Environment and development
in coastal regions and in small islands

Human impacts on Alexandria's marine environment

YOUSSEF HALIM
Department of Oceanography
University of Alexandria, and

FATMA ABOU SHOUK
Alexandria Governorate

Introduction

The environmental problems of Alexandria have grown rapidly in recent decades, in proportion to the growth in population and population density, as well as to the urban and industrial development. The rate of development has accelerated considerably since the turn of the century. In 1905, Alexandria's 370 thousand inhabitants lived in an area of about 4 km^2 between the two harbours. Since then, the city has expanded rapidly eastwards and westwards, beyond its medieval walls, occupying at present an area of about 300 km^2 with a population ten times larger, 4 million, and a density exceeding 1,200 per km^2 (Figs. 1 and 2). Modern Alexandria stretches over a narrow and irregular strip of land between the Mediterranean Sea to the north, Lake Mariout (a major coastal lagoon) to the south and Abu Qir Bay to the east. Topographically, the city appears to be encircled by a belt of aquatic environments subject to multiple human impacts.

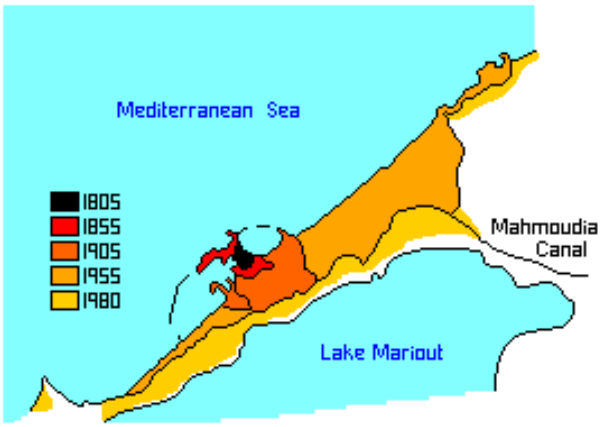

Figure 1: The expansion of the city of Alexandria since 1805.

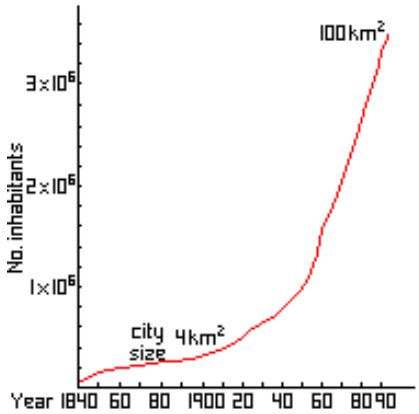

Figure 2: Population growth since 1840.

Environmental issues

In Alexandria, the interface between marine and territorial environments extends along some 100 km of coastline. The city interacts with its aquatic environment in two ways: by discarding all its liquid wastes, domestic and industrial, into the sea, either directly or via Lake Mariout; and by physically altering its coastline, by coastal engineering works.

The total cumulative volume of waste water disposed of into the sea from all point sources along this stretch of coast is about equal to the Nile outflow from the Rosetta outlet: roughly 9 million m^3/day; that is, 3.33 km^3/yr. But this is not river water.

A daily volume of more than one million cubic metres of mixed sewage water is drained from the city. About one third of this is disposed of without any treatment, into the Eastern and Western Harbours and their surroundings. The Qait Bey outfall (Fig. 3), located a few hundred metres from the recently surveyed Pharos site, releases 200,000 m^3 of waste water per day. The Eastern Harbour is the recipient of 7 outfalls. This semi-closed harbour remains permanently turbid, and water visibility is drastically reduced.

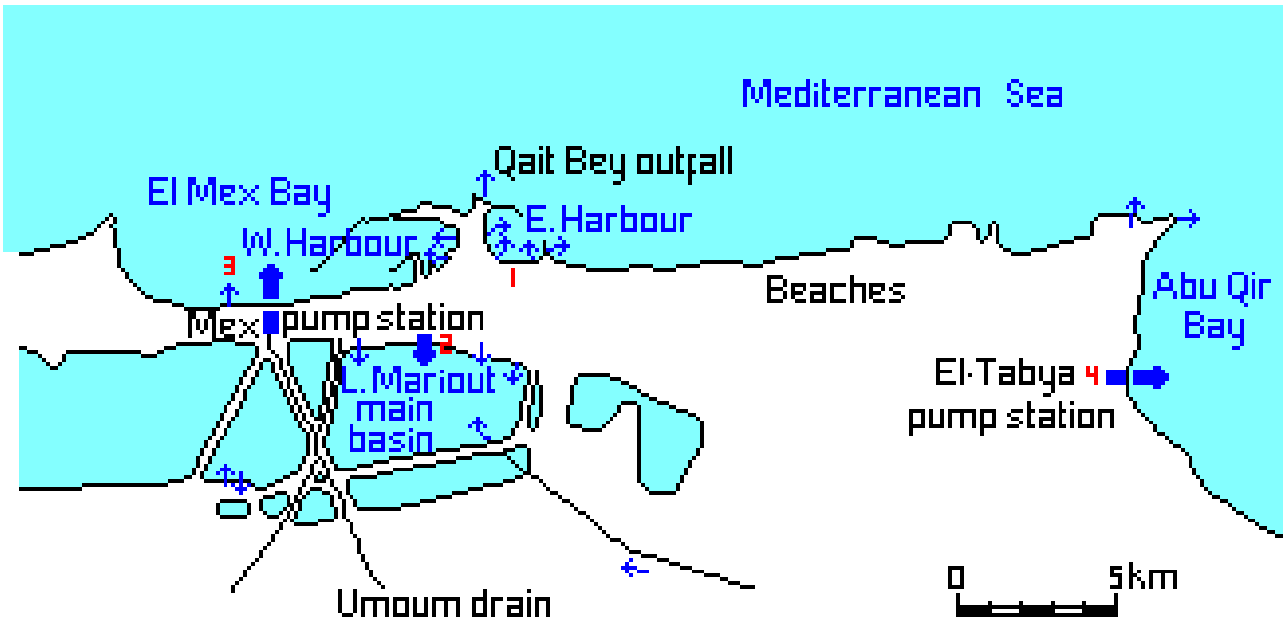

Figure 3: Main outfalls:

1- Qait Bey and Eastern Harbour outfalls: about 200 x 10^3.m^3.d^{-1} untreated waste water.
2- Lake Mariout main basin outfalls: about 500 x 10^3.m^3.d^{-1} primary treated + 300 x 10^3.m^3.d^{-1} untreated municipal waste water.
3- Mex Pump Station on Umoum drain: about 7,000 x 10^3.m^3.d^{-1} agricultural drainage water mixed with the overflow from L . Mariout main basin.
4- El Tabya Pump Station to Abu Qir Bay: about 2,000 x 10^3.m^3.d^{-1} industrial waste water.

Two thirds of the city waste water is released into Lake Mariout and subsequently pumped into Mex Bay, west of the city, together with agricultural runoff drained from the north-west part of the delta. Only half this volume of waste water undergoes primary treatment before being dumped into the Lake. On the eastern side of Alexandria, about 2 million m^3 of industrial waste water per day are pumped into Abu Qir Bay.

All of these outfalls add their load of suspended matter and a variety of contaminants to the inshore environment and to the Lake. Such materials, on sinking to the bottom, contribute to blanketing whatever artefacts are lying on the sea bed. They also cause hypoxic or even anoxic conditions at the bottom in some places, enhancing the processes associated with the absence of oxygen, including anaerobic bacterial processes, which end up releasing hydrogen sulphide, and chemical processes, which might accelerate corrosion, thus damaging some of the artefacts.

There is, however, an encouraging fact in that remedial action is being taken by the Alexandria Governorate. Work is underway to close the Eastern Harbour and Qait Bey outfalls and divert their share of waste water to the Lake after primary treatment.

Of even greater concern, however, are the far-reaching consequences of ill-conceived and misinformed engineering works which modify the coastline, in response to the pressure for economic development.

There are several issues at stake. We know that the foundations of the 15th century Qait Bey fortress appear to be dangerously eroded, particularly on the eastern side. To protect the fortress, the authorities have dumped more than a hundred concrete blocks weighing 7 to 20 tons each, precisely over parts of the submerged archaeological site recently surveyed. There can be no doubt about the urgent need to protect the fortress from the action of the sea, but other options, based on a still needed hydrodynamic survey of the area, have to be considered to protect the fortress and the adjacent archaeological site. Again, on the eastern side of the harbour, a hundred other blocks are aligned on the Silsila promontory, Cape Lochias, the site of the royal quarter in antiquity and

currently a military base. The concrete blocks wait to be dumped to protect this small peninsula from wave action.

New harbours were created east and west of Alexandria, in Abu Qir and Mex Bays, to release the pressure on the main commercial harbour. Breakwaters were built in the vicinity of large effluents, thus preventing the free exchange of inshore waters with the open sea. This led to the accumulation of suspended materials and contaminants inshore. Dredged material from the navigation channels was disposed of at the nearest convenient location. In Abu Qir Bay, infilling with this material covers about 40,000 m^2 which are now dry land. No one knows what submerged remains have been obliterated by the building of breakwaters and by infilling.

The bathing beaches of Alexandria, an important resource for such a summer resort, are subject to continuous erosion. Each year, large amounts of desert sand are spread over the beaches to compensate for the lost material, but the added sand will gradually be removed by the unending wave action and by winter storm surges, ultimately to blanket the nearshore bottom.

A project has recently been submitted to the Governorate for the building of a marina in the inner Eastern Harbour precisely on the site of the recently discovered Ptolemaic harbours. It is a relief to know that the project has been temporarily shelved, albeit only on grounds of feasibility.

The foregoing examples and many others point to an unmistakable trend. Cultural and natural environmental resources are often irreversibly damaged by decisions taken and implemented without prior assessment of the consequences. This is a universal problem. Economic development often outweighs the concern for conservation and management of the natural and cultural ressources.

Management issues

The integrated management of the coastal zone can only be achieved through the adoption of a sound policy supported by adequate institutional arrangements. The policy will aim at ensuring that the protection of the coastal zone resources remains an integral part of the development priorities of the country. It will also aim at the co-ordination of the sometimes conflicting interests and uses of the coastal zone.

Institutional arrangements

Several institutions are involved with the coastal zone: the Organization for Coastal Protection (Ministry of Public Works); the Egyptian Environmental Affairs Agency, responsible for the implementation of the National Coastal Zone Management Plan; the Supreme Council for Antiquities; the Governorate of Alexandria; and the Egyptian Navy. There are therefore several decision-making circles, with little communication, very little co-ordination and sometimes diverging views. A functional mechanism for co-operation and mutual understanding between decision-makers in these institutions, on the one hand, and scientists and archaeologists, on the other, has to be established. A standing intersectorial commission or a board with a clearly defined mandate can achieve this link. Among other things, the board will be mandated to carry out an Environmental Impact Assessment (including an archaeological assessment) prior to the authorization for any governmental or private coastal development project.

Monitoring programme

The land-sea interactions and the coastal zone environment must be continuously monitored in relation to land-based activities. The monitoring programme will have to be carried out by an interdisciplinary team of engineers, marine scientists and archaeologists. The programme will focus on the morphodynamic, hydrodynamic and meteorological processes, the relative sea-level fluctuations, the water quality, the rate of erosion, sediment transport and deposition.

International obligations

The submerged archaeological sites of Alexandria being part of humanity's cultural heritage, it is not inopportune to recall some of the relevant principles stated in the UN Convention of the Law of the Sea and in Agenda 21 adopted by the Rio Earth Summit in 1992.

All States are called upon:

a. to prepare and implement integrated coastal zone management and sustainable development plans,
b. to prepare coastal profiles identifying critical areas,
c. to carry out environmental impact assessment prior to any major project and to follow up the impacts and
d. to improve human settlements, especially the treatment and disposal of sewage and industrial effluents.

While all States have the sovereign right to exploit their natural resources, the enjoyment of such rights shall be in accordance with their duty to protect the environment.

The Egyptian Government, having ratified the UN Convention on the Law of the Sea and being a party to the Agenda 21, is committed to meeting the obligations thereof.

Source:
http://www.unesco.org/csi/pub/source/alex8.htm