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Recent Vegetations Biodiversity in Nile Delta Wetlands in Egypt

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Aquatic plants

Introduction

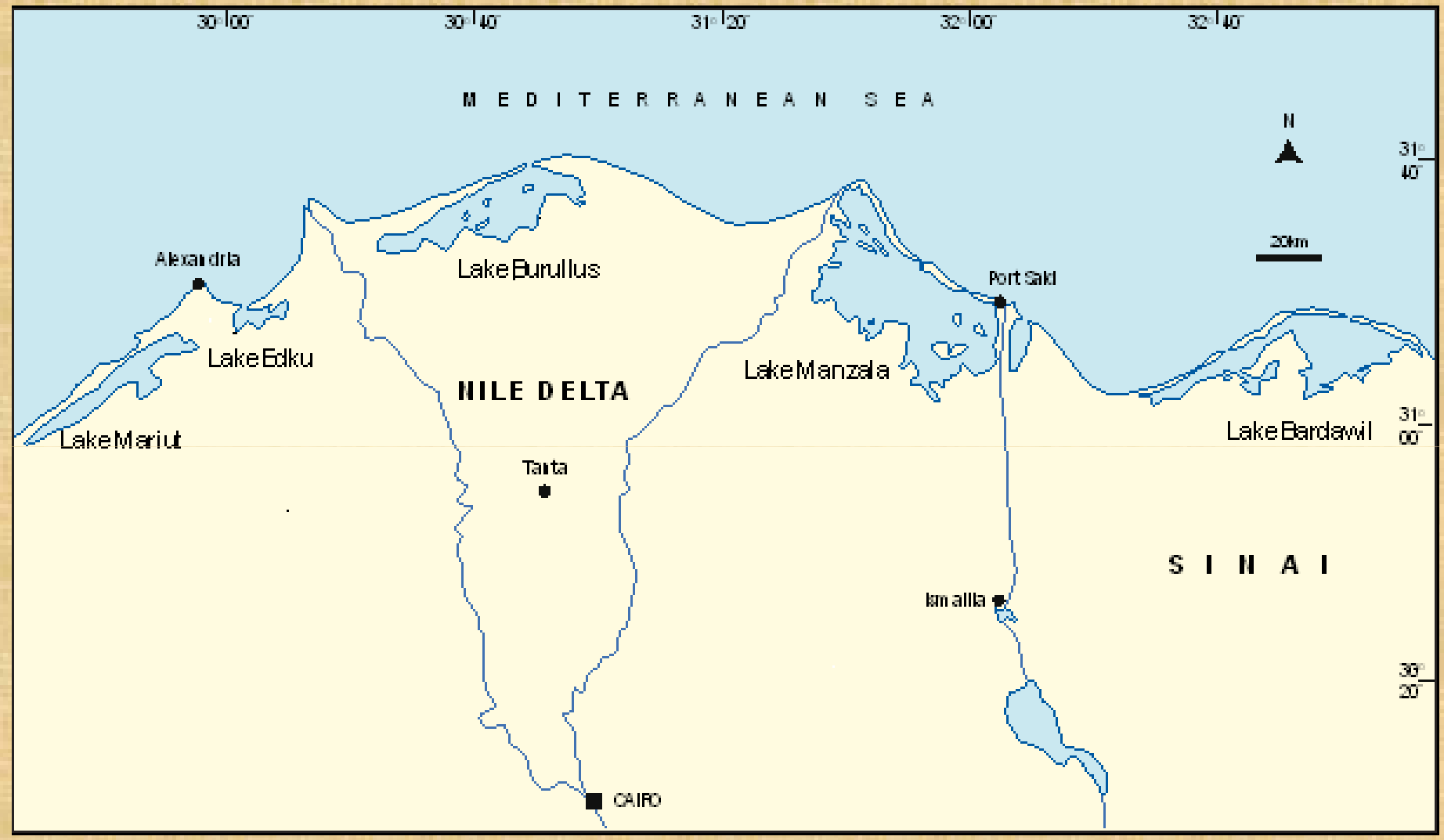
Aquatic plants are an integral part of a lake and its aging process. Many of the threats to fresh waters such as, climate change and eutrophication will result in reduced macrophyte diversity and will, in turn, threaten the faunal diversity of aquatic ecosystems and favour the establishment of exotic species, at the expense of native species.

Wetlands and global climate change

- According to the International Panel on Climate Change (IPCC) and other researchers, Wetlands cover 6% of the world's land surface and contain about 12% of the global carbon pool. Due to this fact, wetlands are playing an important role in the global carbon cycle (IPCC 1998 and Ferrati *et al. 2005).*

- Several problems affect the environment of the Nile Delta lakes such as: Climate change, pollution, land reclamation, intensive aquatic vegetation, over fishing, and eutrophication.

Examples of impacts resulting from projected changes in extreme climate events (STRP Ramsar2002) include; decreased water resource quantity and quality; increased coastal erosion



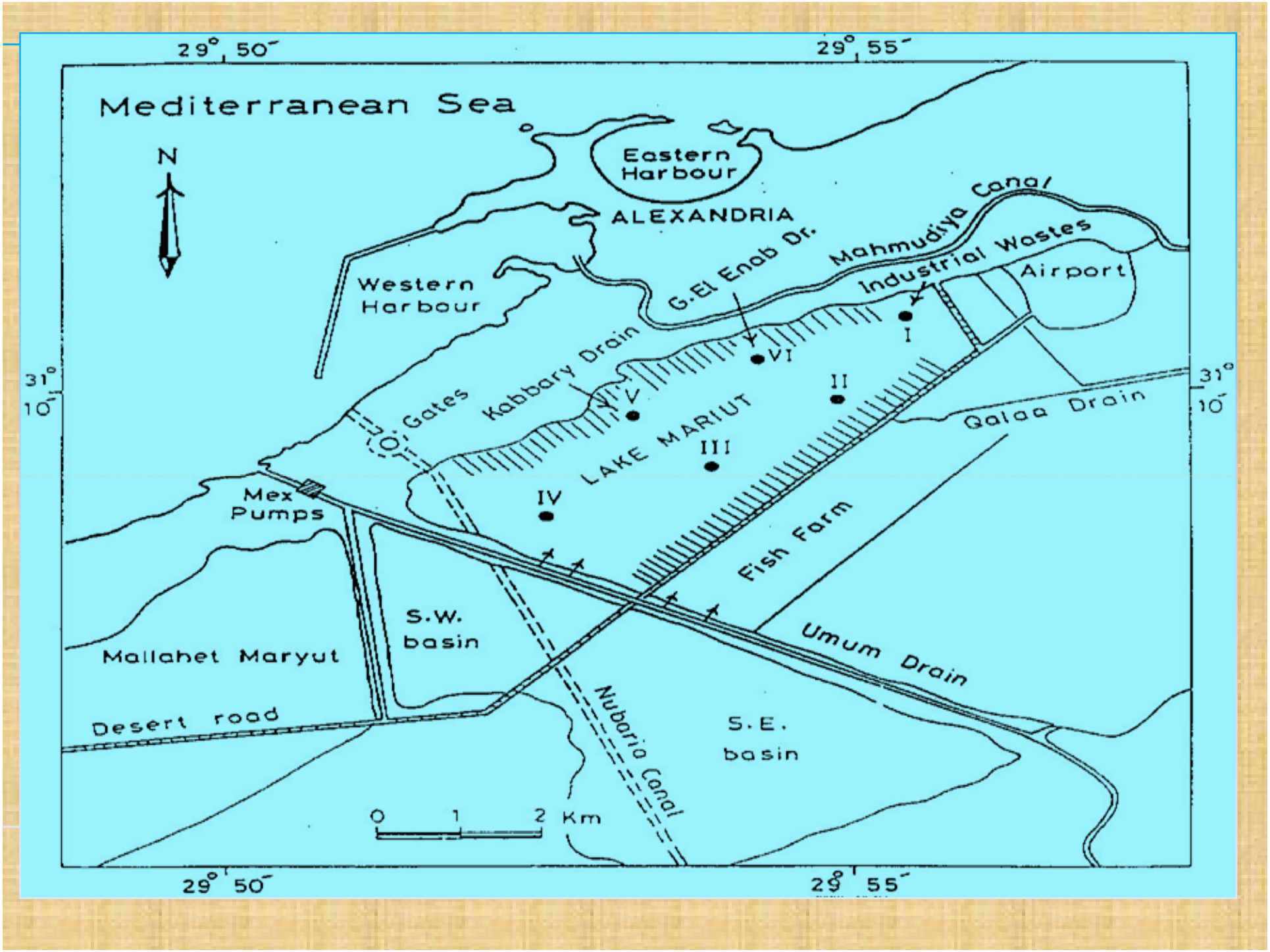
Over 25% of all the Mediterranean wetlands are found along the Mediterranean Coast of Egypt.

1. Lake Maryut

- Located on the north Mediterranean coast
- One of the smallest and most polluted lakes in Egypt
- Latitude/longitude:31°09’11”N 29°53’54”E, Altitude: -13 m
- Covers an area of 65 km2
- Divided into 5 basins

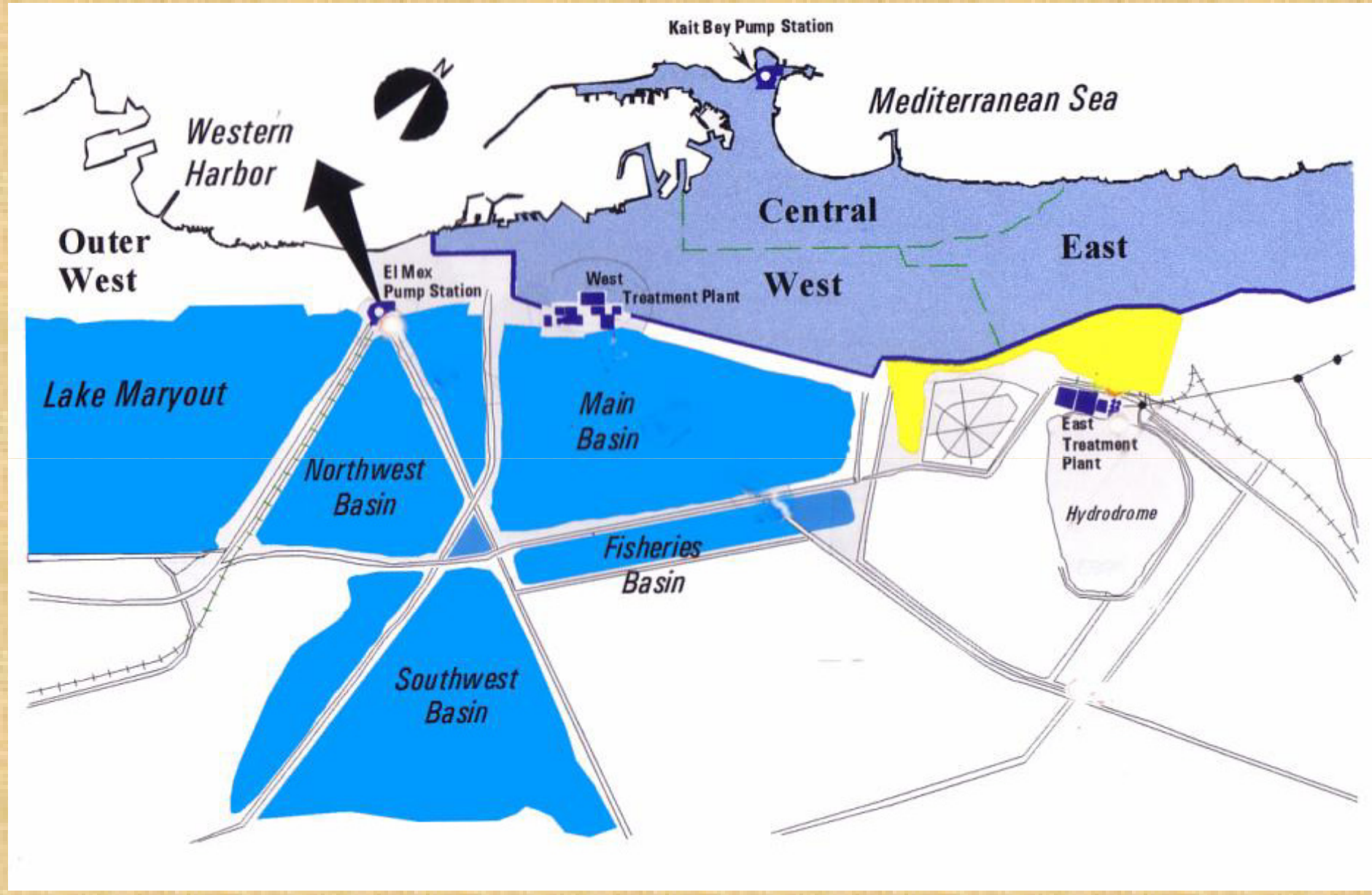
Problems

- Decreased lake area over time
- Significant decrease of fish production
- Continuous negative impacts (Agricultural, untreated industrial and domestic wastes)


29° 50'
29° 55'
Mediterranean Sea
N
Eastern Harbour
ALEXANDRIA
Western Harbour
G.El Enab Dr.
Mahmudiya Canal
Industrial Wastes
Airport
Kabbary Drain
I
VI
V
II
31° 10'
Gates
LAKE MARIUT
III
IV
Qalaa Drain
Mex Pumps
Fish Farm
S.W. basin
Umum Drain
Mallahet Maryut
Desert road
Nubaria Canal
S.E. basin
0 1 2 Km
29° 50'
29° 55'

➢Lake Maryut basins are recharged with agricultural drainage water via a number of drains most important of which are the Omom Drain, Nubaryia Drain, West Nubaryia Drain and Al-Qalaa Drain. These drains carry agricultural drainage water resulting from the irrigation of an area of 450000 feddans of cultivated lands located south of Alexandria which contains high concentrations of various chemical fertilizers and pesticides, as well as sanitary and industrial water drainage as shown in Table 1 (Gaballah.*et al. 2005, ALAMIM, 2009,* Alexandria Lake Maryut Integrated Management ALAMIM Project)

➢The Environmental Problems of Lake Maryut could be summarized as follows:
1- Severe decrease in the concentration of dissolved oxygen
; 2-An increase in the density of water plant growth (green canopy)
; 3- Presence of organic pollutants (agricultural pesticides and industrial wastes
; 4-Expected direct impact on ecosystem and biodiversity.


Kait Bey Pump Station
Mediterranean Sea
Western Harbor
Outer West
Central
East
West
El Mex Pump Station
West Treatment Plant
Lake Maryout
Main Basin
Northwest Basin
East Treatment Plant
Hydrodrome
Fisheries Basin
Southwest Basin

Hydro chemical parameters

Water temperature: average 24 ˚C, range 14 – 30.5 ˚C

Water transparency: average 64.75 cm, range 0 – 250 cm

Salinity: average 3.68 ‰, range 1.65 – 6.86 ‰ (total dissolved salts)

pH: average 8.24, range 7.46 – 8.75

DO: average 5.82 mg/l, range 0 – 14.22 mg/l

BOD: average 52.18 mg/l, range 2.94 – 729 mg/l

COD: average 151.30 mg/l, range 42.67 – 512 mg/l

Nutrients

NH4-N: average 2.24 mg/l, range 0.03 – 15.89 mg/l

NO2-N: average 78.40 µg/l, range 0.71 – 420.89 µg/l

NO3-N : average 0.27 mg/l, range 0.007 – 1.01 mg/l

PO4-P : average 417.90 µg/l, range 2.54 – 2517.74 µg/l

Aquatic vegetations during 2012-2013

Aquatic macrophytes recorded in summer and autumn 2012, winter and spring 2013, were low diversity, indicating continuous pollution hazards. Therefore, macrophytes water pollution indicators were present, such as; *Eichhornia crassipes* and *Potamogeton* and *Ceratophyllum*, particularly in the main basin and Southwest basin too.

Main Basin



Eichhornia crassipes



Ceratophyllum demersum



Potamogeton pectinatus

At station 6, which is known for the abundance of submerged vegetations, a new submerged macrophyte, *P*. *pusillus*, was recorded for the first time in Lake Maryout along the project period, 2009-2013



***Potamogeton pusillus* L. small pondweed**

Northwest Basin



Chara tomentosum



Najas flexilis



Phragmites australis, common reed Spreading on lake borders and show patches inside lake basins

Other vegetations



Cabomba caroliniana



Pistia stratiotes



P. australis and water hyacinths

Lake Burullus

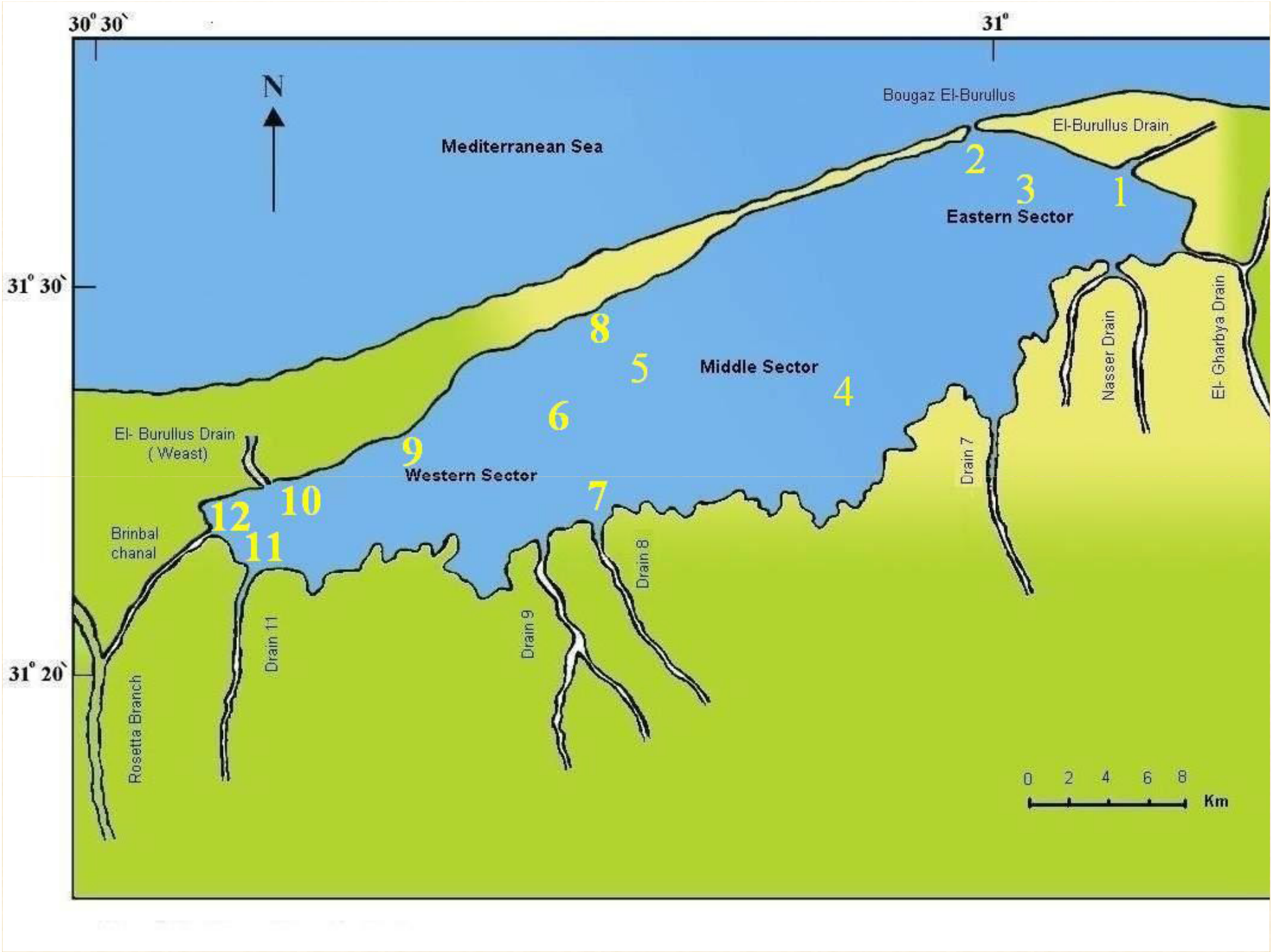
❖It is considered to be a lake and wetland site of International importance for birds under the Ramsar Convention.

❖Burullus extends along the northern fringe of the Nile Delta at latitude 31°22'-31°35'N and longitude 31°31'-32°08'E.

❖Lake Burullus is a shallow brackish lake extending for 47 km along the deltaic Mediterranean coast of Egypt.

❖The lake's area decreased from 502.7 km2 in 1984 to 410 km2 in 1997 (its length decreased from 56 to 47 km, while the width decreased from 15 to 14 km). The water depth reaches 200 cm in the middle and near the sea outlet (Bughaz El-Burullus).

❖According to the map of the world distribution of arid regions (UNESCO 1977), the northern Mediterranean part of the Nile Delta belongs to the arid region. The climatic conditions are warm summers (20–30C) and mild winters (10–20C).


30° 30`
31°
N
Bougaz El-Burullus
El-Burullus Drain
Mediterranean Sea
2
3
1
Eastern Sector
31° 30`
8
5
Middle Sector
4
6
Nasser Drain
El- Gharbya Drain
El- Burullus Drain
(Weast)
9
Western Sector
Drain 7
10
12
7
Brinbal
chanal
11
Drain 8
Drain 11
Drain 9
31° 20`
Rosetta Branch
0 2 4 6 8
Km

Hydrochemical parameters

Water temperatures: average 22.37 ˚C, range 15.5 – 29.20 ˚C

Water transparency: average 23.44 cm, range 10 – 60 cm

Water salinity: average 3.62 ‰, range 0.60 – 15.01 ‰

DO: average 8.37 mg/l, range 1.73 – 17.70 mg/l

BOD: average 18.09 mg/l, range 0.42 – 72.90 mg/l

COD: average 165.03 mg/l, range 20.16 – 531.30 mg/l

Nutrients

NH4-N: average 0.67 mg/l, range 0.011 – 1.74 mg/l

NO2-N: average 104.44 µg/l, range 3.18 – 564.3 µg/l

NO3-N: average 0.20 mg/l, range 0.013 - 0.933 mg/l

PO4-P: average 178.64 mg/l, range 11.85 – 932.62 mg/l

➢The results of summer-autumn seasons 2012, and winter-spring 2013 at Lake Burullus, indicated the disappearance of macrophytes diversity that is characterizing international Ramsar sites wetlands list.

➢Station 5, known to be far from pollution sources, the pollution indicator species dominated (*P. pectinatus* and *Ceratophyllum demersum*) in summer 2012.

➢The submerged *Myriophyllum spicatum* (north of Burullus)



***Myriophyllum spicatum* L.**



***Potamogeton pusillus* L.**



Eichhornia crassipes

Lake Edku

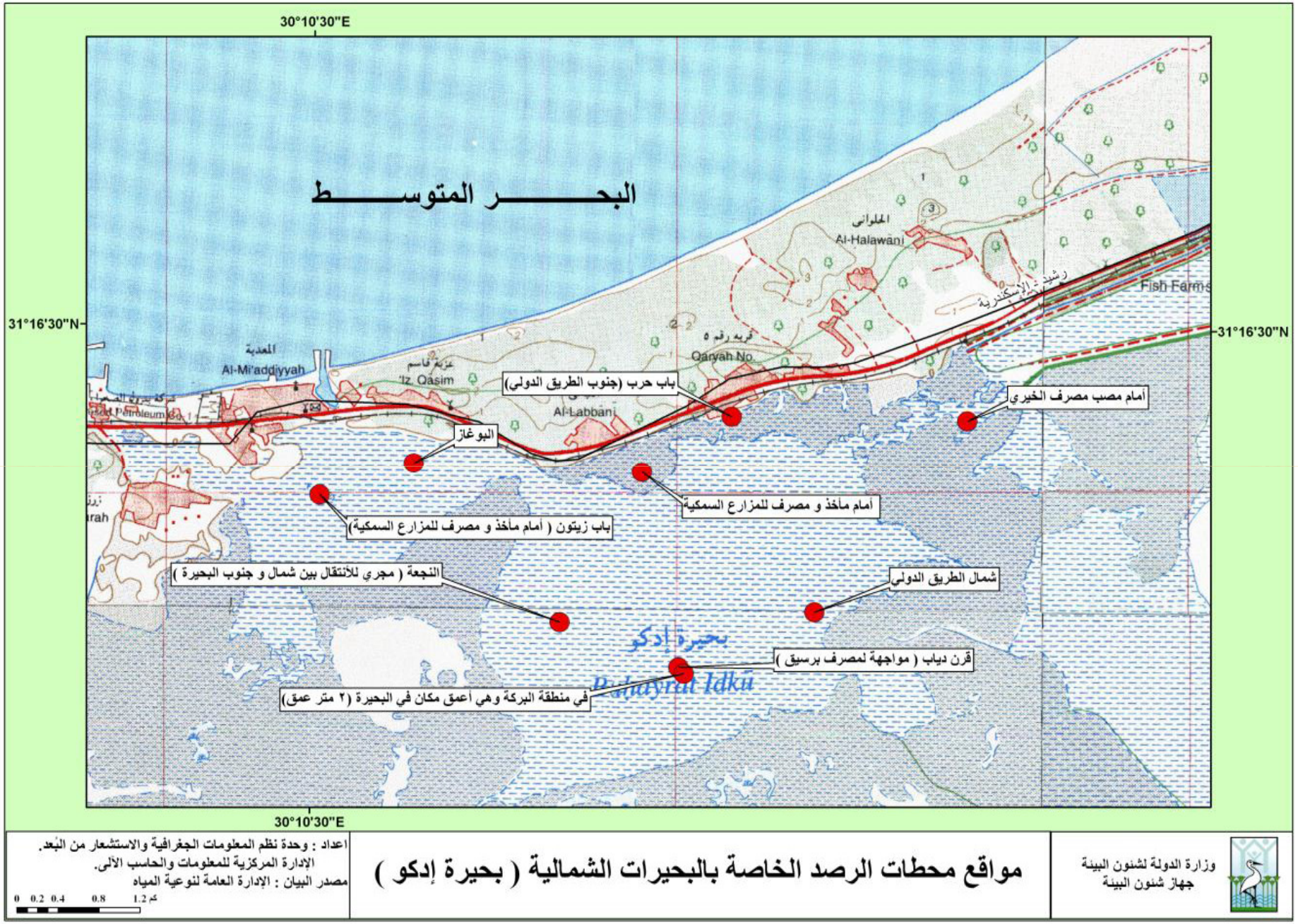
❖Lake Edku is a coastal lagoon in the eastern Mediterranean and is located about 40 Km eastern of Alexandria and 18 Km western of Rosetta branch of the River Nile in Egypt.

❖Area: 62.78 million square meter

❖The lake is connected to the adjacent Abu Qir Bay through Boughaz El Maadiya

❖longitudes 30° 8' E and latitudes 31°10 ' N.

❖Lake Edku has been exposed to different sources of pollution, the agriculture drainage, untreated industrial wastes, untreated wastes of several factories (EEAA, 2000) and the aggregated boats at Boughaz El- Meaddya (i.e. the entrance of the lake) would release the oil wastes and other discharges.



اعداد : وحدة نظم المعلومات الجغرافية والاستشعار من البُعد.
الإدارة المركزية للمعلومات والحاسب الآلى.
مصدر البيان : الإدارة العامة لنوعية المياه

0 0.2 0.4 0.8 1.2 كم

مواقع محطات الرصد الخاصة بالبحيرات الشمالية (بحيرة إدكو)

وزارة الدولة لشئون البيئة
جهاز شئون البيئة

Hydrochemical parameters

Water temperature: average 22.69 ˚C, range 14.0 – 30.8 ˚C

Water transparency: average 26.76 cm, range 15 – 75 cm

Water salinity: average 1.50 gm/l, range < 0.77 – 3.28 gm/l

pH: average 8.47 , range 7.61 – 9.11

DO: average 7.26 mg/l, range 0.93 – 14.31 mg/l

BOD: average 20.71 mg/l, range 5.94 – 58.32 mg/l

COD: average 181.21 mg/l, range 32.0 – 759.80 mg/l

Nutirent

NH4-N: average 0.70 mg/l, range 0.02 – 3.09 mg/l

NO2-N: average 136.9 µg/l, range 2.47 – 472.22 µg/l

NO3-N: average 0.22 mg/l, range 0.43 – 10.33 mg/l

PO4-P: average 323.14 µg/l, range 8.46 – 1078.19 µg/l

•Stations situated in front of fish aquaculture drainage water, *Phragmites* was recorded

•The three forms of aquatic macrophytes were shown in front of fish aquacultures drainage water, along the period of investigation 2012-2013, , such as free-floating (water hyacinths); submerged (*Potamogeton* and *Ceratophyllum demersum* and *Cabomba caroliniana*) and emergent (*Scirpus maritimus)*, which is known to resist salinity changes).

•At the deepest place in the lake, macrophytes diversity was very poor and *Potamogeton*, *Ceratophyllum* and water hyacinths were recorded along the 4 seasons 2012-2013.

•In front of El-Khairy Drain, the emergent *Polygonum amphibium* was recorded in autumn 2012.

Generally the macrophytes diversity was very poor, due to wastewater discarding, without any treatment.

Polygonum amphibium L.,
water smartweed

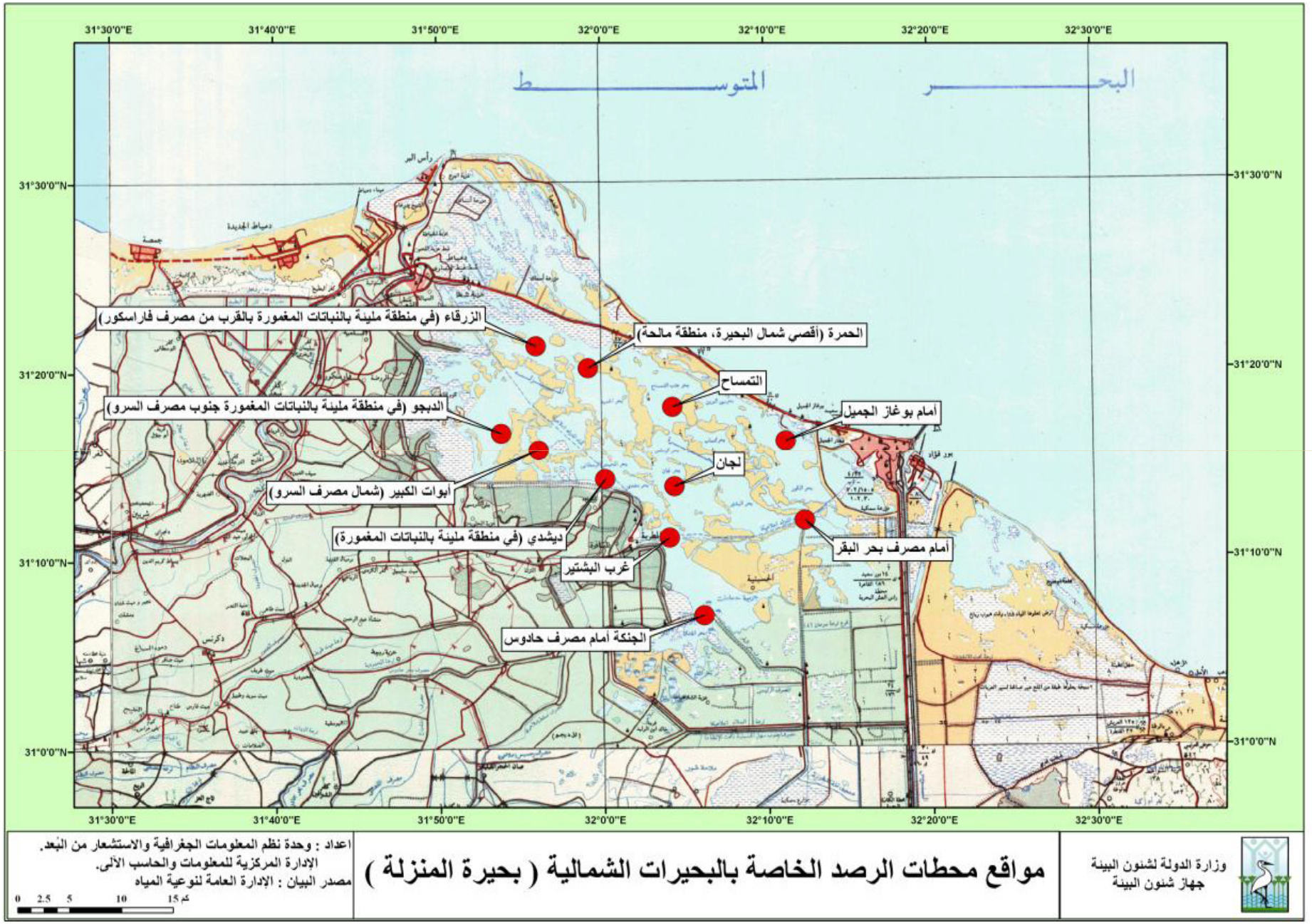


Lake Manzala

Lake Manzala, the largest (60 km long and 40 km wide) of Egypt's Mediterranean wetlands and the most productive for fisheries.

Latitude : 31° 15' 44" N, Longitude 32° 11' 33" E

- It is bounded by the Mediterranean Sea at the north, Suez Canal at the east
- There are over 1000 islands scattered throughout the lake and fish farms take up large areas of its northwest
- This huge shallow lake is suffering from land reclamation, industrial and nutrient pollution, and overgrowth by water hyacinth.
- Formerly saline or brackish, its salinity is reduced by year-round freshwater inflow and poor drainage to the sea, and fish catches are reduced.
- Extensive emergent reed beds, mainly of *Phragmites,* help to localise pollution, but also prevent the circulation of saline water.



مواقع محطات الرصد الخاصة بالبحيرات الشمالية (بحيرة المنزلة)

اعداد : وحدة نظم المعلومات الجغرافية والاستشعار من البُعد.
الإدارة المركزية للمعلومات والحاسب الآلى.
مصدر البيان : الإدارة العامة لنوعية المياه

0 2.5 5 10 15 كم

وزارة الدولة لشئون البيئة
جهاز شئون البيئة

Hydro chemical Parametrs

Water Temperature: average 22.97, range 15.30 – 29.50 ˚C

Water transparency: average 45.84 cm, range 10 – 125 cm

Water salinity: average 22.55 g/l, range 1.44 – 10.44 g/l

pH: average 8.21, range 7.07 – 8.93

DO: average 5.20 mg/l, range 0 – 9.72 mg/l

BOD: average 45.11 mg/l, range 2.43 – 279.45 mg/l

COD: average 134.08 mg/l, range 13.94 – 640.00 mg/l

Nutrients

NH4-N: average 1.29 mg/l, range 0.02 – 12.30 mg/l

NO2-N: average 82.52 µg/l range 1.41 – 563.77 µg/l

NO3-N: average 0.15 mg/l, range 0.006 – 0.91 mg/l

PO4-P: average 173.73 mg/l range 3.05 – 917.39 mg/l

Spring 2013

➢In front of Bahr-ElBakar and Hadous Drains, water hyacinths dominated. At station 5 (partly away from direct pollution source) *Potamogeton pectinatus* and *P. crispus* were show. The stations known for the plenty of submerged vegetations, were very poor with the presence of only pollution indicators, such as P. *pectinatus* and *Ceratophyllum demersum*.

➢In front of El-Serou and Faraskour drains, submerged vegetations prevailed; *P. pectinatus*, *Najas marina* and *Echinochloa stagnina*, these stations are considered poorest as they are known for the plenty of submergents also.



Echinochloa stagnina



Potamogeton crispus



Najas marina

Lake Bardawil

•Lake Bardawil is about 90 kilometers long, and 22 kilometers wide. It covers an area of about 700 km^2.

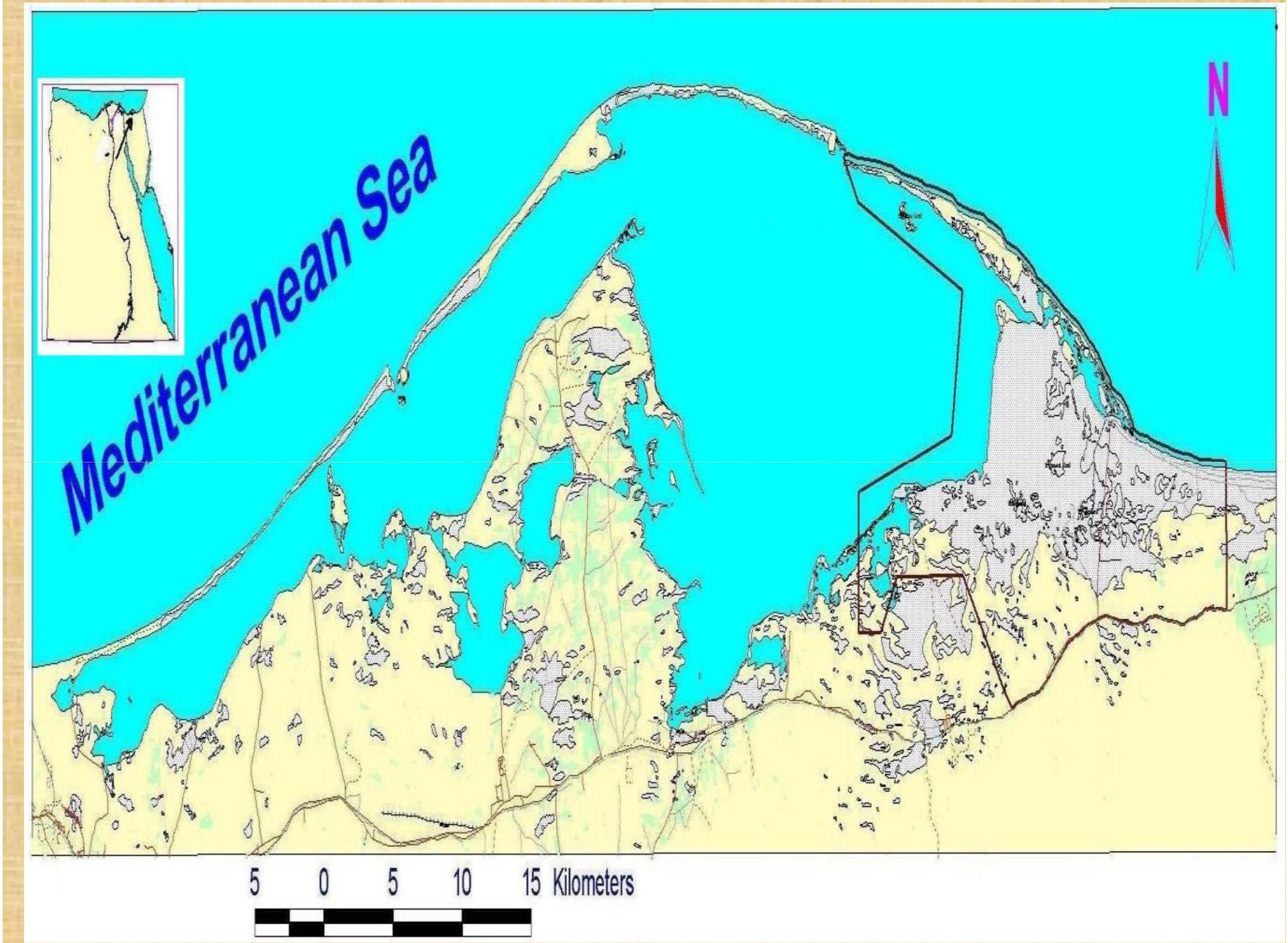
•Latitude 31° 08' 37" N, longitude 33° 13' 58" E

•The extremely saline Lake Bardawil is an important feature of the north coast of Sinai and stretches along much of its length. It is considered the least polluted of all Delta Lakes.

• Since this lake is registered in the Ramsar site of internationally important wetland, it is recommended.

•The lake is a shallow basin, separated from the Mediterranean by a low sandbar that is between 100m and 1km wide and is often covered by seawater.

•The sandy bottom of this shallow lake (0.5-3.0m) is covered by patches of the ditch grass, *Ruppia spiralis* and there is a number of islands. Lake Bardawil is important for its fishery of up to 2500 tones annually.


Mediterranean Sea
N
5 0 5 10 15 Kilometers

Hydrochemical parameters

Water temperature: average 24.03 ˚C, range 17 – 32 ˚C

Water transparency: lake water is transparent allover the year

Water salinity: average 46.36 g/l, range 38.11 – 63.32 g/l

pH: average 8.32, range 7.83 – 9.01

DO: average 5.83 mg/l, range 3.25 – 8.34 mg/l

BOD: average 0.99 mg/l, range 0.16 – 2.70 mg/l

COD: average 12.91 mg/l, range 7.97 – 23.28 mg/l

Nutrients

NH4-N: average 0.022 mg/l, range 0.004 – 0.138 mg/l

NO2-N: average 1.84 µg/l, range 0.26 – 6.384 µg/l

NO3-N: average 0.020 mg/l, range 0.003 – 0.041 mg/l

PO4-P: average 5.37 µg/l, range 0.38 – 32.09 µg/l

1. The green macroalga *Caulerpa taxifolia* was recorded at El-Zaranik station, for the first time in Lake Bardawil history, in summer and autumn 2012.
2. The eelgrass *Zostera marina, Cymodocea nodosa, Ruppia cirrhosa* and *Posidonia oceanica* are native at Bardawil, could be found all year round.
3. The green macroalga *Caulerpa prolifera* was dominant along one year investigation 2012-2013.
4. *Ulva* and two species of green macroalgae *Enteromorpha*; *E. intestinalis* and *E. flexuosa* recorded for the first time
5. In spring 2013, the brown macroalga *Colpomenia*, which is traced for the first time in Bardawil and also the red macroalga *Hypnea*, recorded for the first time too at station5. Probably all the macroalgae have entered to the lake through the Boughaz.
6. The diversity in 2010 – 2011 was much more diverse than the current 2012 - 2013



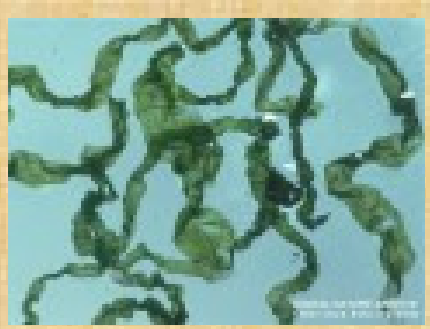
Zostera marina (eelgrass



Cymodocea nodosa



Caulerpa prolifera



Enteromorpha intestinalis



Caulerpa taoxiflia

Activities

- An important management strategy to ensure wetland sustainability is the **prevention** or **reduction** of additional stress that can reduce the ability of wetlands to respond to climate change.

- Maintaining hydrology, reducing pollution, controlling vegetation, and protecting wetland biological diversity and integrity are important activities to maintain and improve the resiliency of wetland ecosystems so that they continue to provide important services under changed climatic conditions (Kusler *et al., 1999, Ferrati et al. 2005).*

Procedures

1. The research project in Nile Delta is very important and must be designed to solve the main problem (ecosystem degradation) and address the following activities.
2. Conducting actual scenarios on the effect climate change on both the coastal areas and the Nile water availability.
3. Adopting different measures, such as water recycling, and exploitation of underground water resources to increase water productivity.
4. Using of modern irrigation techniques and genetically modified seeds which grow with less water demands.
5. Identifying new technology to be applied in water recycling which resulted in the reduction of freshwater discharge to the Mediterranean.
6. Improving technical performance of water supply and deliver system.

7. Adopting different technologies for waterways, ponds, reservoirs and lakes restoration.

8. Reusing wastewater to support the agriculture production with minimal risks to the ecosystem.

9. Integrating bio systems to produce more products and generate less waste.

10. Groundwater and surface water bodies are physically interlinked; and need to be managed in an integrated way.

11. Adopting modern farming technology to increase crop-water productivity and reduce pollutants.

12. Providing guidance with regard to crop production, water requirement and water quality.

Conclusion

i. Enormous progress has been made in increasing our understanding of climate change, and a clearer picture of current and future impacts is emerging.

ii. Research is also shedding light on actions that might be taken to limit the magnitude of climate change and adapt to its impacts (DELS NRC, 2012).

iii. Wetland water systems are very vulnerable to climate change. Changes in quantity and quality of their water through alterations in hydrological regimes will definatly affect its habitat.

iv. Restoration process will need to be realized differently on a regional level, making it important to recognize that specific restoration and management plans is required for each case (Kevin L. E., 2009).

Thank You

For Your

Attention