterranean Sea. These PAs cover an area of approximately 50,000 km^2 (Figure 4-4). They include interconnected marine and terrestrial sectors based on conserving coral reefs and accompanying systems, marine biomes, mangrove bushes, marine islands and adjacent mountain and desert areas. Protected areas in the Aqaba Gulf in the South Sinai Governorate include Ras Mohamed, Nabq, and Abu Galum protectorates. In the Red Sea Governorate, there are the Elba, Red Sea Islands and Wadi el Gemal/Hamata protectorates. The Sallum protectorate is located in the Matrouh Governorate. Although a good percent of Egypt's coastline currently falls within marine protected areas; waters further offshore are generally poorly protected. Marine biozones on the east coast are least protected and most threatened.

Figure 4-3 Marine and Coastal Protected Areas in Egypt

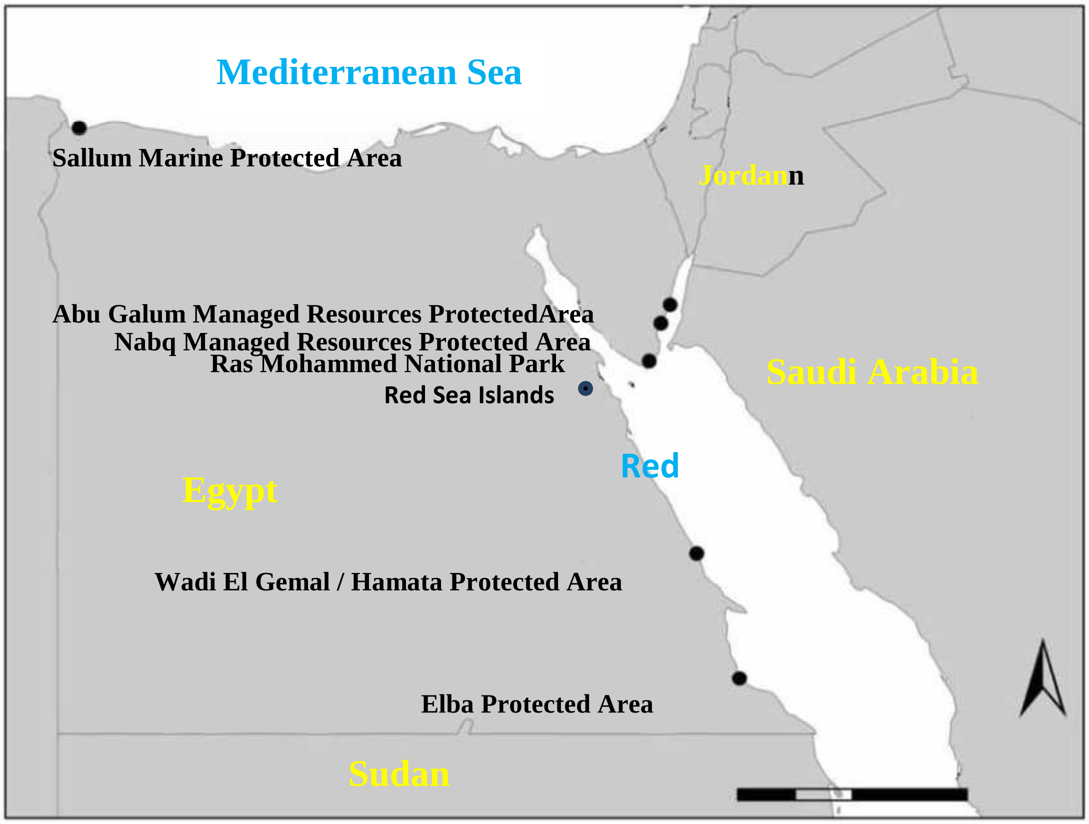
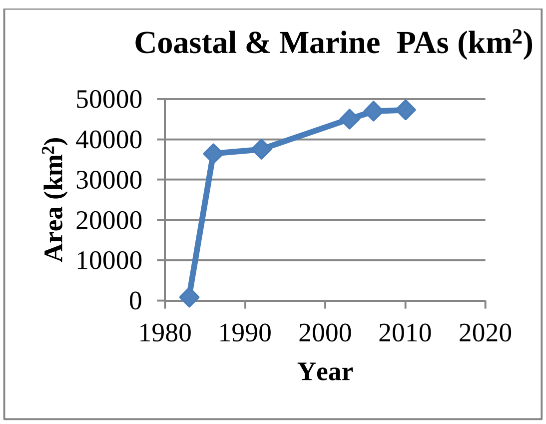


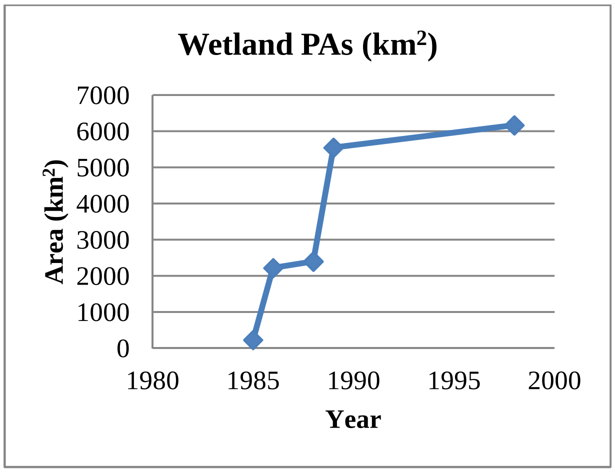
Figure 4-4 Progress of Coastal and Marine Protected Areas from 1980



4.2 Wetland Protected Areas

There are eight Wetland PAs in Egypt, mostly located in the Mediterranean shores and the Nile River banks. Wetland PAs cover an area of approximately 6,500 km^2 (Figure 4-5). They specifically include some northern lakes and coastal zones, as well as islands along the Nile. They protect resident and migratory bird habitats, assist in the management of fisheries, local community development and promote ecotourism. Among these protected areas are: Zaranik in the North Sinai Governorate, Ashtum El Gamil in the Port Said Governorate, Omayed in the Matrouh Governorate, Lake Qarun and Wadi El- Rayan in the Fayoum Governorate, Saluga and Ghazal Islands in the Aswan Governorate and the 144 Nile Islands and El Burrullus in the Kafr El Sheikh Governorate.

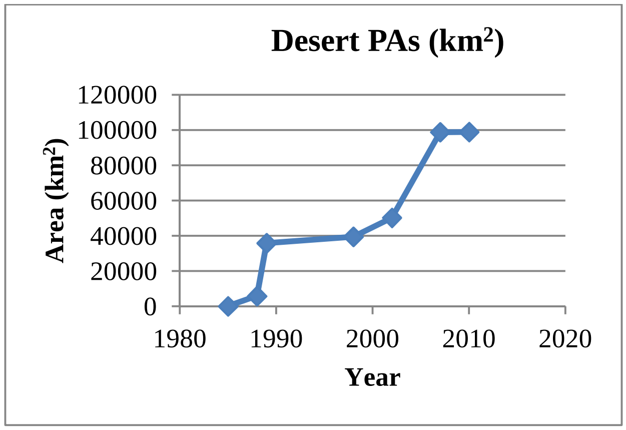
Figure 4-5 Area of Wetland Protected Areas



4.3 Desert Protected Areas

There are nine PAs located in Sinai and the Eastern and Western Deserts of Egypt. Together they cover an area of approximately 100,000 km^2 (Figure 4-6) and include mountains, plains and wadis. They protect the floral and faunal diversity in these regions, regulate and promote safari tourism and support local communities. Desert Pas include the Al-Ahrash in the North Sinai Governorate, Taba and St. Katherine in the South Sinai Governorate, Al Omayed and Siwa in the Matrouh Governorate, the White Desert in the New Valley Governorate, Wadi Asiuti in the Assiut Governorate, Wadi Allaqi in the Aswan Governorate, El Gelf El Kebeer in the El Wadi El Gedid Governorate and El Wahat El Baharia in the El Giza Governorate.

Figure 4-6 Area of Desert Protected Areas



4.4 Geological Protected Areas

There are six geological PAs (Figure 4-7) in Egypt covering an area of approximately 80 km^2 (Figure 4-8), which constitute unique geological phenomena identified as significant scientific and touristic destinations. Geological PAs include the Hassana Dome, the Petrified Forest and Wadi Degla in the Cairo Governorte, the Sannur Cave in the Beni Sueif Governorte, the El Dababiya in the Luxor Governorte and the Niazak Gabal Kamel in El Wadi El Gadid Governorate. The total geological area in Egypt from 1989 to 2012 is shown in Figure 4-9.

Figure 4-7 Geological Protected Areas

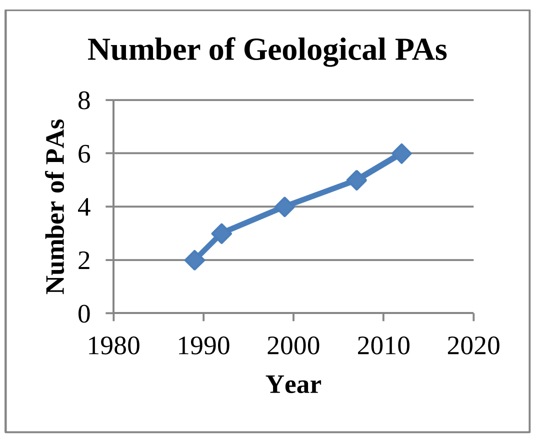


Figure 4-8 Area of Geologic Protected Areas

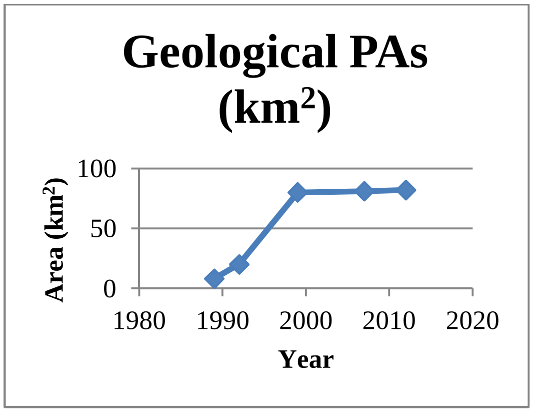
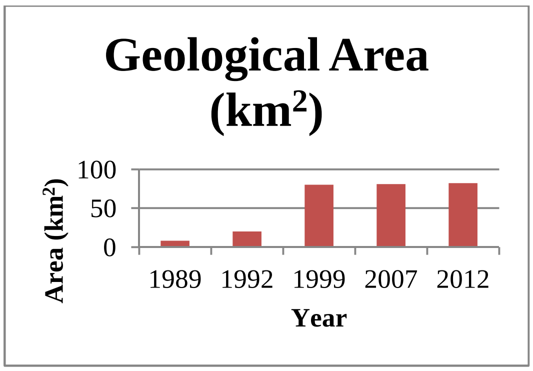


Figure 4-9 Geological Protected Areas from 1989 to 2013



Protected Areas in Egypt fall under six IUCN protected area categories (Figure 4-10) and four general ecological groups (

Figure).

Figure 4-10 IUCN Protected Area Categories

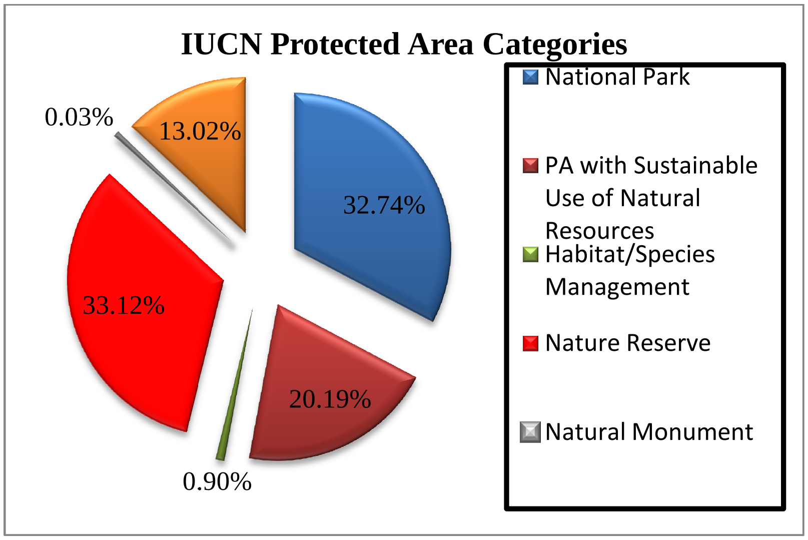
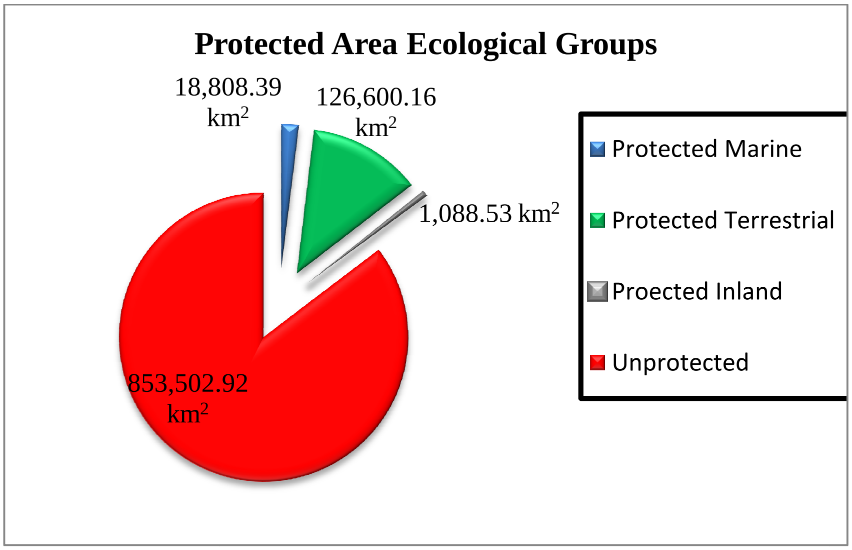


Figure 4-11 Protected Areas Ecological Groups



4.5 Representation of World's Major Habitat Types (Biomes) and Ecoregions in Protected Areas

According to the Worldwide Fund for Nature's (WWF) global classification, Egypt falls in the Palearctic biogeographical realm or ecozone and contains habitat types and ecoregions of global significance. The existing Protected Areas Network contains a good representation of these habitat types and ecoregions.

4.6 Areas of Particular Importance for Biodiversity in Protected Areas

4.6.1 Important Bird Areas (IBAs)

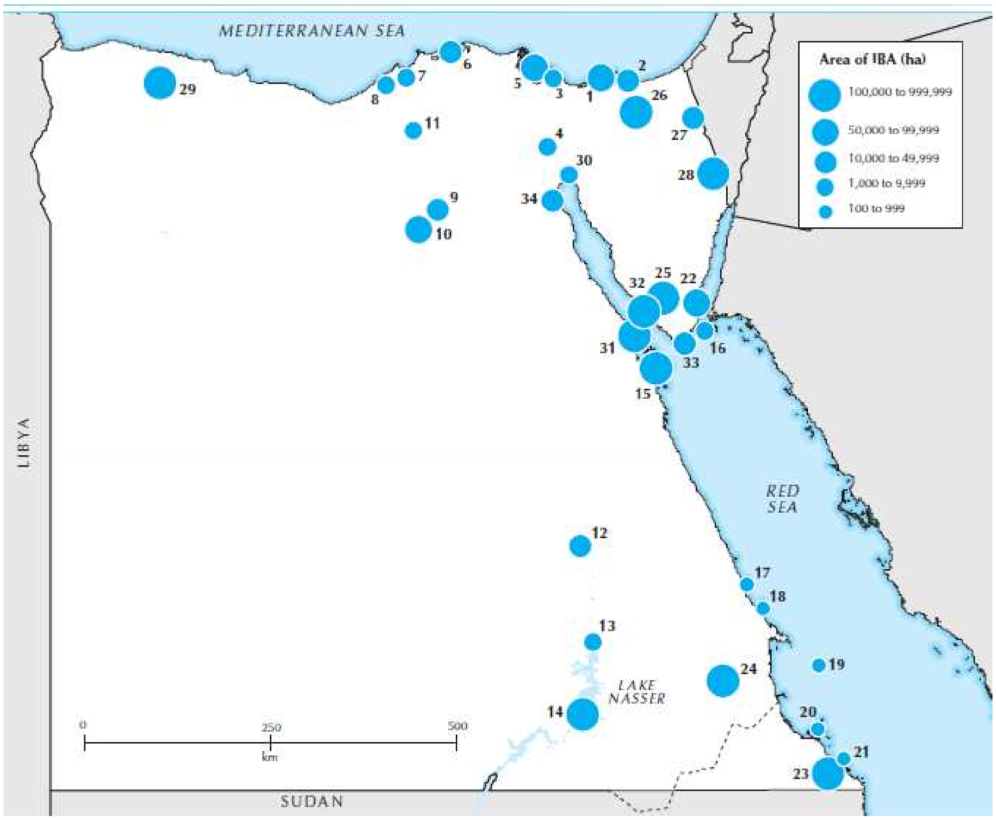
There are a total of 34 Important Bird Areas (IBAs) in Egypt (Table 4-1 and Figure 4-12), comprising a wide range of habitats critical for birds, such as wetlands, high altitude mountains, desert wadis, coastal plains and marine islands. They cover an area of 35,000 km^2 or some 4 % of Egypt's territory. Fifteen IBAs, approximately 44%, fall entirely within the existing protected area network. All of Egypt's avian habitats are represented within the identified network of IBAs, although not equally so.

Table 4-1 Important Bird Areas in Egypt

Total number of IBAs in Egypt	34
Globally threatened species	21
Biome-restricted species*	9
Congregatory species**	24

*Species whose entire global distributions are largely or wholly confined to one biome.
**Species that gather in globally significant numbers at a particular site and at a particular time in their life cycle for feeding, breeding or resting (during migration).

Figure 4-12 Map of Important Bird Areas in Egypt



Four of the 34 IBAs in Egypt are also designated RAMSAR sites, while eight IBAs have the potential to qualify for designation based on the waterbird populations they host (Table 4-2).

Table 4-2 Important Bird Areas Designated and Potentially Qualifying as RAMSAR Sites

Number of Potential RAMSAR Sites	8
Fully Recognized as RAMSAR Sites	4
Partially Recognized	0
Not Recognized	4

Mainstreaming Conservation of Migratory Soaring Birds into Key Productive Sectors along the Rift Valley/Red Sea Flyway

The Government of Egypt has made an ambitious commitment to renewable energy. In February 2008, the government announced its ambitious goal to generate 20 percent of the country's energy production from renewable sources by 2020, which equates to about 7 GW of electricity. The government is concerned about declining supplies of oil and gas. National reserves of fossil fuel is expected to decrease significantly in the coming 4 decades, making renewable sources critical for sustaining the economic growth in the country.

Wind power is proving increasingly to be cost competitive with thermal and nuclear power, but with virtually none of the environmental or social costs of these conventional sources. However, although wind farms are important providers of green energy, they are a lead cause of bird mortality.

Birds have ecological value as key elements of natural systems through the functions birds perform as pollinators, insect eaters, and rodent predators, among others. Bird migration during season changes has inspired man since time immemorial. It has stimulated his feeling of freedom, vigor and owe. Ancient Egyptians venerated the birds, recorded them in hieroglyphics and inscribed them on temple walls and ceilings. African and European cultures have depicted them in archeological relics and legends.

The Rift Valley/Red Sea flyway is the second most important flyway for migratory soaring birds (raptors, storks, pelicans and some ibis) in the world, with over 1.5 million birds of 37 species, including 5 globally threatened species, using this corridor between their breeding grounds in Europe and West Asia and wintering areas in Africa each year.
Due to its geographical location as the land – bridge between these continents, Egypt is a vital host along the flyway. Furthermore, there are five critical migration bottleneck sites where Migratory Soaring Birds coverage lies within Egyptian territory: Suez, Ain Sukhna, Gebel El Zeit, El Qa plain and Ras Mohammed.

Many parts of the flyway at the migration bottlenecks are undergoing rapid development, creating hazards to birds in areas where previously no threats existed. In Egypt, the risks – in order of importance – are the expanding energy and tourism sectors, the waste management, hunting and agriculture sectors.

To protect the productivity and capacity of natural systems and the ecological processes which maintain their functions, a special attention was given to the impact of wind power development on birds, protected areas and other related environmental issues in the recently launched regional project on "Mainstreaming Conservation of Migratory Soaring Birds into Key Productive Sectors along the Rift Valley/Red Sea flyway".

"Mainstreaming Conservation of Migratory Soaring Birds into Key Productive Sectors along the Rift Valley/Red Sea flyway" is a regional project between Governments of Djibouti, Egypt, Eritrea, Ethiopia, Jordan, Lebanon, Palestinian Authority, Saudi Arabia, Sudan, Syria, and Yemen. The project is financed by Global Environment Facility (GEF), BirdLife International, United Nations Development Programme (UNDP), and co-financed by Governments of partner countries. The project is implemented by United Nations Development Programme and other partners in all countries. The overall project goal is to ensure that globally threatened and significant populations of soaring birds that migrate along the Rift Valley/Red Sea flyway are effectively maintained. The immediate Objective is that conservation management objectives and actions for MSBs are mainstreamed effectively into the hunting, energy, agriculture, waste management and tourism sectors along the Rift Valley/Red Sea flyway, making this a safer route for soaring birds.

Environmental Impact Assessment Guidelines and Monitoring Protocols for Wind Energy Development Projects along the Rift Valley/Red Sea Flyway with a particular reference to wind energy in support of the conservation of Migratory Soaring Birds (MSB) were developed in 2013 to guide project implementation.

4.6.2 Species Representation

Approximately 50% of Egypt's flora can be found within its protected areas. Protected Areas having the highest plant and habitat diversity include Elba, Omayed, St. Katherine, Allaqi, Salouga and Ghazal, Nabq and Abu Galum. These PAs also host most of the endemic, threatened and unique plant species in Egypt.

4.6.3 Biological Diversity Hot Spots

Egypt's most important marine biodiversity hot spot, the Red Sea coral reefs, is fairly represented by the existing protected areas network. Similarly, the country's four terrestrial biodiversity hot spots, St. Katherine, Elba, wetlands and the western Mediterranean coastal desert, fall completely within the existing protected areas network.

4.6.4 Endemic and Endangered Species

The distribution of most of the endemic taxa in Egypt coincides with that of the biodiversity hot spots. Thus, they are fairly covered within the existing protected areas network. The coverage of endangered species in the current protected areas network is relatively fair. Taking faunal elements as indicators of coverage, many of the globally endangered species of fauna listed by IUCN that still occur in Egypt are represented in the existing network of protected areas. Examples of endangered species include the Cheetah (*Acinonyx jubatus*), Slender-horned Gazelle (*Gazella leptoceros*), Egyptian Tortoise (*Testudo kleinmanni*), White-eyed Gull (*Larus leucophthalmus*), Small Giant Clam (*Tridacna maxima*), Fennec Fox (*Fennecus zerda*), Four-toed Jerboua (*Allactaga tetradactyla*), Greater Jerboua (*Jaculus orientalis*) and Barbary sheep (*Ammotragus lervia*). Among the 61 endemic species to Egypt, 33 are restricted to the mountains of the St. Katherine Protectorate (South Sinai). That is to say, 60.7 % of the endemics to Egypt are conserved in situ within this PA.

4.6.5 *World Cultural and Heritage Sites*

The existing protected areas network covers important cultural (St. Katherine Monastery) and natural (Wadi El Hetan area of Wadi El Rayan) heritage sites, biosphere reserves (El Omayed and Allaqi protected areas) and RAMSAR sites of international importance (Zaranik, Burullus, Qarun and Rayan).

4.7 Performance of Protected Areas

The performance of protected areas in maintaining the populations of key species is poorly documented. In order to assess the completeness of protected areas coverage and the status of the existing protected area network, an extensive database documenting flora and fauna found in PAs would have to be created. This database would also assist in the. By early 2006, the BioMap project funded by the Italian Cooperation computerized and mapped more than 200,000 records using a GIS. In the meantime, the number of endangered species is used as an indicator of species representation in the current protected areas network.

4.8 Threats and Pressures to Species and their Habitats in Protected Areas

The World Database on Protected Areas (WDPA) held at the UNEP-World Conservation Monitoring Centre (UNEP-WCMC) developed a number of indicators to characterize protected areas of the world in terms of threats and pressures to species and their habitats.

Irreplaceability and pressure indicators for four of Egypt's protected areas included in the WCMC data base, namely Ras Mohamed, Gebel Elba, Wadi El Assuiti and Lake Qarun protected areas were assessed with respect to other PAs in Egypt and in the same ecoregion.

Summaries of the assessments of the irreplaceability of these protected areas and the pressures on them, relative to the average values for the country and ecoregion extracted from WDPA are presented in UNEP-WCMC World Database on Protected Areas 2010 (Overview of protected areas irreplaceability and pressure indicators). The more irreplaceable a PA habitat is, the higher the ranking in any potential prioritization scheme.

5 Threats to Biodiversity

The main threats to biodiversity were identified as habitat loss, habitat degradation, overexploitation, unsustainable use, pollution, the spread of invasive alien species and climate change. These pressures are continuing to increase and are themselves driven by a range of socio-economic drivers, chiefly the growing human population and the associated increase in the consumption of resources. Furthermore, globalization and its negative impacts on resource extraction, along with limited human and financial resources, have also contributed to the loss of biodiversity. Threats are accentuated by increases in the level of desertification due to climate change, as well as human population growth.

Major threats to marine ecosystems are unregulated tourism, exploitation of marine resources, overfishing and fishing in illegal areas (e.g. breeding grounds) and coastal pollution. At present, 20% of Egyptians live in coastal areas, which are also visited annually by 11 million tourists. In addition, more than 40% of industrial activity occurs in the coastal zone.

Pollution causes deterioration of critical habitats and species loss. A concrete example is the Delta wetlands. Excessive use and misapplication of pesticides also causes loss of rare species including those that act as pollinators and natural biological control agents.

Overgrazing and over-fishing contribute to biological degradation. Wildlife utilization is, for the most part, unregulated in Egypt and excessive hunting is endangering a number of wild animals (e.g. gazelles) as well as several species of resident and migratory birds.

Many plant and animal species are located at the limits of their geographical or ecological distribution ranges. Under such conditions, these species have limited tolerance for ecological pressures, as is exemplified by corals in the Red Sea, the Gulf of Suez and the Gulf of Aqaba.

The lack of a sustainable and effective system to address natural heritage management issues is hampering the nation's ability to conserve and manage its unique and critical resources. Poorly regulated marine tourism, coupled with inadequate infrastructure to protect natural resources and insufficient regulations for desert tourism are causing the destruction and degradation of natural habitats, landscapes, cultural heritage sites and other resources. In addition, there is a lack of coordination and cooperation between all relevant stakeholders in regards to data collection, storage and analysis of biodiversity data and the absence of comprehensive legal protection for natural heritage resources outside protected areas. This lack of coherence threatens future sustainable returns from natural resources. All of the aforementioned issues are compounded by the fact that few economic incentives are for biodiversity conservation (National Environmental Action Plan (2002 - 2017)).

5.1 Habitat Loss and Degradation

Destruction of habitat is a major cause of biodiversity loss in Egypt. Direct habitat loss is a major threat to terrestrial, marine and coastal ecosystems, and freshwater ecosystems are particularly severely affected by fragmentation. Land reclamation, urbanization and industrial activities destroy and alter critical natural habitats along with their plant and animal life. There are a range of factors, economic and social, that lead to land-use changes and development pressures, raising serious concern for the integrity of ecosystems in Egypt.

5.1.1 Threats to Wetlands

Egypt's wetlands are subject to a variety of human induced threats, which are leading to the degradation of this valuable national resource. There are multiple threats to wetlands and river ecosystems in Egypt. One of the major threats to wetlands, in the northern coastal lakes in particular, in Egypt is the drainage of water bodies for their conversion into agricultural and settlement developments, ultimately destroying habitat and reducing their areas. Other threats to wetlands include water withdrawal for irrigation, coastal erosion, invasive species, water pollution and overfishing.

The severity of pollution varies from lake to lake, but they all share the same cause of pollution - the discharge of untreated or partially treated industrial and household waste water (mainly sewage) and the dumping of agricultural drainage loaded with fertilizer, pesticide and herbicide residues. The severity of pollution in these lakes can be as follows: Lake Maryout> Lake Manzala> Lake Edku> Lake Burullus. Excess agricultural runoff and domestic wastewater discharge into these water bodies causes an increase in the levels of nitrogen and phosphorous, a process known as eutrophication, causing harm to other forms of life inhabiting these waters. Such malpractices can be traced back to a rapidly growing population and the increased human activity that comes with it.

Applied fishing techniques also have adverse impacts on fish production. They have affected the aquatic environment in many ways. Fishermen use inappropriate techniques to increase their catch. This has caused the killing of the small traits and hence, decreased production. The use of huge nets causes the death of large numbers of non-target species through habitat destruction and being accidentally engulfed by the net (The Environmental Profile, NEAP, 2000).

River systems have also been degraded drastically during the past 50 years. They are being significantly affected by water withdrawals, leaving some small rivers nearly or completely dry, ultimately reducing biodiversity. However, the water quality of the Nile River and Lake Nasser are within international standards (SOE 2007). Many invasive species are also recorded in the Nile River; most important are Water Hyacinth (*Eichhornia crassipes*) and freshwater crayfish. The Water Hyacinth covers some 487 km^2 of the river and the networks of irrigation and drainage canals throughout the country and 151 km^2 of lakes, causing an annual water loss of 3.5 billion cubic meters to evaporation. It also prevents sunlight penetration, causing changes in the ecosystem and species diversity. The uncontrolled spread of freshwater crayfish led to the deterioration of local fisheries, crops and irrigation networks.

5.1.2 Threats to Coastal and Marine Ecosystems

Direct habitat loss is a major threat to coastal and marine ecosystems and is driven by a number of factors: i) the rapid unplanned development of areas such as the north coast and the coast of the Suez Canal; ii) the unsustainable exploitation (ex. bottom trawlers) of marine resources; iii) deterioration of breeding and nursery sites in many areas, especially in the Mediterranean Sea(less in the Red Sea due to the declaration of some protected areas along coasts and islands); iii) commercial ship trafficking in the Suez Canal and oil leakage from some oil fields in the Red Sea; iv) sanitation discharge in the Mediterranean Sea and coastal lakes; v) social pressures on the government to meet the needs of a growing population (unemployment, introduction of new patterns of development, competition for exploiting available resources, lack of public awareness with the importance of inherited culture associated with unorganized development plans and threat of investments due to beach erosion).

Coastal development, intensive tourism and land reclamation for agriculture put pressure on key wildlife habitats in the Mediterranean. Contributing factors to the decline of wildlife habitat in the Mediterranean include historical overexploitation, degradation of beach nesting habitat due to sand extraction, entanglement in fishing gear, loss of sea grass meadows, pollution and increased ship traffic. In the eastern Mediterranean, seabirds are threatened by habitat loss due to drainage, water diversion, changes in annual water regime, eutrophication, reed cutting, landfills, chemical pollution and hunting (UNEP/MAP 2012). For example, the vast tracts of what might have been suitable habitat for the Egyptian Tortoise (*Testudo kleinmanni*) in the North Coast are now uninhabitable for the species. Perhaps the most serious threat to *T. kleinmanni* is the complete (and possibly irreversible) destruction of habitat caused by agricultural activities. Local and regional problems related to pollution, specifically effluents from domestic and industrial sources, oil transportation, refineries and agricultural runoff are also beginning to have serious impacts on wildlife.

Major threats to Red Sea coral reefs include land filling, dredging for coastal expansion, destructive fishing methods, shipping and maritime activities, sewage and other pollution discharges, damage from recreational SCUBA diving, lack of public awareness and the insufficient implementation of legal instruments that promote reef conservation (PERSGA, 2000). In addition, increasing atmospheric carbon dioxide is expected to alter the alkalinity of the world's oceans over the next century making it increasingly difficult for corals and other carbonate secreting organisms to grow. Present predictions are that calcification rates may slow by as much as two-thirds over the next 50 years, with potential for catastrophic effects on reef growth and marine biodiversity in general (Kleypas *et al*., 1999).

Red Sea coral reefs were assessed as at risk primarily due to coastal development, overfishing and the potential threat of oil spills in the heavily trafficked Arabian Gulf and southern end of the Red Sea. Almost two-thirds of Gulf reefs are at risk, largely as the area channels over 30% of the world's oil tankers each year. In other areas, industrial pollution and coastal development are areas are more predominant. Corals in many parts of the Gulf of Aqaba have been degraded due to tourism developments. Reefs in the northern Red Sea and the Arabian Gulf are especially vulnerable to degradation due to limited water circulation and temperature extremes.

5.1.3 Threats to Desert Habitats

Desert habitats cover over 90% of Egypt's territory. From a terrestrial point of view, beyond the Nile Valley Egypt is one of the most hyper-arid countries in the world, with large areas of completely barren desert where no rain has fallen for decades. There is slightly more rainfall in the north closer to the Mediterranean coast, in the mountains of Sinai and in the extreme southeast where fog deposition in Gebel Elba produces the only Egyptian example of an officially (WWF) endangered habitat – a Red Sea Fog Woodland.

The main threats to desert biodiversity are habitat loss and land degradation. The cause of land degradation in the northern coast of Egypt is due to overgrazing, where grasslands have been converted to accommodate seasonal agriculture. Other causes of habitat loss and degradation are air and water erosion, poor land management, limited and ineffective popular participation by locals in conserving the land andthe establishment of several developmental projects.

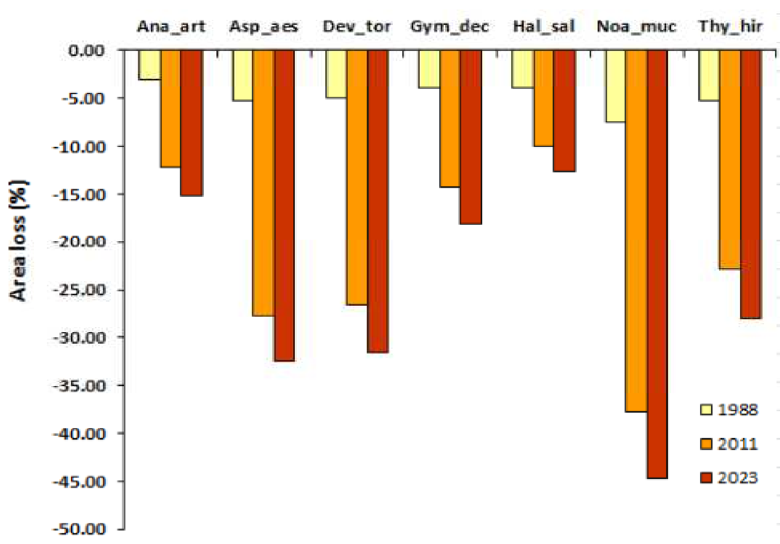
Other threats include increased dryness, which hinders the ability of plants to reproduce; the overharvesting of plants, especially medicinal plants; the hunting of wild animals outside protected areas; logging activities in the Eastern and Western Desert for fire; increased urban development and safari tourism in unpopulated areas; landmines left after World War II in El-Alamein (nearly 17.5 million mines occupying more than quarter million feddans suitable for agriculture); and climate change, which is believed to have led to more droughts, increased temperatures and decreased rainfall.

The impacts of land use changes on the distribution of selected important plant species in an arid landscape in the northwest coastal desert of Egypt was assessed using a random forest modeling approach (Halmy *et al.*, 2013). Out of 244 species found in the area, only the distributions of seven important species were modeled. Important species were defined as those serving crucial functions and providing important services in any ecosystem. This could include, for example, sand stabilizing and nitrogen-fixing plants.

The species selected for the study were *Anabasis articulata* (Ana_art), *Asphodelus aestivus* (Asp_aes), *Deverra tortuosa* (Dev_tor), *Gymnocarpos decanderus* (Gym_dec), *Haloxylon salicornicum* (Hal_sal), *Noaea mucronata* (Noa_muc) and *Thymelaea hirsute* (Thy_hir). Figure 5-1 presents habitat loss, which is expressed as a percentage of the potential habitat area for each species under the baseline climate and no land use changes.

The results indicate that the changes in land use in the area over the last 23 years have resulted in habitat loss for all the modeled species. Projected future changes in land use revealed that all the modeled species would continue to suffer habitat loss (Halmy *et al.*, 2013).

Figure 5-1 Changes in Habitat Area due to Land Use Changes in 1988, 2011 and the projected change by 2023



5.1.4 Threats to Mountain Habitats

Mountains and wades are characteristic of the landscape of much of the Eastern Desert and Sinai. Habitats found in the mountains of South Sinai and the Eastern Desert, particularly Gebel Elba, support unique faunal and floral biodiversity. The loss of biodiversity in mountainous areas is attributed to human activities, such as hunting, logging, trafficking in species, urban development, invasive alien species, climate change and natural disasters (mainly flooding).

5.1.5 Threats to Agricultural Biodiversity

The main threats to agricultural biodiversity in Egypt are: i) urbanization expansion on agricultural land despite the strict legislation governing the destruction of agricultural lands; ii) the introduction of high yielding varieties and their wide use that has led to the neglect and disappearance of traditional varieties and local breeds, the erosion of plant crops and the reduction in livestock genetic diversity; iii) the abandonment of traditional agricultural practices, causing the loss of cultural landscapes and associated biodiversity; iv) the introduction of invasive species, such as the Red Palm Weevil (*Rhynchophorus ferrugineus*), invasive weeds and various agricultural pests, which cause significant economic losses; v) the excessive use of fertilizers and pesticides that has led to the disappearance of important agricultural wildlife (pollinators, kites, owls, foxes, mongoose and wild cats) and groundwater contamination; vi) the absence of suitable successive agricultural cycles; viii) the use of surface flooding irrigation methods, which led to land degradation, reduction of soil fertility and increased soil salinity; and ix) the increased migration from rural to urban areas with an increasing burden on resources.

5.2 Invasive Alien Species

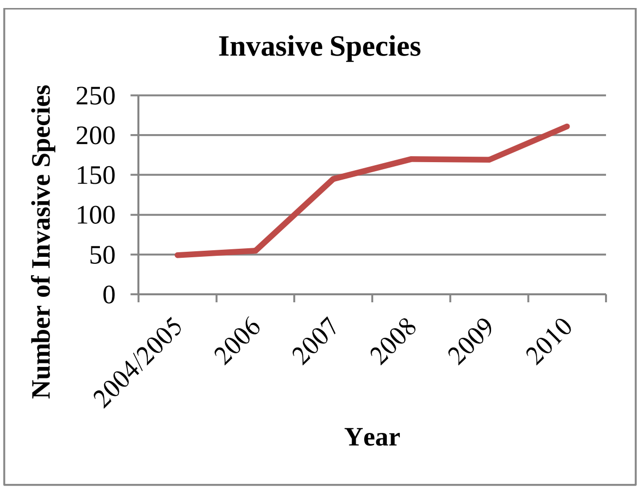
Invasive species continue to be a major threat to all types of ecosystems and species in Egypt. There are no signs of reduction of this pressure on biodiversity, and there are indications that it is increasing. A famous example is the detrimental effect of the introduction of the Water Hyacinth (*Eichhornia crassipes*) in the Nile River and the networks of irrigation and drainage canals throughout the country. Another example is the introduction of the Water Fern (*Azolla filiculoides*) to be used as a biological fertilizer in rice fields which has inadvertently escaped into water courses where it seems to be wiping out a number of other native hydrophytes (e.g. *Lemna spp.* and *Spirodela spp.*). Similarly, the exotic freshwater crayfish (*Procambarus clarkii*) introduced in aquaculture basins found its way into major water channels where it became a serious pest to commercial fish and to biodiversity in general. The recent non-intentional introduction of the Red Palm Weevil and avian flu are other good examples of invasive species. The estimated damage caused by invasive species may be as high as one billion Egyptian pounds.

Several attempts have been made to record different taxonomic groups of alien and invasive species in Egypt. However, most of these did not apply or acknowledge the appropriate international criteria used to evaluate invasive species status.

In one comprehensive recent study by Shaltout (2008), the list of alien species in Egypt included 137 plant species:causals (50 species), naturalizers(50 species), weeds (31 species), invaders (5 species) and transformer (1 species) (Annex 2) distributed in 7 habitat groups: cultivation fields (group I); ruderal places (group П); sand formation (group Ш); aquatic bodies (group IV); gardens and fence lines (group V); Nile land and silty soil (group VI); and wadi beds, stony hillsides, pasture, and newly reclaimed land (group VII).Forty-three of the alien species in the Egyptian flora (17 naturalized and 12 casual species = 32.1% of the total aliens) have at least one aspect of the environmental services. In addition, 111 species (81% of the total aliens) have at least one aspect of the potential or actual economic goods.The alien species in the Egyptian flora belong to 20 origins divided into 14 origins in the old world and 6 origins in the new world. The plants from South America (25 species = 18.2%) are the most represented, followed by Tropical Africa (21 species = 15.3%), North America and South Asia (18 species = 13.1% for each), Tropical America (17 species = 12.4%), Europe (16 species = 11.7%), Medetranian region (15 species = 10.9% for each), West Asia and South Africa (10 species = 7.3% for each one), Tropical Asia (7 species = 5.1% for each), Central America and Asturallia (6 species = 4.4%), South Europe and East Asia (5 species = 3.6%). The study covered introduction of the alien species in the last 250-300 years (1750 to 2008) and concluded that 5 species (3.6% of total species) were introduced between 1800-1850, 49 species (35.8%)in the period 1850-1900, 19 species(13.9%) in1900-1950, 42 species(30.7%) in 1950-2000 and with2 species (*Dichondra micrantha* and *Galinsoga parviflora*) after 2000., and only one species (*Dalbergia sissio*). The probable dates of the introduction of the remaining 18 species were notrecorded.Time lags of the invasive and transformer species in the Egyptian flora ranged between 5 years to 181 years. The time lag isdefined as the period between the time when a species is introduced and the time when its population growth explodes.

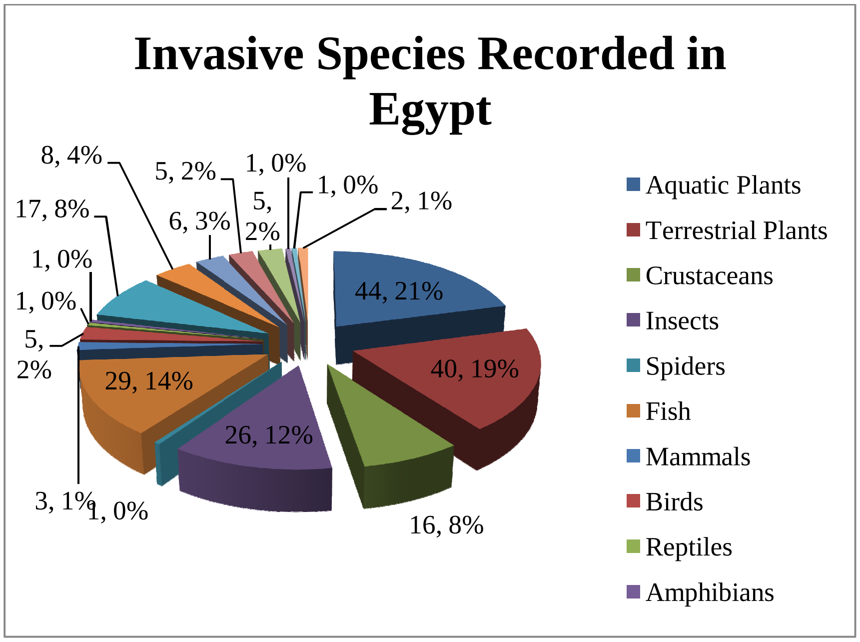
Currently available information about invasive species in Egypt is still insufficient and exerted efforts are still limited in spite of the fact that invasive species represent real threat to Egyptian ecosystems, the economy and human health. Changes in the extent of invasive alien species recorded in the Egyptian environment in the period from 2004 to 2010 are shown in Figure 5-2.

Figure 5-2 Changes in the Extent of Invasive Species in Egypt from 2004 to 2010



In 2010, the number of invasive species increased to 211 species. The recorded species included aquatic plants (44), terrestrial plants (40), crustaceans (16), insects (26), spiders (1), fish (29), mammals (3), birds (5), reptiles (1), amphibians (1), viruses (17), fungi (8), bacteria (6), nematodes (5), mollusks (5), echinoderms (1), coelenterates (1) and polychaetes (2) (Figure 5-3; records presented as number, percentage).

Figure 5-3 Invasive Species Recorded in Egypt



Among the invasive species recorded in Egypt, 21 species were included in the world list of the worst 100 invasive species (Black List) developed by The World Program of Invasive Species (2010). This indicator reflects the extent and spread of invasive species and the measures necessary to be taken to limit their spread.

It is important to note the upward trend in the numbers of invasive species arriving in Egypt and the uncertainty of their number. More expert studies are needed to ascertain the accuracy of recorded invasive species over the years and additional studies are required to record the changes in the extent (land area or coastline) of widely established invasive species in freshwater, marine and terrestrial environments. Such information is important for setting eradication priorities, decision making and formulating and implementing credible invasive species programs and action plans.

As Egypt becomes warmer under the influence of global climate changes, it seems likely that its ecosystems will become increasingly prone to invasions by more alien species. Extreme climate events, such as floods, exacerbate the problem, allowing invasive alien species to move into new areas.

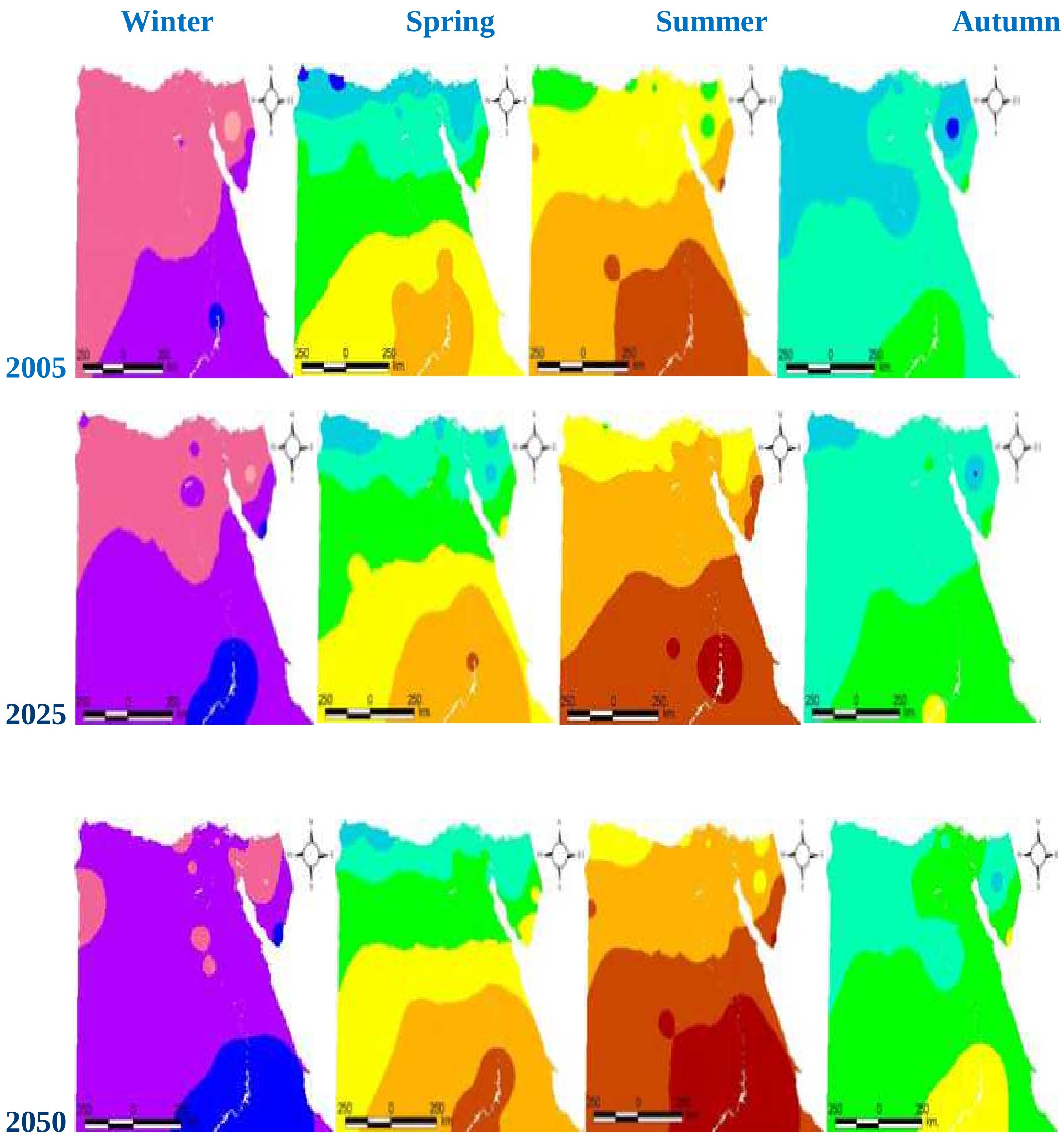
5.3 Climate Change

Studies have shown that Egypt's climate has changed greatly over the last 10,000 years (Bubenger *et al*. 2008), changing gradually from a wet climate (rainfall was more than 300 mm/year) to a more arid climate (less than 50 mm/year). Humans had an intimate relationship with their surrounding environment, coexisting with animals like giraffes and elephants, which later disappeared due to the arid climate.

Seasonal temperature distributions in Egypt in the years 2005, 2025, 2050, 2075 and 2100 were studied by Hegazy *et al*. (2008) (Figure 5-4). According to the study, it is anticipated that temperatures will rise in all four seasons, moving from the southern to the northern parts of

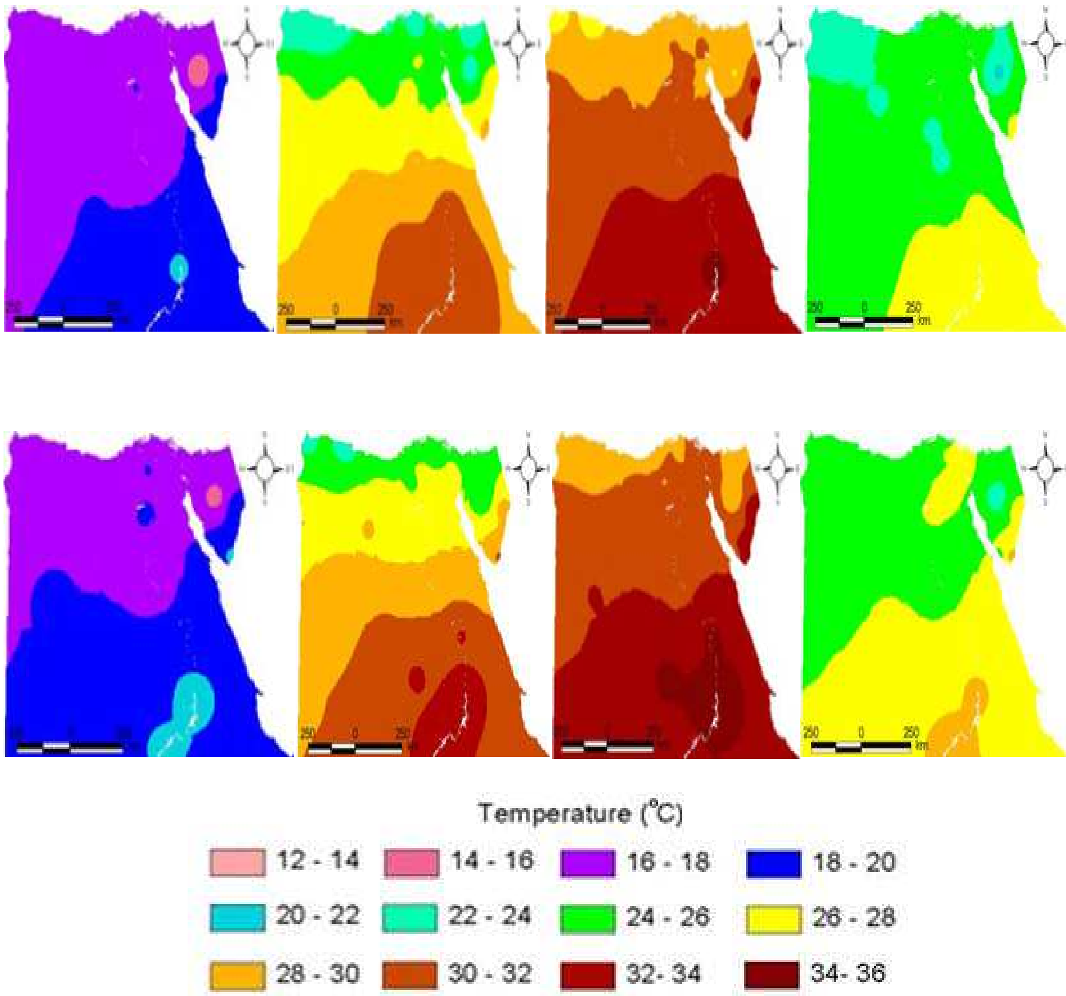
Egypt, in the coming 100 years. This change will require the management of the local agroecosystems in order to adapt planting or sowing practices for the projected climate change scenarios.

Figure 5-4 Seasonal Temperature Distributions in Egypt in 2005, 2025, 2050, 2075 and 2100



2075

2100



The study predicted a contraction in arable land area and a shift in cultivation time. Crop production systems will be under increasing pressure to meet growing national demand in the future. There is also some empirical evidence that higher atmospheric levels of carbon dioxide (CO_2) could result in lower protein levels in some grain crops.

The effects of climate change have been documented in the St. Catherine Mountains by monitoring its impact on the disappearance of living organisms on peaks of St. Catherine due to temperature increases. Studies proved that annual changes in temperatures will accelerate the Sinai Baton Blue's (*Pseudophilotes siniacus*) risk of extinction. The decline in the Sinai Baton Blue, the smallest butterfly in the world, is due to the decrease in the flowering rate of the Sinai Thyme (*Thymus decussatus*) by about 40% or more during drought years. Sinai Baton Blue larvae feed on buds, while adult butterflies feed on the flower nectar of the Sinai Thyme. If the temperature continues to rise, the Sinai Thyme will continue to decline in numbers. Furthermore, exposure to additional human threats, such as over grazing and the collection of Sinai Thyme for medical purposes, will further increase the butterfly's risk of extinction.

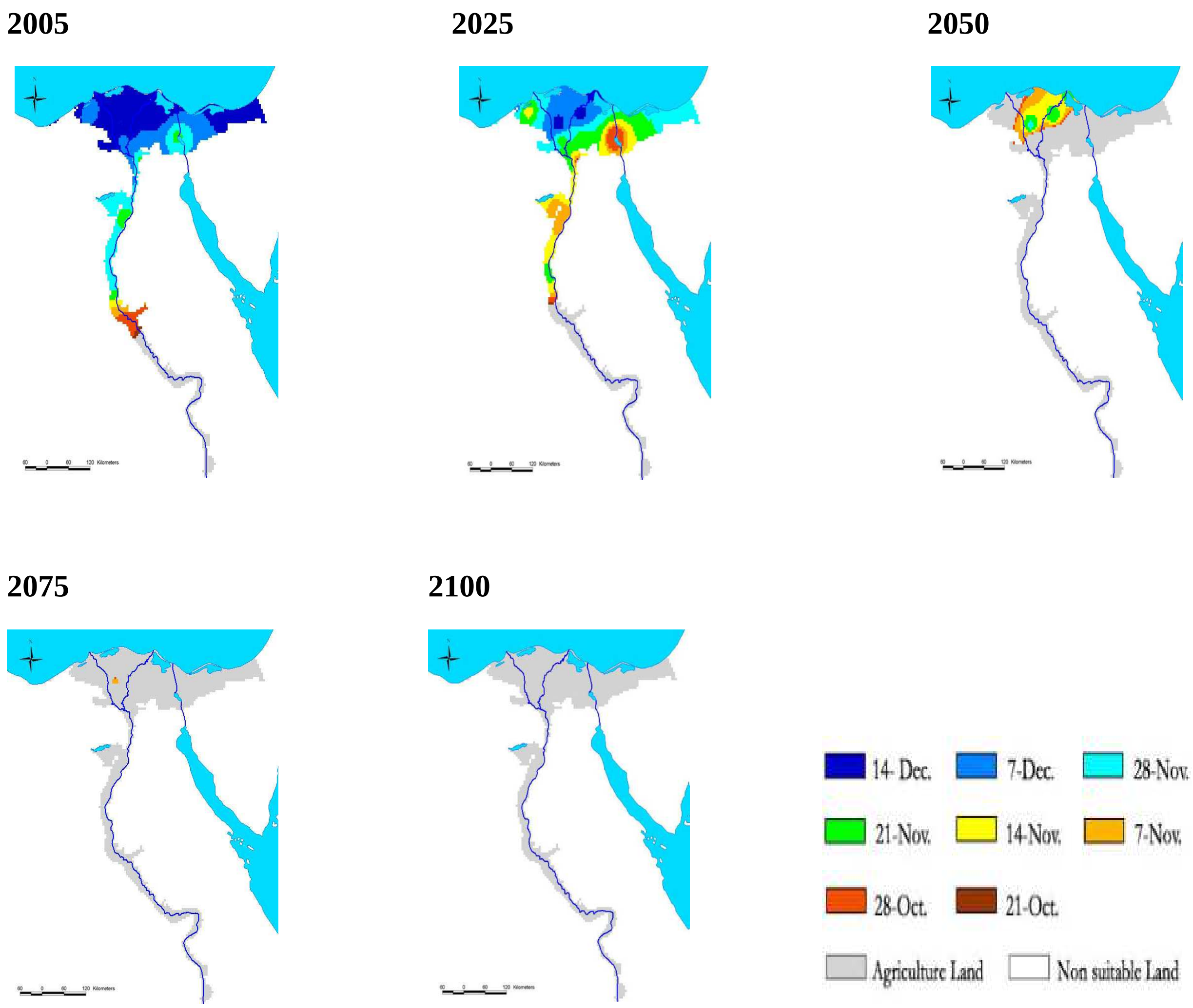
Species distribution models are increasingly used for the prediction of the potential distribution of species in response to disturbances or changes resulting from human intervention. Predictive habitat distribution models are used as important tools for assessing the impact of land use changes, climate change and other forms of human interference on different species. Habitat distribution models have proven to be useful for modeling both commonly distributed species (Franklin, 1998) as well as rare species (Wu & Smeins, 2000; Williams *et al*., 2009).

A limited number of studies have been undertaken to assess the impact of climate change on Egyptian animal and plant species. This may be due to the fact that models are relatively new and the availability of biodiversity data records of Egyptian fauna and flora are sparse and not well organized.

The influence of rising temperatures on the spatial and temporal distribution of four of the major economic crops in Egypt was studied by Hegazy et al., 2008. The species selected for the study were cotton (*Gossypium barbadense* L., cv. Giza 89), wheat (*Triticum aestivum* L., cv. Gemiza 9) (Figure 5-5), rice (*Oryza stiva* L., cv. Sakha 101) and maize (Zea mays L., cv. Hybrid 10). Optimum air temperature allowing maximum growth for each of the study crop cultivars and the current and projected air temperature patterns in the future years were used for the projection of the seasonal and crop distribution maps in the years 2005, 2025, 2050, 2075 and 2100.

Results showed that sowing dates of a target crop may be managed in order to allow maximum predicted planting area in the same region. The current maximum area suitable for planting cotton and wheat will be greatly affected by the projected increase in air temperature.

Figure 5-5 Projected Temporal and Spatial Distribution of Wheat Cultivar Gimeza 9 in the Years 2005, 2025, 2050, 2075 and 2100



A number of studies have been carried out to model species distributions to assess the effect of climate change on Egypt's biodiversity, including recent studies that have been carried out to predict the potential distribution of 75 species of Egyptian reptiles. An occupancy model (a type of population viability analysis) was used to assess the potential impacts of global warming on the world's smallest butterfly, the Sinai Baton Blue (*Pseudophilotes sinaicus*) of St. Katherine. Maxent was used to test the potential impact of climate change on the distribution of Egyptian antelopes (Barbary Sheep (*Ammotragus lervia*), Nubian Ibex (*Capra nubiana*), Dorcas Gazelle (*Gazella dorcas*), and Slender-horned Gazelle (*Gazella leptoceros*)) using the A2 and B2 emission scenarios of Global Circulation Models. The effect of climate change on Egyptian butterflies and mammals (using Maxent algorithm and A2 and B2 emission scenarios of a different Global Circulation Model) was discussed and took into consideration the effectiveness of the Egypt's PA network in conserving Egypt's biodiversity under current and future climates (using Zonation software). According to modeling studies, it was concluded that some species could lose up to 80% of their home range while others go extinct.

The BioMAP project (http://biomapegypt.org) studied the distribution of each Egyptian butterfly and mammal species. Data on each species were collated from available sources and an actual and predicted distribution map for each species were provided (using Maxent); each species was also assessed according to the IUCN guidelines and criteria. In another study, Maxent was used to predict the potential distribution of the Nubian Ibex (*Capra nubiana*) in South Sinai, and showed that the presence of water was the environmental factor most influential in their distribution in South Sinai.

The projected impact of modeled climate scenarios (A1B, A2A and B2A) on the distribution of 7 plant species in the arid northwest coastal desert of Egypt by 2040 varied (the modeled species by 2040 varied from species to another (Figure 5-6). Some of the species were projected to be adversely affected by the changes in climate, while other species are expected to benefit from these changes. The combined impact of the changes in land use and climate pose serious threats to most of the modeled species. The study found that all the species are expected to suffer loss in habitat, except *Gymnocarpos decanderus*. The results showed that some species, such as *Noaea mucronata* and *Asphodelus aestivus*, may suffer serious threats in the area under the combined land use and climate change scenarios. The study highlights the importance of assessing the impact of land use/climate change scenarios on other species of restricted distribution in the area in order to help shape policy and mitigation efforts to protect and preserve biodiversity in Egypt's deserts.

Figure 5-6 Gain/Loss in Habitat Area under Three Climate Change Scenarios Combined with Different Land Use Scenarios by 2023: a) No land use; b) Current land use; and c) Projected land use. (Gain/loss is expressed as percentage of the potential habitat area for each species under the baseline climate and no land use)

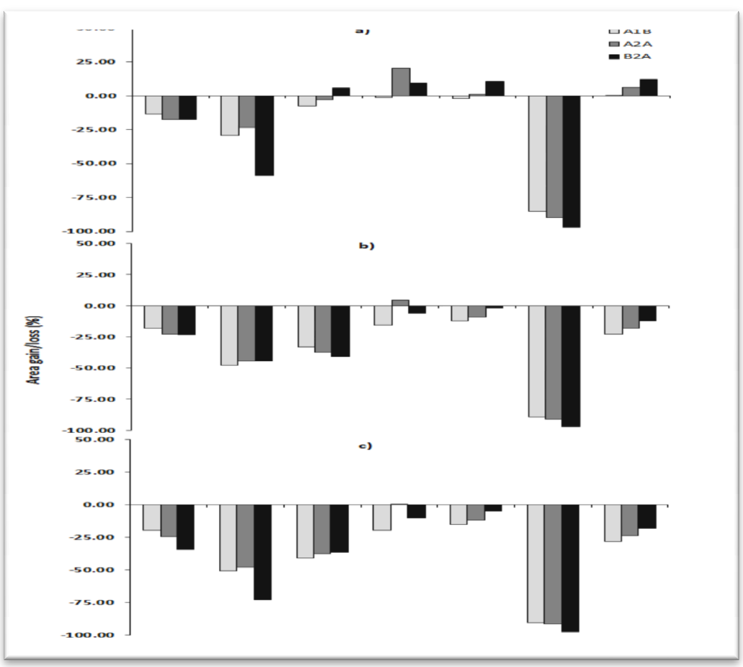
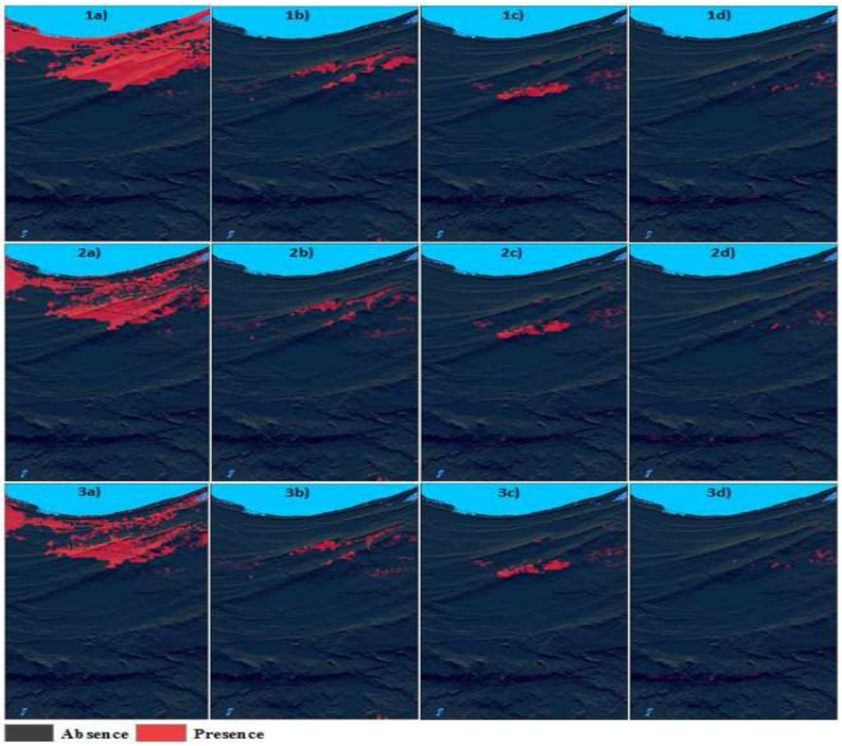


Figure 5-7 shows the potential distribution of Noaea mucronata under different land use and climate scenarios (Halmy et al., 2013). Scenarios 1, 2 and 3 represent natural landscape, current land use and future land use by 2023, respectively; and a, b, c and d represent the average climate (1950-2000), A1B, A2A and B2A climatic scenarios, respectively. The scenarios used in this study represent different emission scenarios according to Intergovernmental Panel on Climate Change's (IPCC) 4th assessments. Both A2A and B2A are high greenhouse emission scenarios, while A1B is a medium green house emission scenario that assumes balance between all sources of energy (fossil & non-fossil).

Figure 5-7 Potential distribution of *Noaea mucronata* under different land use and climate scenarios



5.4 Overexploitation and Unsustainable Use

In Egypt, overexploitation and destructive unregulated harvesting practices of wild species to meet consumer demand threatens biodiversity. Major exploited groups include medicinal plants, mammals for wild meat and recreational hunting, birds for food and the pet trade, and amphibians for traditional medicine and food. Terrestrial, inland water, coastal and marine ecosystems and their associated species are widely used for commercial, semi-commercial and subsistence purposes through both formal and informal markets. While some of this use is well managed and/or is at levels within the capacity of the resource for renewal, much is thought to be unsustainable.

Overfishing is also a problem in freshwater wetlands, although in many cases adequate data are not available to quantify the extent of the loss. Such practices can ultimately lead to major shifts in community composition. By-catch from fisheries can be a major threat to groups such as sharks and turtles.

5.5 Pollution

Pollution from nutrients (nitrogen and phosphorous) and other sources is a continuing and growing threat to biodiversity in terrestrial, inland water and coastal ecosystems. Pollutants such as fertilizer and pesticides from agriculture, wastewater treatment systems and industry, including mining and oil or gas extraction, harm biodiversity directly through mortality and reduced reproductive success, and also indirectly through habitat degradation. Inland wetlands and coastal marine habitats face a major threat from waterborne pollutants. Meanwhile, atmospheric pollution in terrestrial systems, particularly the deposition of eutrophying and acidifying compounds such as nitrogen and sulfur, is of major concern.

5.6 Threats to Protected Areas

The main threats to protected areas in Egypt are illustrated in Figure 5-8 and Figure 5-9..

Figure 5-8 Threats to Biodiversity in Protected Areas

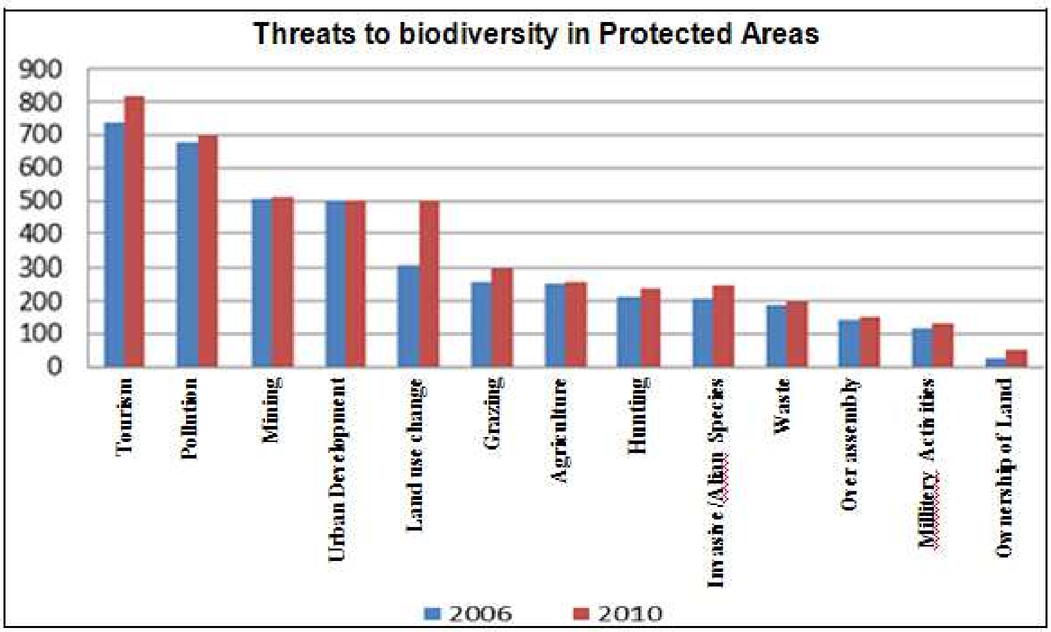
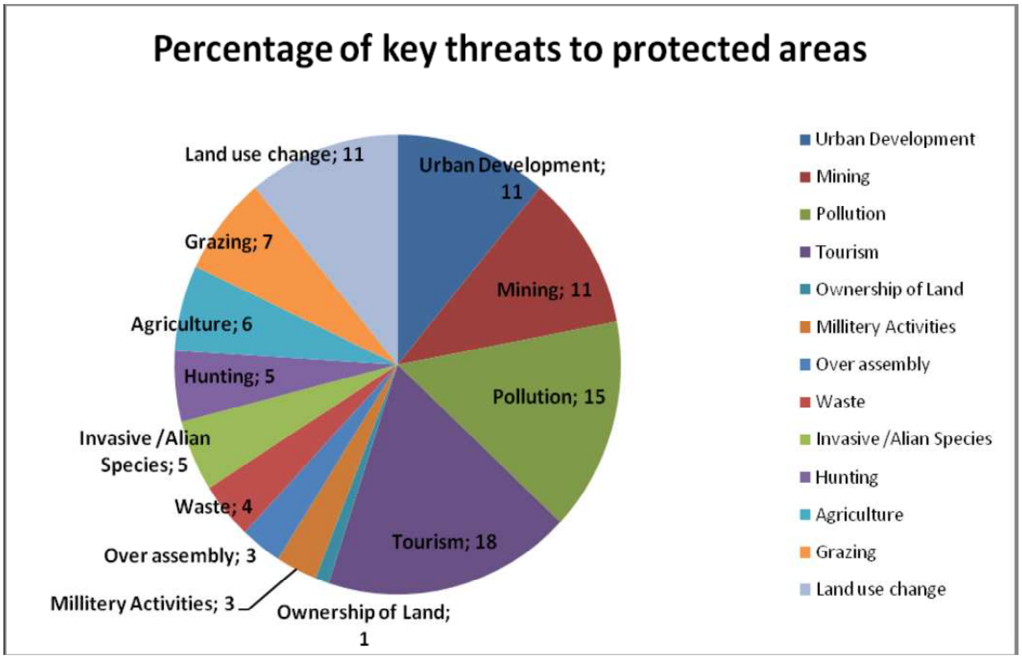


Figure 5-9 Percentage of Key Threats to Protected Areas (SOE, 2010)



6 Implications of Biodiversity Changes for Ecosystem Services and Human Well-being

The relationship between biodiversity and ecosystem services is complex. The role of biodiversity in the supply of ecosystem goods and services has been categorized as provisioning, regulating, cultural and supporting; and, biodiversity may play multiple roles in the supply of these types of services. For example, in agriculture, biodiversity is the basis for a provisioning service (food, fuel or fiber is the end product), a supporting service (such as microorganisms cycling nutrients and soil formation), a regulatory service (such as through pollination and pollution control), and potentially, a cultural service in terms of spiritual or aesthetic benefits, education or cultural identity. The loss and degradation of biodiversity will therefore have serious social, economic, cultural and ecological implications.

As mentioned earlier, Egypt has unique biodiversity that contributes to the economy and supports human wellbeing. Biodiversity in Egypt is deteriorating at the level of ecosystems, species and populations; and, genetic diversity is also declining. Climate change is likely to exacerbate many of the risks associated with other stressors, by further taxing the already compromised resilience of natural systems, and reducing the choices open to individuals and policy makers.

The impact of biodiversity loss is difficult to determine precisely due to the complexity of the processes involved. The loss of biodiversity will impact severely on the livelihoods of the many people who directly or indirectly depend on natural resources. Egypt, like many other countries, has not carried out a systematic quantitative assessment of how changes in biodiversity have impacted the provision of ecosystem services, or how the production of ecosystem services has impacted biodiversity. Some examples of the impacts of major threats on biodiversity and associated effects on ecosystem services and human well-being are summarized in the sections below.

6.1 Impact of Habitat Loss and Degradation (Conversion)

6.1.1 Impacts on Biodiversity

Habitat loss and degradation causes the decrease in natural habitat, in particular sensitive habitats, such as coral reefs and mangroves, as well as the reduction of species composition, the fragmentation of landscapes and soil degradation.

6.1.2 Potential Impacts on Ecosystem Services and People

Impacts of habitat loss and degradation include decreased agricultural production, loss of water regulation potential, reliance on fewer crop plants and livestock species, decreased commercial and subsistence fisheries, decreased coastal protection and loss of medicinal plants and associated traditional knowledge.

Examples:

The degradation of wetland and river ecosystems reduces the prospects for increased food production from agricultural land and freshwater ecosystems. This is important because biodiversity forms the basis of agriculture and fisheries, and enables the production of foods, both wild and cultivated, contributing to the health and nutrition of all people. Wild fish are caught from inland waters, and frequently make up large fractions of dietary protein for riverside or lake communities. Local communities depend on medicinal plants for health care and subsistence.

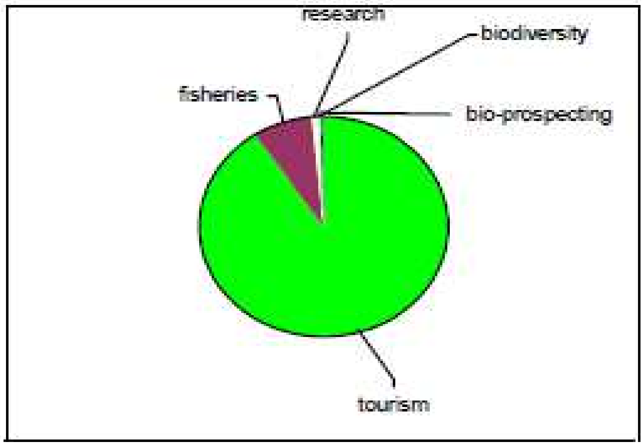
In spite of efforts exerted to increase fish production in all waters and applying measures for sustainability, such as closed seasons (in Lake Qarun , Wadi El-Rayan, Lake Bardawil, Suez Gulf and Red Sea), forbidding illegal fish gear and providing fish fries, there is still a remarkable decline in wild fish production. In the Red Sea, fish production was reduced from 82,000 tons in 1999 to 47,000 tons in 2006. In the Mediterranean Sea, fish production was reduced from 89,000 tons in 1999 to 46,000 – 47,000 tones during 2002-2004, then it increased to 72,000 tons in 2006. In El-Manzala Lake, fish production was reduced from 87,000 tons in 1998 to 41,000 tons in 2006, In Lake Nasser, it amounted to 26,000 tons in 2006 after it was 53,000 tons in 1997. On the other hand, fish production from Lake Brullus increased from 50,000 to 60,000 tons, and in the Timsah and Bitter lakes production increased from 2,700 tons in 1998 to 6,162 in 2006. In Lake Bardawil it increased from 2,000 tons in 1998 to 4,000 tons in 2006. There was also an increase in overfishing of fish fries, going from 13 million in 1998 to 41 million in 2006.

Between 1950 and 2008, Lake Manzala, the largest of Egypt's Mediterranean coastal wetlands and the most productive for fisheries, has lost nearly 70% of its surface area to farmland. Lake Maryout has been reduced by more than 75% of its former size and is still shrinking; if current trends continue, the lake could cease to exist by 2015. Another example is the Egyptian gazelle, which used to live in many places, is now restricted to 3 areas (the Eastern and Western Deserts and South Sinai).

The phenomenal coral reef formation is vulnerable to environmental changes, such as climate change. Harmful activities also threaten the existence of coral reefs, such as sewage discharge, spillage and human handling. In addition, fast development of tourism in Hurghada, Sharm El-

Sheikh and on the Gulf of Aqaba has led to the establishment of more hotels to accommodate for the increase in the number of local and international tourists, putting more pressure on the fragile marine ecosystems. Thus, there is a threat to Egypt's coral reefs and immediate action is required to protect this precious natural resource on which the tourism industry heavy relies on (Figure 6-1).

Figure 6-1 Relative Size of Revenues from Market Based Reef-related Goods and Services

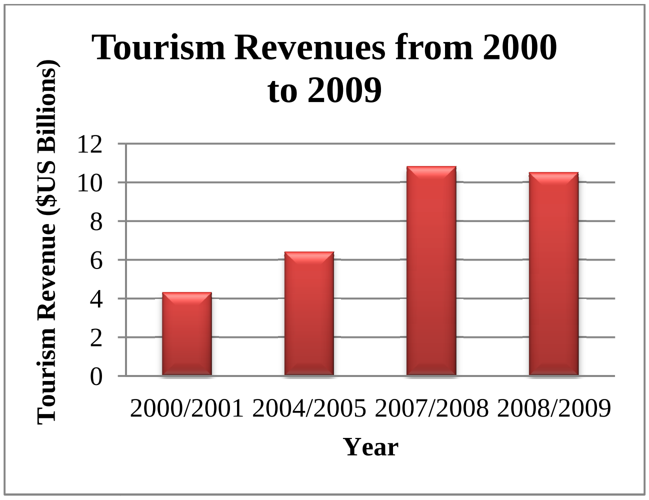


The quality of the environment is frequently the primary attraction for tourists. The continuing pressures on ecosystems will ultimately lead to their loss and degradation, significantly reducing the natural resources tourists came to enjoy.

Coastal tourism is the largest sub-sector within the Egyptian tourism market (Hilmi *et al*., 2012). While coastal tourism depends largely on intact reefs, it is also the single most important cause of reef degradation in Egypt. Over the last 3 decades, live coral cover has declined in Egypt and coral cover has started to show signs of degradation. One reference estimates that for selected sites there has been a decrease between 20-30% in the Egyptian Red Sea between 1987 and 1997 (Jamson *et al*. 1997) and this has been largely attributed to the impact of the expanding tourism industry in the country.The damage is caused by tourism's use of coral reefs (trampling, breaking of corals by divers, etc.) and through tourism facilities themselves (sewage, run-off, sedimentation, coastal alteration, etc.).

Tourism revenues increased from US$ 4.3 billion to 10.8 US$ 4.3 billion from 2004/2005 to 2007/2008, up by about 69%. . Tourism revenues were affected by the 2008/2009 financial crisis (Figure 6-2) and the political instability in the country since the 2011 revolution.

Figure 6-2 Tourism Revenues from 2000 to 2009 (Ministry of Tourism, 2009)



As mentioned earlier, the total contribution of Travel & Tourism to GDP was EGP217.1bn (12.6% of GDP) in 2013, and is forecast to rise by 1.1% in 2014, and to rise by 4.9% pa to EGP353.2bn (12.2% of GDP) in 2024, if both direct and indirect tourism related activities are considered). The tourism industry also provides employment for 12% of the national work force (AFP, 2007). Much of the revenue from tourism is derived from the Red Sea region (IUCN-USAID, 2007).

According to global estimates (World Bank, 2002), counting only the economic value of coral reef fisheries, tourism and shoreline protection, the cost of destroying 1 km of coral reef ranges between US$ 137,000 and 1,200,000 over a 25-year period. Properly managed coral reefs can yield an average of 15 tons of fish and other seafood per km^2 each year. This means that the total annual economic value of Egypt's Red Sea reef ecosystem is estimated at US$ 205.5 million to US$ 1,800 million and can yield about 1,400 tons of seafood annually (Hilmi *et al*., 2012)..

The issue of desertification has been recognized as a major economic, social and environmental problem of national and global dimensions. Possible implications range from human malnutrition to social instability involving community dislocation and forced emigration.

The high rate of population growth in the dry land associated with poor economic performance, exacerbated by degrading natural resources and, consequently, adding to the causes and effects of the desertification problem (The Environmental Profile, NEAP, 2000).

6.2 Impact of Invasive Species

6.2.1 Impacts on Biodiversity

Invasive species compete with and predate on native species,causing changes in ecosystem functions, and threateningspecieswith extinction.

6.2.2 Potential Impacts on Ecosystem Services and People

Potential impacts of invasive species includes the reduction of species diversity and homogenization, genetic contamination, loss of traditionally available resources, loss of potentially useful species, losses in food production, increased costs for agriculture, fisheries, water management and human health and disruption of water transport.

Examples:

The inadvertent introduction of the Water Hyacinth (*Eichhornia crassipes*) (Figure 6-3) in the Nile River led it to find its way into irrigation networks and drainage canals, rendering it a serious pest. Infected areas in Egypt amounted to 487 km^2, covering most of canals, and about 151 km^2 in lakes. Water loss resulting from evaporation in the infected areas amounts to 3.5 billion m^3 annually. This quantity is considered adequate to irrigate an extra 432 km^2 annually. This plant has caused water stream clogging and the changing of environmental components. It prevents sun light and oxygen from reaching submerged plants, which causes the decline of other aquatic organisms, and thus aquatic biodiversity.

Figure 6-3 Water hyacinth Hyacinth (*Eichhornia crassipes*)

Similarly, an exotic species of freshwater crayfish (*Procambarus clarkii*) (Figure 6-4) was introduced in aquaculture basins at the beginning of the 1980s. The crayfish eventually found its way into major water channels where it became a serious pest to commercial fish and to biodiversity in general. Freshwater crayfish are considered to be one of the biggest invasive species in the Egyptian aquatic environment. Two species of *Procambarus* have been recorded in Egypt, *Procambarus clarkii* and *Procambarus zonangulus*. *Procambarus clarkii* has invaded most of the upper and lower Egyptian governorates from the northern delta to Asuit. The existence of these species has caused many problems to fishermen, irrigation systems and agricultural crops. They burrow in fields, causing water flooding into other fields. They feed on buds of crops, attack fish nets and cause harm to fish.

Figure 6-4 *Procambarus clarkia*

Another example is the introduction of the Water Fern (*Azolla filiculoides*) (Figure 6-5) as a biological fertilizer in rice fields. The fern inadvertently escaped into water courses where it wiped out a number of other native hydrophytes (e.g. *Lemna spp.* and *Spirodela spp.*).

Figure 6-5 Water Fern (*Azolla filiculoides*)

The recent non-intentional introduction of Red Palm Weevil (*Rhynchophorus ferrugineus*) (Figure 6-6) and avian flu are other good examples of invasive species. Their estimated damage may cost the country billions of Egyptian pounds.

Figure 6-6 Red Palm Weevil (Rhynchophorus ferrugineus)

6.3 Impact of Overexploitation and Unsustainable Use

6.3.1 Impacts on Biodiversity

Overexploitation and the unsustainable use of resources causes extinctions and decreases populations sizes,introduces alien species after resource depletion andhomogenization and brings about changes in ecosystem functioning.

6.3.2 Potential Impacts on Ecosystem Services and People

Impacts of overexploitation and the unsustainable use of resources include decreased availability of resources, decreased income earning potential, increased environmental risk (decreased resilience) and spread of diseases.

Examples:

Virtually all-present Egyptian water bodies are fished to their maximum capacity and some have been overexploited already; potential production increase is marginal. Without additional production systems, either the percentage of self-sufficiency or the consumption per capita will decrease. The plan to maintain per capita consumption levels at 10 kg (or even to increase to over 14 kg in 2017) are not realistic, unless present production levels of existing resources are preserved and strong expansion of aquaculture and/or import takes place. Production levels are endangered already in a number of the current production areas by developments in other sectors: e.g. land reclamation in Lake Manzala and hyper-salinization in Lake Qarun. Fish production from all aquatic resources has increased by 69% in the period between 1989 and 1998.

Applied fishing techniques also have adverse impacts on fish production. They have affected the aquatic environment in many ways. Fishermen use inappropriate techniques to increase their catch. This has caused the killing of the small species traits and hence, decreased production. The use of large nets causes the death of a large number of non-target species through habitat destruction and being accidentally entangled by the net (The Environmental Profile, NEAP, 2000).

During the last 25 years, about 40 % of desert ecosystems plant species became extinct as a result of overexploitation for food and medicine. As a result of drought and unregulated hunting activities during the last 60 years, Mountain Gazelles (*Gazella gazella*), Scimitar-Horned Oryxes (*Oryx dammah*), Addaxes (*Addax nasomaculatus*) and Bubal Hartebeasts (*Alcelaphus buselaphus*) disappeared completely. Only Dorcas Gazelles and Rhim Gazelles (*Gazelle leptoceros*) remain and are presently threatened with extinction due to contraction of their ranges.

Furthermore, Loggerheads and Green Turtles have been listed as Endangered by the IUCN while the Leatherback Turtle is listed as Critically Endangered (UNEP/MAP 2012) due to degradation of beach nesting habitat and the loss of sea grass meadows which serve as feeding grounds for adult turtles.

Bird populations at IBAs face excessive mortality and disturbance due to unregulated hunting for food and supplementary income, falcon trapping and improper pest control practices.

Desertification results from a combination of the inherent fragility of the ecosystem and the excessive use that is beyond the productive capacity of the ecosystem itself. Such is the case in the degradation of rangeland in the northern coastal belt from overgrazing and the degradation of plant cover.

6.4 Impact of Climate Change

6.4.1 Impacts on Biodiversity

Climate change will to cause species extinctions, the expansion or contraction of species ranges, as well as changes in species compositions, interactions and distribution.

6.4.2 Potential Impacts on Ecosystem Services and People

Impacts of climate change include changes in resource availability (e.g. fisheries and crop plants), the spread of diseases to new ranges, changes in the effectiveness of protected areas and changes in the resilience of ecosystems (e.g. mangroves and coral reefs).

Examples:

Climate change impacts on biodiversity have been recorded throughout several monitoring programs: coral bleaching in 2007; Ombet trees (*Medemia argum*) (Figure 6-7) on elevated areas of Elba Mountain; medicinal plants in the St. Katherine mountain; and the Sinai Baton Blue (*Pseudophilotes sinaicus*) (Figure 6-8) with a home range that doesn't exceed 5 km^2.

Figure 6-7 Ombet Tree (*Medemia argum*)

Figure 6-8 Sinai Baton Blue Butterfly (*Pseudophilotes sinaicus*)

A warmer and more varied climate is expected in Egypt by 2030. Predicted impacts of climate change on Egypt include rising sea levels, temperature and precipitation, which will affect not only people but also biodiversity. Such changes may have an impact on vulnerable species of fauna and flora, threatening them to extinction. These expected changes will have a significant impact on water resources, agriculture and natural resources. Some sectors and/or activities are particularly vulnerable to climate change, namely health, tourism and the coastal strip where a considerable part of the country's socio-economic development is concentrated and which increasingly suffers from encroachment by the Mediterranean. The impact includes the migration of 2.5 million Egyptians to less risky areas, the loss of 250,000 jobs and 40 billion Egyptian pounds in agricultural production and tourism.

The impact of sea level rise, by reducing the area of coastal ecosystems, will increase hazards to human settlements. The degradation of coastal ecosystems and coral reefs will have very negative impacts on the tourism industry. The decline of fish stocks and their redistribution has major implications for food security and nutrition in poor regions, as communities often rely on fish protein to supplement their diet.

The low-lying land, especially farm land, located in the northern part of the Delta will be vulnerable to submersion with subsequent reduction in cropland area and agricultural biodiversity (Figure 6-9) (UNEP/ MAP/ Regional Activity Centre for Specially Protected Areas, 2009). This submersion could happen quickly under the joint effect of climate change, rise in temperature and the reduction of the sediment being carried down (blocked by the Aswan Dam).

Figure 6-9 Potential Impact of Sea Level Rise on the Nile Delta

Today

0.5 m sea level rise

1.0 m sea level rise

Tourism, one of the main sources of Egypt's national income, is predicted to be affected in the future by climate change. The number of tourists coming to Egypt's coasts each year is expected to decline because of the potential impact of climate change on coral reefs. Worldwide, almost all coral reefs have been affected by climate-change induced coral bleaching (Figure 6-10) at one time or another. Corals depend on a certain kind of algae (*Zooxanthellae*), using the nutrients they produce while providing the algae with physical support, protection and maintenance in adequate levels of sunlight for photosynthesis. When exposed to high water temperatures (more than 1°C or 2 °C rise in sea surface temperature above normal summer maximal temperatures for a period longer than 3–5 weeks), corals expel the algae, resulting in loss of coral color.

Figure 6-10 Coral Bleaching in the Red Sea (SOE, 2007)

Climate change will potentially affect biodiversity and species composition of Egyptian ecosystems, although not enough studies or data are available on this. There will be changes in the distribution of vector-borne infectious diseases and a reduction in the production of major crops. It also predicted that Egypt will be vulnerable to water stress while water demand increase amidst uncertainty of the Nile's flow. This will pose a serious threat to Egypt given the country's dependence on the Nile for irrigation and potable water.

It is predicted that Egypt will suffer from global changes in the distribution of flowering plants and pollinating insects due to climate change, which are predicted to cause dramatic declines in the ecosystem services they provide. The annual cost of losing Egyptian pollinators to the Egyptian national income was estimated in 2003 at approximately EGP 13.5 billion ($2.4 billion, 3.3% of the 2003 GDP).

6.5 Impact of Pollution

6.5.1 Impacts on Biodiversity

Pollution is known to cause extinctions, higher mortality rates, changes in species compositions, interactions and distribution, as well as nutrient loading and acidification.

6.5.2 Potential Impacts on Ecosystem Services and People

Impacts from pollution include decreased ecosystem resilience and productivity, the loss of coastal protection (with the degradation of reefs and mangroves and eutrophication) and anoxic water bodies leading to loss of fisheries.

Examples:

Northern Delta lakes are affected by nitrogen pollution greater than their critical loads. This pollution triggered eutrophication in lakes and the associated increases in algal blooms, impacting biodiversity and fisheries in lakes. For instance, Lake Maryout water pollution causes a remarkable effect on fish catch. The present catch is less than one fifth of the catch recorded in the sixties. Similarly, in Lake Edku, industrial waste and chemicals used to spur agricultural productivity nearby are severely damaging fish habitats in the lake, greatly affecting the fishing industry.

The quality of water available has a substantial bearing on fisheries. Pollution caused some fish species to go extinct and others to decrease in numbers (e.g. Sardine). The highest toxic residues were found where drainage water is present (northern lakes and fish farms) and in canals close to agricultural land. Toxic substances can build up in the tissues of fish, posing health hazards to the consumer.

Agricultural exports are also threatened by environmental degradation. Without controlling the use of pesticides and chemical fertilizers, rationalizing water use and improving other farming conditions, Egypt could lose its market share in agricultural exports, such as onions and potatoes. Industrial establishments have to acquire ISO 14000 or similar certificates to export their products abroad as eco-labeling will soon become a requirement to export to European countries.

7 Updating the National Biodiversity Strategy and Action Plan

Article 6 of the CBD on "General Measures for Conservation and Sustainable Use" states that each Party shall in accordance with its particular conditions and capabilities:

- Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity. This has come to be the principal instrument for the implementation of the Convention at the national level and to be known as NBSAPs.
- Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes or policies.

In 1998, Egypt prepared an NBSAP spanning the years 1998 to 2017 through a wide consultative process. In 2014, Egypt, as a Party to the CBD, has revised its NBSAP in line with the new CBD Strategic Plan for Biodiversity 2011–2020, through another wide participatory process. A 15 member National Biodiversity Committee representing various stakeholders and six working groups, assisted by national and international consultants, working in thematic and cross-cutting areas have been established to guide the update of the NBSAP. After initial stocktaking and appraisal of the current status of national biodiversity and the underlying causes of biodiversity loss, 6 strategic goals were identified to address the decline in biodiversity and achieving the Aichi Targets.In addition, the NBSAP sets clear national biodiversity targets and priorities and aims for the integration of biodiversity concerns into relevant sectors and contributing towards the achievement the global biodiversity agenda and the Millennium Development Goals (MDGs)..The **draft**NBSAP 2011-2020 has the following strategic goals and targets:

Strategic Goal 1: Conserve and manage terrestrial and aquatic biodiversity to ensure sustainable use and equitable benefits to the people:

Target 1.PAs network secured and expanded to cover 17% of total terrestrial and inland water and at least 5% of coastal and marine representative areas, especially priority sites of particular importance for biodiversity and key ecological processes.

Target 2.Action plans for conservation and / or rehabilitation of most threatened species and endemic species at risk are developed and implemented.

Target 3.National gene banks, seed banks, green belts, botanical gardens and public gardens are strengthened and effectively managed through integrated strategy for *ex situ* conservation of biodiversity together with measures for its implementation.

Target 4.By 2016, promote research on the potential impacts of GMOs on biodiversity and on related socio-economic aspects, and on methodologies to assess these in making import and export decisions.

Target 5. All invasive alien species (IAS) and pathways are identified and prioritized, measures are in place to manage pathways to prevent their introduction and establishment, and priority species are controlled or eradicated.

Target 6. The multiple anthropogenic pressures on coral reefs and other vulnerable ecosystems are minimized, so as to maintain their integrity and functioning by 2016.

Target 7. Conservation of biological resources through the adoption of ecologically sustainable agricultural and pastoral management practices, including control of fertilizer and pesticides, , traditional land use and water management systems, introduction of modern irrigation systems, etc.

Target 8. Incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, taking into account national socio economic conditions.

Target 9. By 2017, apply CBD tools to monitor and control the impact of tourism on biodiversity, in particular in protected areas and vulnerable ecosystems.

Target 10.By 2020, measures, including waste management plans and law enforcement,are in place to prevent and reduce the impact of pollution and waste on ecosystems, especially on wetlands and coastal and marine areas.

Target 11.Negative effects of different sectoral policies (land-use planning, transport, energy, uncontrolled urbanization, etc.) on priority elements of biodiversity are minimized, and measures to correct these effects are applied through developing andimplementing land use management plans and enforcing land use regulations.

Strategic Goal 2: Sustainable use of natural resources:

Target 12.Promote the sustainable utilization of terrestrial wildlife resources (Fauna and Flora)through developing or strengthening legislations and policies regulating /prohibiting hunting and capturing wildlife and expanding integrated management programs on rangelands, restoration of species and abatement of desertification.

Target 13.By 2017, promote the implementation of good fishing practices in wetlands and in both the Mediterranean and Red Seas, favourable to protection of fish and their habitats.

Target 14. Development of coastal zone management plans, establishment of marine protected areas, control hazard, and illegal and unsustainable fishing.

Target 15. Maintain agricultural and pastoral ecosystems and indigenous agro-biodiversity and support their rational and sustainable use though pilot projects and awareness campaigns.

Target 16. By 2017, promote the sustainable use of all genetic resources for food and agriculture and promote agricultural diversification of agricultural land in Egypt.

Target 17. By 2020, reduce the impacts of pesticides on biodiversity and ecosystem services to the half of the current situation.

Strategic Goal 3: Regulate Access to and Benefit sharing from genetic resources and associated traditional knowledge.

Target 18.Effective operational access and benefit-sharing (ABS) mechanism (measures and legislation) in place, in accordance with national laws and relevant international obligationsand serving national priorities relating to biodiversity.

Target 19.By 2020, create operational mechanisms to protect the knowledge, innovations and practices of local communities embodying traditional lifestyles relevant to the conservation and sustainable use of biodiversity.

Strategic Goal 4: Improve our understanding of biological diversity and ecosystem functioning in a changing environment:

Target 20. The national CHM becomes a nationwide inter-agency mechanism for monitoring the implementation and results of the NBSAP and other biodiversity related programmes, and compiling and synthesizing all existing data and information on national biodiversity and dissemination of this knowledge to a wider audience.

Target 21. The knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Strategic Goal 5: Prepare for climate change and combat desertification:

Target 22. Research and implement measures and strategies to strengthen local-level biodiversity resilience to desertification.

Target 23. By 2015, investigate and monitor all the effects of climate change on biodiversity and ecosystem services.

Target: 24. Research and implement adaptation and mitigation measures and strategies to strengthen local-level biodiversity resilience to climate change.

Strategic Goal 6: Build partnerships and integrate biodiversity into all national development frameworks:

Target 25. Raising environmental awareness of Egyptians of the importance of biodiversity and ecosystem services through integrating environmental themes by 2020 into university and school curricula, promoting green media, and supporting youth clubs and eco-industry.

Target 26. Government has developed and adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan by 2015.

Target 27. By 2016, ensure that the National Strategy is supported by effective legislation and institutional framework to improve its enforcement.

Target 28. Financial resources for the effective implementation of the Strategic Plan for Biodiversity 2011-2020 has been mobilized of from all sources, and increased substantially from the current levels.

Target 29. By 2020, biodiversity values are promoted and integrated into national and local policies, planning processes, development plans, and a mechanism to support their incorporation into national accounting and reporting systems is developed.

The Aichi Biodiversity strategic goals targets of the Convention's Strategic Plan for Biodiversity 2011-2020 adopted at Nagoya, Japan in 2010 (CBD, 2010) are listed in Annex 3.

The contribution of the NBSAP targets to the Aichi Biodiversity Targets of the Strategic Plan for Biodiversity 2011-2020 is outlined in Table 7-1.

Table 7-1 Contribution of NBSAP Targets to the Aichi Biodiversity Targets

National Biodiversity Target	Corresponding Aichi Biodiversity Target
Target 1	5,11
Target 2	12
Target 3	13
Target 4	19
Target 5	9
Target 6	10
Target 7	7,8
Target 8	3
Target 9	10
Target 10	8
Target 11	2
Target 12	7,14
Target 13	6
Target 14	6,11
Target 15	4,7,14
Target 16	13
Target 17	8
Target 18.	16,18
Target 19	16,18
Target 20	1,17,19
Target 21	19
Target 22	15
Target 23	10,15
Target 24	15
Target 25	2
Target 26	17
Target 27	17
Target 28	20
Target 29	1,2

8 Mainstreaming of Biodiversity in Relevant Sectoral and Cross-Sectoral Plans

The NBSAP leading up to 2020 provides a national framework for implementing the three objectives of the Convention and a significant contribution towards the global biodiversity agenda and integration of biodiversity concerns into relevant sectors and sets clear national priorities.

i) The contributions of the NBSAP to the achievement of the CBD Strategic Plan for Biodiversity and the Aichi Targets 2011-2020 are described in Sections 9 and 11 of the report.

ii) A number of national 2020 biodiversity targets are set for integration of biodiversity considerations into broader national plans, programmes and policies, economic and social sectors and levels of government.

iii) The actions contained in the NBSAP to 2020 address the main threats to national biodiversity, namely habitat loss and degradation, invasive alien species, pollution, overexploitation and unsustainable use and climate change.

9 Actions taken to implement the Convention on Biological Diversity and the National Biodiversity Strategy and Action Plan 1998-2017

National responses to the continuing loss of biodiversity are varied and threats to biodiversity are addressed through a number of activities. Some of the most significant results achieved in support of the implementation of the CBD and of Egypt's NBSAP are summarized below.

9.1.National Biodiversity Strategy and Action Plan

The Convention on Biological Diversity (CBD), coming into force at the end of 1993, requires all member states to develop a National Biodiversity Strategy and Action Plan (NBSAP) as the primary mechanism for the implementation of the CBD strategic plan with the aim to stimulate conservation action at the national level. TheNBSAP (1997-2017) was developed by Egypt using a wide participatory approach. The strategy was adopted by the Government in 1998 in response to Egypt's obligations under the CBD.

Although the NBSAP stimulated conservation action at the national level and contributed to a better understanding of biodiversity, its value and management have not been fully effective in addressing the main drivers of biodiversity loss or mainstreaming biodiversity and ecosystem services in development activities. Egypt, as a Party to the CBD, is revising its NBSAP in line with the new CBD Strategic Plan for Biodiversity 2011–2020, which includes reference to improving mainstreaming.

9.2.International and Regional Agreements and Strategies for Cooperation

Egypt is party to many conventions and agreements having provisions for the conservation of biodiversity, such as the Convention Relative to the Preservation of Fauna and Flora in their Natural State, the African Convention on the Conservation of Nature and Natural Resources, the

Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on the Conservation of Migratory Species of Wild Animals, the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (also known as the RAMSAR), the United Nations Convention on the Law of the Sea, the Convention on Biological Diversity and its biosafety and access and benefit sharing protocols, the United Nations Framework Convention on Climate Change, the United Nations Convention to Combat Desertification, the Convention for the Protection of the Mediterranean Sea against Pollution, the Protocol for the Protection of the Mediterranean Sea against Pollution from Land Based Sources and the Protocol Concerning Mediterranean Specially Protected Areas.

9.3.National Legislation, Institutional Support and Capacity Building to Protect Biodiversity

Egypt established a system and legislation for the conservation of its natural heritage. Of these, the most important are Law 48 (1982) for the Protection of the Nile River and Water Channels, Law No. 124 (1983) for Fishing, Aquatics and Regulating Fish Farms, Law 102/1983 as the legal framework for the declaration and management of protected areas (followed by the declaration of Ras Mohammed in South Sinai as the first protected area in Egypt), Law 124 /1983 for the regulation and management of fisheries, Law 101/1985 to secure a suitable source of funding for protected areas, Law 4/1994 on environmental protection, which constituted a supportive national legislation helping to fulfill Egypt's obligations under the CBD and regulating hunting of wild animals and prohibiting the destruction of their natural habitats.

Most recently the new constitution (the 2013 constitution, which will be subject for referendum on 14-15 January 2014) has clearly stated under sections 45 and 46 that the State is obliged to maintain protected areas and protect threatened and endangered species, provide the humane treatment of animals and promote wise and sustainable utilization of natural resources.

In order to strengthen the environmental structure and management process, the powers and duties for inspection, enforcement, and environmental assessment of the EEAA was increased and the NCSwas established. NCS liaises and coordinates activities with all sectors and departments of EEAA as well as with other relevant national, regional and international institutions.

Staff in Egypt's NCS reached more than 694 employees in 2013, including 7 holding PhDs, 33 with MSc degrees, 31 with BSc degree and 127 with higher intermediate education, with the remainder having basic essential education.

9.4.Protected Area Based Conservation

As indicated earlier, protected areas have been one of the primary responses for maintaining biodiversity in Egypt. They have expanded over the past 30 years in both number and area (Figure 4-1 and Figure 4-2). By 2013, 30 protected areas were established, extending over 14.6 % of the total land and marine areas of the country. They include a representative range of national habitats and physiographic regions, along with other sites of importance. The PAs network as of 2013 is presented in Annex 4. They also cover major habitat types/biomes and ecoregions of global importance identified in Egypt. However, the coverage did not meet the CBD 2020 Aichi Target. Outside protected areas, the proportion of sustainably managed production landscapes for agriculture, fisheries and aquaculture, amongst others, is limited.

In 2009, an assessment of management effectiveness of protected areas was carried out according to international standards using the Management Effectiveness Tracking Tool (METT) for seven PAs (Wadi Degla, St. Catherine, Nabq, Ras Mohammed, Northern Islands of the Red Sea, Wadi El-Gemal and the White Desert). The assessment was later extended to cover 11 PAs (39% of current protected areas), exceeding the target adopted by the CBD, which requires Parties to conduct evaluation for at least 30 % of their protected areas by 2010.

The main findings of the assessments were as follows:

- PAs generally meet their conservation objectives and the staff technical skills are generally good;
- The PA system is a vitally important socio-economic asset to Egypt but many benefits are unrealized;
- PAs are all under-resourced, far below the norm for Developing Countries or even for Africa;
- There is a marked disparity in the allocation of staff and budgets to areas as opposed to their needs and the national priorities in regard to biodiversity value;
- The conversion of land use, recreational use (especially tourism) and hunting are considered as the greatest pressures operating on the PA system and coordinated national strategies are required to address these issues;
- While there appears to be good local relations, local people don't necessarily support the PAs and they are not involved in management decisions;
- The system is vulnerable as a result of poor law enforcement, overexploitation of resources, lack of resources and excessive pressure on managers to accommodate unsustainable demands; and
- Site planning is generally poor and only half of the protected areas have formal management plans or definitive work plans.

The lack of financial resources is currently one of the main limitations to the effective management of existing protected areas in Egypt. Major sources of protected areas funding in Egypt currently include national government budget, bilateral and multilateral agencies (e.g. member countries of the Organization for Economic Co-operation and Development (OECD), the Global Environment Facility (GEF) and the World Bank). Generally, however, neither government budgets nor international assistance have kept pace with the expansion of Egypt's protected area network since the CBD came into force in 1993. In order to match the regional or developing countries norms, Egypt would need a many fold increase on current expenditure.

Although public sector funding and bilateral/multilateral assistance will certainly continue to be important funding sources, new and innovative financial mechanisms are required to fill existing and future funding gaps. Financial sustainability is a critical requirement of the effective protected area networks envisaged by Aichi Target 11.

Considering this situation and the economic value of protected areas, a number of economic instruments have been applied in Egypt to generate funds for protected areas and to make them financially self-sustaining. While several of these mechanisms have been around for some years, their successful implementation may also require new approaches to ensure protected areas indeed retain critical funds for effective performance and future growth.

9.5.*Ex-situ* Based Conservation (Breeding, Propagation and Rehabilitation)

Outside protected areas, complementary *ex-situ* conservation measures were undertaken for 17 animal and plant species. They resulted in the success of captive breeding for several endangered species for the first time in Egypt. These included the Scimitar Oryx (*Oryx dammah*), Arabian Oryx (*Oryx leucoryx*), Caracal (*Caracal caracal schimitizi*) and Crested Porcupine (*Hystrix cristata*). The cheetah (*Acinonyx jubatus*) was introduced for the first time since 40 years, in addition to breeding the fourth generation of Dorcas Gazelle (*Gazella dorcas*). African turtles became also available in large numbers.

Efforts have also been undertaken to rehabilitate some endemic flora and fauna species to increase their numbers in their natural habitats to protect them from extinction. These included the cultivation of some plant species in St. Katherine PA, including Arfeja (*Annarhinum pubscens*), Zayteia (*Septemcrenata nepeta*), Alloseeg (*Sailne shimperiana*), Alghasah (*Ballota kaiseri*) and St. Katherine Thyme (*Origanum syriacum*) with fenced areas to protect them from random grazing and other threats where the number of fenced areas reached 52 distributed in 18 sites; the rehabilitation of wild turtles (*Testudo kleinmanni*) within Zaranik protected area after its discovery in an area outside the PA; the reproduction of the Acacia tree (*Acacia raddiana*) in Wadi al Gemal PA; the reproduction of the Haglig tree (Balanites aegyptiaca) in the Elba PA; the reproduction of Sarh plant (*Maerua crassifolia*) in Wadi al Gemal PA (wild animals like gazelle, hyrax, hares and Al teatel pastures over seed, flowers and leaves of this plant); and the reproduction of the Nabq plant (*Zizyphus spina – Christi*) known as the apple of the desert in the Nabq PA.

Some of the most important endangered animal species that are currently under breeding are the Dorcas Gazelle(*Gazella dorcas dorcas*), the Nubian Ibex (*Capra ibex nubiana*), the Barbary Sheep (*Ammotragus lervia*), the Hyrax (*Procavia species*), the Fennec Fox (*Vulpes zerda*), the Striped Hyena(*Hyaena dubbah*), the Caracal (*Caracal caracal schmitizi*), the Swamp Cat (*Felis chaus*),the Addax Antelop (*Addax nasomaculatus*), Scimitar Oryx (*Oryx dammah*) and the Leptocerus Gazelle (*Gazella leptocerus leptocerus*), which is believed to be on the verge of extinction. These animals have all been bred successfully. A list of animals that are part of the *ex-situ* conservation program can be found in Annex 5.

***Medemia argun:* A Palm of Ancient Egypt**

Medemia argun (Figure 9-1) is acritically endangered palm species thathasamysterious history of its discovery. Itis an important piece of Egypt’s cultural and natural heritage. Itis a little known genus of fan palm in sub-tribe *Hyphaeninae* of tribe *Borasseae* (Sub-family *Coryphoideae*). The leaves of *Medemia* have been used for making mats; leaves are elastic, soft and strong. Camel's men made shackles for their camels from its leaves, they considered it better than doom and dates palm leaves. Bedouin used *Medemia* for making excellent ropes. The wood of the palm was used in building houses.

Figure 9-1 Medemia argun Trees and Fruits

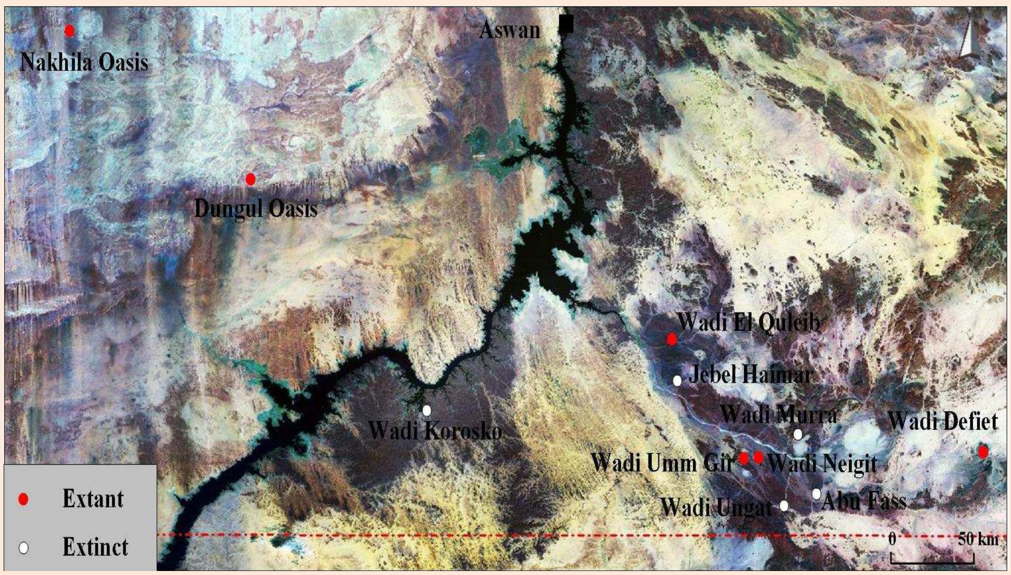
In the 1820s, fruits of *Medemia* had been first discovered as sub-fossil material among the offerings to the dead in Pharaonic tombs dating back to the 5th Dynasty including Tutankhamun’s tomb. In 1837, *Medemia* had been discovered alive in Wadi Delah, northern Sudan. Since then, few records of *Medemia* were reported by explorers active in northern Sudan. By the end of the 19th century, the Nubian Desert at the north of Sudan had dried up and British colonial officials in Sudan warned that the groves of *Medemia* were in danger of the extermination by the local people who wove matting from the leaves.

In March 1963, four *Medemia* trees were recorded in three sites east of the Nile in Egypt; Wadi Korosko, Wadi Difeit and Wadi Murra. And in November 1963, a population of female tree and seven juveniles was recorded in Dungul Oasis, Western Desert. A year after, a female *Medemia* treewas recorded at Nakhila Oasis along with remains of five other trees that had been felled, perhaps by nomads collecting leaves or fruits. Scientists suspected that *Medemia* might have become extinct, because it was unreported for more than 30 years. In October 1995, however, a *Medemia* population was rediscovered in Wadi Delah, northern Sudan. Shortly after its rediscovery in Sudan, in 1998, it was recorded in Egypt at Dungul Oasis; 36 trees with one fruiting female and three males were recorded.

Although *Medemia* has survived, population size appears to be limited in Sudan and highly restricted in Egypt. Moreover, the likely impact of climate change on *Medemia* in these critical sites is unknown. In the rare ecosystem in the Nubian Desert, *Medemia* supports the wild life by providing shelter and fruits as food for the animal life. The loss of *Medemia* will be a catastrophic cultural and natural heritage for Egypt.

A field survey had been conducted to produce an accurate map of the distribution of *Medemia* in Egypt (Figure 9-2). A list of 12 potential localities of *Medemia* distributed in southern Egypt was produced. *Medemia* population is highly fragmented in Egypt. The distance to the nearest neighbour site for the populations ranges from ca. 5 km for clustered sites (Wadi Neigit, Wadi Umm Gir) to ca. 100 km for remote sites (e.g. Nakhila Oasis). Population size varies widely; Wadi Neigit, Wadi Quleib, Wadi Umm Gir, Gebel Meshbeh and Wadi Defiet contain only one individual each. In Nakhila Oasis, only two individuals recorded (both males). At Dungul Oasis, 25 individuals were recorded at the most recent census (November 2011), including three females and three males.

Figure 9-2 *Medemia argun* Distribution in Egypt



The largest Egyptian population of *Medemia* at Dungul Oasis was monitored at intervals over a period of six years. *Medemia* has been extinct in five reported Egyptian localities, but confirmed its presence in five other sites, four of which are new records (Wadi Quleib, Wadi Umm Gir, Wadi Neigit and Gebel Meshbeh). Fruits were collected from Dungul Oasis during the field survey and were treated by water soaking and physical scratching to obtain the best treatment for germination. An *ex_situ* conservation experiment had been conduct in the Desert Garden of Aswan University in 2003; now three females and four males are growing there. In addition, *in_situ* conservation experiments had been conducted at Wadi Allaqi Biosphere Reserve.

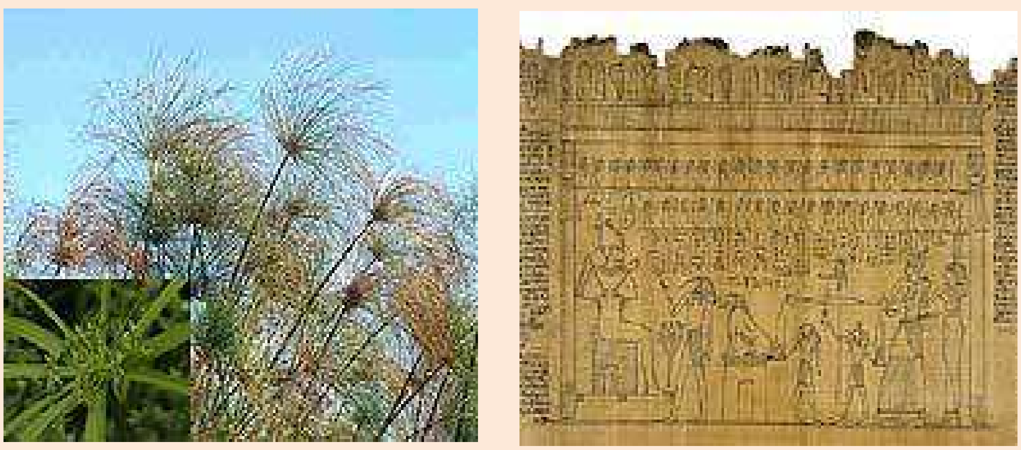
Nubian Desert extends in southern of Egypt and northern of Sudan in the eastern region of the Great Sahara Desert. The oases resemble like islands of life in the middle of the desert. Kurkur Oasis, Dungul Oasis and Nakhila Oasis are the most important oases in the Nubian Desert. They preserve vital parts of the Nubian history that may contribute to understanding of the North African origins of the Egyptian civilization. The Nubian Western Desert contained essential trading routes, due to the difficulty of traveling through the Nile Cataracts. Darb Al-Arbain and Darb Al-Galaba were the most famous routes that corridor between north and south of the Nubian Western Desert.

Ancient Egyptian Papyrus

Cyperus papyrus (papyrus sedge, paper reed, Indian matting plant, Nile grass) is a species of aquatic flowering plant belonging to the sedge family Cyperaceae. It is a tender herbaceous perennial, native to Africa, and forms tall stands of reed-like swamp vegetation in shallow water.

Papyrus has a very long history of use by humans, notably by the Ancient Egyptians (Tallet, (2012). Egyptians used Papyrus for many purposes, most famously for making papyrus paper (Figure 9-3). Its name in Greek and in English is widely believed to have come from Egyptian. A little boat (box) in which the mother of Prophet Musa put him before throwing the box into the Nile was made of papyrus dated back to 1350 – 1340 B.C. (Hammouda, 1999). She saved her son from being killed by the soldiers of King Pharaoh. The adventurer Norwegian anthropologist Thor Heyerdahl built two boats from papyrus, Ra and Ra II, in an attempt to demonstrate that ancient African or Mediterranean people could have reached America. He succeeded in sailing Ra II from Morocco to Barbados. In recent years papyrus has been the subject of intense ecological studies centered on its prodigious growth rate and ability to recycle nutrients.

Figure 9-3 *Cyperus papyrus* Plant and Paper



Long before there were textbooks, newspapers or email, the Egyptians came up with a way to record history. They designed their own paper called papyrus from reeds Papyrus (Cyperus papyrus). The word 'paper' comes from the Egyptian word 'papyrus'. Egyptians used papyrus for 4000 years until other plants and trees were used to make paper for economic reasons. Papyrus is still made, but normally only as a tourist attraction. It is nearly extinct in its native habitat in the Nile Delta, where in ancient times it was widely cultivated.

Tackholm and Drar (1950) reported that papyrus became almost extinct in Egypt more than 150 years earlier. The last traveler to notice it was Baroness V. Minutoli at Damietta and on the banks of Lake Manzala. No further record was made and the plant was considered extinct. For the purposes of teaching and research few specimens were introduced from Paris in 1872 and cultivated in Cairo and Alexandria gardens (El Hadidi, 1971). However, in 1968 El Hadidi discovered a stand of about 20 plants of C. papyrus among other reeds in a fresh water swamp close to Um Risha Lake of Wadi El-Natrun depression, Western Desert, Egypt. Recently, C. papyrus has been recorded in wetlands associated with the downstream section of the Damietta Branch of the Nile River (Serag, 2000) and in some islands of Nile River in the area of Cairo

(Hussein, 2000). Ragab was the first one to bring back papyrus to Egypt after its disappearance. In 1960, he travelled to Sudan and brought rhizomes of papyrus to Egypt which he planted on the banks of the Nile at Giza in a small plot which served as a nursery. It enabled him to establish a small plantation and start a flourishing papyrus sheet making industry with drawings of ancient Egyptian paintings (Ragab, 1980). During the past 50 years or so, Ragab was able to produce and export more than 10 million papyrus paper sheets.

9.6.Managing Invasive Species

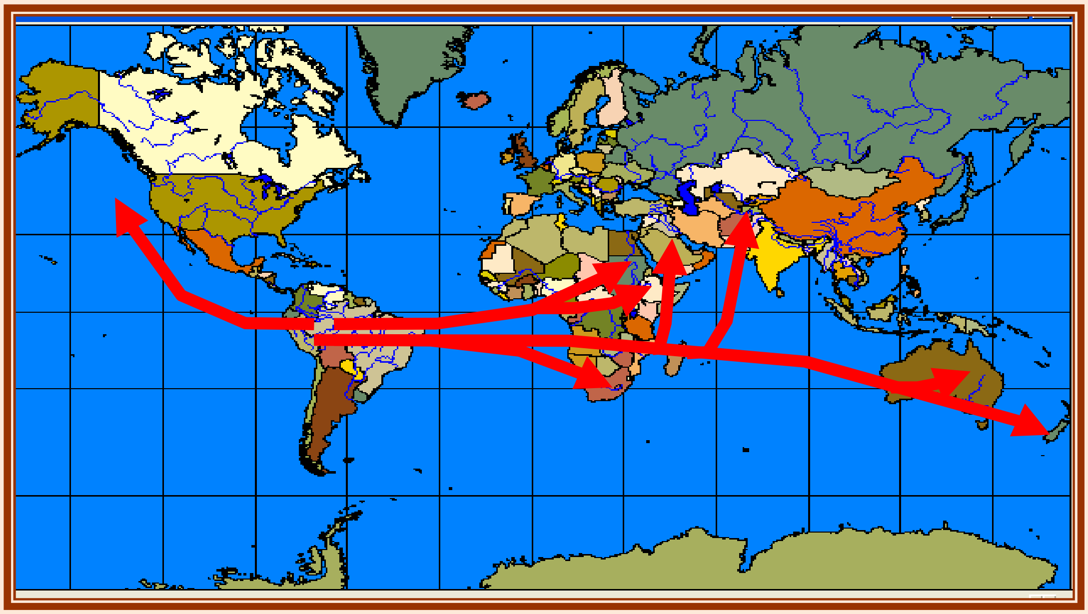
Successful management of invasive species relies on preventing the introduction and spread of species to new areas, as well as controlling and eradicating established invaders in accordance with different international agreements and organizations to which Egypt is party. In this regard, ample efforts were undertaken by the Ministry of Environment in collaboration with other relevant agencies to record different taxonomic groups of invasive species in Egypt, to control invasive species transported by seas and ballast water, and to obtain information about current status of marine alien-invasive species. Although this signifies the national intent to manage biological invasions, there are no pieces of legislation or strategies and management plans to control and eradicate existing ones and to prevent the introduction of new ones. Exerted efforts are still limited and the number of invasive species arriving in Egypt is increasing in spite of the fact that invasive species represent real threats to Egypt's ecosystems, economy and human health. Moreover, information on existing management activities either does not exist or is not readily available. Combating invasive species is beyond the country's current human, financial and technical capacity and requires participation of all concerned agencies.

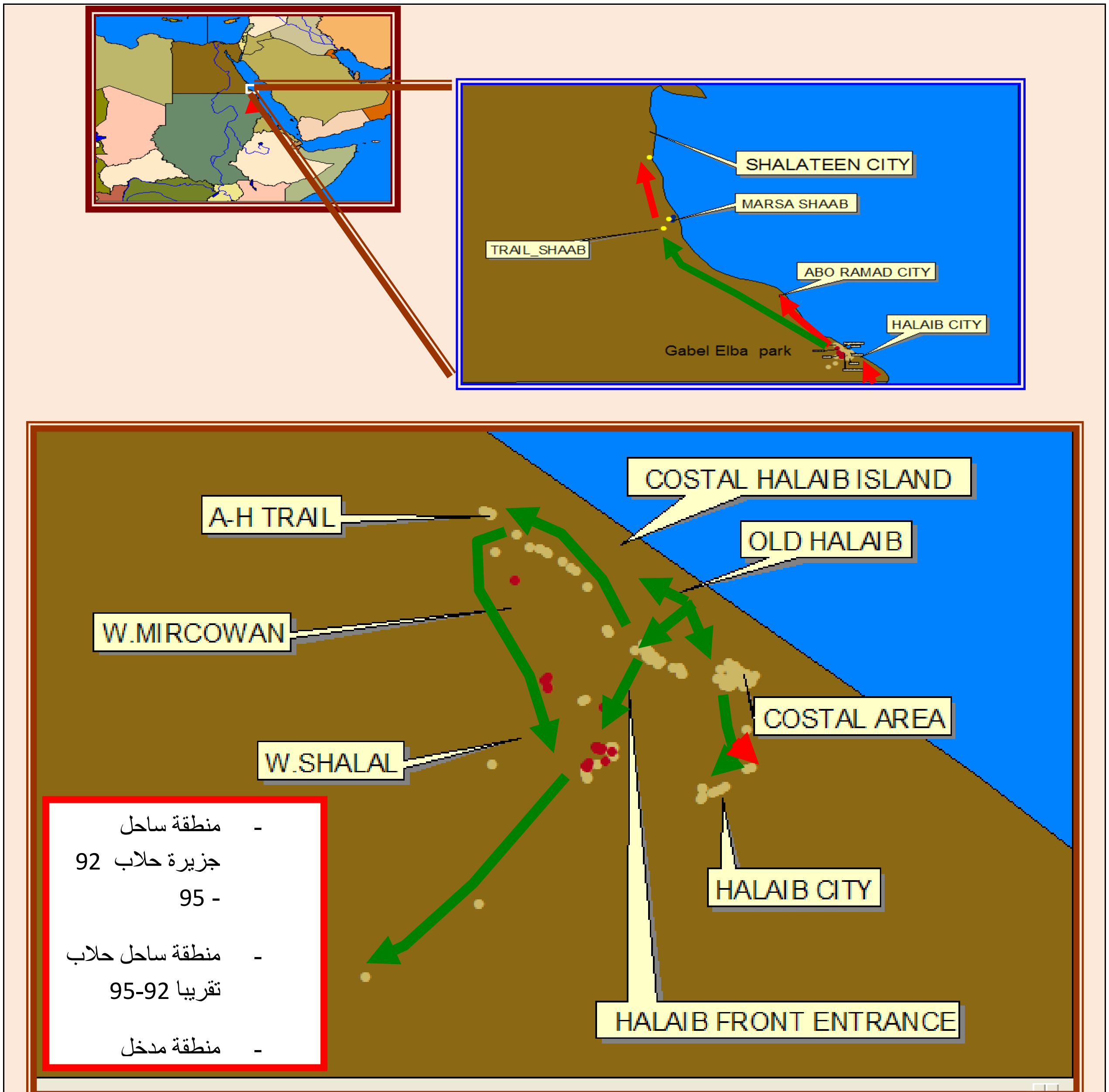
Mesquite: an alien invasive species

Mesquite (*Prosopis juliflora*) (Figure 9-4), a native Central American plant species,was introduced in the 1980s by one of the locals into the Gebel Elba PA for the purpose of forestation and coal production. It has spread (Figure 9-5) by grazing animals up to 150 km north along the Red Sea coast and 0.5 to 23 km east where it became a serious threat to the protectorate, as well as Egypt's plant diversity and general biodiversity in the southeast. Its spread has negatively impacted the whole ecosystem functions and water balance in the area. It led to condensation of local plant cover, increasing grazing in many of the protected areas, including salt marshes along the Red Sea coast and the protectorate desert plains and valleys. An environmental monitoring program has been ongoing since 1994 and a combat program was developed with participation of local communities.

Figure 9-4 Mesquite (*Prosopis juliflora*)

Figure 9-5 Spread of Mesquite





Current distribution status of mesquite(*Prosopis juliflora*)

9.7.Managing Wildlife Trade and Use

Although there is no reliable information available on wildlife trade and use in Egypt because they are not appropriately regulated, or managed through permit and licensing systems, all available data suggest that intensive commercial collection and habitat destruction are the two main factors which have led to the disappearance of many wildlife species in Egypt. For instance, the Egyptian Tortoise (*T. kleinmanni*) is disappearing from much of its former range because of intensive collection for trade and habitat destruction despite that it was protected by the Minister of Agriculture Decree 1403 for 1990. This decree however was not implemented and has joined similar wildlife conservation legislation in their fate of ineffectiveness. Egypt is probably one of the most important countries in the international trade of migratory species, whether through direct export of its natural resources which are mostly endangered or its position as a transit country for many species that come from Africa or species that are being smuggled through illegal trade. There have been exerted efforts since early 2000 to form administrative and scientific committees to strictly regulate and control all Egyptian "seaports and airports", as well as to prohibit the trading of endangered species and carry out inspection campaigns in hotels and bazaars that sell endangered species and/or their derivatives (leather and ivory handicrafts). However, these efforts have not been as effective due to the limited qualifications and capacities of committee members and customs employees (mostly veterinarians). These institutions and their personnel require the enhancement of their technical and institutional capacities. They require training in conducting scientific surveys on the current statuses and trends of endangered species, in order to issue exporting permits on a scientific basis. There is also a need to implement education and public awareness campaigns at all levels.

9.8.Managing Agriculture and Biodiversity

Sustainable agriculture has received increasing attention because expanding agriculture is globally the principal driver of biodiversity decline. The extensification of agriculture in Egypt required more land than intensive agriculture to achieve the same production levels. Although it may have fewer impacts on wildlife and human health, it led to habitat loss and fragmentation, as well as the erosion of genetic diversity. In response, the National Gene Bank (NGB) situated in the Agricultural Research Center (Giza) began the process of collecting, conserving, describing, evaluating, regenerating and documenting the genetic resources of the flora, fauna and micro-organisms in the agricultural field. The NGB's capacity encompasses 200,000 genetic origin samples, but the plant genetic origins of the field and horticulture crops is estimated to be ≥ 35,000 genetic origins, 500 of which are vegetables collected from the breeding programs and international gene banks. More than 8,000 genetic resources were evaluated. The evaluation of these genetic resources included field, molecular, cytological, chemical and biochemical evaluation. All the information and data obtained during field and lab evaluations are documented in their database. In addition to conserving accessions of true seeds, the NGB has an in vitro tissue culture laboratory and storage facilities for short and medium term conservation of vegetatively propagated species. Cryopreservation equipment for long term in vitro conservation, including orthodox seeds, is present in the tissue culture laboratory. Protocols for in vitro shoot tips cryopreservation of grapes have been optimized and established.

In addition, there are many botanic gardens in Egypt with competent staff and good management. Almost all of the Egyptian plant collections are kept in the herbaria of the universities, research centers and botanical gardens. Nine of these herbaria have been registered in the Index Herbarium of the New York Botanical Garden.

In addition to the establishment of the NGB as the primary *ex-situ* conservation facility, there are several botanical gardens which were established during the last 120 years (Annex 6). Most of these botanical gardens belong and are supervised by the Ministry of Agriculture and Land Reclamation.

The use of genetically modified organisms (GMOs) was identified as one of the new approaches that combine the most effective, least harmful practices from intensive and extensive farming. However, the use of GMOs in agriculture, and also in aquaculture, potentially presents both threats and opportunities for biodiversity. To maximize the benefits and to minimize the potential threats of GMOs for biodiversity, the status of GMOs in Egypt was studied within a national framework concerned with the safety of handling, transporting and using GMOs through the Biosafety project funded by GEF/UNEP. A draft law has been prepared and approved by the Ministry of Justice pending its submission to the People's Assembly.

Organic agriculture in Egypt dates back to the mid-1970s. Biofertilizers and compost have been produced and applied to legume crops and cereals to increase food production while reducing the amount of chemical fertilizers applied to crops. The Ministry of Agriculture has realized the importance of organic farming of vegetables, fruits and some crops. Egypt's first organic farm was launched in 1977 by Sekem which recognized that fertilizers and pesticides were degrading the soil and seeping into the food chain. By 2013/2014, the total area of organic farming had reached about 170,000 hectares (Table 9-1). There are over 700 farms and 160 companies working in this field.

Table 9-1 Development of Organic Farming in Egypt

Year	Area (ha)	% Organic
2005	24,548.4	0.72
2006	14,165	0.41
2007	19,205.89	0.54
2008	40,000	1.13
2009	56,000	1.58
2010	82,167	2.23
2013	170,000	1.7

Source: The Central Laboratory for Organic Farming, National Agricultural Research Center, Giza, Egypt

The Ministry of Agriculture and Land Reclamation is taking necessary steps to issue a decree outlining the rules and procedures of organic farming for conserving the newly reclaimed agricultural lands (e.g. Tushka Project in the southwest Egypt) from the excessive use of fertilizers and herbicides. A number of certifying agents are starting now to register, inspect and certify organic products.

9.9.Local Community Empowerment-Conserved Areas

Local community empowerment-conserved areas are increasingly recognized as legitimate and powerful tools for biodiversity conservation and sustainable use. In Egypt, none of the existing protected areas is being managed by local communities. Although local communities are not excluded from protected areas, their role in safeguarding biodiversity remains a challenge to real progress. However, the linkages between poverty alleviation and well-functioning ecosystems is emphasized at the local and community level, where the impacts are felt, as well as at a national level where important decisions about economic growth and development are made. Local communities are encouraged to actively participate through partnership arrangements as in the case of the medicinal plants project. A number of important poverty alleviation and community development programs have been initiated. These programs present opportunities for improving natural resource management and employment for local communities and linking biodiversity and social development.

9.10. Regulating Access and Benefit Sharing of Genetic Resources and Associated Traditional Knowledge

By ratifying the Nagoya Protocol on access and benefit sharing of genetic resources and associated traditional knowledge in 2013, Egypt is committed to the implementation of the benefit sharing provisions of the CBD once the protocol enters into force. To date, Egypt has no national legislation or administrative mechanisms pertaining to access to Egypt's genetic resources and associated traditional knowledge and benefit sharing from their utilization. The absence of legal and administrative mechanisms to regulate access to Egypt's genetic resources and to set conditions for benefit-sharing is a key constraint towards achieving more meaningful benefit sharing. However, a draft law on the regulation of access to genetic resources and related traditional knowledge and the equitable sharing of benefits from their use has been finalized. In addition, a strategy on medicinal plants, including improving partnerships with the private sector and civil society, was completed and adopted by the Egyptian Government.

9.11. Recognizing the Value of Cultural Diversity and Traditional Knowledge

The CBD's Strategic Plan and the Aichi Biodiversity Targets support greater respect of traditional knowledge and its full integration and reflection in the implementation of the CBD at all levels, with the full and effective participation of indigenous and local communities (Aichi Target 18).

Egypt embarked on the protection and documentation of traditional knowledge and their usage, particularly in protected areas. This was achieved through the registration of 38 species of medicinal plants in South Sinai, 45 species in North Sinai, 19 species in the Elba area, 13 species in the Western Desert and 16 species in the Eastern Desert. Furthermore, handicrafts and linkages of cultural heritage with natural heritage in protected areas were registered.

The recently finalized draft law on the regulation of access to genetic resources and related traditional knowledge and the equitable sharing of benefits from their use covers the protection of traditional knowledge, innovations and practices of communities concerned with biological resources within a framework recognizing their individual and collective rights.

9.12. Managing the Impacts of Climate Change on Biodiversity through Mitigation and Adaptation

Adaptation to climate change refers to the adjustment in natural or human systems in response to actual or expected climate stimuli or their effects which moderates harm or exploits beneficial opportunities. Examples include the establishment of new environmental regulations and institutions, the development of water supply, coastal infrastructure and the management of forests. Mitigation is an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases such as carbon dioxide, methane and nitrous oxide.The Ministry of State for Environmental Affairs established the "Climate Change Central Department" which includes General Directorates for Risks and Adaptation, Mitigation and Clean Development Mechanism, research and Technology of Climate Change and Climate Change Information. The Climate Change Central Department is pursuing a low-carbon development strategy for sustainable development in the context of national plans of different sectors through pilot and operational adaptation and mitigation projects with the support of UNDP and other agencies.

9.13. Communication, Education and Public Awareness

A Communication, Education and Public Awareness Strategy (CEPA) was prepared in 2009 following CBD guidelines. It covers issues such as the importance of taking necessary steps to conserve biodiversity; allocating suitable materials in the field of education, communication and defining targeted groups; mainstreaming biodiversity in education strategies; establishing an effective method for communication and exchange of information; developing data bases and establishing websites; publishing books, reports, CD's, films, videos; and holding workshops, TV and radio interviews, delivering lectures for targeted groups. This strategy has achieved success in raising public awareness that can be manifested through the increasing number of protected area visitors and the increasing number of electronic mail reporting violations in protected areas by local inhabitants, as well as public and foreign tourists.

10. Mainstreaming Biodiversity into National Sectoral and Cross-Sectoral Strategies, Action Plans and Programmes

The impacts and root causes of biodiversity loss cut across a wide range of economic sectors. It is therefore essential to "mainstream" biodiversity in development policy and planning processes, rather than pursue them as separate agendas. The challenge of integration, or "mainstreaming", is to bring on board and engage other development sectors, in particular those government ministries and agencies that are responsible for national development.

10.1. National Biodiversity Targets and the Millennium Development Goals

The UN Millennium Declaration and the Millennium Development Goals (MDGs) call upon countries to "integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources". The requirements of integration cover several dimensions: i) integrating the multiple perceptions, needs and aspirations of different stakeholders; ii) integrating economic, social and environmental objectives – or making informed choices between them where full integration is not possible; iii) integrating technical planning concerns in political decision-making processes; iv) linking policy making processes with budget allocation mechanisms; v) linking different sectoral strategies and vi) linking local, national and global levels.

The links between the national biodiversity targets contained in the NBSAP to 2020 and the MDGS are outlined in Table 10-1.

Table 10-1 Millennium Development Goals and National Biodiversity Targets

MDGs	National Biodiversity Targets
Goal 1. Eradicate extreme poverty and hunger	3,5,7,12,13,15,16,
Goal 2. Achieve universal primary education	
Goal 3. Promote gender equality and empower women	18,19
Goal 4. Reduce child mortality	
Goal 5. Improve maternal health	17
Goal 6. Combat HIV/AIDS, malaria, and other diseases	

Goal 7. Ensure environmental sustainability	18,22,23,24,25,29
Goal 8. Develop a global partnership for development	20,21,23,24

10.2. Mainstreaming Biodiversity Concerns into Productive Sectors

To date, most biodiversity conservation agendas have been addressed by the NCS/EEAA, with modest success in mainstreaming biodiversity concerns into productive sectors in the country, most importantly in the tourism and agricultural sectors (the two sectors with the most natural affinity with biodiversity). Strategies were approved for wetlands (2005), ecotourism (2006) and the maintenance of natural habitats (2007) involving various institutions, such as the National Commission for Sustainability, the National Committee for the Integrated Management of Coastal Areas, the National Committee on Climate Change and the National Committee on Wetlands and Sub-Humid Areas, with a view to aligning political strategies and work plans. In addition, programs have been introduced for enhancing the effectiveness of relevant government agencies, as have studies on the need for new institutions at the central and local government levels. Finally, programs for mobilizing financial resources from national and international sources have been launched in support of projects favoring biodiversity conservation.

There is still limited evidence showing that biodiversity concerns are being seriously considered in policies, legislation and regulations governing most of the productive sectors in the country. Biodiversity conservation is still viewed as an environmental issue and was not effectively integrated into national development planning and policy-making. Therefore, it did not receive priority attention in the face of competing needs. The main challenges to integration are:

I) Lack of awareness of the potential impacts of biodiversity loss for ecosystem services and for people. Much remains to be done to understand and forecast the likely socioeconomic impacts of biodiversity loss at the local and national levels.

II) The lack of effective institutional mechanisms for integrating biodiversity issues in broader national development policies to ensure coordination, cross-sectoral policy integration and budgetary allocations. Implementation of the NBSAP should not be the sole responsibility of the Ministry of Environment but of all stakeholder governmental institutions.

The exceptions to this being the tourism sector where biodiversity has been seen for some time now as an important resource critical for the continued growth and diversification of the tourism industry in the country. Also in the agriculture sector, where biodiversity has direct implications for this important economic sector and where the Ministry of Agriculture regulates the import and export of wildlife. The National Land Use Map acknowledges the existing and future PA boundaries which carries some weight in influencing some of the land use plans. The Ministry of Foreign Affairs plays a role in managing the protocol aspects of international agreements related to biodiversity in coordination with the NCS/EEAA. In other sectors biodiversity concerns are seldom integrated in the planning phase, but rather in a precautionary reactive fashion in order to avoid negative impacts. The EIA/ ESIA process has been a critical instrument in integrating biodiversity concerns in the development agenda in Egypt.

Protected areas have been the main vehicle for mainstreaming biodiversity. The Environmental Impact Assessment process has become the main systemic tool for managing risks to biodiversity (Figure 10-1 and Figure 10-2). Biodiversity is regularly being taken into consideration in most of the major development projects subjected to the EIA process. This has proven to be a critical tool in managing impacts on biodiversity resources outside the PAs network, where there is still a need for legislation that regulates their use. It is also obvious that the environment is maintained and considered in most national action plans of different sectors; a person responsible for the environment is found in each ministry, in addition to an environmental department in every governorate.

Protected areas have been the main vehicle for mainstreaming biodiversity. The Environmental Impact Assessment process has become the main systemic tool for managing risks to biodiversity (Figure 10-1 and Figure 10-2). Biodiversity is regularly being taken into consideration in most of the major development projects subjected to the EIA process.

Figure 10-1 Environmental Impact Assessments of Development Projects

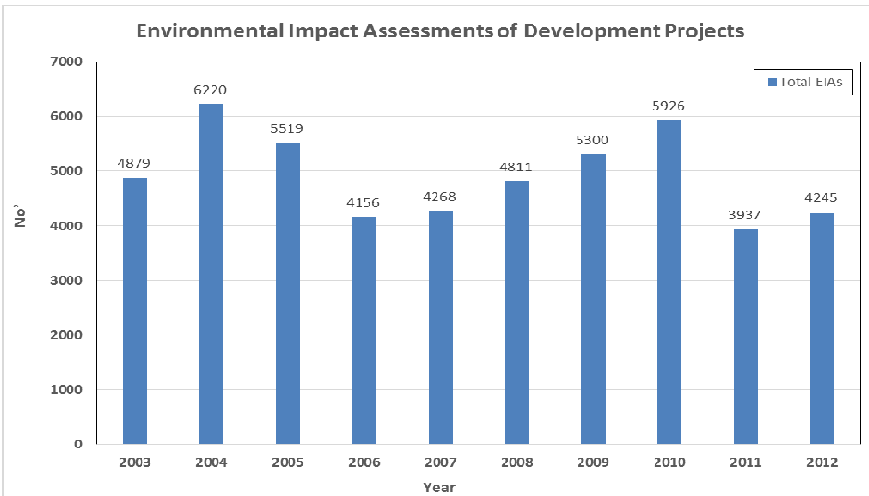
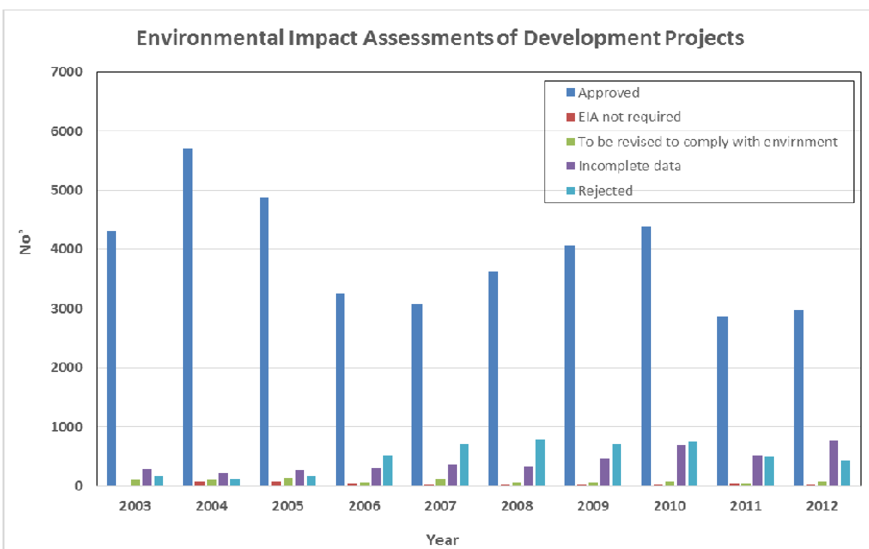


Figure 10-2 Environmental Impact Assessment Statuses



11.Status of Implementation of the National Biodiversity Strategy and Action Plan 1998-2017 and the Convention on Biological Diversity 2010 Targets

Egypt's NBSAP was approved by the Government in 1998. The actions taken by Egypt to implement the CBD and the outcomes of these actions, as described in Section 9 of this report, should be seen as direct contributions to the implementation of the NBSAP 1908-2017. It should also be noted that the NBSAP 1998-2017 was developed with limited guidance from the CBD as it predated the first CBD Strategy and Action Plan 2002-2010. Thus, no clear national targets or indicators have been established and the NBSAP was not structured to be directly related to the global biodiversity conservation agenda (CBD 2010 targets). Instead, it addressed the Egyptian situation at the time of its development. The NBSAP 1998-2017 had six main goals and a national action plan composed of 11 programmes categorized into enabling and supporting, applied research and monitoring projects.

In April 2002, the Parties to the CBD committed themselves to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth. They identified 7 global focal areas (COP VII/30) and a provisional framework of 11 goals and 21 action-oriented targets (COP VIII/15) for achieving their commitment.

The seven global focal areas are:

I. Reducing the rate of loss of the components of biodiversity, including: (i) biomes, habitats and ecosystems; (ii) species and populations; and (iii) genetic diversity;
II. Promoting sustainable use of biodiversity;
III. Addressing the major threats to biodiversity, including those arising from invasive alien species, climate change, pollution, and habitat change;
IV. Maintaining ecosystem integrity, and the provision of goods and services provided by biodiversity in ecosystems, in support of human well-being;
V. Protecting traditional knowledge, innovations and practices;

Ensuring the fair and equitable sharing of benefits arising out of the use of National responses to the continuing loss of biodiversity are varied and threats to biodiversity are addressed through a number of activities. Some of the most significant results achieved in support of the implementation of the CBD and of Egypt's NBSAP are summarized below.

VI. genetic resources; and
VII. Mobilizing financial and technical resources, especially for developing countries, in particular least developed countries and Small Island developing States among them, and countries with economies in transition, for implementing the Convention and the Strategic Plan.

The links between the NBSAP 1998-2017 goals and the CBD 2010 focal areas are outlined in Table 11-1.

Table 11-1 Links between the Egyptian NBSAP 1998-2017 and CBD 2010 Focal Areas

NBSAP main goals	Links with CBD 2010 Focal areas
1. Management of natural resources should be founded on scientific basis that ensure maintenance of natural balances.	Strongest relevance to targets (a) Reducing the rate of loss of biodiversity and (d) Maintaining ecosystem integrity.
2. Development of Egyptian scientific and technological capabilities in the fields of biodiversity conservation, and development of institutional and managerial capacities	Broad relevance to all targets in particular target (c) Addressing the major threats to biodiversity
3. Mobilize national capacities and resources to conserve biodiversity with its ecological, taxonomic and genetic elements; to ensure the sustainability and rational use of these elements.	Meets target (b) Promoting sustainable use of biodiversity
4. Set programs of action that ensures the positive participation of people, in biodiversity conservation, and in enjoying their equitable shares of benefits of these endeavors.	Meets targets (f) Ensuring the fair and equitable sharing of benefits arising out of the use of genetic resources and (e) Protecting traditional knowledge, innovations and practices
5. Establishment of legal instruments and economic and social incentives that support conservation and sustainable use of natural resources.	Meets targets (b) Promoting sustainable use of biodiversity and (d) Maintaining ecosystem integrity, and the provision of goods and services provided by biodiversity in ecosystems, in support of human well-being
6. National actions should complement regional and international actions in the fields of biodiversity conservation.	Supports the implementation of international commitments to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level

11.1. Progress towards Implementing the National Biodiversity Strategy and Action Plan 1998-2017

Annex 7 provides an assessment of progress made towards implementing each of the programmes as outlined in the NBSAP 1998 - 2017. Progress in implementation is mixed, with significant progress in few areas, and limited progress in many others.

11.2. Progress towards Implementing the Convention on Biological Diversity 2010 Targets

The Nature Conservation Sector of the EEAA has adopted and implemented various measures and programs to meet the challenges of biodiversity in Egypt. Some of these programs are in progress and others are still in initial stages. Table 11-2 and Table 11-3 summarize the national achievements made towards the 2010 Targets of the Convention on Biological Diversity (CBD).

As mentioned previously, to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level, Parties to the CBD committed themselves to seven global focal areas (COP VII/30) and a provisional framework of 11 goals and 21 action-oriented targets (COP VIII/15).

Table 11-2 provides an assessment of progress made towards the CBD 2010 targets using the CBD focal areas and the indicators developed by the Biodiversity Indicators Partnership (BIP) for measuring progress (http://www.bipindicators.net/LinkClick.aspx?fileticket=6AmjPbR9ZYI%3d&tabid=59) (CBD Decision VIII/15). Table 11-2 suggests that trends of biodiversity status in Egypt are in a down turn and are not meeting the global targets; this is despite a significant increase in conservation efforts and expenditures (as clearly indicated by the expansion of the PA network and the substantial investment in biodiversity focused projects in Egypt).

Table 11-2 Progress Made Towards Global Focal Areas

Focal Area	Headline Indicator	Progress made
1. Status and trends of the components of biodiversity	1.1 Trends in extent of selected biomes, ecosystems, and habitats	In most cases habitats, ecosystems and biomes have declined in area or quality or both. This is especially true in habitats that are subject to socioeconomic pressures, such as wetlands, rangelands, marine habitats and agricultural landscapes. Reclamation, overgrazing, quarrying and urbanization are amongst the leading threats.
	1.2 Trends in abundance and distribution of selected species	Ungulates and waterbirds have been subject to extended monitoring efforts over the past two decades that can be used in evaluating trends with some confidence. Wintering waterbird numbers have shown significant declines, while ungulates have shown shrinkage in range and decline in numbers.
	1.3 Coverage of protected areas	The number and area of protected areas has grown significantly (from 21 PAs occupying 77,776 km² to 30 PAs covering 141179.5 km² in 2013) now representing over 14% of the land area of Egypt.
	1.4 Change in status of threatened species	The number of threatened species has increased partly due to recent assessments of previously un-assessed groups, such as reptiles and amphibians. No species have come out of the threat category due to improved conservation, but rather due to changes in threat classification globally.

Focal Area	Headline Indicator	Progress made
2. Sustainable use	2.1 Areas under sustainable management	Some success stories but proportionally the area and proper application of concept is still minimal.
	2.2 Proportion of products derived from sustainable sources	The trend is growing, but contribution is still small.
	2.3 Ecological Footprint and related concepts	Not available.
3. Threats to biodiversity	3.1 Nitrogen Deposition	Not available.
	3.2 Invasive Alien Species	Number of invasive species is stable or increasing, and impact and area of occurrence is extending.
4. Ecosystem integrity and ecosystem goods and services	4.1 Marine Trophic Index	Marine Trophic Index (MTI) for Egypt (see http://www.seaaroundus.org/eez/818.aspx) seems stable
	4.2 Water quality of fresh water ecosystems	Generally declining.
	4.3Connectivity/fragmentation of ecosystems	Egypt falls in a region strongly affected by river ecosystem fragmentation (http://www.bipindicators.net/riverfragmentation/2010)
	4.4 Health and well-being of communities dependent on system goods	No national level data.
	4.5 Biodiversity for food and medicine	Limited national level data.
5. Status of traditional knowledge, innovations and practices	5.1 Status and trends of linguistic diversity and numbers of speakers of indigenous languages	Linguistic diversity is maintained and not immediately threatened.
6. Status of access and benefits sharing	*To be determined*	Draft law on the regulation of access to genetic resources and related traditional knowledge and the equitable sharing of benefits from their use has been finalized pending approval by the Egyptian Government.
7. Status of	7.1 Official	Egypt has been the host of 29 GEF funded projects

Focal Area	Headline Indicator	Progress made
resource transfers	development assistance provided in support of the CBD	with a total cost of US$ 133 million; about a third of this went to biodiversity focused activities.

Table 11-3 provides an assessment of progress made at the national level towards the CBD 2010 targets using the CBD provisional framework of goals and targets.

Table 11-3 Progress Made towards CBD 2010 Targets

2010 Goals and Targets	**National Progresses/Achievements**
Goal 1. Promote the conservation of the biodiversity of ecosystem habitats and biomes	
Target 1.1 At least 10% of each of the world's ecological regions effectively conserved	By 2013, 30 protected areas were established, covering over 146,000 km^2 or about 14.6 % of the total land and marine areas of the country.
Target 1.2: Areas of particular importance to biodiversity protected	The nationally designated protected areas system contains a good representation of Egyptian habitats with high biological significance, along with other sites of importance such as biodiversity hotspots, cultural heritage, geological formations, landscapes of outstanding natural beauty and Important Bird Areas (IBAs). According to the WWF global classification, Egypt falls in the Palearctic biogeographical realm or ecozone and contains habitat types and ecoregions of global significance. Existing Pas network contains a good representation of these habitat types and ecoregions. Egypt's most important marine biodiversity hot spot (i.e. Red Sea coral reefs) is fairly represented by the existing PAs network. Similarly, the country's four terrestrial biodiversity hot spots (St. Katherine, Elba, wetlands and western Mediterranean coastal desert) fall completely within existing protected areas.
GOAL 2: Promote the conservation of species diversity	

2010 Goals and Targets	**National Progresses/Achievements**
Target 2.1: Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups	The distribution of most of the endemic taxa in Egypt coincides with that of the biodiversity hot spots. They are fairly covered within the existing PAs network. Outside protected areas, complementary *ex-situ*conservation measures were undertaken for 17 animal and plant species. They resulted in the success of captive breeding for several endangered species for the first time in Egypt. These included Oryx dammah and Arabian Oryx, Caracal and porcupine. Cheetah was introduced for the first time since 40 years, in addition to breeding the fourth generation of Egyptian Gazelle. African turtles became also available in large numbers. Efforts have also been undertaken to rehabilitate some endemic flora and fauna species to increase their numbers in their natural habitats to protect them from extinction. These included: cultivation of some plant species in St. Katherine PA, including Arfeja (*Annarhinum pubscens*), Zayteia (*Septemcrenata nepeta*), Alloseeg (*Sailne shimperiana*), Alghasah (*Ballota kaiseri*) and St. Katherine Thyme (*Origanum syriacum*) with fenced areas to protect them from random grazing and other threats where the number of fenced areas reached 52 distributed in 18 sites; rehabilitation of wild turtles (*Testudo kleinmanni*) within Zaranik protected area after its discovery in an area outside the PA; reproduction of Acaciaree (*Acacia raddiana*) tree in Wadi al Gemal PA; reproduction of Haglig tree (*Balanites aegyptiaca*) in Elba PA; reproduction of Sarh plant (*Maerua crassifolia*) in Wadi al Gemal PA (wild animals like gazelle, hyrax, hares and Al teatel pastures over seed, flowers and leaves of this plant); and reproduction of Nabq plant (*Zizyphus spina – Christi*) known as the apple of the desert in Nabq PA.

2010 Goals and Targets	**National Progresses/Achievements**
	From the most important endangered animal species that are currently under breeding are Dorcas Gazelle(*Gazella dorcas dorcas*), Nubian Ibex (*Capra ibex nubiana*), Barbary Sheep (*Ammotragus lervia*), Hyrax (*Procavia species*), Fennec Fox (*Vulpes zerda*), Striped Hyena(*Hyaena dubbah*), Caracal (*Caracal caracal schmitizi*) ,Swamp Cat (*Felis chaus*); in addition to 3 species: Addax Antelop (*Addax nasomaculatus*), Oryx (*Oryx dammah*) and Lepto cerus gazelle which is believed to be on the verge of extinction. These animals have bred successfully. The coverage of endangered species in protected area network is fair. Taking faunal elements as indicators of coverage, many of the globally endangered species of fauna listed by IUCN occurring in Egypt are represented in the existing network of protected areas, e.g. Slender-horned Gazelle (*Gazella leptoceros*), Egyptian Tortoise (*Testudo kleinmanni*), White-eyed Gull (*Larus leucophthalmus*), Small Giant Clam (*Tridacna maxima*), Fennec Fox (*Fennecus zerda*), Four-toed Jerboua (*Allactaga tetradactyla*), Greater Jerboua (*Jaculus orientalis*), and Barbary sheep (*Ammotragus lervia*). Hunting regulations in Law 4 / 1994 were updated recently by Law 9 / 2009 and its executive regulations, which provided an updated listing of protected species in Egypt. These legislative reviews do represent a step forward and a positive advancement in the legal framework governing the hunting issue; however it still falls short of addressing the harvest of biodiversity resources in a more holistic and comprehensive manner.

2010 Goals and Targets	**National Progresses/Achievements**
Target 2.2: Status of threatened species improved	Important steps taken included establishment of rudimentary systems for waterbird hunting, regulation of wildlife collection and trade (for scientific research and the pet trade) and CITES management. Most recently the 2013 constitution has clearly stated under sections 45 and 46 that the State is obliged to maintain protected areas and protect threatened and endangered species.
Goal 3. Promote the conservation of genetic diversity	
Target 3.1: Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained.	The National Gene Bank (NGB) situated in the Agricultural Research Center (Cairo)undertakes the process of collecting, conserving, describing, evaluating, regenerating and documenting the genetic resources of the flora, fauna and micro-organisms in the agricultural field. Plant genetic resources of field and horticulture crops existing in NGB conservation facility is estimated in 2006 at more than 35,000 genetic origins, 500 of which are vegetables collected from breeding programs and international gene banks. Almost all the Egyptian plant collections are kept in the herbaria of the universities, research centers and botanical gardens (e.g. Aswan, Orman, Kobba Palace and Zohareya in Cairo; Montazah Palace and Antoniadis in Alexandria). The amount or rate of loss of genetic diversity is poorly known. The Ministry of Agriculture has been instrumental in coordinating this target. The National Gene Bank (NGB) situated in the Agricultural Research Center (Cairo) Major efforts are still needed to conserve genetic diversity of the livestock.
Goal 4. Promote sustainable use and consumption.	

2010 Goals and Targets	**National Progresses/Achievements**
Target 4.1: Biodiversity-based products derived from sources that are sustainably managed, and Production areas managed consistent with the conservation of biodiversity.	Biodiversity-based products have been a practice with local communities in few protected areas. These products include medicinal plants and teas, mats, handicrafts, dancing costumes etc. These are usually marketed nationally. Production in these areas is managed consistent with the conservation of biodiversity. It is envisaged that these are to be determined soon and conserved to sustain biodiversity-based incentives.
Target 4.2 Unsustainable consumption, of biological resources, or those impacts upon biodiversity, reduced.	The 2013 constitution has clearly stated under sections 45 and 46 that the State is obliged to promote wise and sustainable utilization of natural resources. Law 4 / 1994 (amended by law 9/2009) on environment protection constitutes a supportive national legislation to fulfill Egyptian obligations under the CBD and CITES and regulating hunting of wild animals and prohibiting the destruction of their natural habitats.
Target 4.3: No species of wild flora or fauna endangered by international trade	The 2013 constitution has clearly stated under sections 45 and 46 that the State is obliged to protect threatened and endangered species.
Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced	
Target 5.1. Rate of loss and degradation of natural habitats decreased	Increase in PAs numbers and area addresses this issue. Egypt's investment map, prepared in 1997 and updated in 2000 in collaboration with the Ministry of State of Environmental Affairs and other ministries such as Ministry of Agriculture, Industry, Tourism, Housing, and Culture, has integrated the natural protectorates in the nation's development. The result was the issuance of the Presidential Decree (154/2001) for the land-use map of Egypt.

2010 Goals and Targets	**National Progresses/Achievements**
Goal 6. Control threats from invasive alien species	
Target 6.1. Pathways for major potential alien invasive species controlled Target 6.2. Management plans in place for major alien species that threaten ecosystems, habitats or species.	Exerted efforts are still limited and the number of alien invasive species arriving in Egypt is increasing in spite of the fact that invasive species represent real threats to the Egyptian ecosystems, economy and human health. Moreover, information on existing management activities either does not exist or is not readily available. Combating Invasive species is beyond the country's current potentials in terms of human, financial and technical resources, and requires participation of all concerned agencies. To maximize the benefits and to minimize the potential threats of GMOs for biodiversity, the status of Genetically Modified Organisms (GMOs) in Egypt was studied within a national framework concerned with safety of handling, transport and use of GMOs through Biosafety project funded by GEF/UNEP. A draft law has been prepared and approved by the Ministry of Justice pending its submission to People's Assembly.
Goal 7. Address challenges to biodiversity from climate change, and pollution	
Target 7.1. Maintain and enhance resilience of the components of biodiversity to adapt to climate change. Target 7.2. Reduce pollution and its impacts on biodiversity	Egypt is currently implementing a number of adaptation and mitigation projects funded by the national Government, GEF and international donors to help strengthen resilience to climate change. The Environment Law 4/1994 amended by law 9/2009 is regulating pollution on land and water in effort to conserve and protect the environment and the associated life including biodiversity. Biofertilizers and compost have been produced and applied to legume crops and cereals to increase food production while

2010 Goals and Targets	National Progresses/Achievements
	reducing the amount of chemical fertilizers applied to crops. The Ministry of Agriculture is promoting organic farming of vegetables, fruits and some crops to decreasing the use of fertilizers and pesticides that degrade the soil and seep into the food chain. By 2010, the total area of organic farming has reached about 82,167 ha. The Ministry is taking necessary steps to issue a decree outlining the rules and procedures of organic farming for conserving the newly reclaimed agricultural lands (e.g. Tushka Project in the southwest Egypt) from the excessive use of fertilizers and herbicides. A number of certifying agents are starting now to register, inspect and certify organic products.
Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods	
Target 8.1. Capacity of ecosystems to deliver goods and services maintained. Target 8.2. Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people maintained	Ecosystems have been maintained through the declaration of nationally designated PAs and Environmental Impact Assessment of major development projects. EIA has become a critical tool in managing impacts on biodiversity resources outside PAs, where there still is a need for legislation that regulates their use. The protection of coral reefs, mountain ecosystems and mangroves, among other has enhanced the support for livelihoods at the national level. Enactment of Protected Species and Protected Areas regulations has also supported this component.
Goal 9 Maintain socio-cultural diversity of indigenous and local communities	
Target 9.1. Protect traditional knowledge, innovations and practices	Traditional knowledge and practices are an important element of the conservation practice and these are greatly encouraged to maintain the linkages between the people and their livelihoods Egypt has embarked on the protection and documentation of traditional knowledge and

2010 Goals and Targets	**National Progresses/Achievements**
Target 9.2. Protect the rights of indigenous and local communities over their traditional knowledge, innovations, and practices, including their rights to benefit sharing.	their usage particularly in protected areas; through registration of 38 species of medicinal plants in South Sinai, 45 species in North Sinai, 19 species in Elba's area, 13 species in western desert, 16 species in eastern desert; in addition to registration of handicrafts and linkage of cultural heritage with natural heritage in protected areas. The recently finalized draft law on the regulation of access to genetic resources and related traditional knowledge and the equitable sharing of benefits from their use covers the protection of traditional knowledge, innovations and practices of communities concerned with biological resources within a framework recognizing their individual and collective rights. Local communities are encouraged to actively participate through partnership arrangements as in the case of the medicinal plants project. A number of important poverty alleviation and community development programs have been initiated, and presented opportunity for improving natural resource management and employment for local communities and linking biodiversity and social development. Although local communities are not excluded from protected areas, their role in safeguarding biodiversity remains a challenge to real progress. However, the linkages between poverty alleviation and well-functioning ecosystems is emphasized at the local and community level, where the impacts are felt, as well as at a national level where important decisions about economic growth and development are made.
Goal 10. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources	
Target 10.1. All access to genetic resources is in line with the Convention on Biological	To date, Egypt has no national legislation or administrative mechanisms pertaining to

2010 Goals and Targets	National Progresses/Achievements
Diversity and its relevant provisions Target 10.2. Benefits arising from the commercial and other utilization of genetic resources shared in a fair and equitable way with the countries providing such resources in line with the Convention on Biological Diversity and its relevant provisions	access to Egypt's genetic resources and associated traditional knowledge and benefit sharing from their utilization. The absence of legal and administrative mechanisms to regulate access to Egypt's genetic resources and to set conditions for benefit-sharing is a key constraint towards achieving access to genetic resources in line with the CBD and its relevant provisions or meaningful benefit sharing. However, a draft law on "Access and Fair Benefit Sharing" has been finalized; and a strategy on medicinal plants including improving partnerships with private sector and civil society was completed and adopted by the Egyptian Government in 2013.
Goal 11: Parties have improved financial, human, scientific, technical and technological capacity to implement the Convention	
Target 11.1. New and additional financial resources are transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention in accordance with Article 20. Target 11.2. Technology is transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with its Article 20, paragraph 4.	GEF, EU, USAID, Italian Cooperation and other funding sources provided financial support for the implementation of Egypt's obligations to the CBD. The national government provided ample counterpart and in kind contribution. Egypt has not received technologies to allow for effective implementation of its commitments under the CBD.

It could be concluded that although the Egyptian NBSAP did not enjoy a clear and structured approach for its implementation, and in fact the NBSAP may not have been the main guiding force behind many of the numerous efforts and projects carried out in the conservation field in Egypt over the past two decades, many of its objectives and focal areas were addressed, some to a high level of achievement (e.g. those related to PA establishment and management and the NCS/EEAA capacity development). On the other hand, objectives addressing the introduction of biodiversity concerns and priorities into the mainstream of the Egyptian socio-economic landscape were not well addressed, or at least were not widely or systematically addressed. This is reflected in the limited adoption of biodiversity issues in the policies and regulations of most mainstream sectors. Overall, successes have been mainly in short and medium term achievements, with limited impact on policy level processes and root causes (despite multiple efforts), particularly those outside the environmental realm and in the mainstream economic sectors.

Moreover, some CBD target areas that were not clearly addressed by the Egyptian NBSAP were nevertheless dealt with in an adequate way (e.g. biosafety and access and benefit sharing issues) by the wide variety of activities and projects that were initiated by the NCS/EEAA and relevant NGOs.

Generally speaking, CBD targets that are directly related to the NCS/EEAA and under their direct influence resulted in the greatest degree of achievement and more closely followed the stated objectives. The dominant role of the NCS/EEAA over the NBSAP implementation and the inability to more fully or sustainably engage other stakeholders probably contributed to the limited mainstreaming success of the NBSAP. This is probably partly an outcome of the inherent difficulty of Egyptian Governmental and NGOs alike to form cooperative links across sectoral lines and not a specific issue for the NCS/EEAA. However, this is likely to have been exacerbated by the general low value or importance given to biodiversity in Egypt, particularly in governmental institutions.

The absence of a clear implementation schedule and to some extent the infrequent monitoring and assessment of the NBSAP has also contributed to some degree of ambiguity about the status of the NBSAP amongst potential stakeholders. National Reports are excellent sources of reporting and accounting of achievements, but provide limited guidance for future follow up and forward planning.

The inadequate participatory process that governed the implementation of NBSAP in the past probably contributed to the erosion of the NBSAP value as a national planning document and confirmed its place as an NCS/EEAA plan.

12. Progress towards Implementing the Convention on Biological Diversity's Strategic Plan 2011-2020 and Aichi Targets

National responses to the continuing loss and threats to biodiversity are addressed through a number of activities as contributions to the achievement of the CBD Strategic Plans for Biodiversity and the Aichi Targets 2011-2020. Some of the most significant results achieved in support of the implementation of the CBD and of Egypt's NBSAP are summarized in Sections 9 and 11 of this report.

The updated NBSAP, leading up to 2020, sets the framework for implementing the three objectives of the Convention and achieving the Aichi targets. Implementing Egypt's NBSAP to 2020 in support of Aichi targets will in particular require:

- Increased human and financial resources to NCS in general, and PAs in particular and increase skills in financial resource identification and mobilization.
- Identification and securing additional international funding.
- Strengthening the science base for biodiversity conservation and management, including mapping and classifying ecosystems, Red Listing, spatial biodiversity planning and biodiversity information management.
- Further systematic conduction of surveys and research studies to complete and increase biological information on flora and fauna.
- Documentation of existing national biodiversity related scientific and traditional knowledge.

- Review of the biodiversity-related mandates of different bodies and their articulation.
- Strengthening and refining policy and legislation, including strengthening the interface between science and policy.
- Mainstreaming biodiversity across all levels of government, including land-use planning, agriculture, fisheries, mining, transport, tourism and other sectors.
- Identification of biodiversity priority areas at the landscape scale, based on science for protected area expansion, mainstreaming and restoration of ecosystems.
- Flexible and dynamic management of PAs according to conditions of each protectorate is essential.
- Use of the scientific approach to achieve successful management of PAs and meaningful and effective partnership with local communities, governmental, private sectors and NGO's to manage protectorates.
- Increase public awareness and education at all levels of the importance of biodiversity for socio-economic development and the corresponding goods and services it provides.
- Collaboration between ministries to strengthen implementation of the Cartagena Protocol on Biosafety and Nagoya Protocol on Access and Benefit Sharing.
- Improved co-ordination among and within the relevant agencies.
- Strengthened cooperation and collaboration among relevant agencies (government, I/NGOs, local communities).
- Establishment of adequate legal framework for the management of pollution and waste.
- Further strengthening of the powers and duties of the NCS/EEAA for enforcement, inspection, and environmental assessment.
- Application of reliable monitoring mechanisms/indicators towards measuring actual progress in the implementation of the NBSAP.
- Preparation and implementation in collaboration with NGO and private sector partners of a comprehensive well focused communication, education and awareness raising strategy on the socio-economic importance of biodiversity across all levels of society.
- Focused communication, education awareness programs on the socio-economic need and importance of biodiversity and its conservation across all levels of society, including good marketing and the encouragement of eco-tourism.
- Effective cooperation among law enforcement agencies for effective biodiversity conservation and curbing illegal trade in wildlife species.
- Appropriate legislation and law enforcement to translate policies into practice.
- Positive incentive measures, which promote conservation and sustainable use.
- Ex-situ programs to protect, recover and restore endangered species and populations.

13. Achievement of the Relevant 2015 Targets of the Millennium Development Goals

In the light of Egypt's commitment to achieve the targets of the Millennium Development Goals (MDG) by 2015, several national committees were established (sustainable development, integrated management of coastal zones, climate change, wetlands and conservation of biodiversity) to achieve harmonization between policies, strategies and national action plans of development, by executing specific indicators to determine implementation efficiency in different fields, such as environmental sustainability, reduction of poverty pressure, enabling women, improving the quality of health and education. Egypt prepared many strategies and specialized programs addressing the conservation of wetlands in 2005, ecotourism in 2006 and medicinal plants conservation in 2007. The eight MDGs are integrated in the National Development Plan 2008-2011 under the different key areas. This shows the government's commitment to achieving the MDGs. Implementation of the CBD at the national level represents a direct contribution to the implementation, in particular Goal 7 of the MDGs - "Ensure environmental sustainability"

Extreme poverty and hunger have been slightly reduced in Egypt, and there is good progress in improving access to social services. Egypt has achieved universal primary education, reduced child mortality rates, improved maternal health, and combated HIV/AIDS and other major diseases. While access has improved, the quality of social services remains a challenge (African Development Bank Report, 2012).

14. Lessons Learned from the Implementation of the Convention on Biological Diversity

Egypt has unique biodiversity that contributes to the economy and supports human wellbeing. A significant portion of Egypt's Gross Domestic Product (GDP) is directly related to the use of biological resources and the role of biodiversity in the supply of ecosystem goods and services is gaining recognition. Loss of biodiversity will affect the ability of ecosystems to deliver their valuable goods and services and will have serious social, economic, cultural and ecological implications.

Trends from available indicators suggest that the state of biodiversity is declining and the pressures upon it are increasing despite the many national efforts taken to conserve biodiversity and use it sustainably. The threats to biodiversity continue to increase and are themselves driven by a range of socio-economic drivers, chiefly the growing human population and limited human and financial resources.

Climate change will act synergistically with other threats with serious consequences for biodiversity. Systematic quantitative assessments are needed to determine how changes in biodiversity would impact the provision of ecosystem services, or how the production of ecosystem services has impacted on biodiversity.

Government's fiscal difficulties over the last few years have impacted significantly on resource availability.Many of the policies and plans have not been finalized and/or implemented due to lack of both financial and human resources.

National responses to the continuing loss of biodiversity are varied and responses so far have not been adequate to address the scale of biodiversity loss or reduce the pressures.

The impact of these responses cannot be precisely assessed due to the lack of monitoring programs over a certain period of time, owing to the shortages in human resources and institutional capacities.

Protected areas have been Egypt's most important and effective tool to conserve its biodiversity, prevent ongoing losses of species and habitats and fulfill its international commitments, particularly where the biodiversity protection concept was developed to include sustainable development management inside protected areas.

The performance of protected areas in maintaining populations of their key species is poorly documented. There is a need to assess the completeness of coverage and status of the existing protected area network and identify additional sites which make important contributions towards the comprehensiveness and proportional representatives of the PAs network. It is also worthwhile to establish a database which can be used in future assessments of the PAs network in the country and in order to evaluate the PAs network in terms of species of flora and fauna represented in the network.

Poverty alleviation and community active participation through partnership arrangements indevelopment programs present opportunities for improving natural resource management and employment for local communities and linking biodiversity and social development.

New approaches to ensure protected areas retain trained staff and critical funds for effective performance and future growth should be examined.

The lack of financial resources is currently one of the main limitations to the effective management of existing protected areas in Egypt. Neither government budgets nor international assistance have kept pace with the expansion of Egypt's protected area network since the CBD came into force in 1993.

There is great potential for promotion of nature-based tourism and tourism in protected areas to generate necessary funds for conservation, and to provide economic opportunities for local communities and incentives to PAs staff. This was evidenced by the continuous and significant increase in the number of tourists visiting PAs and the associated increase in revenue from PAs over the last decade.

There are several areas that need improvement and effectiveness, particularly in regards to coordination and cooperation between government agencies; the mainstreaming of biodiversity; wetland, coastal, marine and arid land biodiversity management; invasive alien species; biosafety; and access and benefit sharing.

Combating invasive species is beyond the country's current potential in terms of human, financial and technical resources, and requires participation of all concerned agencies.

Without enforcing environmental regulations in regard to land use and new development activities to save the natural habitat and preserve the monuments of Egypt, loss of biodiversity and nature-derived benefits will continue decline.

The absence of legal and administrative mechanisms to regulate access to Egypt's genetic resources and to set conditions for benefit-sharing is a key constraint towards achieving a meaningful access and benefit sharing framework.

The absence of legal and administrative mechanisms to implement the Cartagena Protocol on Biosafety is a key constraint towards the safe transfer, use and transboundary movement of GMOs.

Effective implementation is hampered by the lack of mainstreaming of biodiversity into other sectors, the lack of communication among and within agencies and lack of sufficient coordination and cooperation among all concerned parties due to lack of effective institutional mechanism for integrating biodiversity issues in broader national development policies.Mainstreaming of biodiversity into key economic sectors should be a priority.

PAs and the Environmental Impact Assessment process are currently the main systemic tools for managing risks to biodiversity. The revised NBSAP is an opportunity to fully utilize the various tools for integration of biodiversity in all development activities.

Enhancement of cross-sectoral integration requires that policy and key decision makers need to be sensitized to the issues facing biodiversity and should be educated on the socio-economic importance of biodiversity and that protection of biodiversity does not hinder economic development.

Implementation is also hampered by lack of mainstreaming of environmental education within the curricula, limited awareness of policies and legislation among the general public, limited sharing of information between ministries and other stakeholders, lack of financial support for postgraduate studies in environmental fields and insufficient environmental awareness programs for industrial and other sectors.

All of these are compounded by the fact that there are no economic incentives for biodiversity conservation. The application of economic instruments in biodiversity has not been fully appreciated for the mainstreaming of biodiversity values and ecosystems services into development planning and resource allocation.

Major efforts are needed to assess taxonomic groups or species that have not been assessed to determine their conservation status including crop genetic diversity and animal genetic resources and their conservation.

Biosystematics services among different institutions are limited and fragmented. They lack coordination, infrastructure and modern equipment for storage and collection. They also lack qualified staff and training programs for specialists and technicians, in addition to lacking information technology systems and databases for the management of biosystematics data. There is also the issue of inaccessibility of biosystematics-related library services and literature resources.

Agencies need to be educated on their responsibilities for implementation of the Convention on Biological Diversity and other biodiversity related conventions. This should assist in broadening the mindset of the involved persons.

15.References

Abdel-Azeem A. M. and F. M. Salem (2013). How many species of fungi are there in Egypt? Fifth National Report, Rio Convention.

Abdel Rahman S.H. (2011). Mediterranean coastal lagoons management: Interaction between aquaculture and capture fisheries, Cagliari, Italy, FAO General Fisheries Commission for the Mediterranean, 28-30 June 2011.

Abdelnasser, M. (2011). Environmental Legislation in Egypt,CEDARE.

Abou Zaid M. (2000). Overview of the status of Red Sea coral reefs in Egypt. Unpublised Report, 39 pp.

Abou Zaid M. (2001). Status of Red Sea coral reefs. The Egyptian coast. Mimeo.

Abou Zaid M. (2002). Impact of the diving actibities on the coral reefs along the Red Sea coast of Hurghada, mimeo Marine Biology and Fish Science ection, Zoology Department, Al-Azhar University, Cairo, Egypt.

African Convention on the Conservation of Nature and Natural Resources

African Development Bank (2012). Egypt 2012-2013 Interim Strategy Paper, Regional Development North I (ORNA)

Assuit University www.aun.edu.eg/abstract_th.php?R_ID=4058

Ayache F., J. R. Thompson, R. J. Flower, A. Boujarra, F. Rouatbi and H. Makina (2009). Environmental characteristics, landscape history and pressures on three coastal lagoons in the Southern Mediterranean Region: Merja Zerga (Morocco), Ghar El Melh (Tunisia) and Lake Manzala (Egypt). Hydrobiologia 622 (1): 15-43.

Ayyad M. A. (1998). Multipurpose species in the Arab African countries, UNESCO, Ciaro, Egypt.

Baha El Din S. M. (1999). Important Bird Areas in Africa and Associated Islands – Egypt. In African Important Bird Areas, BirdLife International, pp 241-264.

Baha El-Din, S. M. (2003). A status report of the Protected Area Network of Egypt, IUCN, 80 PP.

Baha El-Din, S. M. (2005). A preliminary list of threatened species in Egypt, Report submitted to Nature conservation.

Barcelona Convention (1976). Convention for the Protection of the Mediterranean Sea against Pollution.

Boulos L. (1999-2005). The Flora of Egypt, Vol. 1-4, Al Hadra Publishing, Cairo.

Boulos L. (1999). Flora of Egypt. Vol. 1., Cairo, Egypt, Al Hadra Publishing, 417 pp.

Boulos L. (2000). Flora of Egypt. Vol. 2., Cairo, Egypt, Al Hadra Publishing, 325 pp.

Boulos L. (2002). Flora of Egypt. Vol. 3., Cairo, Egypt, Al Hadra Publishing, 373 pp.

Boulos L. (2005). Flora of Egypt. Vol. 4., Cairo, Egypt, Al Hadra Publishing, 617 pp.

Boulos L. (2009). Flora of Egypt. Chick List, Cairo, Egypt, Al Hadra Publishing, 410 pp.

BirdLife International (2014) Country profile: Egypt. Available from: http://www.birdlife.org/datazone/country/egypt. Checked: 2014-04-10

Bourjea J., Frappier J., Quillard M., Ciccione S., Roos D., Hughes G., and Grizel H.(2007). Mayotte Island: another important green turtle nesting site in the south east Indian Ocean. Endang. Species Res. (3):273-282.

Bush A., A. Sabri (2000). Mining for Fish: Privatization of the "Commons" along Egypt's Northern Coastline, In Middle East Report 216, Losing Ground: The Politics of Environment and Space Vol 30 (Fall 2000).

Bubenger O., A. Bolten, F.Darius (2007). Atlas of Culture and Environmental Change in Arid Africa, Heinrich- Barth- Institut, Koln, Germany 239 pp.

Butchart *et al*. (2010). Global Biodiversity: Indicators of Recent Declines. Science328: 1164 – 1168.

Cesar Environmental Economics Consulting (2003). The Economics of worldwide coral reef degradation, Cesar Environmental Economics Consulting, The Netherlands, p.6

Cesar H. (2003). Economic valuation of the Egyptian Red Sea coral reefs. Report prepared for Monitoring, Verification and Evaluation Unit of the Egyptian Environmental Policy Program, funded by USAID.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P. & Van den Belt, M., 1997. The value of the world's ecosystem services and natural capital. *Nature,* 387: 253–260.

CBD (1992). Convention on Biological Diversity and its biosafety and access and benefit sharing protocols, Montreal. http://www.cbd.int/

CBD (2010). Strategic Plan for Biodiversity 2011–2020 and Aichi Biodiversity Targets. Convention on Biological Diversity, Montreal. http:// www.cbd.int/sp/targets/

CBD (2011). About the Nagoya Protocol. Convention on Biological Diversity, Montreal. http://www.cbd.int/abs/about/

CBD (2012). Global Biodiversity Outlook-3, Convention on Biological Diversity.

Convention Relative to the Preservation of Fauna and Flora in their Natural State (1933).

CITES (1973). Convention on International Trade in Endangered Species of Wild Fauna and Flora (Amended in 1979). http://www.cites.org/eng/disc/E-Text.pdf

CMS (1979). Convention on the Conservation of Migratory Species of Wild Animals. http://www.cms.int/document/convtxt/cms_ convtxt.htm

Day J. C. and Roff J. C. (2000). Planning for representative marine protected areas: A framework for Canada's ocean, World Wildlife Fund Canada, Toronto.

BioMAP (2004). Biodiversity and Assessment Project, Egyptian Enviromental affairs Agency, Enviromental Management Sector (see: http://biomapegypt.org)

EEAA (1996). Guidelines for Develoment in coastal arteas, Egyptian Enviromental affairs Agency, Enviromental Management Sector, 24 pp.

EEAA (1998). Egypt National Biodiversity Strategy and Action Plan for 1998 to 2017, Egyptian Environmental Affairs Agency.

EEAA (1998). Towards Establishing a Network Plan for Protected Areas in Egypt (1998). Expert Group Report submitted to the Egyptian Environmental Affairs Agency.

EEAA (2002). Environmental Action Plan (2002-2017), Egyptian Environmental Affairs Agency, Egypt.

EEAA (2003, 2005, 2007, 2009). 1st, 2nd, 3rd and 4th Egyptian National Report on the Biodiversity Convention, Egyptian Environmental Affairs Agency.

EEAA (2004). Conservation Measures in Saint Katherine protectorate", UNDP, GEF, Conservation & Sustainable Use of Medical Plants, Flora of Saint Catherine protectorate, Final Report (2004), Medical Plants conservation project/UNDP/GEF, Ministry of State for Environmental Affairs, EEAA, Nature Conservation sector.

EEAA (2004-2010). State of the Environment Reports 2004 - 2010. Cairo: Egyptian Environmental Affairs Agency

EEAA (2006). Protected Areas of Egypt: Towards the Future. Egyptian Environmental Affairs Agency.

EEAA (2008). Alexandria Lake Mariout Integrated Management(ALAMIM).CEDARE.

EEAA(2008). Annual Report 2008: International Cooperation Projects, Report submitted to Nature Conservation Sector, Egyptian Environmental Affairs Agency, Ministry of State for Environmental Affairs.

EEAA (2012). Law 4 for the Protection of the Environment.Available at:http://www.eeaa.gov.eg/english/main/law4.asp(Accessed: April, 2012).

Egyptian Ministry of Agriculture and Land Reclamation Strategy till 2017, Giza, Egypt.

Egypt's Constitution (2013)

El Gazzar A. and Hammouda A.A. (2006). Nine revived records to the flora of Egypt. Egyptian J. Biol. (8): 74 – 80.

El Hadidi M.N. (1992). A historical flora of Egypt: a preliminary survey. In Friedman R. and Adams B. (eds.) "The followers of Horus, studies dedicated to M.A. Hoffman 1944-1990", Oxford Press, pp 144 -155

El Hadidi M.N. and Hosni H.A. (1996). In The Biodiversity of African Plants, L.J.G. van der Maesen et al. (eds.), Kluwer Academic Publishing, pp 785-787.

El-Hadidi, M.N. and Hosni, H.(2002). Flora Agyptiaca, Vol.1., Part 1. The Palm Press, Cairo, 151pp.

El-Hadidi and Hosni (2000). Flora Agyptiaca, Vol. 1, Part 2. The Palm Press, Cairo, 151pp.

El-Hennawy M.T., M. Said, H.K. El-Hennawy, B. Rabia, W.A. Ibrahim, A.E. Ismael, H. M. Rashad, A.A. Abdelwahab, M.A. El-Helw (2009). The Wetlands and Biodiversity Baseline Report for the Nile Basin, A publication of the Nile Basin Initative by the Nile Transboundary Environmental Action Project.

El-Sadek I., Mancini1 A., Hanafy M., and Girondot M. (2013). Green Turtle Nesting Activities on Zabargad Island, A Major Bookery in the Southern Egyptian Red Sea. Report of a research project funded byHurghada Environmental Protection and Conservation Association (HEPCA), Hurghada, Egypt and Rufford Small Grants,BoomerageforEarth Conservation andIdeaWild.

El-Shabrawy, G.M., Khalil, M. T. Macrobenthos of Lake Bardawil and Zaranik Lagoon. A report presented to Nature Conservation Sector, EEAA. MedWetCoast Project, Conservation of Wetland and Coastal Ecosystems in the Mediterranean Region, Ecological Survey of Zaranik Nature Protectorate, GEF, 30 pp., 2003)

El-Tantawy N. (2012). Economic Impact of Lake Edku Pollution. International Conference on Applied Life Sciences, Turkey, September 10-12, 2012

Farag H.and El-Gamal M.(2011). Assessment of the Eutrophic Status of Lake Burullus (Egypt) using Remote Sensing,International J. Environmental Science and Engineerin. (IJESE).

Fayed A., El-Garf I., Abdel-Khalik K., Kamal El-Deen A., Hatab E. (2004). Flora Survey of Saint Katherine Protectorate (South Wades), Ministry of State for Environmental Affairs, Egyptian Environmental Affairs Agency.

FAO statistics (2010). Aquaculture production in Egypt from 1950 to 2010.

Fisher, M.R. and Khalifa A. (eds.) (2003), Status of Biodiversity of Nile River, 9th edition Workshop held at British Council, Cairo.

Fouda, M. M, Baha El-Din, S. M., Ibrahim, M., Khalaf, E.A and Hafez, M, 2005, Hunting regulations in Egypt, Report submitted to NatureConservation, 29 PP.

Fouda, M. M, Hanefy, M. and Ismail, M. (2004). Economics and analysis of sustainable use of Samadi Reef" Dolphin House", Marsa Alam, 6th Conference Biology and Biodiversity, Cambridge, U.K.

Franklin J. (1998). Predicting the distribution of shrub speies in southern California from climate and terrain-derived variables. Journal of Vegetation Science 9:733-748.

Gamil, H. and El-Karyony. L. (1994). Phosphorus, Nitrogen, Loading and trend of fish catch as index of Lake Mariot Eutrophication.

Garcia A., Cuttelod A. and Abdul Malak D. (2010). The status and distribution of freshwater biodiversity in Northern Africa, IUCN Red List of Threatened species – regional assessment.

GAFRD (1999). General Authority for Fish Research and Development. Annual Report, GAFRD, 288 pp.

GAFRD (2001). General Authority for Fish Research and Development. Annual Report (1997-2001), GAFRD.

GAFRD (2012). General Authority for Fish Resources Development, Annual Report, GAFRD.

Gilbert F., Rashad S., Kamel M., Ismael A. E. James M. and Zalat S. (2010). Monitoring of the endemic Sinai Baton Blue Butterfly *Pseudophilotes sinaicus* in St Katherine Protectorate, South Sinai. Egypt. J. Biol.12: 18-26.

Gilbert F. and Zalat S. (2008). Butterflies of Egypt: Atlas, Red Data Listing & Conservation, Al-Kelma Press, Giza, Egypt

Goldley B.J., Broderik A.C. and Hays G.C.(2001). Nesting of green turtles (*Chelonia mydas*) at Ascension Island, South Atlantic. Biological Conservation 97:151-158.

Halmy M. W., Gessler P.E., Hicke J., Heneidy S. Z. (2013) Implications of human induced changes on the distribution of important plant species in the northwestern coastal desert of Egypt. In proceeding of workshop on Global Climate Change Biodiversity and Sustainability: Challenges and Opportunities, University of Idaho, USA, March 2013.

Hassan M.M.A., Abu Zaid M. and Hanafy M.H. (2002). Status of coral reefs in the Red See - Gulf of Aden. In C.R. Wilkinson (ed.), Status of coral reefs of the world, 2002, GCRMN Report, Australian Institute of Marine Science, Townsville, Chapter 2, pp 45-52.

Hegazy A.K., Hammouda O. Lovett-Doust J., and Gomaa N.H. (2008). Population dynamics of *Moringa perigrena* along altitudinal gradient in the northwest sector of the Red Sea. J. Arid Environments 72:1537-1551.

Hegazy *et al*. (2009). State of the Environment: Egypt, GEO South-Eastern Europe and Eastern Mediterranean Symposium On Earth Observation Services for Monitoring the Environment and Protecting the General Public, 8-10 June 2009, Athens, Greece.

Heneidy S.Z. and Bidak L.M. (2004). Potential uses of plant species of the coastal Mediterranean region. Pakistan J. Biol. Sc. 7:1010-1023.

Herman, C. (2003). Economic Valuation of the Egyptian Red Sea Coral Reef. The Egyptian Environmental Policy Program Executive Committee and USAID/ Egypt.

Hilmi N., Safa A., Reynaud S, and Allemand D. (2012). Coral Reefs and Tourism in Egypt's Red Sea. Topics in Middle Eastern and African Economies **24**:

Hudgson,G., Hill J., Kiene W., Maun L., Mihaly J., Liebeler J., Schauman C. and Torres R. (2006). A Guide to Reef Check. Coral Reef Monitoring, Reef Check Foundation, Pacific Palisades, California, USA.

IUCN Red List of Threatened Species: Mammals of Egypt (2001). IUCN. 2001.

IUCN Red Data List Categories (2013). IUCN Species Survival Commission, IUCN, Gland, Switzerland.

IUCN/UNEP (1985). State of the Reefs – Indian Ocean.

Jamson *S.C.*, Mostafa H.M. and Reigl B. (1997). Rapid ecological assessment of the diving sites in the Egyptian Red Sea, Winrock International (Arlington VA), Environmentally Sustainable Tourism Project Report to USAID, Cairo, Egypt.

Khalil M.T., A. A. Saad, M.R. Fishar, T. Z. Bedir (2013). Ecological Studies on Macrobenthic Invertebrates of Bardawil Wetland, Egypt. World Environment 3(1): 1-8

Khedr A. A. (2006). Regional patterns of rarity and life history elements in the flora of Egypt. Taeckholmia 26: 141 – 160.

Kleypas J,, Buddemeier R.W.,Archer D., Gattuso J.P.,.Langdon C. and Opdyke P.N (1999). Geochemical consequences of increased atmospheric carbon dioxide on coral reefs. Science 284:118-120.

Kotb M.M.A., Abu Zaid M. and Hanafy M.H. (2001). Overall evaluation of the coral reefs status along the Egyptian Red Sea Coast. Biologia Marina Mediterranea 8 (1): 15-32.

Mangrove Monitoring Program: Re-evaluation of certain sites around Hurghada, Safaga and Qussier 2005 2011 (2013). A Report by T. M. Attalla, Red Sea Marine Park Rangers Team, NCS/EEAA.

Mapping Mangroves (2012). Tropical Forest Update ITTO 21:13.

Mehanna, S.F. (2008). Northern Delta Lakes, Egypt: Constraints and Challenges, International Conference on Research for Development in Agriculture and Forestry, University of Hohenheim, 7-8 October 2008, Stuttgart-Hohenheim.

Moores M. (2012) Egypt's lakes:'a truly tragic environmental tale'. In Talking Naturally, 12 Feb.2012.

Ministry of Tourism (2001). Tourism in Egypt, Cairo, Egypt.

National Development Plan 2008-2011

National Gene Bank, Giza, Egypt (2007)

PERSGA (2004). Status of mangroves in the Red Sea and Gulf of Aden.Regional Organization for the Conservation of the Environment in Red Sea and the Gulf of Aden

PERSGA (2010). The status of coral reefs in the Red See and the Gulf of Aden, Summary and Recommendations. Technical Series No. 16, PERSGA, Jeddah

PERSGA (2009). Status of Coral Reefs in Red Sea and Gulf of Aden. The Regional Organization for the Conservation of the Environment in Red Sea and the Gulf of Aden (PERSGA), Jeddah.

PERSGA (2003). Coral reefs in the Red Sea and the Gulf of Aden: Surveys 1990 – 2000 Summary and Recommendations. Technical Series No. 7, PERSGA, Jeddah.

Pilcher N. and Abu Zaid M. (2000). The Status of coral reefs in Egypt. Global Coral Reef Monitoring Network (GCRMN).

Public Law 48 (1982) for the Protection of the Nile River and Water Channels

Protocol Concerning Mediterranean Specially Protected Areas (1994). Barcelonsa, 1994.

Public Law No. 124 (1983) for Fishing, Aquatics and Regulating Fish Farms, Law 102/1983.

Public Law 104 (1994) on environment protection amended by Law 9 /2009.

Rees A.F., Jony M., Margaritoulis D. and Godley B.J. (2008). Satellite tracking of a green turtle, *Chelonia mydas*, from Syria further highlights importance of North Africa for Mediterranean turtles. Zoology in the Middle East 45(1):23-26.

Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA)(2010).

Rosenzweig *et al.* (2007). Assessment of observed changes and responses in natural and managed systems. In *Climate Change 2007: Impacts, Adaptation and Vulnerability,Fourth Assessment Report of the IntergovernmentalPanel on Climate Change* (eds. Parry, M.L., Canziani, O.F.).

Rurhuis A., A. P.van Duijin, A.Roem, A. Ouwehand *et al*. (2013). Aquaculture business opportunities in Egypt, Wageningen, Wageningen University and Research Center, The Netherlands.

Saad M. A.H. (2003). Management impact of diffuse pollution on the socio-economic development opportunities in the coastal Nile delta lakes. Diffuse Pollution Conference Dublin 2003.

Samy M., Sanchez Lisaso J.L. and Forcada A. (2011). Status of marine protected areas in Egypt (2011). Animal Biodiversity and Conservation 34 (1):165-177.

Sarant L. (2012). Nature middle east.2012.163; Published online 22 November 2012, Scores of endangered turtles killed in Egypt.

Shaltout S. (2008). Ecological study on the alien species in the Egyptian Flora. Thesis submitted to the Faculty of Science, Tanta University, in partial fulfilment of M.Sc. degree in Botany (Ecology).

Shaltout K. H. and Eid E. M. (2010) Important Plant Areas in Egypt with Emphasis on the Mediterranean Region. Report of a workshop hosted at Cairo University with the technical and financial support from the International Union for Conservation of Nature (IUCN), Plantlifeand Agence Franciase de Development (AFD).

Shaltout K.H. *et al*. (2004). Flouristic Survey of Saint Katherine Protectorate (Northern Wades).

Shaltout K.M., El-Hennawy M., Nafeaa A., Abo-Bakr S., Ghazaly O., Eid E. and Fouda M. (2009).National Progress Towards Targets of the Global Strategy for Plant Conservation, Egyptian Environmental Affairs Authority.

Soliman, A. A. (2005). Status of Biodiversity in Protected Area. Report submitted to Nature Conservation Sector. 25 pp.

Smithsonian National Museum of Natural History (2005). Mammal Species of the World.

Spalding M.D., Ravilious C. and Green E.P. (2001). World Atlas of Coral Reefs. Prepared by UNEP World Conservation Monitoring Centre, Berkeley, University of California Press, CA, USA.

Spalding *et al*. (2007). Marine Ecoregions of the World A Bioregionalization of Coastal and Shelf Areas. BioScience57 (7):573-583

Tallet, P. (2012). "Ayn Sukhna and Wadi el-Jarf: Two newly discovered pharaonic harbours on the Suez Gulf". *British Museum Studies in Ancient Egypt and Sudan* **18**: 147–68. ISSN 2049-5021. Retrieved 21 April 2013.

Tawfik, R. T. (2010), "Economic Valuation of Coral Reefs and the Ecosystem Services Approach to Environmental Management", University of East Anglia, UK, PhD thesis.

Tourism Development Authority (TDA) (2003). Environmental Management Guidelines for Coastal Hotels and Resorts, TDA, Egypt.

Tourism Development Authority (TDA) (2003). Landscape best practices Red Sea Tourism, Egypt.

Travel & Tourism Economic Impact – Egypt (2012). World Travel & Tourism Council, 2012, pp 2-5.

UN (1982). United Nations Convention on the Law of the Sea.

UN (2000). Millennium Development Goals.

UN Convention on Wetlands of International Importance Especially as Waterfowl Habitat (1971). Ramsar Convention.

UNFCCC (1992). United Nations Framework Convention on Climate Change. http://unfccc.int/resource/docs/convkp/conveng.pdf

UNDP / Institute of National planning (2005). Millennium Development Goals: "Second Country Report", Egypt, 74 PP.

UNDP /Institute of National Planning (2004). Egypt Human Development Report: "Choosing Decentralization for good governance", Al-Ahram.

UNEP (1980). Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources.

UNEP (2005). United Nations Environment Programme/ Programme for the Assessment and Control of Marine Pollution in the Mediterranean (UNEP/MAP/MED POL 2005).

UNEP/ MAP/ Regional Activity Centre for Specially Protected Areas (2009). Potential impact of sea level rise on Nile Delta: Sub-Regional Report on Vulnerability and Impacts of Climate Change on Marine and Coastal Biological Diversity in the Mediterranean Arab Countries.

UNEP (2012).United Nations Environment Programme/Mediterranean Action Plan (UNEP/MAP 2012) – State of the Mediterranean Marine and Coastal Environment.

UNEP (2012). Keeping Track of Our Changing Environment From Rio to Rio+20 (1992-2012).

UNEP (2012). Global Environment Outlook-5. United Nations Environment Programme.

UNEP-WCMC (2010).WorldDatabase on Protected Areas, WCMC, Cambridge.

Wilkinson C. (2002). Status of Coral Reefs of the World 2002, Australian Institute of Marine Science, Global Coral Reef Monitoring Network (GCRMN) Report, Townsville, Australia.

World Program of Invasive Species (2010). Global listof the worst 100 alien invasive species.

World Resources Institute (2013). Status of coral reefs in the seas of the Middle East: (Red Sea and Arabian Gulf), WRI.

Williams J.N.. Seo C., Thorne J., Nelson J.K., Erwin S., O'Briaen J.M. and Shwartz W. (2009). Using species distribution models to predict new occurrences for rare plants. Diversity and Distribution 15:565-576.

WCMC (2012). Protected Planet Report 2012:Tracking progress towards global targets for protected areas (IUCN, Gland, Switzerland and UNEP-WCMC, Cambridge, UK.

WWF (2007). Global Biogeographic Classifications

Wu X. B. and Smeins F.E. (2000). Multiple scale habitat modeling approach for rare plant conservation. Landscape and urban planning 51:11-28.

Yahia M. (2014). Why sea turtles die in Lake Bardawil Nature Middle East 58; Published online 9 March 2014.

Zahran M.A. and Willis A.J. (2009). The Vegetation of Egpyt. 2nd Ed., Springer, Heidelberg.

Annex 1. List of nationally threatened plant species (Shaltout and Eid, 2012)

Species	Status	IPA
Abutilon bidentatum A. Rich.	Vulnerable	Halayeb Triangle
Acacia asak (Forssk.) Willd.	Rare	Halayeb Triangle
Acacia etbaica Schweinf.	Vulnerable	Wadi El Gemal, Halayeb Triangle
Acacia mellifera (Vahl) Benth.	Endangered	Halayeb Triangle
Acacia oerfota (Forssk.) Schweinf.	Rare	Halayeb Triangle
Acacia pachyceras var. *najadensis* (Chaudhary) Boulos	Vulnerable	Saint Katherine
Acacia seyal Delile	Rare	Saluga and Ghazal
Actiniopteris semiflabellata Pic. Serm.	Rare	Halayeb Triangle
Aethionema carneum (Banks & Sol.) Fedtsch.	Rare	Saint Katherine
Ajuga chamaepitys (L.) Schreb.	Rare	Saint Katherine
Alkanna strigosa Boiss. & Hohen.	Rare	Saint Katherine
Allium crameri Asch. & Boiss.	Rare	Saint Katherine
Allium sinaiticum Boiss.	Endangered	Saint Katherine
Althaea ludwigii L.	Indeterminate	Omayed
Alyssum marginatum Steud. ex Boiss.	Rare	Saint Katherine
Anabasis syriaca Iljin	Vulnerable	Saint Katherine
Anastatica hierochuntica L.	Endangered	Saint Katherine, Wadi El Gemal
Aneilema aequinoctiale (P. Beauv.) Kunth	Indeterminate	Halayeb Triangle
Anogramma leptophylla (L.) Link	Rare	Halayeb Triangle
Anthemis microsperma Boiss. & Kotschy	Rare	Western Mediterranean coastal dunes
Anticharis linearis (Benth.) Hochst. ex Asch.	Vulnerable	Saint Katherine, Halayeb Triangle
Arabidopsis kneuckeri (Bornm.) O.E. Schulz	Endangered	Saint Katherine
Arabis verna (L.) R. Br.	Rare	Saint Katherine
Asperugo procumbens L.	Rare	Saint Katherine
Asplenium ceterach L.	Rare	Saint Katherine
Astomaea seselifolium DC. Coll-Mém.	Rare	North Sinai Mountains
Astragalus caprinus L.	Rare	Omayed
Astragalus intercedens Sam. ex Rech.f.	Indeterminate	Saint Katherine
Astragalus sanctus Boiss.	Rare	Saint Katherine
Astragalus sparsus Decne.	Rare	Saint Katherine
Astrgalus echinus DC.	Rare	Saint Katherine
Asyneuma rigidum (Willd.) Grossh.	Endangered	Saint Katherine
Atractylis aristata Batt.	Rare	Saint Katherine
Atractylis carduus var. *marmarica* Täckh. & Boulos	Rare	Western Mediterranean coastal dunes
Atraphaxis spinosa L.	Vulnerable	Saint Katherine

Avicennia marina (Forssk.) Vierh.	Vulnerable	Nabq, Hurghada, Wadi El Gemal
Ballota saxatilis C. Persl	Vulnerable	Saint Katherine
Barleria acanthoides Vahl	Vulnerable	Halayeb Triangle
Bellevalia sessiliflora (Viv.) Kunth	Rare	Sallum Area
Blainvillea acmella (L.) Philipson	Rare	Halayeb Triangle
Bolanthus hirsutus (Labill.) Barkoudah	Indeterminate	Saint Katherine
Boscia angustifolia A. Rich.	Endangered	Halayeb Triangle
Boscia senegalensis Poir.	Endangered	Halayeb Triangle
Brandella erythraea (Brand) R.R. Mill	Endangered	Halayeb Triangle
Bryonia syriaca Boiss.	Endangered	Saint Katherine
Bupleurum falcatum subsp. *exaltatum* var. *linearifolium* (DC.) H. Wolff	Rare	Saint Katherine
Bupleurum nanum Poir.	Rare	Omayed
Cadaba farinosa Forssk.	Rare	Halayeb Triangle
Cadaba glandulosa Forssk.	Vulnerable	Halayeb Triangle
Cadaba rotundifolia Forssk.	Endangered	Halayeb Triangle
Callipeltis cucularis (L.) Steven	Rare	Wadi El Gemal, Saint Katherine
Caralluma acutangula (Decne.) N.E. Br.	Indeterminate	Halayeb Triangle
Caralluma edulis (Edgew.) Benth. & Hook.f.	Rare	Halayeb Triangle
Carduncellus mareoticus (Delile) Hanelt	Rare	Omayed
Carissa spinarum L.	Endangered	Halayeb Triangle
Carthamus glaucus M. Bieb.	Rare	Omayed, Sallum Area
Carthamus nitidus Boiss.	Rare	Halayeb Triangle
Centaurea alexandrina Delile	Rare	Omayed, Western Mediterranean coastal dunes
Centaurea glomerata Vahl	Rare	Western Mediterranean coastal dunes
Ceratonia siliqua L.	Endangered	Saint Katherine
Cheilanthes coriacea Decne.	Rare	Halayeb Triangle
Cheilanthes pteridioides (Reichard) C. Chr.	Rare	Saint Katherine
Chlamydophora tridentata (Delile) Ehrenb. ex Less.	Rare	Lake Mariut
Chrozophora brocchiana Vis.	Vulnerable	Halayeb Triangle
Cissus quadrangularis L.	Rare	Halayeb Triangle
Cleome droserifolia (Forssk.) Delile	Indeterminate	Saint Katherine, Nabq, Wadi El Gemal, Wadi Allaqi
Clerodendrum acerbianum (Vis.) Benth. & Hook.f.	Rare	Lake Burullus
Coccinia abyssinica (Lam.) Cogn.	Endangered	Halayeb Triangle
Coccinia grandis (L.) Voigt	Indeterminate	Halayeb Triangle
Colutea istria Mill.	Rare	Saint Katherine
Cometes surattensis L.	Indeterminate	Saint Katherine, Halayeb

		Triangle
Commelina forsskaolii Vahl	Rare	Halayeb Triangle
Commiphora gileadensis (L.) C. Chr.	Rare	Halayeb Triangle
Commiphora quadricincta Schweinf.	Rare	Halayeb Triangle
Convolvulus palaestinus Boiss.	Rare	Saint Katherine
Corallocarpus schimperi (Naudin) Hook.f.	Rare	Halayeb Triangle
Cordia sinensis Lam.	Vulnerable	Halayeb Triangle
Cornulaca ehrenbergii Asch.	Extinct	Saint Katherine
Cotoneaster orbicularis Schltdl.	Vulnerable	Saint Katherine
Cotula anthemoides L.	Rare	Western Mediterranean coastal dunes
Crataegus x sinaica Boiss.	Vulnerable	Saint Katherine
Crotalaria impressa Nees ex Walp.	Rare	Halayeb Triangle
Cucumis dipsacus Ehrenb. ex Spach	Rare	Halayeb Triangle
Cucumis pustulatus Hook.f.	Rare	Halayeb Triangle
Cuscuta chinensis Lam.	Vulnerable	Halayeb Triangle
Cyanotis barbata D. Don	Endangered	Halayeb Triangle
Cynomorium coccineum L.	Rare	Lake Burullus, Western Mediterranean coastal dunes
Cyperus bulbosus Vahl	Vulnerable	Halayeb Triangle
Daucus syrticus Murb.	Rare	Lake Burullus, Omayed
Delonix elata (L.) Gamble	Rare	Halayeb Triangle
Dianthus sinaicus Boiss.	Rare	Saint Katherine
Diceratella elliptica (DC.) Jonsell	Vulnerable	Halayeb Triangle
Dicoma tomentosa Cass.	Rare	Halayeb Triangle
Diplocyclos palmatus (L.) C. Jeffrey	Rare	Halayeb Triangle
Dipterygium glaucum Decne.	Indeterminate	Wadi Allaqi, Halayeb Triangle
Dodenaea viscosa (L.) Jacq.	Rare	Halayeb Triangle, Saint Katherine
Dracaena ombet Kotschy & Peyr.	Endangered	Halayeb Triangle
Ebenus armitagei Schweinf. &Taub.	Rare	Omayed
Echinops macrochaetus Fresen.	Rare	Saint Katherine
Elymus farctus (Viv.) Runem. ex Melderis	Rare	Omayed
Enicostema axillare (Lam.) Raynal	Rare	Halayeb Triangle
Ephedra pachyclada Boiss.	Endangered	Saint Katherine
Epipactis veratrifolia Boiss. & Hohen.	Indeterminate	Saint Katherine
Equisetum ramosissimum Desf.	Rare	Saint Katherine
Erodium arborescens (Desf.) Willd.	Indeterminate	Saint Katherine
Euclea racemosa Murray	Rare	Halayeb Triangle
Euphorbia hierosolymitana Boiss.	Rare	Saint Katherine
Euphorbia paralias L.		Omayed
Euphorbia polyacantha Boiss.	Indeterminate	Halayeb Triangle
Evolvulus nummularius (L.) L.	Endangered	Halayeb Triangle
Fagonia tenuifolia Steud. & Hochst. ex Boiss.	Rare	Halayeb Triangle

Ferula sinaica Boiss.	Endangered	Saint Katherine
Fibigia clypeata (L.) Medik.	Indeterminate	Saint Katherine
Ficus carica L.	Endangered	Saint Katherine
Filago prolifera Pomel	Rare	Halayeb Triangle
Flueggea virosa (Willd.) Voigt	Rare	Halayeb Triangle
Fumana arabica (L.) Spach	Endangered	North Sinai Mountains
Galium ceratopodum Boiss.	Indeterminate	Saint Katherine
Galium mollugo L.	Rare	Halayeb Triangle
Geranium trilophum Boiss.	Indeterminate	Halayeb Triangle
Glaucium arabicum Fresen.	Rare	Saint Katherine
Glossonema boveanum (Decne.) Decne.	Rare	Nabq, Wadi El Gemal
Glossonema boveanum subsp. *boveanum* Decne.	Rare	Saint Katherine, Halayeb Triangle
Gomphocarpus sinaicus Boiss.	Vulnerable	Saint Katherine
Grewia villosa Willd.	Extinct	Halayeb Triangle
Halopyrum mucronatum (L.) Stapf	Rare	Halayeb Triangle
Haloxylon persicum Bunge	Endangered	Saint Katherine
Helianthemum sancti-antonii Schweinf. ex Boiss.	Endangered	Saint Katherine
Heliotropium aegyptiacum Lehm.	Rare	Halayeb Triangle
Holosteum umbellatum subsp. *glutinosum* (M. Bieb.) Nyman	Vulnerable	Saint Katherine
Hyoscyamus pusillus L.	Rare	Saint Katherine, Nabq
Ifloga spicata subsp. *elbaensis* Chartek	Endangered	Halayeb Triangle
Indigofera argentea Burm.f.	Vulnerable	Wadi Allaqi, Halayeb Triangle
Indigofera coerulea Roxb.	Rare	Halayeb Triangle
Indigofera spiniflora Boiss.	Rare	Halayeb Triangle
Indigofera tritoides Baker	Indeterminate	Halayeb Triangle
Ipomoea obscura (L.) Ker Gawl.	Rare	Halayeb Triangle
Ixiolirion tataricum (Pall.) Herb.	Indeterminate	Saint Katherine
Jacquemontia tamnifolia (L.) Griseb.	Indeterminate	Halayeb Triangle
Jasminum fluminense Vell.	Rare	Halayeb Triangle
Jasminum grandiflorum subsp. *floribundum* (R. Br. ex Fresen.) P.S. Green	Rare	Halayeb Triangle
Jatropha glauca Vahl	Rare	Halayeb Triangle
Juncus bufonius L.	Rare	Lake Manzala, Lake Burullus
Juncus punctorius L.f.	Rare	Saint Katherine
Juniperus phoenicea L.	Endangered	North Sinai Mountains
Justicia ladonoides Lam.	Rare	Halayeb Triangle
Kedrostis gijef (J.F. Gmel.) C. Jeffrey	Rare	Halayeb Triangle
Kickxia gracilis D.A. Sutton	Vulnerable	Halayeb Triangle
Kickxia macilenta (Decne.) Danin	Rare	Saint Katherine
Lactuca undulate Ledeb.	Rare	Saint Katherine
Lallemantia royleana (Benth.) Benth.	Endangered	Saint Katherine

Lantana viburnoides (Forssk.) Vahl	Rare	Halayeb Triangle
Lappula sinaica (DC.) Asch. & Schweinf.	Rare	Saint Katherine
Leucas inflata Benth.	Extinct	Saint Katherine
Leucas neuflizeana Courbai	Indeterminate	Halayeb Triangle
Linaria tenuis (Viv.) Spreng.	Vulnerable	Saint Katherine
Linum pubescens Banks &Sol.	Indeterminate	Saint Katherine
Lobularia arabica (Boiss.) Muschl.	Rare	Lake Bardawil, Lake Manzala, Lake Burullus, Omayed
Maerua crassifolia Forssk.	Rare	Wadi El Gemal, Wadi Allaqi, Halayeb Triangle
Maerua oblongifolia (Forssk.) A. Rich.	Indeterminate	Halayeb Triangle
Malcolmia crenulata (DC.) Boiss.	Indeterminate	Saint Katherine
Mannia androgyna (L.) A. Evans	Rare hepatics	Halayeb Triangle
Matthiola arabica Boiss.	Vulnerable	Saint Katherine
Maytenus senegalensis (Lam.) Excell	Vulnerable	Halayeb Triangle
Medicago hypogaea E. Small	Indeterminate	Saint Katherine
Melhania denhamii R.Br.	Vulnerable	Halayeb Triangle
Melica persica Kunth	Rare	Saint Katherine
Merremia aegyptia (L.) Urb.	Rare	Halayeb Triangle
Mimosa pigra L.	Rare	Saluga and Ghazal, Halayeb Triangle
Monsonia senegalensis Guill. & Perr.	Rare	Halayeb Triangle
Morettia parviflora Boiss.	Indeterminate	Saint Katherine
Moringa peregrina (Forssk.) Fiori	Vulnerable	Wadi El Gemal, Saint Katherine
Muscari salah-eidii (Täckh. & Boulos) Hosni	Probably extinct	Saint Katherine
Nasturtiopsis coronopifolia (Desf.) Boiss.	Rare	Western Mediterranean coastal dunes
Nonea ventricosa (Sm.) Griseb.	Rare	Saint Katherine
Notoceras bicorne (Aiton) Amo	Rare	Saint Katherine
Nymphaea caerulea Savigny	Endangered	Lake Manzala
Nymphaea lotus L.	Endangered	Lake Manzala, Lake Edku
Ocimum forsskaolii Benth.	Endangered	Halayeb Triangle
Ogastemma pusillum (Coss. & Durand ex Bonnet & Barratte) Brummitt	Indeterminate	Saint Katherine
Olea europaea L.	Vulnerable	Halayeb Triangle
Olea europaea var. *sylvestris* (Mill.) Lehr	Vulnerable	Wadi El-Rayan
Onopordum alexandrinum Boiss.	Rare	Western Mediterranean coastal dunes
Onopordum ambiguum Fresen.	Vulnerable	Saint Katherine
Onychium divaricatum (Poir.) Alston	Rare	Halayeb Triangle
Ophioglossum polyphyllum A. Braun	Rare	Halayeb Triangle
Origanum isthmicum Danin	Endangered	North Sinai Mountains

Origanum syriacum subsp. *sinaicum* (Boiss.) Greuter & Burdet	Rare	Saint Katherine
Orobanche ramosa var. *ramosa* L.	Rare (IUCN)	Wadi Allaqi
Orthosiphon pallidus Royle ex Benth.	Rare	Halayeb Triangle
Oryzopsis holciformis (M. Bieb.) Hack.	Rare	Saint Katherine
Otostegia fruticosa (Forssk.) Penz.	Indeterminate	Saint Katherine
Oxalis anthelmintica A. Rich.	Rare	Halayeb Triangle
Oxygonum sinuatum (Meisn.) Dammer	Rare	Halayeb Triangle
Paracaryum bungei (Boiss.) Brand	Rare	Saint Katherine
Paracaryum rugulosum (DC.) Boiss.	Rare	Saint Katherine
Parietaria debilis G. Forster	Rare	Halayeb Triangle
Pavonia kotschyi Hochst. ex Webb	Endangered	Halayeb Triangle
Pedalium murex L.	Indeterminate	Halayeb Triangle
Pegolettia senegalensis Cass.	Rare	Saint Katherine, Halayeb Triangle
Peristrophe paniculata (Forssk.) Brummitt	Vulnerable	Halayeb Triangle
Phagnalon nitidum Fresen.	Rare	Saint Katherine
Phyllanthus reticulatus Poir.	Indeterminate	Halayeb Triangle
Picris longirostris Sch. Bip.	Rare	Saint Katherine
Plagiochasma rupstre (J. R. Frost & G. Forst) Steph.	Rare hepatics	Halayeb Triangle
Plantago sinaica (Barn.) Decne.	Rare	Saint Katherine
Pleurostelma schimperi (Vatke) Liede	Endangered	Halayeb Triangle
Plicosepalus curviflorus (Benth. ex Oliv.) Tiegh.	Vulnerable	Halayeb Triangle
Plumbago zeylanica L.	Rare	Halayeb Triangle
Poa sinaica Steud.	Vulnerable	Saint Katherine
Polygala irregularis Boiss.	Rare	Halayeb Triangle
Priva adhaerens (Forssk.) Chiov.	Indeterminate	Halayeb Triangle
Psilotrichum gnaphalobryum (Hochst.) Schinz	Rare	Halayeb Triangle
Pulicaria petiolaris Jaub. & Spach	Indeterminate	Halayeb Triangle
Pupalia lappacea var. *velutina* (Moq.) Hook f.	Rare	Halayeb Triangle
Ranunculus asiaticus L.	Rare	Saint Katherine
Rhamnus dispermus Boiss.	Rare	Saint Katherine
Rhus abyssinica Hochst. ex Oliv.	Rare	Halayeb Triangle
Rhus tripartita (Ucria) Grande	Vulnerable	Saint Katherine, Wadi El Gemal, Halayeb Triangle
Riccia congoana Steph.	Rare hepatics	Halayeb Triangle
Ricotia lunaria (L.) DC.	Rare	Saint Katherine
Ridolfia segetum (L.) Moris.	Indeterminate	Saint Katherine
Robeshia schimperi (Boiss.) O.E. Schulz	Endangered	Saint Katherine
Rosularia lineata (Boiss.) A.Berger	Rare	North Sinai Mountains

Triumfetta flavescens Hochst. ex A. Rich.	Rare	Halayeb Triangle
Tulipa stylosa Stapf	Endangered	Saint Katherine
Umbilicus botryoides Hochst. ex A. Rich.	Rare	Halayeb Triangle
Umbilicus rupestris (Salisb.) Dandy	Rare	Saint Katherine
Vahlia digyna (Retz.) Kuntze	Indeterminate	Saluga and Ghazal
Verbascum decaisneanum Kuntze	Endangered	Saint Katherine
Verbascum letourneuxii Asch. & Schweinf.	Rare	Omayed, Western Mediterranean coastal dunes
Verbascum sinaiticum Benth.	Rare	Saint Katherine
Veronica campylopoda Boiss.	Rare	Saint Katherine
Veronica kaiseri Täckh.	Probably extinct	Saint Katherine
Viola cinerea Boiss.	Endangered	Halayeb Triangle
Volutaria sinaica (DC.) Wagentiz	Indeterminate	Saint Katherine, Halayeb Triangle
Vulpia myuros (L.) C.C. Gmel.	Rare	Saint Katherine
Waltheria indica L.	Indeterminate	Halayeb Triangle
Zehneria anomala C. Jeffrey	Indeterminate	Halayeb Triangle
Zilla spinosa subsp. *biparmata* (O.E. Schulz) Maire & Weiller	Vulnerable	Wadi Allaqi, Nabq, Wadi El Gemal
Zoegea purpurea Fresen.	Vulnerable	Saint Katherine
Zosima absinthifolia (Vent.) Link	Rare	Saint Katherine
Zygophyllum album L.f. var. *album*	Rare	Western Mediterranean coastal dunes
Zygophyllum coccineum L.	Indeterminate	Western Mediterranean coastal dunes, Nabq, Hurghada, Wadi El Gemal

Endemic plant species:

Species	Status	IPA
Allium crameri Asch. & Boiss.	Rare	Saint Katherine
Anarrhinum pubescens Fresen.	Endangered	Saint Katherine
Anthemis microsperma Boiss. & Kotschy	Rare	Western Mediterranean coastal dunes, Saint Katherine
Astragalus camelorum Barbey	Endangered	Lake Bardawil, Saint Katherine
Astragalus fresenii Decne.	Endangered	Saint Katherine
Atractylis carduus var. *marmarica* Täckh. & Boulos	Rare	Western Mediterranean coastal dunes
Ballota kaiseri Täckh.	Endangered	Saint Katherine
Bellevalia salah-eidii Täckh. & Boulos	Endangered	Lake Bardawil
Biscutella didyma var. *elbensis* (Chartek) El Naggar	Endangered	Halayeb Triangle
Brassica deserti Danin & Hedge	Endangered	Saint Katherine
Bromus aegyptiacus Tausch		Lake Manzala, Lake Mariut
Bufonia multiceps Decne.	Endangered	Saint Katherine
Colchicum cornigerum (Schweinf. ex Sickenb.) Täckh. & Drar	Endangered	Saint Katherine
Daucus syrticus Murb.	Rare	Omayed
Elymus farctus (Viv.) Runem. ex Melderis	Rare	Omayed
Epipactis veratrifolia Boiss. & Hohen.	Indeterminate Unique orchid in Egypt	Saint Katherine
Euphorbia obovata Decne.	Rare	Saint Katherine
Grimmia anodon Bruch & Schimp. var. *sinaitica* Renauld & Cardot	Endemic mosses	Saint Katherine
Hyoscyamus boveanus (Dunal) Asch. & Schweinf.		Saint Katherine
Ifloga spicata subsp. *elbaensis* Chartek	Endangered	Halayeb Triangle
Lupinus digitatus Forssk	Endangered	Wadi Allaqi
Micromeria serbaliana Danin & Hedge	Endangered	Saint Katherine
Muscari salah-eidii (Täckh. & Boulos) Hosni	Probably extinct	Saint Katherine
Najas pectinata (Parl.) Magn.		Saint Katherine
Origanum syriacum subsp. sinaicum (Boiss.) Greuter & Burdet	Rare	Saint Katherine
Pancratium arabicum Sickenb.	Endangered	Western Mediterranean coastal dunes
Phagnalon nitidum Fresen.	Rare	Saint Katherine
Phlomis aurea Decne.	Endangered	Saint Katherine
Plantago sinaica (Barn.) Decne.	Rare	Saint Katherine
Polygala sinaica var. *sinaica* Botsch.	Rare	Saint Katherine

Primula boveana Decne. ex Duby	Endangered	Saint Katherine
Pterocephalus arabicus Boiss.	Endangered	Saint Katherine
Rorippa integrifolia Boulos	Endangered	Saint Katherine
Rosa arabica Crép.	Endangered	Saint Katherine
Scorzonera drarii Täckh.	Probably extinct	Saint Katherine
Silene leucophylla Boiss.	Endangered	Saint Katherine
Silene odontopetala Fenzl		Saint Katherine
Silene oreosinaica Chowdhuri	Endangered	Saint Katherine
Silene schimperiana Boiss.	Endangered	Saint Katherine
Sinapis allionii Jacq.	Endangered	Lake Burullus, Lake Mariut
Solanum nigrum var. *elbaensis* Täckh. & Boulos	Probably extinct	Halayeb Triangle
Sonchus macrocarpus Boulos & C. Jeffrey	Rare	Lake Burullus
Tortula kneuckeri Broth. & Geh.	Endemic mosses	Saint Katherine
Veronica kaiseri Täckh.	Probably extinct	Saint Katherine
Vicia sinaica Boulos	Indeterminate	Saint Katherine
Zygophyllum album L.f. var. *album*	Rare	Western Mediterranean coastal dunes

Near Endemic plant species:

Species	Status	IPA
Allium barthianum Asch. & Schweinf.	Rare	Sallum Area
Allium desertorum Forssk.		Omayed
Astragalus caprinus L.	Rare	Omayed
Bellevalia sessiliflora (Viv.) Kunth	Rare	Sallum Area
Biarum olivieri Blume	Endangered	Lake Bardawil
Bupleurum nanum Poir.	Rare	Omayed
Carduncellus mareoticus (Delile) Hanelt	Rare	Lake Mariut, Omayed, Sallum Area
Carthamus glaucus M. Bieb.	Rare	Omayed, Sallum Area
Centaurea alexandrina Delile	Rare	Omayed, Western Mediterranean coastal dunes
Centaurea glomerata Vahl	Rare	Omayed, Western Mediterranean coastal dunes
Ebenus armitagei Schweinf. &Taub.	Rare	Omayed
Helianthemum sphaerocalyx Gauba & Janch.	Endangered	Omayed, Western Mediterranean coastal dunes
Iris mariae Barbey	Rare	Lake Bardawil
Kickxia floribunda (Boiss.) Täckholm & Boulos		North Sinai Mountains, Nabq
Lobularia arabica (Boiss.) Muschl.	Rare	Omayed
Lycium schweinfurthii subsp. *aschersohnii* (Dammer) Feinbrun		Western Mediterranean coastal dunes
Medemia argun (Mart.) Württemb. ex H. Wendl.	Endangered	Dungul and Dineigil Oases
Onopordum alexandrinum Boiss.	Rare	Western Mediterranean coastal dunes
Ornithogalum trichophyllum Boiss. & Heldr. In Boiss.		Omayed
Plantago crypsoides Boiss.		Omayed, Western Mediterranean coastal dunes
Salsola longifolia Forssk.		Omayed
Taverniera aegyptiaca Boiss.		Wadi El Gemal
Tephrosia purpurea subsp. *apollinea* (Delile) Hosni & El-Karemy		Wadi El Gemal, Saluga and Ghazal
Verbascum letourneuxii Asch. & Schweinf.	Rare	Omayed, Western Mediterranean coastal dunes, Sallum Area
Zygophyllum dumosum Boiss.	Vulnerable	North Sinai Mountains

Mediterranean endemic species:

Species	Status	IPA
Ajuga iva (L.) Schreb.		Western Mediterranean coastal dunes, Sallum Area
Alkanna lehmanii (Tin.) A. DC.		Western Mediterranean coastal dunes
Allium myrianthum Boiss.		Sallum Area
Ammophila arenaria (L.) Link		Omayed, Western Mediterranean coastal dunes, Sallum Area
Anacyclus monanthos subsp. *monanthos* (L.) Thell.		Western Mediterranean coastal dunes, Sallum Area
Arisarum vulgare Targ. Tozz.		Lake Mariut, Omayed, Sallum Area
Asphodelus aestivus Brot.		Western Mediterranean coastal dunes
Astragalus boeticus L.		Lake Bardawil, Lake Burullus, Omayed, Sallum Area
Atractylis cancellata L.		Omayed
Brassica nigra (L.) Koch		Lake Manzala, Lake Burullus
Bromus aegyptiacus Tausch		Lake Manzala, Lake Mariut
Bromus diandrus Roth		Lake Manzala, Lake Burullus, Lake Mariut
Bupleurum nodiflorum Sm.		Omayed
Carduncellus mareoticus (Delile) Hanelt		Lake Mariut
Carex extensa Good		Lake Manzala, Lake Burullus
Carthamus lanatus L.		Omayed
Centaurea pumilio L.		Lake Burullus, Omayed, Western Mediterranean coastal dunes
Crucianella maritima L.		Western Mediterranean coastal dunes
Cyperus conglomeratus Rottb.		Lake Bardawil, Lake Burullus
Daucus litoralis var. *forsskaolii* Boiss.		Western Mediterranean coastal dunes
Daucus littoralis var. *littoralis* Sm.		Lake Bardawil
Daucus syrticus Murb.	Rare	Lake Burullus, Omayed, Western Mediterranean coastal dunes
Echinops spinosus L.		Western Mediterranean

		coastal dunes
Echium angustifolium Mill.		Lake Bardawil, Lake Mariut
Echium angustifolium subsp. *angustifolium* Mill.		Western Mediterranean coastal dunes, Sallum Area
Echium angustifolium subsp. *sericeum* (Vahl) Klotz		Omayed, Western Mediterranean coastal dunes, Sallum Area
Echium rubrum Forssk.		Sallum Area
Elymus farctus (Viv.) Runem. ex Melderis		Lake Burullus, Lake Mariut, Omayed, Western Mediterranean coastal dunes
Enarthrocarpus lyratus (Forssk.) DC.		Lake Mariut, Western Mediterranean coastal dunes, Sallum Area
Enarthrocarpus pterocarpus (Pers.) DC.		Sallum Area
Erodium chium (L.) Willd.		Sallum Area
Erodium gruinum (L.) L'Her		Lake Mariut
Erodium laciniatum (Cav.) Willd.		Lake Bardawil, Lake Burullus
Erucaria hispanica (L.) Druce		Lake Bardawil, Lake Mariut
Euphorbia hierosolymitana Boiss.	Rare	Omayed
Fagonia cretica L.		Lake Mariut
Fumaria judaica Boiss.		Lake Mariut
Gagea fibrosa (Desf.)Schult. & Beauverd	Endangered	Omayed
Glebionis coronaria (L.) Tzvelev		Lake Burullus, Western Mediterranean coastal dunes
Hymenocarpos circinnatus (L.) Savi		Western Mediterranean coastal dunes
Hyoscyamus muticus L.		Lake Mariut
Hyoseris radiata subsp. *graeca* Halácsy		Sallum Area
Hyoseris scabra L.		Omayed, Sallum Area
Lathyrus marmoratus Boiss. & Blanche		Lake Burullus, Omayed, Western Mediterranean coastal dunes
Leontodon tuberosus L.		Western Mediterranean coastal dunes
Limoniastrum monopetalum (L.) Boiss.		Lake Bardawil, Lake Burullus, Lake Mariut, Omayed, Western Mediterranean coastal dunes, Sallum Area
Limonium narbonese Mill.		Sallum Area
Limonium pruinosum (L.) Chaz.		Lake Bardawil, Lake Manzala, Lake Burullus

Limonium sinuatum subsp. *sinuatum* (L.) Mill.		Sallum Area
Limonium sinuatum subsp. *bonduellei* (Lestib.) Sauvage & Vindt		Sallum Area
Lobularia maritima (L.) Desv.		Western Mediterranean coastal dunes
Lotus creticus L.		Omayed, Western Mediterranean coastal dunes, Sallum Area
Lotus polyphyllos E.D. Clarke		Omayed, Western Mediterranean coastal dunes, Sallum Area
Lycium europaeum L.		Omayed, Western Mediterranean coastal dunes
Lycium schweinfurthii Dammer		Lake Burullus
Lycium schweinfurthii var. *schweinfurthii* Dammer		Western Mediterranean coastal dunes
Muscari bicolor Boiss.		Lake Bardawil
Nicotiana glauca R. C. Graham		Western Mediterranean coastal dunes
Pancratium maritimum L.		Lake Bardawil, Lake Burullus, Omayed, Western Mediterranean coastal dunes, Sallum Area
Paronychia argentea Lam.		Lake Bardawil, Western Mediterranean coastal dunes
Paronychia capitata (L.) Lam.		Western Mediterranean coastal dunes
Phagnalon rupestre (L.) DC.		Western Mediterranean coastal dunes
Phlomis floccosa D. Don		Omayed
Plantago crassifolia Forssk.		Lake Manzala, Lake Burullus, Western Mediterranean coastal dunes
Plantago squarrosa Murray		Lake Burullus, Western Mediterranean coastal dunes
Prasium majus L.	Vulnerable	Omayed
Salsola tetragona Delile	Endangered	Omayed
Scabiosa eremophila Boiss.	Rare (IUCN)	Omayed
Silene colorata var. *colorata* Poir.		Sallum Area
Silene rubella L.		Lake Burullus, Lake Mariut, Western Mediterranean coastal dunes
Silene succulenta Forssk.		Lake Burullus, Omayed, Western Mediterranean coastal dunes, Sallum Area

Solanum elaeagnifolium Cav.		Lake Bardawil
Sonchus bulbosus (L.) N. Kilian & Greuter		Western Mediterranean coastal dunes
Sporobolus pungens (Schreb.) Kunth		Omayed, Western Mediterranean coastal dunes
Suaeda pruinosa Lange		Western Mediterranean coastal dunes, Sallum Area
Thesium humile var. *humile* Vahl		Sallum Area
Trigonella maritima Poir.		Lake Mariut

IPA	**National threatened habitat**	**Is this habitat also threatened across the whole Mediterranean**
Lake Bardawil, Lake Manzala, Lake Burullus	Marine Sand bar	Yes
Lake Manzala	Coastal salt marshes	Yes
Lake Manzala, Lake Burullus, Lake Mariut	Reed swamps: *Phragmites australis* (Cav.) Trin. ex Steud.	Yes
Lake Burullus	Sand formations	Don't know
Lake Burullus	Lake islets	Don't know
Lake Edku, Lake Mariut	Mediterranean wetland	Yes
Omayed	Non-saline depressions	Yes
Omayed	Rocky ridges and plateau	Yes
Omayed	Dry salt marshes	Don't know
Omayed, Western Mediterranean coastal dunes	Coastal sand dunes	Yes
Moghra Oasis	Inland reed swamps	Don't know
Moghra Oasis	Gravel desert	Yes
Moghra Oasis	Sand hammocks	Don't know
Sallum Area	Inland sand plains	Yes
Sallum Area, Saint Katherine, Halayeb Triangle	Wadis (i.e. desert valleys)	Yes
Wadi El-Rayan	Uninhabited Saharan oasis	Don't' know
Wadi El-Rayan	Limestone escarpments	Don't' know
Wadi El-Rayan	Inland wetland	Don't' know
Nabq, Hurghada	Mangrove swamps	No
Hurghada	Red Sea coastal plain	No
Hurghada, Wadi El Gemal, Wadi Allaqi	Downstream parts of the wadis (i.e.	Yes

	desert valleys)	
Wadi El Gemal	Coastal marshes	Yes
Lake Nasser	Khors (i.e. side branches of the lake)	No
Saluga and Ghazal	Nile Islands	No
Halayeb Triangle	Sandy plains	No

Annex 2. Alien species in the Egyptian flora (Shaltout, 2008)

I: Intentional introduction
A: Accidental introduction.

I- Causals					
1	*Alcea rosea*	**I**	26	*Ipomoea pes-caprae* subsp.*brasiliensis*	**I**
2	*Althaea ludwigii*	**I**	27	*Ludwigia erecta*	**A**
3	*Amaranthus tricolor*	**I**	28	*Lupinus albus*	**A**
4	*Apium grveolens*	**I**	29	*Medicago sativa* subsp. *sativa*	**I**
5	*Arundo donax*	**I**	30	*Melinis repens* subsp. *grandiflora*	**I**
6	*Avena sativa*	**I**	31	*Nicotiana plumbaginifolia*	**I**
7	*Brassica rapa*	**I**	32	*Nicotiana rustica*	**I**
8	*Briza maxima*	**I**	33	*Nigella sativa*	**I**
9	*Clitoria ternatea*	**I**	34	*Panicum antidotale*	**I**
10	*Coriandrum sativum*	**I**	35	*Panicum maximum*	**I**
11	*Cyperus alternifolius* subsp. *flabelliformis*	**I**	36	*Panicum miliaceum*	**I**
12	*Dichondra micrantha*	**A**	37	*Paspalum racemosum*	**I**
13	*Ehrharta calycina*	**I**	38	*Petroselinum crispum*	**I**
14	*Eleusine coracana*	**I**	39	*Phalaris aquatica*	**I**
15	*Eleusine floccifolia*	**I**	40	*Phleum pratense*	**I**
16	*Elodea canadensis*	**I**	41	*Pisum sativum* subsp. *sativum*	**I**
17	*Eragrostis sarmentosa*	**I**	42	*Sesbania sericea*	**A**
18	*Eragrostis tef*	**I**	43	*Setaria italica*	**I**
19	*Eragrostis tremula*	**I**	44	*Sorghum x drummondii*	**I**
20	*Eruca sativa*	**I**	45	Sporobolus wrightii	**I**
21	*Foeniculum vulgare* subsp. *vulgare*	**I**	46	*Sporobolus natalensis*	**I**
22	*Hedysarum coronarium*	**I**	47	*Trifolium alexandrinum*	**I**
23	*Hibiscus sabdariffa*	**I**	48	*Trifolium incarnatum* var. *incarnatum*	**I**

24	*Holcus annuus*	**A**	49	*Vigna unguiculata* subsp *sesquipedalis*	**I**
25	*Hordeum vulgare*	**I**	50	*Viola tricolor*	**I**

II- Naturalizers					
1	*Argemone mexicana*	**A**	26	*Galinsoga parviflora*	**A**
2	*Atriplex canescens*	**A**	27	*Heliotrobium curassavicum*	**A**
3	*Atriplex holocarpa*	**A**	28	*Lantana camara*	**I**
4	*Atriplex lindley* subsp. *inflata*	**A**	29	*Lathyrus sativus*	**A**
5	*Atriplex nummularia*	**A**	30	*Matricaria recutita*	**I**
6	*Atriplex semibaccata*	**A**	31	*Nicandra physalodes*	**I**
7	*Atriplex suberecta*	**A**	32	*Nicotiana glauca*	**A**
8	*Bidens bipinnata*	**A**	33	*Nothoscordum gracile*	**A**
9	*Bromus catharticus*	**A**	34	*Oxalis pes-caprae*	**A**
10	*Blainvillea acmella*	**A**	35	*Parkinsonia aculeata*	**I**
11	*Chenopodium ambrosioides*	**I**	36	*Phalaris canariensis*	**I**
12	*Conyza albida*	**A**	37	*Plantago exigua*	**I**
13	*Conyza canadensis*	**A**	38	*Populus euphratica*	**I**
14	*Cuscuta campestris*	**A**	39	*Ricinus communis*	**I**
15	*Cuscuta chinensis*	**A**	40	*Rubus sanctus*	**I**
16	*Dactylis glomerata*	**I**	41	*Salix tetrasperma*	**I**
17	*Datura metel*	**I**	42	*Securigera securidaca*	**A**
18	*Datura innoxia*	**A**	43	*Sesbania sesban*	**I**
19	*Datura stramonium*	**A**	44	*Solanum elaeagnifolium*	**A**
20	*Euphorbia hyssopifolia*	**A**	45	*Stenotapharum secundatum*	**I**
21	*Euphorbia lasiocarpa*	**A**	46	*Symphyotrichum squamatum*	**A**
22	*Euphorbia mauritanica*	**A**	47	*Tagetes minuta*	**A**

23	*Euphorbia serpens*	**A**	48	*Verbesina encelioides*	**A**
24	*Festuca arundinacea*	**A**	49	*Xanthium strumarium*	**A**
25	*Ficus carica*	**I**	50	*Ziziphus spina-christi*	**I**

III- Weeds

1	*Acrachne racemosa*	**A**	17	*Digitaria violascens*	**A**
2	*Amaranthus blitoides*	**A**	18	*Eleusine indica*	**A**
3	*Amaranthus caudatus*	**A**	19	*Euphorbia heterophylla*	**A**
4	*Amaranthus hybridus* subsp. *cruentus*	**A**	20	*Euphorbia hirta*	**A**
5	*Amaranthus hybridus* subsp. *hybridus*	**A**	21	*Euphorbia inaequilatera* var. *inaequilatera*	**A**
6	*Amaranthus palmeri*	**A**	22	*Euphorbia prostrata*	**A**
7	*Amaranthus retroflexus*	**A**	23	*Lepidium sativum* subsp. *sativum*	**A**
8	*Amaranthus spinosus*	**A**	24	*Lepidium virginicum*	**A**
9	*Ambrosia artemisiifolia*	**A**	25	*Merremia dissecta*	**A**
10	*Briza minor*	**A**	26	*Oenothera drummondii*	**A**
11	*Bromus inermis*	**A**	27	*Paspalum dilatatum*	**A**
12	*Cenchrus biflorus*	**A**	28	*Phalaris arundinacea* var. *picta*	**A**
13	*Cenchrus echinatus*	**A**	29	*Physalis angulata*	**A**
14	*Chenopodium botrys*	**A**	30	*Physalis ixocarpa*	**A**
15	*Chloris pycnothrix*	**A**	31	*Sorghum halepense*	**A**
16	*Commelina benghalensis*	**A**			

IV- Invasives					
1	*Azolla filiculoides*	**I**	4	*Ipomoea carnea*	**I**
2	*Bassia indica*	**I**	5	*Prosopis juliflora*	**I**
3	*Dalbergia sissio*	**I**			

V Transformers			
1	*Eichhornia crassipes*	**I**	

Annex 3. Aichi Biodiversity Strategic Goals and Targets

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio-economic conditions.

Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use

Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that over-fishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are mini-mized, so as to maintain their integrity and functioning.

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 11: By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Target 17: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the

Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011–2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

Annex 4. Protected Areas Network in 2013 (EEAA, 2013)

Protectorate	Date of Declaration	Type	Area (km^2)
1.Ras Mohamed and two Islands of Tiran and Sanafeer	1983	Natural Heritage Protectorate	850
2.Zaranik and Sabkhet Al Bardawil	1985	Wetland Protectorate & Fowl Natural Retirement	230
3.Al Ahrash Protectorate Fowl Natural Retirement	1985	Desert Protectorate & Resources Development	8
4.Al Omayed Natural Protectorate	1986	Coastal /Desert Protectorate/Bio- Surounding Protectorate	700
5.Elba Natural Protectorates	1986	Natural National Parks Protectorate	35600
6. Saluga and Ghazal	1986	Wetlands & Natural Scenery Protectorate	0.5
7. St. Katherine	1988	Desert Protectorate & World Cultural Heritage	5750
8.Ashtum El Gamil Protectorate	1988	Wetland Protectorate & Fowl Natural Retirement	180
9 Qaroun Protectorate	1989	Wetland Protectorate	1385
10. Wadi El Rayan Protectorate	1989	Natural National Site & World Natural Heritage	1759
11. Wadi El Allaqi Protectorate	1989	Desert Protectorate- Bio-Surrounding Protectorate	30000
12.Wadi El Assyouti Protectorate	1989	Reproduction & Multipurpose Protectorate	35
13.Qubet El Hasana Protectorate	1989	Geological Protectorate	1
14 Petrified Forest Protectorate	1989	Geological Protectorate	7
15.Wadi Senour Cave Protectorate	1992	Geological & National heritage Protectorate	12
16. Nabq Protectorate	1992	Multipurpose Protectorate	600
17. Abu Gallum Protectorate	1992	Natural Scenery Protectorate	500

Protectorate	**Date of Declaration**	**Type**	**Area (km^2)**
18. Taba Protectorate	1998	Desert & Natural Site Protectorate	3595
19. Al Burrulus Protectorate	1998	Wetland Protectorate	460
20.Nile River Islands (144)Protectorates	1998	Wetland Protectorates	160
21. Wadi Degla Protectorate	1999	Desert Land Protectorate	60
22. Siwa Protectorate	2002	Desert & Civilizational Site Protectorate	7800
23. White Desert Protectorate	2002	Desert Protectorate	3010
24. Wadi El Gemal/ Hamata Protectorate	2003	Desert Protectorate	7450
25. Red Sea Northern Islands	2006	Resources development	1991
26. El Gulf El Kebeer	2007	Natural National park	48523
27. El Dababiya	2007	Geological Protectorate	1
28. El Salum	2010	Marine protected area	383
29. El Wahat El Bahreya (Mount English, Black desert, Al Magrafah & Desert)	2010	Natural heritage	109
30. Niazak Gabal Kamel, El Wadi El Gadid	2012	Natural National Park	**0.5**

Annex 5. Animals in *Ex-situ* Conservation Programmes

#	Animal	Initial Number (2002/2003)	Total Number After *ex-situ* Reproduction					Reproduction Source
			2005/2006	2006/2007	2007/2008	2008/2009	2009/2010	
1	Dorcas Gazelle (*Gazelle dorcas dorcas*)	17	24	36	64	71	91	Sinai Peninsula and Eastern Desert
2	Nubian Ibex (*Capra Ibex nubiana*)	4	17	21	29	27	30	Sinai Peninsula
3	Barbary Sheep (*Ammotragus lervia*)	4	19	24	27	31	31	Breeding center
4	Addax Antelop (*Addax nasomaculatus*)				4	6	7	Inserting 4 in raising program (2009) breeding center
5	Scimitar oryx (*Oryx dammah*)				2	4	9	Inserting 2 in raising program (2009) breeding center
6	Arabian oryx (*Oryx leucoryx*)				2	4	6	Inserting 2 in raising program (2009) breeding center
7	Striped Hyena (*Hyaena hyaena dubbah*)	2	2	4	6	8	8	Sinai Peninsula
8	Caracal (*Caracal caracal schmitzi*)				2	4	4	Sinai Peninsula inserting 2 in raising program

#	Animal	Initial Number (2002/2003)	Total Number After *ex-situ* Reproduction					Reproduction Source
			2005/2006	2006/2007	2007/2008	2008/2009	2009/2010	
								(2010) breeding center
9	Fennec Fox (*Vulpes zerda*)	6	7	13	13	20	23	Sinai Peninsula
10	Hyrax (*Procavia Species*)	4	8	15	26	40	40	Sinai Peninsula
11	Crested Porcupine (*Hystrix cristata*)	4	4	8	12	21	23	Sinai Peninsula
12	Cheetah (*Acinonyx jubatus*)					2	3	Inserting 2 in raising program (2011) breeding center
13	Egyptian Goose (*Alopochen aegyptiacus*)	10	37	73	109	133	164	Nile Valley
14	Egyptian Turtle (*Testudo kleinmanni*)	12	24	26	30	36	67	Western north coast
15	African Turtle (*Geochelone sulcata*)	5	212	320	639	908	1,216	Area between borders of Egypt, Libya, Chad and Sudan

Annex 6. List of Botanical Gardens in Egypt

No.	Name of Botanical Garden	Present Area (Feddan)*	Date of Establishment	No. of Families	No. of Genera	No. of Species
1	Ain Shams Univ., Fac. of Sci.	3	1953	114	750	1200
2	Alexandria Univ., Fac. of Sci.	2	1942			500
3	Cairo Univ., Fac. of Agric.	15	1947	31	64	80
4	Orman Bot. Gard., Giza	28	1873	90	520	600
5	Zohriya, Gezeira, Cairo	8	1868	57	143	442
6	Quba Palace, Cairo	124	1960	72		551
7	Zoo Garden, Giza	80	1890	68	208	342
8	Manial Palace, Giza			61	150	239
9	Agriculture Museum, Dokki, Giza		1937	32	73	94
10	Azbakiya Garden, Cairo	10	1867	41	83	800
11	Antoniadis Garden, Alexandria	45	1860			62
12	Al-Nozha Garden, Alexandria		300 BC.			

No.	Name of Botanical Garden	Present Area (Feddan)*	Date of Establishment	No. of Families	No. of Genera	No. of Species
13	Rose Garden, Alexandria	5	1928			
14	Aswan Garden, Aswan	17	1928	59	97	371

* Feddan= 4,200 m^2

Source: Ministry of Agriculture and Land Reclamation, 2014

8.1 Annex 7. Progress towards Implementing the National Biodiversity 8.2 Strategy and Action Plan 1998-2017

Following is a systematic examination of each of the programmes as outlined in the NBSAP 1998 - 2017. The original text of each programme component is shown in italics.

1. Programme for Institutional Development and Capacity Building for Nature Conservation

Component 1: Develop the structure and build the capacity of the NCS within the EEAA to fulfill its mandate under Law 102, Law 4 and international conventions.

The efforts to restructure and build the capacity of the NCS have gone through many phases and are still ongoing. In the late 1990s and early 2000, the European Union supported an ambitious effort to develop target protected areas in Egypt along with providing some important support for the central NCS offices. Between 2005 and 2008, the Italian Cooperation provided financial support for a further effort that sought to restructure the NCS and establish it as an independent agency parallel to the EEAA, rather than being under it, with financial autonomy and greater flexibility in decision making. That effort prepared the ground for a more ambitious GEF supported project (ongoing to date), which is seeking to achieve the targets set forth by the previous endeavor. Still, there is limited success to date in achieving structural changes that would enable the NCS to carry out its mandate. On the other hand capacity building efforts and projects (e.g. NCS Capacity Building Project from 2005-2008, funded by the Italian Cooperation) had moderate success in developing some capacity within NCS.

Status of Implementation	Outcome	Obstacles	State of knowledge
Incomplete. Efforts are still underway to restructure NCS and build its capacity to mainstreaming outside the environmental regulatory bodies.	Good capacity building although partial, but current structure still has limited ability to implement its mandate	Governmental structures and overlaps do not accommodate needed flexibility and financial independence	Good. Many internal reports and reviews available

Component 2: Capacity building within, and networking between, other Line Ministries, Governorates and other government organizations having an impact upon Egypt's natural heritage resources.

This component had a small degree of ad hoc achievement resulting largely from implementation of cross cutting or joint projects between the EEAA and other main stream ministries and governorates, but there are no planned activities to fulfill this component's objective. The most important bodies were those involved with tourism activities and regulations. A broad collaboration was established with the Ministry of Tourism and the Tourism Development Authority (TDA), as well as the Red Sea and the South Sinai Governorates to help manage the Red Sea protected areas in the service of tourism activities. Some other capacity building and collaboration resulted from cooperation with the ministries of Agriculture and Interior (on wildlife trade and CITIES implementation), and with the ministries of Health and Agriculture (on bird flu and other zoonotic diseases).

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Limited and localized efforts	Some capacity building in important governorates and key ministries, but networking limited and mostly not institutionalized but based on personal contacts	Lack of joint clear articulate plans. Weak coordination amongst governmental stakeholders	Limited. Systematic documentation of efforts or results and follow up actions are required

2. Protected Areas Identification and Management Programme

Component 1: Identify the PA Network. Identification involves the establishment of a system plan that assesses all existing, candidate and potential protected areas and reviews and assesses them through field and desk studies.

As indicated earlier, this component had the highest rate of implementation as a result of carrying out a Protected Area System Plan in the late 1990s and its use for the expansion of the PA Network and the declaration of new PAs. The number of PAs in Egypt had increased from 21 in 1999 (covering about 77,776 km²) to 30 in 2013 (covering over 141,179.5 km² and extending over 14.6 % of the total land and marine areas of the country.

Although the System Plan has gaps in both coverage and representation, it has succeeded in guiding the PA Network planning effort in a rational way.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Complete, but in need of revision and updating	A system plan that has been implemented and led to more than doubling the PA	Limited involvement of other governmental	Excellent documentation from field monitoring and

	network size	and non-governmental stakeholders. Limited funding.	surveys

Component 2: Develop management and infrastructure of the PA network, including the development and implementation of management plans for existing protected areas.

A great effort has been dedicated towards meeting this objective during the past 15 years, since the adoption of the NBSAP. Prior to the mid-1990s there were rudimentary efforts to establish management planning for the PA network, largely focused on southern Sinai. From the mid-1990s, and with the advent of the new millennium, a more organized approach was underway with many donor funded projects supporting this effort. Much of the NCS/EEAA efforts over the past two decades have been focused on addressing the need of proper management of PAs as its top priority with much support from the donor community.

In South Sinai the EU supported the development of PA management efforts for over a decade, which resulted in establishing good capacity (probably the best in the country to date), infrastructure and a management planning process of some degree of competence.

In the Red Sea region, the USAID supported multiple projects aiming at the establishment and management of marine and terrestrial PAs, especially as ecotourism resources. Two major projects were implemented over a decade that had major components supporting the development of PA management.

In the Western Desert the Italian cooperation supported and continues to support PA management initiatives, with a long involvement with the Wadi El Rayan / Wadi El Hitan PA and elsewhere.

GEF/UNDP funding was made available to support management planning in three Mediterranean coastal PAs (Zaranik, Burullus and Omayed).

The NCS Capacity Building Project (2005-2008, funded by the Italian Cooperation), attempted to establish a unified planning and reporting system for the PA network, with moderate success.

Today most Egyptian PAs have some management planning process. The format and quality of these plans are variable and the degree of their implementation is also variable but generally modest. As indicated earlier (Section 9.4), the assessment of management effectiveness of protected areas was carried in 2009 for 11 Pas, thus exceeding the target adopted by the CBD, which requires Parties to conduct evaluation for at least 30 % of their protected areas by 2010.

Status of Implementation	Outcome	Obstacles	State of knowledge
Partially complete, but patchy	Management plans (of variable quality) available for most PAs, but infrastructure and implementation lagging in most cases	Limited and non-sustainable funding, inappropriate NCS management structure	Very good. Well documented plans, reviews and capacity assessments

3. National Biodiversity and Natural Heritage Inventory and Monitoring Programme

Component 1: The Biodiversity Department will be strengthened to be a focal point to coordinate and facilitate biodiversity research and monitoring

Although concrete steps have been taken to fulfill this component, outcomes fall short of achieving its objective. The Biodiversity Department of the NCS has been the subject of multiple development efforts, which had partial success in establishing a sustainable and capable body.

The National Biodiversity Unit (prototype of the Biodiversity Department) was established with GEF support as part of the ground work for developing a Biodiversity Country Study in the early 90s and the NBSAP in the late 90s. The early efforts succeeded in establishing a basic database of Egyptian biodiversity resources and produced a good collection references, as well as establishing the basic capacity in the department. Subsequent efforts included the Biomap Project, an ambitious project supported by the Italian Cooperation that aimed to create a modern and efficient biodiversity data management system at the Biodiversity Department. The project succeeded in making a vast collection of biological observations and developed some innovative assessment tools and provided some excellent outputs in the form of web resources, publications and training opportunities. However, the project did not manage to establish resident capacity within the department and much of its products have dissipated, leaving behind a structure that is still weak both technically and organizationally.

Status of Implementation	Outcome	Obstacles	State of knowledge
Partially complete	Biodiversity Department still with limited capacity and weak and fragmented capability	Failure to develop local capacity. Non-sustainable financial resources to maintain	Very good. Well documented reports, data bases, studies and reviews

		institutional memory	

Component 2: Institutional strengthening and capacity building for other organizations involved in biodiversity research and monitoring

Some sporadic efforts were conducted over the past two decades that mostly aimed at capacity building and training of personnel from EEAA partner organizations, either in Government or in the NGO, academia or private sector. Examples include training of Ministry of Interior personnel on CITES enforcement; a workshop on Red List development and assessment of endangered species; and workshops on invasive species involving academics and practitioners from other ministries. The undertaking of these efforts did not follow a structured approach, but rather were on ad *hoc* basis. The outcome of these efforts is difficult to evaluate, but undoubtedly helped to raise awareness and strengthen capacity within these organizations and established better communications with the EEAA.

There is no evidence of institutional development in organizations outside the EEAA/NCS in response to biodiversity issues or needs.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Incomplete	Limited and scattered inputs to support some of the major collections	No structured approach and limited financial resources	Very limited documentation of efforts

Component 3: A Natural History Museum will be established to promote the study and research of biodiversity in Egypt and the region (Middle East/North Africa).

Efforts to establish the Egyptian Natural History museum did not go beyond the proposal and planning phase and the establishment of a virtual natural history museum in Sharm El Sheikh. Some of the activities carried out to implement the NBSAP, and in support of the establishment of the Biodiversity Department at the NCS all help establish a strong ground on which the future museum could be established. The large capital required to establish the museum has probably been a main obstacle in the face of its establishment.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Incomplete	Preliminary plans and	Limited	Fair

	proposals drawn. A virtual natural history museum in Sharm El Sheikh	funding opportunities and limited effort made	

4. National Hunting Management Programme

This program was meant to focus on the development of a comprehensive system of wildlife management in Egypt with sustainable management and financial systems.

Over the past two decades many activities have been implemented with varying degrees of success and sustainability, but the main goal of establishing a comprehensive hunting management system in Egypt was not achieved. Important steps taken included establishment of rudimentary systems for waterbird hunting, regulation of wildlife collection and trade (for scientific research and the pet trade) and CITES management. There were also several serious initiatives in 2010 for the establishment of hunting reserves/hunting concessions: one for Houbara Bustard in the Matruh Governorate and one for Ibex in the Eastern Desert. None of these plans materialized though some came very close to being implemented. Security concerns and concerns over the ability of Egyptian authorities to control the hunting activities properly were the main obstacles. Not all these steps managed to become institutionalized properly. The CITES management is currently under the control of the Ministry of Agriculture, while the efforts to manage wildlife trade have faded. Similarly, the waterbird hunting regulations have had limited application and reach.

Many high profile wildlife violations helped initiate national campaigns that garnished substantial public support and highlighted the need for a sustainable hunting system in the country. Examples include a campaign against bird of prey catching for falconry; a campaign against collection of sea cucumbers; a campaign against hunting of ungulates; and a campaign against collection of reptiles for the pet trade.

There were also several important capacity building efforts, most importantly for CITES management.

Hunting regulations in Law 4/1994 were updated recently by Law 9/2009 and its executive regulations, which provided an updated listing of protected species in Egypt. These legislative reviews do represent a step forward and a positive advancement in the legal framework governing the hunting issue. However, it still falls short of addressing the harvest of biodiversity resources in a more holistic and comprehensive manner.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Partial. Efforts made	Some hunting regulations	Limited ability to	Fairly good

covered elements of the system, but not in an integrated comprehensive manner	established. Improved wildlife protection legislation. Sporadic efforts and ad-hoc arrangements made to control and regulate wildlife harvesting in different parts of the country and for certain species	coordinate with other concerned governmental bodies, huge scale of the issue, low awareness and weak law enforcement	

5. Natural Heritage Resources Management Programme

This is a program to address the adverse impacts of current activities on, and to develop protection measures more specific for the management of, natural heritage resources outside Protected Areas (i.e. not under the auspices of Law 102 / 1983) and cover issues not addressed by other programs.

There were few achievements under this program compared with the effort that has been dedicated within the PA network. Biodiversity outside the PA network still remains particularly vulnerable, despite many diverse efforts that sought to address some aspects of biodiversity loss and degradation outside the PA network. These included, for example, the new legislation regulating hunting outside the PA network (but implementation is still sporadic and weak); the development of tourism development standards for coastal developments along the Red Sea (although this is not closely implemented); and private captive breeding initiatives and community based resource management initiatives in and near PAs. As indicated before, complementary *ex-situ* conservation measures were undertaken outside protected areas for 17 animal and plant species. Efforts have also been made to rehabilitate some endemic flora and fauna species to increase their numbers in their natural habitats to protect them from extinction.

On the other hand there was little advancement made towards the systemic treatment of the major biodiversity conservation issues outside PAs (e.g. landscape planning and invasive species management, etc.). The major exception to this is the EIA process, which has become the main systemic tool for managing risks to biodiversity outside (and inside) the PA network. Biodiversity is regularly being taken into consideration in most of the major development projects subjected to the EIA process. This has proven to be a critical tool in managing impacts on biodiversity resources outside the PA network, where there still is a need for legislation that regulates their use.

In the area of biosafety, much progress was made to establish the national legislation that implements the provisions of the Cartagena Protocol on Biosafety. This was achieved through a major collaborative effort under the Ministerial Committee for Drafting of the Biosafety Law.

This collaborative effort brought to the table representatives from at least 10 national authorities, NGOs and experts including the Ministry of Environment, Ministry of Health and Population and its agencies, Ministry of Agriculture and Land Reclamation, the Center for Agricultural Research and the Committee for Bio-security, Ministry of Foreign Trade and Industry, Foreign Affairs Ministry, Ministry of Higher Education and of State for Scientific Research, Supreme Council for Universities, Academy of Scientific Research and Technology, Confederation of Industries and the Chamber of Commerce.

The final draft of the proposed law regulating the handling of genetically engineered products in Egypt was referred to the Legislation Department of the Ministry of Justice for review from the legislative aspect and was subsequently submitted to the People's Assembly (through the Council of Ministers) for promulgation.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Incomplete.	Examples include: Inclusion of biodiversity concerns in the EIA process. Tourism development standards, sporadic captive breeding and local community resource management initiatives. Draft law regulating the handling of genetically engineered products in Egypt	Lack of planning and coordinated approach. Limited ability or willingness to coordinate with other stakeholders (outside EEAA)	Good.

6. International Conventions Compliance Programme

Egypt's international and regional obligations dictated by the conventions to which it is signatory.

Extensive efforts were made to meet Egypt's commitments to international and regional conventions and agreements related to biodiversity. Egypt is signatory to at least nine international biodiversity related conventions and agreements, most important of these is the CBD, CMS, AEWA, CITES, RAMSAR, and the Cartagena Protocol on Biosafety and the Nagoya Protocol on ABS. The EEAA is the focal point for most of these agreements and has spent a great deal of effort in meeting their reporting and follow up obligations, actively participating in meetings and discussions. On the other hand, implementation at the local level faced different degrees of difficulty and as a consequence variable effectiveness as outlined above.

Institutional development supporting Egypt's international obligations still remains limited, but included some important steps. Most importantly, capacity within NCS/EEAA to deal with the international reporting and follow up obligations and maintain an institutional memory was established. CITES convention management authority (within the Ministry of Agriculture) also witnessed significant development.

There were also important legislative developments that reflect Egypt's international obligations, including the Egyptian Biosafety Law for implementing national obligations under the Cartagena Protocol on Biosafety. This law has been approved by the Legislative Committee of the Cabinet of Ministers. It was further approved by the Cabinet of Ministers and forwarded to the Legislative Institution to be promulgated into law. Other important legislative advancement include the Egyptian draft law on access and benefit sharing to implement the national obligations under the Nagoya Protocol on ABS, and the revisions of Law 4/1994 and its executive regulations amended by Law 9/2009, which have been made to better reflect Egypt's international obligations (e.g. protecting many of the taxa listed by some conventions, such as CMS).

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Good efforts	Improved responsiveness and awareness of international obligations, but limited institutional development	Limited planning and coordinated approach. Inadequate capacity and appears to be of low priority	Fairly good

7. Public Awareness, Education and Involvement Programme for Natural Heritage

Component 1: Build public awareness capabilities within the NCS.

Fair efforts were made to establish the public awareness capacity at the NCS. However, a nominal unit was established, where capacity accumulation has taken place as a byproduct of multiple activities and in response to arising needs of the NCS. A Communication, Education and Public Awareness Strategy (CEPA) was developed in 2009 for the NCS following CBD guidelines, but there was limited support and follow up on its implementation.

Status of Implementation	Outcome	Obstacles	State of knowledge
Partial	Nominal public awareness department with limited capacity.	Inappropriate NCS structure leading to lack of guidance and limited sustainable financing	Fairly good

Component 2: Improve the quantity and quality of information about natural heritage and capacities of information distributors to disseminate this information.

There were numerous educational, promotional and informational products made, ranging from pamphlets to t-shirts to high quality documentary movies and newsletters. Although the quality was fairly high overall, the outreach was limited and the dissemination localized in most cases. However, it is most likely that the educational materials stemming from NCS activities did contribute significantly to the current biodiversity awareness levels in Egypt. In most cases, these resources have been strongly appreciated by the public.

These products were the result of temporary interventions funded by donors, and thus the production of such materials was short lived until available stocks were depleted. There are little internal financial resources made available to produce new materials or reproduce old ones.

Status of Implementation	Outcome	Obstacles	State of knowledge
Fairly good. Improved outputs, but still limited dissemination capacity	Many high quality materials produced and disseminated. Improved native capacity, but low sustainability	Limited sustainable financing	Fairly good

Component 3: Integrate natural heritage and biodiversity conservation into the national education curriculum and build education institutions and teaching capacities in this field.

Biodiversity has had increasing coverage in school curricula, as well as in university undergraduate and graduate programs. For elementary and high schools, issues of protected areas and wildlife had some casual mention, but there are an increasing number of students addressing biodiversity issues in their graduate studies. Although there are dedicated environmental studies in a number of universities, the level of specialization and depth of knowledge of biodiversity issues is still limited.

At least three donor projects had dedicated activities aiming at mainstreaming biodiversity and environmental considerations into school curricula and school children.

Most advanced graduate biodiversity related studies are still carried out in foreign institutions, where levels of expertise and knowledge base are much greater than in Egypt.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Incomplete	Sporadic reference to natural heritage in school curricula. More in-depth integration in a number of university programs	Limited planning and coordinated approach. Inadequate capacity and low priority	Fairly good

Component 4: Increase awareness of the business, NGO and local community about natural heritage issues.

Most efforts to raise awareness of the business community of biodiversity values have targeted the tourism sector in the Red Sea and South Sinai areas within the framework of ecotourism development. Other sectors targeted, although to a lesser extent, were the organic farming and medicinal plant production sectors. Links with other sectors are not strong or evident, but most recently the renewable energy sector was and still is a subject of intensive efforts to raise awareness of wind energy and migratory bird conflicts.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Partial	Multiple scattered initiatives by private sector and NGOs with	Limited planning and coordinated approach	Fairly good

	varying success		

8. National Wetlands Management Programme

This program will seek to establish a national framework for wetlands management and develop and implement integrated management plans for priority wetlands.

The main objectives met under this program were the establishment of management plans for four key wetlands in northern Egypt: Bardawil, Burullus, Wadi El Rayan and Qarun. This was a product of the MedWet project (a GEF/UNDP project) and the Wadi El Rayan Project (an Italian Cooperation/UNDP project). The implementation of these plans is variable or very limited to date. However, this planning effort helped to establish a core of expertise with a focus on wetland management at large and within the NCS. It also aided in the development of a draft wetland conservation strategy. However, it did not evolve further into an institutional unit within the NCS or lead to the adoption of a national wetland conservation strategy.

There are numerous efforts made to manage the Nile water resources and associated fisheries, but these are mostly socio-economic processes with little consideration to biodiversity issues, although with great impact on biodiversity.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Partial	Management plans established at select wetlands, but no effective national framework established and limited implementation	Complex coordination and planning. Limited financial resources and weak law enforcement capacity	Moderate

9. National Marine and Coastal Management Programme

Component 1: Establish a dynamic process for national comprehensive coastal zone planning, encompassing economic and social issues, and based upon strategic planning activities undertaken at the national level.

The protection and management of the Egyptian coastlines, extending for almost 3000 km along both the Mediterranean and the Red Sea is undoubtedly a priority for Egypt. Numerous initiatives have taken place in support of enhancing marine coastal zone resources management over the past two decades; although not all had biodiversity conservation as one of their explicit targets. They, nevertheless, had great relevance in most cases.

In 1994, a National Committee for Integrated Coastal Zone Management was established (activated in 2000-2001). The committee is primarily composed of the various governmental bodies and authorities concerned with different aspects of coastal zones management, as well as representatives of academic institutions, the private sector, and NGO's. The committee identified four priority areas for action, including pollution prevention in the Gulf of Suez, urban development in the Red Sea, biodiversity conservation in the Gulf of Aqaba and combating erosion along the Mediterranean coastline. The committee, however, does not have a clear mandate and real authority over the coastal zone. On the ground there is limited evidence of its effectiveness in guiding development and planning.

Several discrete coastal zone management initiatives have taken place in recent years, including the Alexandria Integrated Coastal Zone Management Project, which was developed with assistance from the World Bank (through a grant from the GEF) and is expected to have positive environmental impacts with the objective of contributing to a reduction in the load of land-based sources of pollution entering the Mediterranean Sea, especially from Lake Maryout and Alexandria. Other initiatives include a Strategy for Implementing Integrated Coastal Zone Management Process in Egypt; Integrated Coastal Zone Management (ICZM) in the North Coast; Coastal Area Management Programme (CAMP) Fuka-Matrouh and the Red Sea Coastal and Marine Resource Management project.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Fairly complete	Multiple coastal zone planning efforts for both Red sea and Mediterranean, but attempts at comprehensive approaches have limited success and implementation lagging	Complex coordination and planning. Overlapping jurisdictions. Limited cooperation and weak law enforcement capacity	Moderate

Component 2: Sustainable use of marine and coastal resources is to be achieved through a combination of scientific research, appropriate quotas and regulations, active monitoring and enforcement, and pilot projects allowing exploitation of certain resources by local people.

Marine and coastal resources management attracted many interventions over the past two decades. These include the National Oil Spill Contingency Plan established in 1998; the Red Sea Coastal and Marine Resource Management (GEF/World Bank funded project); the Egyptian Environmental Policy Program (USAID funded project) specifically including protection of biological resources in the Red Sea; the Red Sea LIFE (USAID funded project); the Gulf of Aqaba PA project (EU funded) and the GEF/UNDP MedWet project are amongst the more important initiatives that sought to establish different models of sustainable use of marina and coastal resources in both the Red Sea and Mediterranean.

The Red Sea LIFE project was specifically developed to help local people establish sustainable livelihoods in the coastal zone of the southern Red Sea.

In most cases these initiatives helped establish local capacity and provided resources for short term interventions, but their impacts at policy level were modest. Impact on the ground was variable but fairly significant in the Red Sea and Gulf of Aqaba.

Status of Implementation	Outcome	Obstacles	State of knowledge
Partial	Multiple initiatives with moderate to good success, but no comprehensive or systemic approach	Overlapping jurisdictions. Limited cooperation and weak law enforcement capacity	Good

10. National Arid Lands Management Programme

This program seeks to establish a national framework for the management of arid lands and will develop and implement integrated management plans for desert areas which are valuable rangelands and important natural and cultural heritage sites.

In fulfilling requirements of the United Nation Convention to Combat Desertification (UNCCD), ratified by Egypt, a National Action Plan (NAP) and a NAP National Coordination committee in Egypt was established, headed by the Minister of Agriculture and Land Reclamation and representatives from eight other ministries. The Committee was tasked with the formulation of general policies in accordance with the commitments of Egypt towards the implementation of the UNCCD, and coordination among ministries, authorities, NGOs and varied stakeholders concerned with combating desertification. The activities of the NAP have had limited implementation on the ground.

Many of the desert PAs has management plans that promote sustainable utility of arid lands, however implementation is some was limited or short lived in most cases. Community based resources management has been promoted in most desert PAs, where local communities live in close contact with biodiversity resources and are highly dependent on them.

Status of Implementation	Outcome	Obstacles	State of knowledge
Partial	National Action plan to combat desertification provides elements for a comprehensive approach, but implementation limited. Multiple site based initiatives in PAs, including community based management	Complex coordination and planning. Limited integration of local communities	Limited

11. Nature Based Tourism Management and Development Programme

The program will promote environmentally sound, sustainable tourism through the development of a national system to manage nature-based tourism and projects to demonstrate "wise use", ecotourism practices and technologies, in particular at Governorates where there is considerable on-going nature-based tourism. (i.e. South Sinai, Red Sea, Western Desert).

The past two decades witnessed a huge growth in nature-based tourism and ecotourism in Egypt. Many of the conservation efforts and PA management plans have had ecotourism development as a central theme that links nature conservation with economic benefit. There are numerous projects that led to establishing various guidelines and management practices and aimed at providing supportive measures to help develop ecotourism in a sustainable manner.

The development of ecotourism and ecotourism guidelines in the Red Sea perhaps had the greatest share of attention, with large investments from the EU and USAID in establishing a wide network of mooring buoys, as well as capacity building and sustainable financing for Red Sea PAs. The Red Sea Sustainable Tourism Initiative (RSSTI, USAID funded) specifically targeted ecotourism development in the Red Sea, while the Red Sea LIFE project aimed at maximizing local community benefit from the tourism industry. In the Western Desert the Italian Cooperation has been supporting the PA network there with the aim of establishing PAs as the nucleus for ecotourism in that region. The EU on the other hand supported the development of ecotourism infrastructure in South Sinai.

Moreover, ecotourism has been identified at the policy level as an important sector for growth by both the Ministry of Tourism and the Ministry of Environment. This common vision has led, in some cases, to significant cooperation and active mainstreaming of biodiversity conservation goals, driven mainly by economic incentives. Some of the good examples of collaboration and mainstreaming are the establishment of a development code for coastal tourism infrastructure along the southern Red Sea coast, a code established between the EEAA, TDA and Red Sea Governorate.

However, despite the overall activity, growth and positive collaboration in ecotourism development, there is still a large gap and need for mainstreaming of ecotourism objectives into other productive sectors that have direct and detrimental impacts on the prospects of ecotourism and its natural resource base. Important sectors include the petroleum and mineral extraction industries, agriculture, fisheries, energy and transportation.

Status of Implementation	**Outcome**	**Obstacles**	**State of knowledge**
Fairly complete, though no systemic approach achieved	Numerous sites based and regional initiatives made to promote nature-based tourism particularly in the Red Sea and Sinai with good success. However, no integrated comprehensive approach has been established	Overlapping jurisdictions, low willingness to coordinate and cooperate	Good

Progress in Egypt toward achieving the 2010 target of "significantly reducing the rate of biodiversity loss" is mixed, with significant progress in few areas, and limited progress in many others. As mentioned previously, important areas of the CBD that were not clearly addressed by the Egyptian NBSAP 1998-2017 include biosafety issues, benefit sharing, and local community participation.

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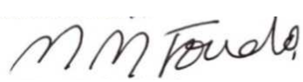
Signature of officer responsible for submitting national report



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