INTEGRATED COASTAL ZONE MANEGEMENT IN SAUDI ARABIA – 2003

Preliminary Assessment

Presidency of Meteorology and Environment
ICZM Committee Members

CONTENTS

EXECUTIVE SUMMARY

As in many other countries around the world, the early 1970s in Saudi Arabia were a time of growing awareness and concern over resource and environmental degradation. Sections of our coast were showing visible signs of this pressure and this generated considerable discussion as to how we should deal with it. This was what prompted Saudi Arabia to pursue a path toward national coastal zone management planning. Such a wise approach emerged as a recognizable entity over 35 years ago, when we began to see signs of growing concern over rapidly increasing pressures on the coastal zone and the preservation of valuable coastal resources appeared to be threatened. Concerned people (mostly within government) began to espouse the need for the management of the coastal zone in an integrated system. However, the years saw a series of successes and failures of attempts to deal with these pressures in a coordinated way.

In its effort to control environmental problems associated with the immense development in all aspects of life in the coastal area, Saudi Arabia adopted several steps and policies. This report will review the present situation with regards to the coastal management strategies adopted, and present the progress achieved in this field. It will also highlight some of the learned experiences and related aspects in integrated coastal zone management (ICZM) with special reference to the Red Sea coast.

1 INTRODUCTION AND ACKNOWLEDGEMENTS

Historically, the Red Sea has played an important role as a commercial trade route connecting Asia with nations bordering the Mediterranean. The importance of the Red Sea as a sea lane increased significantly after the opening of the Suez Canal in 1869. It is connected at the south with the Indian Ocean via the narrow and shallow Strait of Bab Al-Mandab, which is only 26km wide, and the Mediterranean Sea in the north via the Gulf of Suez and the Suez Canal.

Saudi Arabia occupies almost 80% of the Arabian Peninsula and is surrounded by semi-enclosed water bodies - the Red Sea in the west and the Arabian Gulf in the east. In the last three decades, both seas have been vulnerable to contamination mainly as a result of human activity and industrial development. Due to the nature of the Kingdom's economy which depends mainly on oil exports, most of the attention has been focused on the effect of the oil industry on marine habitats. However, sources of pollution are also taken into consideration.

The Red Sea lies between 30^0N and12^0N, almost in a straight line (Fig.1) with an average width of 280km. The maximum depth is about 2500m, with an average of about 491m. The total surface area is estimated as about 438,000-450,000km^2, while the volume varies between 215,000km^3 and 251,000km^3. Three bathymetric zones are distinguished:

1. The coral reef zone and coastal shelves
2. The main trough
3. The axial trough

The coastal shelf in the northern part of the Red Sea is less expanded than in the southern part, where the shelf extends up to 80km offshore. For the purpose of fisheries studies, the area is divided into three sectors - the Northern Sector, the Middle Sector and the Southern Sector. Saudi Arabia possesses the longest shoreline of any country on the Red Sea which is about 1,740km and covers 13 degrees of Latitude. From the environmental viewpoint: the area is divided into four biogeographic zones:

1. The Gulf of Aqaba
2. The northern zone
3. The central zone
4. The southern zone

By 1994, the Presidency of Meteorology and Environment (PME) had prepared an ICZM National Plan and it was submitted to the Cabinet of Ministers. Cabinet decided to form a National Committee comprising PME, the Coast Guard, the Wildlife Commission, the Ministry of Agriculture and the Ministry of Municipality, to review the plan. There was contention between some of the agencies on whether there was a need for such a Plan and PME acted as a negotiator to resolve this conflict. The Plan since been approved by the Ministerial Committee for Environment (MCE) in 1996 and was submitted to the Cabinet of Ministers. Between 1996 and 2001 a number of meetings were held at the Experts Council, and in 2002 the Council approved the Plan. The final approval of the Council of Showra is expected by mid-2004.

This report was prepared at the request of the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA) and it serves as a preliminary assessment of integrated coastal zone management experience in Saudi Arabia. The authors wish to acknowledge the report on "The Need for a Coastal Zone Management Plan". Special thanks are also due to the PME committee members for joint data gathering and help with the report presentation.

2 THE SAUDI ARABIAN RED SEA COASTAL ENVIRONMENT

2.1 Red Sea Natural Resources

The location, climatic conditions and the oceanographic characteristics of the Red Sea, have a significant influence on the distribution and ecology of all types of living resources which are linked together, all responding to any disturbance (whether natural or man-made) to the environment. A comprehensive study on Red Sea ecology conducted by national bodies (PME) and international bodies (IUCN) has revealed information on the distribution and ecology of seabirds, marine mammals, sea grass beds, turtles, etc.

2.1.1 Physical characteristics

The Saudi Arabian Red Sea coast is rich in natural resources. There is an extensive reef system that takes the form of coastal fringing reefs, platform reefs, patch reefs, coral pinnacles and ribbon-like barrier reefs (Bemert & Ormand, 1981; De Vantier *et.al*, 2000). Red Sea reefs are highly developed in the northern and central parts but fade out towards the south because of the sedimentary input from the various wadis and streams.

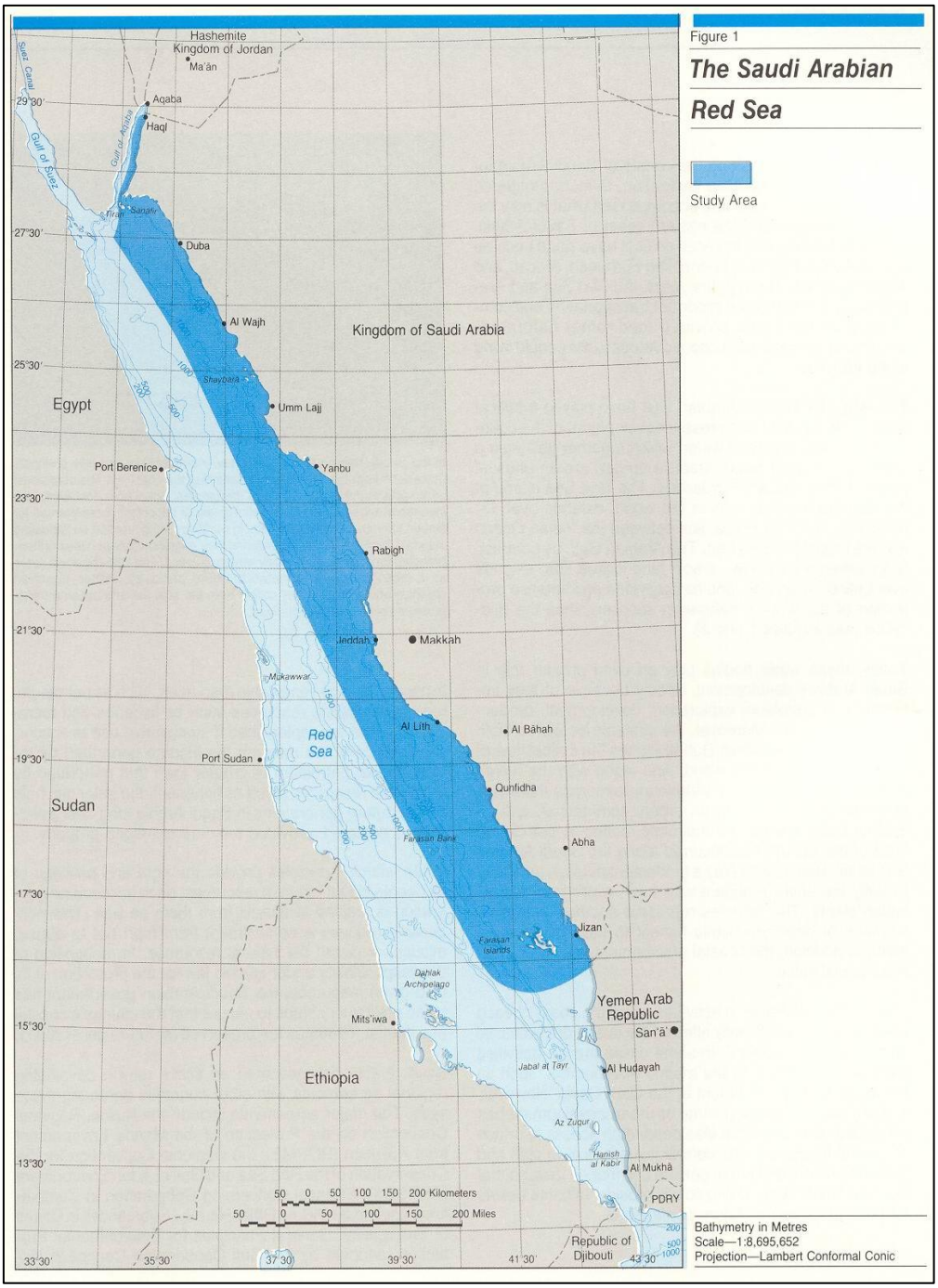
The continental shelf broadens south of 21^0N reaching a maximum width of 50km. In the north, the coastal plain narrows down to about 1km near the Gulf of Aqaba (Ormond, *et al*. 1984b; NCWD, 2001). As the climate is extremely arid, much of the biological productivity of the Red Sea is confined to a narrow and shallow coastal strip and originates mostly from habitats such as coral reefs, mangroves and sea grass beds. Four important coral community types are recognized within the central to northern Red Sea that are related to the degree of exposure, water transparency and depth (Sheppard 1985 and 1991; De Vantier *et. al.,* 2000).

The Red Sea is one of only three areas in the world with more than 50 genera of hermatypic scleractinian corals (Shahmatcher, 1976). De Vantier *et. al* (2000) identified 260 species of hermatypic scleractinia (59 genera and 15 families) from the northern and central Red Sea and of these, at least nine species may be endemic to this area. Sheppard & Sheppard (1991, 1997) reported 30 species of soft coral, gorgonians and fire corals. The main reason for this abundance is the extremely benevolent environment due to the fact that the Red Sea is relatively deep (maximum depth 2,600m in the axial trough), and has effective water circulation. Thus, mixing of water masses and exchange with the Indian Ocean reduces high salinity caused by evaporation, while periodic cold cycles and hot cycles occur in the north and south respectively (Neuman & McGill, 1962; Thompson, 1939). Secondly, the Red Sea is surrounded mainly by desert with relatively sparsely populated shores.

The main feature of the mean seawater temperature along the coast of the Saudi Arabia Red Sea is the gradual decrease from $31.9C^o$ in the south at Frassan Island to $26.4C^o$ at Al-Wajh in the north, while it is $28.7C^o$ at Jeddah. The seawater temperature range between Al-Wajh and Frassan was higher ($5.3C^o$) than that between Al-Wajh and Jeddah ($3.1C^o$), a fact also reported by Edward (1987) and Sofyani (1984).

Mean seawater transparency decreases from 33.75m in the north to 9.8m in the south, with 27.14m at Jeddah. Seawater visibility around Frassan Island is remarkably lower than around Jeddah and lower still than at Al-Wajh and the lowest recorded was at Sheik Mirbat Island. This is due to the fact that the area is shallow with mixed sandy and silt bottom and

subjected to the impact of runoff from the Al-Hamid Wadi during the rainy season as well as high productivity and the sandy bottom which is stirred up by wave action. Conversely, the highest visibility which is recorded at Al-Wajh is probably due to low productivity, deep water and hard bottom. In general, the natural physical parameters such as temperature and water transparency that have been recorded during surveys, increase the viability of live coral at Al-Wajh and Jeddah and reduce it around Frassan Island.



2.1.2 Fisheries

The dominant features of Red Sea fish stocks are their diversity and the complexity of their distribution. However, from research conducted by the Ministry of Agriculture, the major stocks were identified as finfish species associated with the reefs. These fish include demersal reef species such as grouper and emperor fish which live amongst coral as well as inshore pelagic species and open-water fast moving species such as tuna, mackerel, barracuda and adult jacks (Figure 2). The latter are found far offshore, with the exception of barracuda and jacks which often are found in the vicinity of the reef.

Deepwater stocks such as snappers live along the edge of the continental shelf were the seabed dips abruptly. Research conducted on this fishery has revealed that *Pristipomoides* are one of the most important species caught by deep-water trawling off Farasan Islands. The dominant species in snapper stock are *Pristipomoides multidens* and *Lutijanus bohar*. Pelagic species, which include sardinella, are usually found in the inner passage of the Farasan bank and certain locations along the coast. Indian mackerel (*R. kanagurta)* schools concentrate mainly in the southern part of the Red Sea whereas king mackerel, *S. commerson,* dominates the landings from the Farasan Bank.

Lagoons and bays stocks comprise species which are found in the muddier shallow water of bays and creeks along the coast. Typical species are grey mullet, juvenile jacks and mojarr.

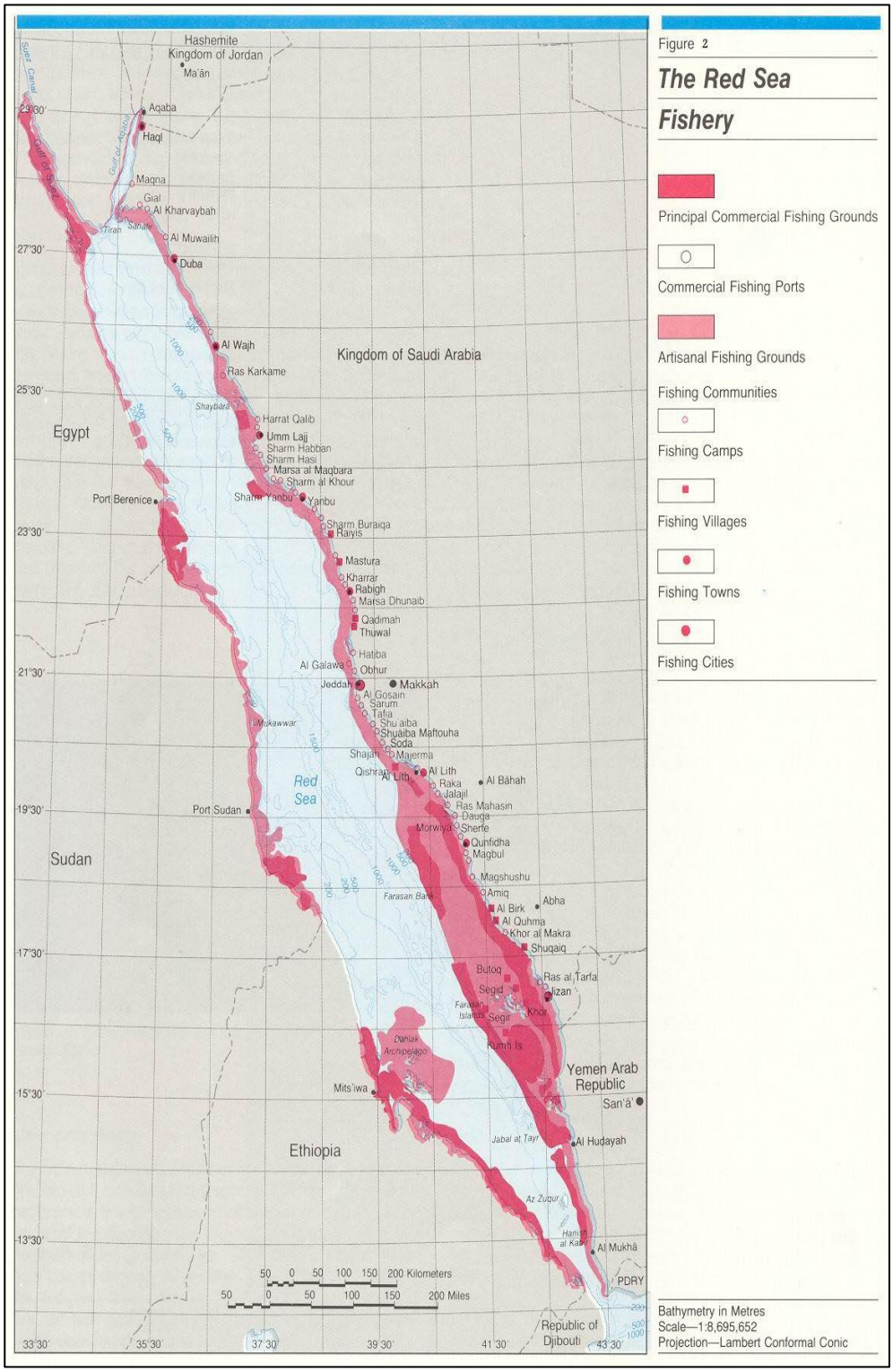
Fishing pressure in general ranges from low to medium at all locations except at sites which are remote from the coastguard stations around Frassan and al-Wajh. These areas are subjected to continuous over-fishing from foreign fishing boats and local fishermen in Frassan Island or from foreign fishermen who are hired by Saudi fishermen at Sheik Mirbat Island. Some fishermen were reported to be using destructive fishing methods to drive fish into their nets. The situation in Jeddah is even worse with the impacts of over-fishing (including the use of spear guns) are compounded by physical damage from irresponsible anchoring and dragging of private fishing boats or diving boats over coral reefs, particularly in places without mooring such as Jeddah.

2.1.3 Crustaceans

Two major crustacean stocks can be distinguished in the Red Sea - shrimps and lobsters.

Shrimp stocks are concentrated mainly in the southern part of the Red Sea, between Farasan Islands and the Gizan coast. There are also some locations around Al-Gunfedah and Al-Khoriba, in the far north, where shrimp can be found in low concentrations. *P. semisulcutus* is the most important species in the shrimp fishery.

Rock lobster stocks are found mainly in the coastal area extending north of Jeddah to the Gulf of Aqaba. This area is characterized by a complex reef system which in many places is exposed to open water action and this is a very suitable habitat for rock lobster. *Panulirus penicillatus* is the main species in the area and it supports a semi-commercial fishery.



2.1.4 Corals

The physical conditions characterizing the Red Sea provide an ideal environment for coral growth. About 74 genera and 194 species of coral have been identified and of these, 8.5% are endemic (PME, 1987).

Corals are scattered along both sides of the Red Sea, but tend to thrive at their best in the central and northern regions (Head, 1987) in four distinct groups -

1. Fringing reef
2. Soft coral
3. Fire coral
4. Barrier reefs

The fringing reef is the basic morphological type. It lies parallel to the shoreline, and at some locations it is penetrated by a narrow channel forming a natural harbor recognizable from the coast. These formations are locally known as a Sharm. For centuries, corals supported the activity of the artisanal fishery, provided building materials, and have been collected as souvenirs. Due to the beauty and diversity of the coral community, they provide an important recreational and tourism resource.

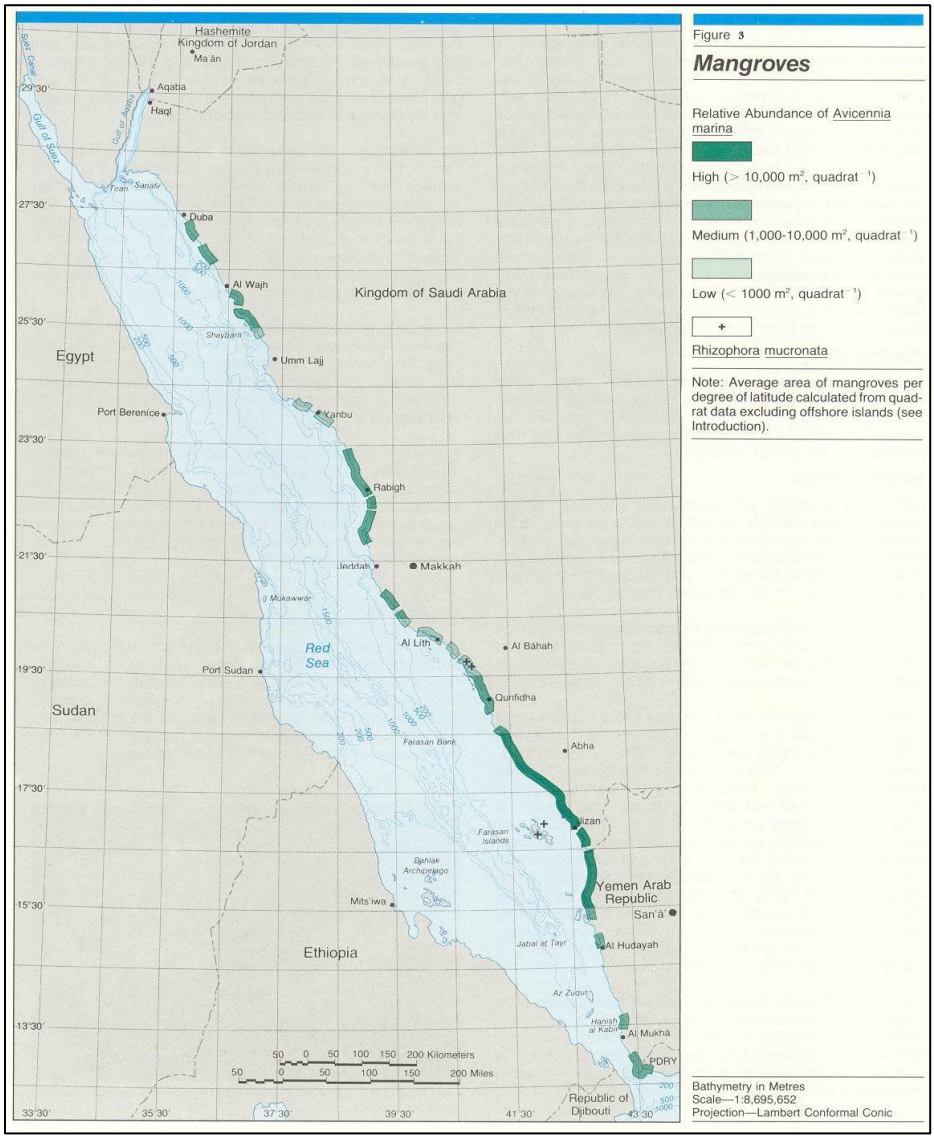
Overall the coral reefs along the Saudi Arabian coast of the Red Sea are generally in good condition. However, in particular locations, parts of the coastal reef are under severe environmental stress especially when they are close to densely populated and industrialized cities such as Jeddah and Yanbu. Human impacts on coral reefs communities along the coast are considered low to medium at Jeddah, low at Frassan Island and lower still Al-Wajh. This is a reflection of the fact that Jeddah is a big and busy city with a population of around 2 million and still experiencing rapid growth. At Jeddah, coral reefs are damaged through a number of popular tourist and recreational activities such as SCUBA diving, snorkeling and walking on coral. Trash also accumulates on the sea floor and coastal activities such as construction, dredging and land filling along the coast of Jeddah mainly at the South Corniche increase the amount of silt and sand in the water column. This in turn reduces light intensity and affects coral growth rate or kills them completely. In addition, other impacts such as domestic and industrial sewage effluent and discharges from desalination plants, are also known to affect the coral environment.

2.1.5 Mangroves

These salt tolerant trees occur in the upper intertidal zone in sheltered shores, or nearshore waters. Mangroves can usually support a complex community of animals but due to the high salinity, high temperature and low oxygen levels of the Red Sea, the faunal diversity is limited. The distribution of mangrove species is associated with the availability of fresh water resources. Thus, the concentration of mangrove swamps is greater in the southern part of the Red Sea where fresh water discharges from wadis are higher than in the Northern part (Figure 3).

Two species are found in the Saudi Arabian Red Sea, namely *Avicennia marina* and *Rhizophora mucronata*, with the later restricted to the Farasan Bank region .

Mangals play an important role in the coastal ecosystem. They represent one of the main vegetation habitats along the Red Sea coast, an area of high primary productivity, a nursery area for some important commercial fish species (mullets, porgies, etc) and nesting and roosting sites for birds. In addition, mangroves accumulate and retain sediment and prevent coastal erosion.



2.1.6 Seabirds

Three main groups of birds have been identified in the Red Sea coastal environment (Evans, 1987), namely -

- 16 breeding species, one endemic;
- 30 migratory non-breeding species; and
- 13 coastal species (not marine).

The concentration of the bird colonies seems to be higher in the north and in the south, where islands and reef formations are abundant.

2.1.7 Marine mammals

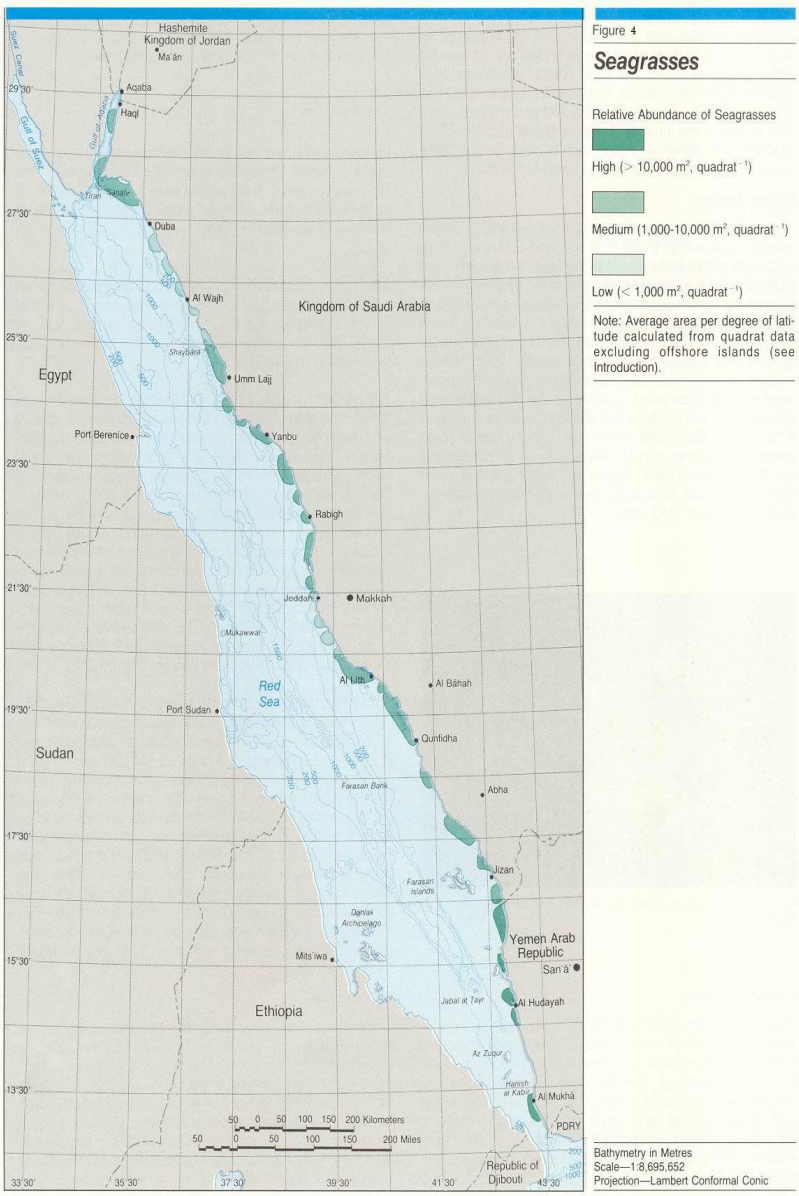
In the Red Sea, 10-11 species of cetaceans have been recorded (Frazier, 1987) and these include dugong and several other species such as dolphins, whales and porpoises. However, not much information is available on the biology and ecology of Red Sea cetaceans.

Within Saudi Arabian territorial waters, five sites have been identified as supporting moderate populations of dugong which Is the only herbivorous marine mammal. These are: 1) Tiran Island 2) Wajh bank 3) Sharm al Khaur 4) Al-Lith and 5) Gizan . The largest Cetacean population is centred on the Wajh Bank area .

2.1.8 Seagrass

Sea grass beds play an important role as sources of food for many key species including dugongs, green turtles and seabirds. Some fish species also depend on seagrass for food *e.g.* rabbit fish and surgeonfish. Furthermore, seagrass beds provide an ideal nursery for shrimp, juvenile fish and many invertebrates.

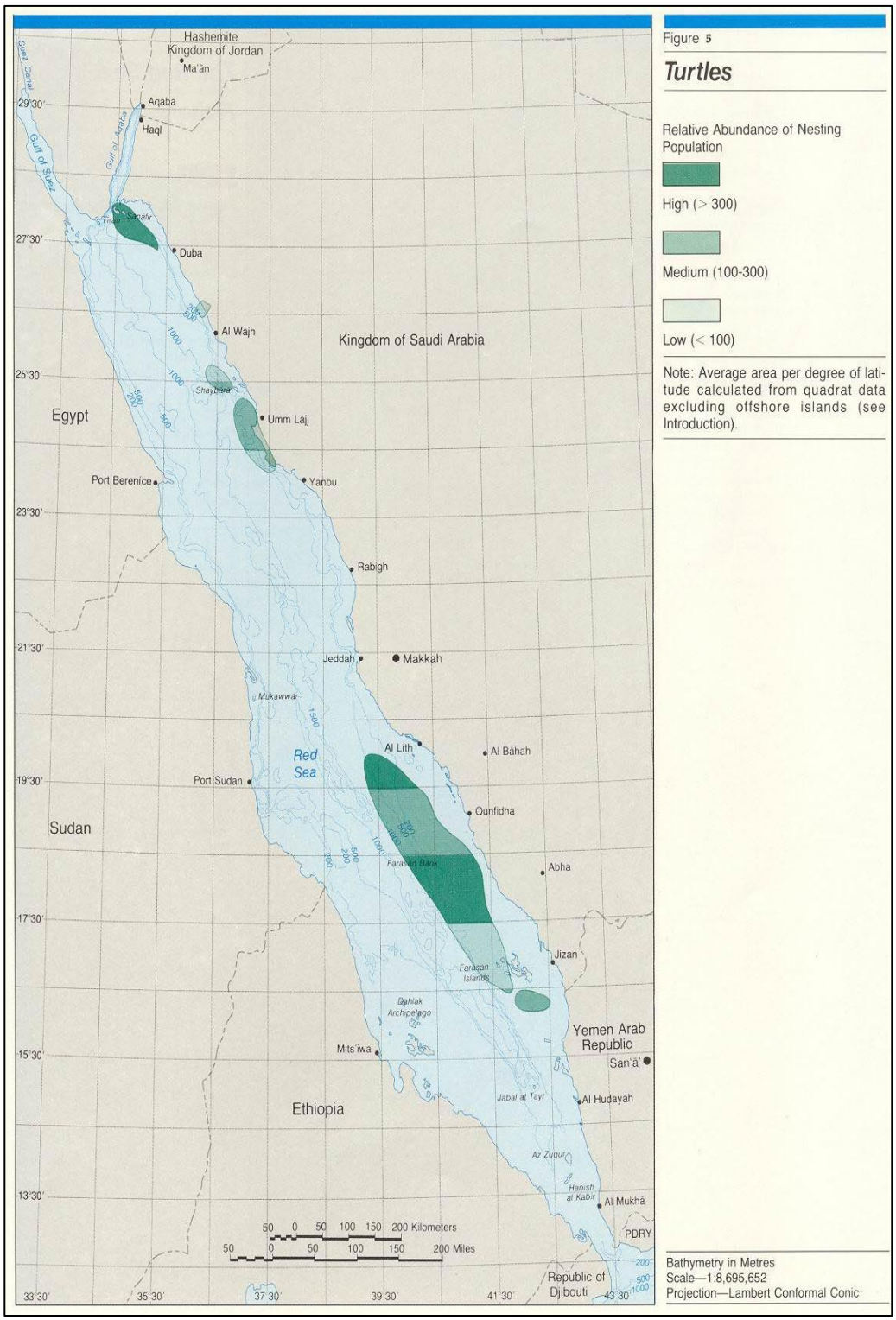
The abundance and distribution of seagrass beds and other habitats were mapped by a survey of the resources of the Red Sea and the Arabian Gulf carried out by PME and IUCN. While ten species of seagrass were identified (see Figure 4), seagrass beds are not so common. This is due to the rough topography of the Red Sea which is dominated by coral formations.



2.1.9 Turtles

Two species dominate the turtle population in the coastal area. These are the Green turtle C*helonia mydas* and the Hawksbill turtle E*retmochelys imbricate*. Nesting areas have been mapped by PME & ICUN (Figure5). Islands scattered off shore along the whole Red Sea coast provide suitable nesting sites for sea turtles, and only a few similar sites are found on the mainland. Hawksbill turtles nest at scattered locations along the beaches,

usually around March-April especially in the region between Cape Baridi and Abu Madd (north of Yanbu). Green turtles nest on Cape Baridi beaches (Vine, 1987).



2.2 Socio-economic perspective

2.2.1 Demographics

According to the Ministry of Finance and National Economy, the Kingdom population in 1998 was about 19 million and it is currently estimated as 20.2 million (Fig 9) with an average annual growth rate of 2.98%. The density of population is 10/km^2 and 85.7% of the population is considered urban. Life expectancy is 70 years for men and 73 years for women and 40% of the population is under 15 years old. There are an estimated 3.2 million households in Saudi Arabia and the average per household is 6.3 persons.

A Semitic people, Saudi Arabs share a common religion, Islam, and a common language, Arabic. Literacy rate is 73.4%. The annual Gross Domestic Product (GDP) per head of population is $6910.

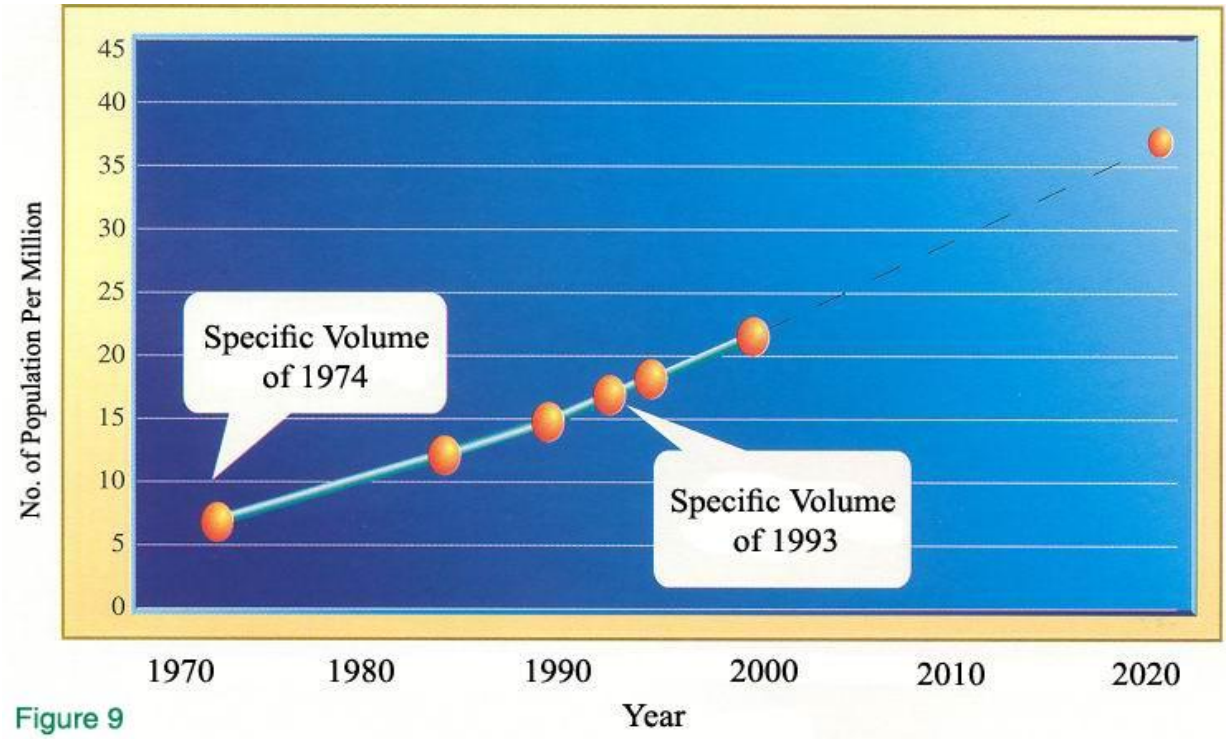


Figure 9

The industrial sector is the major employer (46.8%), and this is followed by the petroleum industry – production, refining and export. Those living in commercial sea ports are employed in a variety of sectors ranging from state administration to coastal and marine fisheries. In general, the fisheries sector provides employment for about 5% of the workforce, however, this figure will be higher if it is extended to include artisanal fishers in little coastal villages and towns that are dispersed along the coast.

The Human Development Index for Saudi Arabia is 74.0.

2.2.2 Economic investment in the coastal zone – the case of Yanbu

Since the early 1980s the Royal Commission began its planning at Yanbu with a thorough survey of the project site, which was located on a desert plain, sandwiched between the Hejaz Mountains and the Red Sea. From the site's inland boundary, a network of small water courses snake their way down to the sea.

The Yanbu site lacked everything required to support even a minimum level of human existence, let alone full-blown industrial development. Unlike Jubail, the site was far from the nearest metropolitan area and ready access to essential goods and services. The challenge therefore was enormous. It had to provide power, water, roads, airport, industrial port, telephones, housing, schools, health care facilities and all other services and facilities required by a modern industrial city.

The Commission has been very successful in its investment in infrastructure at Yanbu. Moreover, the developments have been made with full consideration of the environment as attested by the awards made to the Commission (Fig 7).

Figure 7

ENVIRONMENTAL AWARDS

In recognition of its environmental programs, the Royal Commission received two international prizes in 1988 — the Sasakawa Award from the United Nations and a commendation from the Kuwait-based Regional Organization for the Protection of the Marine Environment.

Power and Water

For the past two decades, Yanbu Industrial City has been a utility island, self-contained and unconnected to any regional power or water systems. For example, Yanbu's power needs have been supplied by nine gas-turbine and three steam-turbine generators, all capable of burning either gas or fuel oil. Together, these units can produce 900 MW of electric power at required voltages.

That situation, however, has now changed, with the completion of two projects. A 380/kv line has linked the Yanbu power system with the western regional grid, while new potable water lines now connect the industrial city with a nearby SWCC desalination plant and Yanbu Al-Bahr town. Besides being versatile, the power and water plant has certain design features, including multiple fuel use and alternative steam supplies that make it extremely reliable.

Water Desalination and Distribution

Water from the Red Sea is fed to nine desalination units which use heat recovered from the gas-turbine power generators to produce steam, which is then condensed into fresh water. Additional steam can also be provided by steam turbines. The desalination units at Yanbu can produce over 95,000m^3 of fresh water daily. Some of this desalinated water is chlorinated and rematerialized to become potable water. The rest, still chemically pure, is used for industrial processes. Water is distributed throughout the city to households, industrial users and other facilities by means of several pumping stations and about 510km of underground piping.

Industries require huge amounts of cooling water and as no year-round natural source of freshwater is available, the cost of producing desalinated water for cooling purposes would be prohibitive. Roughly 60% of the seawater that passes through the pumping station in Yanbu's main power and water complex goes to supply process cooling water for industry. The balance is used by the plant's steam-turbine generators and desalination units to produce power and water.

With the ability to pump 11.04 million cubic meters of water a day, the Yanbu facility is the largest pressurized cooling system in the world, yet its operation is uncomplicated - cool seawater enters the system at the main pumping station; following filtration and chlorination, water flows to the industries through 27km of underground piping; the industries return used seawater via gravity mains to an outfall channel that discharges into the Red Sea 5km Southeast of the intake channel. To minimize adverse environmental effects, industries are not allowed to return water to the outfall channel that could jeopardize coral growth on the nearby barrier reef that protects part of the Yanbu's port complex.

Wastewater Treatment

The Royal Commission tries to maximize the use of desalinated water through the treatment and reuse of all wastewater. Sanitary wastewater is collected from all over the city and treated. The resultant high quality effluent is then reused as irrigation water.

Industrial effluents are collected and treated in a special system that has been installed as part of the infrastructure in Yanbu's industrial parks. Following treatment, this wastewater is pumped back to the industrial areas for reuse.

Both industrial and sanitary wastewater treatment plants are located in a combined treatment facility adjacent to Yanbu's power and water complex.

Other wastes are transported to Yanbu's 440 hectare landfill, located in a far corner of the industrial area, where waste material is disposed of according to type.

Environmental considerations

As mentioned above, the approach adopted at Yanbu has integrated development and environmental protection. The approval process for a new development is illustrated in Fig.8 below.

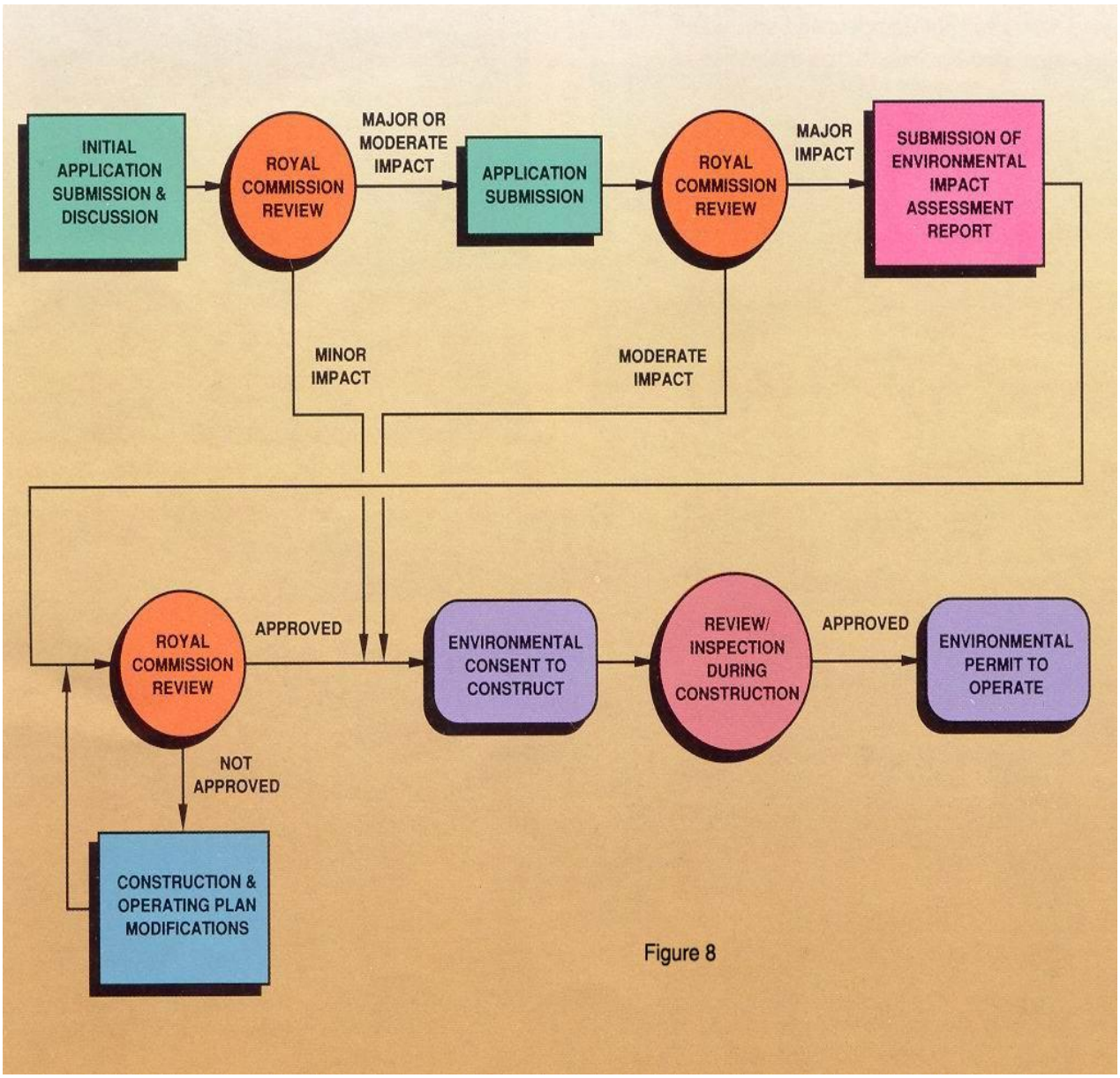


Figure 8

3 COASTAL PROBLEMS AND THEIR CAUSES

The major threats to the marine environment of the Red Sea and Gulf of Aden are related to land-based activities. An assessment[1] of land-based sources and activities affecting the marine environment in the region showed that the main impacts arose from urbanization and coastal development (*e.g.* dredge and fill operations), industries (including power and desalination plants and refineries), recreation and tourism, waste water treatment facilities, power plants, coastal mining and quarrying activities, oil bunkering and habitat modification (such as the filling and conversion of wetlands). These impacts can be considered under two main groupings, namely coastal developments (alternations) and wastewater discharges (pollution)

3.1 Coastal developments

The physical alteration and destruction of habitats by coastal development arise from both large-scale coastal construction projects including recreational facilities, hotels and restaurants, as well as the smaller scale but greater number of developments on privately owned riparian land.

In some parts of the Saudi Arabian Red Sea, coastal areas are under environmental stress especially where they are close to densely populated and industrialized sites (such as Jeddah, Yanbu and Jizan). The identified threats are expected to increase in future due to the proximity of coral reefs to development sites (Sheppard *et. al.,* 1992). The major threat is a localized one and arises from the expansion of cities by extensive filling of coastal habitats, discharges from desalination plants, raw sewage discharges, dredging, uncontrolled coastal development adjacent to fringing reefs, tourism developments and shipping (PERSGA, 1998).

The practice of extending coastal land by reclamation is exemplified by the type of coastal development that can be seen in Jeddah, which is one of the largest cities in the Saudi Arabia with a population of about 2.7 million. The situation in Jeddah is completely different from smaller Red Sea urban centres. Jeddah is the principal seaport of Saudi Arabia, and has witnessed great change after the discovery of oil. It is an entry point for Muslim pilgrims on their annual pilgrimage (Hajj) to Makkah. It has become a busy commercial seaport, a leading air terminal, and a major business and industrial center. Under these circumstances, development is inevitable.

Development along the Jeddah coastline has in the main taken place without adequate evaluation of the potential environmental impacts. The construction of large projects has required significant dredge and fill operations which have adversely impacted the coastal environment. In addition to the direct destruction of marine life and key habitats by reclamation, the suspended fine materials resulting from these activities create additional widespread damage to marine life smothering benthic communities and affecting surrounding ecosystems (mangroves, sea grass beds and coral reefs). The decline in

[1] Dr Ziad H. Abu-Ghararah - background document for a workshop on implementation of the Global Programme of Action in the PERSGA and ROPME regions (Manama, Bahrain, 2-5 December 1996). (This document and similar assessments for other regions are available on the GPA website.)

marine and coastal productivity as measured by the landings from shrimp and other demersal fisheries[2] is a notable consequence.

The majority of land reclamation and dredging activities within the coastal zone occur on privately owned coastal land and, as a result of an increase in private land ownership along the coastal strip, these activities and their resultant impacts have yet to peak. The coastal fringe is not adequately protected against these impacts and its physical morphology is changing in many places due to coastal land excavation and reclamation which is extending the landward boundaries or creating semi-enclosed lagoons. Such lagoon areas often experience concentrations of pollutants and algal blooms often result adversely affecting the coastal and marine environment.

Land reclamation processes have contributed to the severe destruction of some environmentally sensitive areas affecting essential elements of the coastal food web. As a result, fish stocks and yields have been affected. Coastal land use conflicts have alienated the public from the coast, hindered the necessary coastal monitoring process, and impeded the implementation of contingency plans by the concerned administrative agencies.

3.2 Wastewater discharges

The advanced wastewater treatment systems in Yanbu produce wastewater suitable for industrial reuse or irrigation, and only a limited amount is discharged to the sea. However, most of the wastewater treatment plants in Jeddah are overloaded and the effectiveness of treatment is very low. This results in a low quality effluent which still has an impact on the coastal environment.

Much of the rapid expansion of Saudi Arabia's urban centers has been achieved through the extensive use of desalinated water to meet the demands of the population and industry and in 1992, there were 18 desalination plants operating along Saudi Arabia's Red Sea coast with a total combined capacity of 726,343m^3/day. The discharges from the eight Jeddah plants and the five plants along the coast of Jeddah and Shuaibah, include chlorine and anti-scaling chemicals, large quantities of NO_2 and SO_2, brine which exceeds by 1.3 times the ambient salinity concentration of the Red Sea, and a temperature of 41°C (approximately 9°C above the average ambient Red Sea temperature) (De Vantier & Pilcher, 2000). The resulting impact on marine ecosystems due to thermal pollution and the elevated levels of salt and chlorine in the return waters vary with the volumes of water and the location of the discharge.

There are four oil refineries located along the eastern side of the Red Sea. Although treatment facilities are provided for all the refineries and the quality of the treated effluent is generally acceptable, the refineries still pose a threat to the marine environment in the absence of adequately enforced regulations related to effluent discharges into the coastal and marine environment.

In Yanbu, off-loaded ballast water is discharged into the Red Sea after removal of residual oil, but up to 8.8 tonnes/year of oil and grease are still discharged into the sea.

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[2] Source: UNEP/PERSGA: *Assessment of Land-based Sources and Activities Affecting the Marine Environment in the Red Sea and Gulf of Aden.* UNEP Regional Seas Reports and Studies No. 166, UNEP, 1997. Available in PDF format on the GPA website.

Another source of pollution is the untreated or partly treated industrial and domestic wastewaters that are discharged into the coral reef environment at many points along the shoreline. The untreated sewage is particularly dangerous to the marine environment (Mandura *et. al.,* 1994).

3.3 Other threats and impacts

Another threat to coral reefs is regional in nature and includes destructive fishing methods with direct and indirect physical impacts on ecological parameters. There are also regional pollution events associated with massive oil spills (Gladstone *et. al.,* 1999; Ormond *et. al*., 1984c).

4 THE RESPONSE TO DATE

In recognition of the value of its coastal areas and resources, and the threats posed by existing and potential problems, Saudi Arabia has put in place a number of measures which will manage the process of coastal development to ensure that its benefits are sustainable.

4.1 Coastal policies, legislation and other regulatory instruments

The Government of Saudi Arabia has taken several steps and decisions to control and protect the coastal environment. The most salient of these are listed below.

Environment Protection Standards These are contained in Document No.1401-01, 1402H (1982), PME Ministry of Defense and Aviation Kingdom of Saudi Arabia.

National Oil Spill and Hazardous Substances Contingency Plan This plan is set in Decision No. 157 dated 20/11/1411 H, (June 1991) by the Council of Ministers. This decision called for the formation of a committee from five governmental bodies, to be involved in the implementation of this plan. Members of this committee are:

1. Ministry of Defense and Aviation PME
2. Ministry of Interior Coastal Guards and Defense
3. Ministry of Petroleum and Minerals
4. Port Authority
5. Ministry of Municipalities and Rural Areas

Environmental Impact Assessment A draft for the implementation of Environmental Protection Standards, and Principles and Procedures for Environmental Impact Assessment (PME).

Rules and Regulations for Saudi Arabian Sea Ports Issued under Ministerial Resolution No.181 (9-10-1395 H) (1975). Administered by the Seaports Authority of Saudi Arabia.

Fisheries Regulations Rule for implementation of the Saudi Arabian Regulations for Fishing, Exploitation and Protection of Living Aquatic Resources in the Territorial Waters of the Kingdom of Saudi Arabia issued under Ministerial Resolution No. 21911 (27-03-1409 H), Nov.1988, administered by Ministry of Agriculture.

Wildlife protection Establishment of the National Commission for Wildlife Conservation and Development (NCWCD) in May 1986. The main goal of this commission is to preserve, protect and develop Wildlife within the Kingdom. Several protected areas were already established and supervised by NCWCD - Assir National Park established in the Southern part of the Kingdom and supervised by the Ministry of Agriculture.
Wildlife protected Areas regulation. Issued under Ministerial Resolution No. 124 (26-10-1415 H), March 1995, administered by the NCWCD.

International obligations Saudi Arabia has accepted its role in the international arena of environmental protection and management by acceding to and ratifying a number of international conventions and other agreements. The most salient of these are listed in the box below -

Major Regional and International Agreements entered into by Saudi Arabia

1. Kuwait Regional Convention on Protection of the Marine Environment from pollution by (ROPME).
2. The Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (PERSGA).
3. Protocol Concerning Cooperation in combating pollution by oil and other harmful substances in cases of Emergency : General Principles for Environmental Protection (adapted by the Gulf Cooperation Counsel in Nov. 1989).
4. Protocol Concerning Marine pollution resulting from Exploration and Exploitation of the Continental Shelf (adopted by the ROPME member states in June 1989).
5. Protocol for the Protection of the Marine Environment against land-Based Sources (adopted by the ROPME member states in Feb. 1990).
6. The Arab Declaration on Environment and Development (adopted on 14 Oct. 1986 in Tunis).
7. International Convention on Civil liability for oil pollution damage (CLC)
8. The Establishment of and Int. Found for Compensation for oil pollution damage.
9. World Charter for Nature.
10. Gulf Cooperation Council. A draft law concerning environment protection for GCC member states.
11. World Conservation Strategy.
12. Convention on International Trade in Endangered Species of Fauna and Flora (CITES).

The Kingdom is also involved actively in several International Agencies that are concerned with the Environment

(UNEP) United Nations Environmental Programme
(IUCN) International Union for the Conservation of Nature and Natural Resources
(WMO) The World Meteorological Organization
(ACOPS)The Advisory Committee on Pollution of the Sea
(IPCC) Intergovernmental Panel on Climate Change

4.2 Coastal and marine data and information

Beside PME as the principal governmental body involved in marine environmental studies, several other governmental agencies also contribute to environment issues, as a result of some environmental responsibilities having been incorporated in their rules and regulations. These are :

1. Ministry of Agriculture - Fisheries Regulations, Forest and Farmland Regulations (M/22 dated 3-5-1398 H)
2. Ministry of Education- - Regulations for Antiquities
3. Ministry of Higher Education
4. Universities and Research Institutes involved in marine environment studies

The Faculty of Marine Science of King Abdul Aziz University on the western coast has conducted an oceanographic survey of the marine communities and properties of the coastal waters between Yanbu and Jeddah, as well as other research programs which involve chemical, biological and geological aspects of the Saudi Red Sea coast .

The Water Resources and Environment Division of the Research Institute of King Fahad University of Petroleum and Minerals on the Eastern coast, established three working groups involved in relevant environment studies :

- Water Resources Group.
- Environmental Pollution Group, which in turn is divided into -
  - Water pollution studies
  - Solid waste studies
  - Air pollution studies
- Bioenvironmental Studies Group, comprising -
  - Marine science
  - Oil spill studies

Under the Royal Commission for Jubail and Yanbu, a regular program was set up to collect data related to selected physical, chemical and biological parameters in Yanbu for pollution control purposes.

As a major producer of freshwater from seawater, the Saline Water Conversion Corporation (SWCC) must ensure the quality of its products. The SWCC therefore established a control laboratory in every plant to monitor, on daily basis, the environment around the site and detect any changes. In 1987, a research Center was established in Jubail to carry out the technical and practical research dealing with desalination processes. Finally, at King Abdul Aziz City for Science and Technology (KACST), funding has been obtained for environmental and pollution research jointly with the Saudi Arabian Bureau of Standards and the Ministry of Municipalities and Rural Areas.

4.3 Institutional Framework

4.3.1 PME Role and Responsibilities

In 1981 the General Directorate of Meteorology became the Meteorology and Environmental Protection Administration (MEPA), and more recently it became the Presidency of Meteorology and Environment (PME). Its duties and responsibilities have been spelled out by the Royal Decree No.71M/8903. Beside its meteorological activities, PME became the major government body responsible for the control of pollution and the protection of the environment in the Kingdom.

PME is nationally responsible for environmental affairs and matters related to environmental protection such as issuance and implementation of environmental standards, assessment of environmental status and the development of policies necessary to conserve and improve the environment. Specific responsibilities of PME are:

- Propose environmental quality standards for the ambient environmental and pollution sources as well as appropriate pollution control measures for implementation;
- Submit reports on the environmental impacts of major industrial projects;
- Provide advice and technical consultation for industrial and agricultural activities in order that they meet environmental standards;
- Prepare reports on the status of the environment;
- Propose solutions for resolving conflicts between human activities and the natural environment.

One of the major tasks and responsibilities of PME is the facilitation of periodical meetings involving the concerned authorities with an interest in the problems that stem from the disposal of sewage effluent into coastal areas. PME is also tasked with coordinating the search for short-term and long-term alternatives to the discharge of sewage into the marine environment. It is also a PME task to lead the efforts towards recycling and reusing water resources in the face of acute water shortage in most areas. Such actions must be taken even if only to reduce the costs of freshwater manufacturing through desalination.

PME is also playing a leading role in all attempts to limit the detrimental effects on the environment. This authority is performing the tasks of inspection and supervision and application of penalties against those who break the law following the issuing of the Public Order on the Environment in 2003. PME works closely with the Shura Council in the Council of Ministers to develop draft plans for the administration of coastal areas. These plans will guide authorities in the coastal areas to develop their operational plans with regard to their areas in order to be reviewed and approved on the part of PME to guarantee environmental protection and sustainability of resources.

The Ministry of Petroleum and Mineral Resources is the ministry responsible for the control of oil and its derivatives exported from coastal cities. The Ministry has developed contingency plans to deal with any accidents which may occur during the execution of its tasks and responsibilities. It is the task of PME to supervise these plans and ensure that they are executed effectively by the responsible organizations.

4.3.2 Coordination among coastal agencies concerned with development

A Coastal Committee has been established with representatives of the relevant ministries and other bodies to receive and process applications for coastal development. The Committee advises PME and/or any other agency with the power to grant or withhold approvals for coastal development.

A developer from either governmental or the private sector, can lodge a development application for any of the following activities :

1. Land reclamation of the owned area along the shoreline
2. Land reclamation or dredging within the coastal area
3. Utilization or land acquisition of reclaimed area
4. Development projects on owned coastal areas especially along the waterfront
5. Developmental projects or rehabilitation of sites that previously had been reclaimed or dredged incompletely or without complying fully with the requirements of the Coastal Committee.

The application is lodged by the land owner or his representative with the concerned municipality requesting approval for the proposed development (Figure 6). The municipality forwards the application to the Coastal Committee within two weeks of receiving it from the applicant having made sure that the following criteria have been satisfied by the application :

- Request viability
- Request compliance with rules
- Environment friendly

- Common efficiency

The Coastal Committee must respond within 4-6 weeks with its advice to the municipality. The advice will indicate the required action as necessary. The municipality, upon approval of the request, has to notify the Committee of the permit interval.

The approval process described above is a generic one. Following is a more detailed account of the process when applied to specific and more common development proposals.

The process of coastal land reclamation and dredging

Any projects which will alter the coast or have a negative effect on land or in the water are prohibited by law in principle. For example, the owners of water frontages are not allowed to dredge or reclaim whether for tourist or residential developments, public or private. However, such actions may be permitted for proposals which are considered to be in the national interest, or security, or of significant economic interest, *e.g.* projects related to widening or deepening of navigational channels and their maintenance.

These projects are normally initiated or coordinated by one of the following government agencies: the Ministry of Defense and Aviation, Ministry of Interior, Ministry of Petroleum and Minerals, Port Authorities, the Royal Commission of Jubail and Yanbu, Ministry of Agriculture, the electrical plants, desalination plants, and other agencies related to scientific research or environmental monitoring.

The agency concerned or its representative will apply to the municipality of the locality, using the prescribed application papers which include the environmental impact study. The application must also address the implementation methods and the disposal plans for the dredging spoils, as well as the duration of the project activities.

The national Coastal Committee will assess the viability and the justification of the proposal to reclaim and dredge within the coastal area, assuring itself that the proposed work is rerquired either for security or rehabilitation or general interests or reshaping of the coastline. In agreeing to the proposal, the Committee will prescribe specific conditions it feels are necessary to minimize impacts and, in particular, to protect the coral reefs (Fig 6).

Harbors and Bridges

The establishment of new private harbors is discouraged. To the extent possible, the design of harbors and bridges should employ floating construction to as to avoid the creation of physical barriers which alter water circulation or impede its movement. In undertaking such constructions, no damage must be done to living marine resources. .

It is recommended that harbor development should be integrated within comprehensive coastal management plans. It is therefore important for the private sector to remain aware of such management plans and to stay in touch with the relevant agencies.

Sea-based pollution sources from harbor operations such as reception facilities must be subject to detailed regulations and no permit should be given without them. The owner of the project or its operation management is responsible for the containment and removal of waste.

Wherever there is a need for gas-station establishment, the owner has to comply with all conditions of the permit. In particular, he/she must provide a contingency plan for dealing with marine pollution emergencies. PME has to approve this plan and sign the permit before he/she is allowed to operate.

Development of private water frontage areas

As noted above, the development of coastal areas particularly along the shoreline, is not allowed except in the case of national interest, security, economy and public utilities undertaken by designated governmental organizations.

If a developer still wishes to apply for a permit, an application must be lodged with the municipality in four copies. The application must clearly describe the development activities and the coastal land involved, as well as provide an EIA study indicating the effect of the development on the surrounding environment, including consideration of alternatives and/or remediation of any impact.

Upon the approval of the study by PME, the formal designation of coastline boundaries must determine the built-up areas together with areas that are to remain free of development and serve as “green” areas for recreation.

Project monitoring by the relevant agencies

Various agencies (mainly those with membership of the national Coastal Committee) must fulfill their environmental protection mandates, together with their goals and objectives of monitoring coastal developments and ensuring environmental safety and security as well as human health and safety and the protection of the Kingdom's natural resources on a sustainable basis. In order to do this, they are empowered to inspect and monitor all development projects in the coastal area without prior notification, to take samples and have them analyzed whenever they determine it is necessary.

If the findings of these investigations indicate a serious situation which needs to be addressed, the following actions will take place :

- The investigating agency sends notification of its findings to the offending party with a directive to stop the illegal action and adhere to the conditions, regulations or other undertakings. A copy of such notification should be sent to the related municipality and PME for follow up.
- If the offence is not remedied within one month, the investigating agency must report the infringement to the relevant Governorate.
- The Governorate accordingly should instruct whomever necessary to formally notify the offender and request a response according to the relevant regulations, within one week. The Governorate notifies the related agencies of the action taken.
- The cost of remediation and rehabilitation will be borne by the developer.

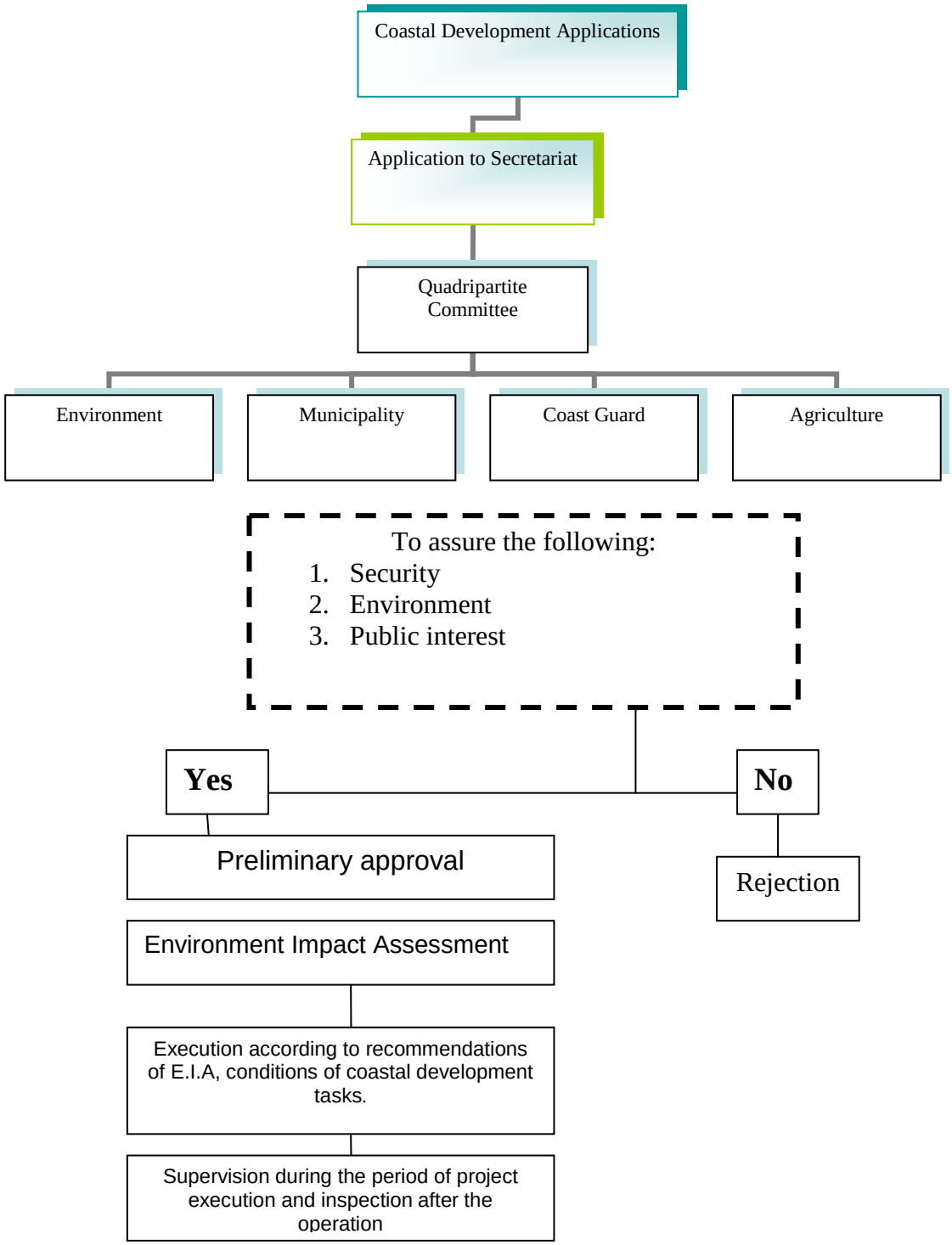

Figure 6.

4.4 Other Measures

4.4.1 National Oil Spills Contingency Plan

The National Contingency Plan for combating Marine Pollution from Oil and other Hazardous Substances in Emergency Cases (KSA1991) was officially initiated in the period immediately prior to the largest oil spill in history. The decision of the Council of Ministers, gives the prime responsibility for oil spill response to the PME thus ensuring that reporting, surveillance and response capabilities are available to deal effectively with a spill originating in Saudi Arabian waters.

The Red Sea is of strategic importance to Saudi Arabia's economic development and this is also the case with the other neighbouring countries. In addition, a large proportion of the world oil supplies is transported through the Red Sea and the threat of an oil spill is significant along the entire Red Sea coastal waters, and especially so in Saudi Arabian waters due to the large-scale petroleum production and associated marine activities. It is the policy of the Kingdom of Saudi Arabia that the exploration for oil and the transportation of oil and other harmful substance, must be carried out in such a manner as to minimize the risk of environmental and economic damage or threat to public health. In the event of a spill, swift and effective action will be taken to minimize the environmental and public health risks.

The National Contingency Plan is the umbrella plan that is general in nature, but it identifies the authorities and responsibilities of the major agencies and organizations, the national response system, the major resources available, and the general national response strategy. Regional and area contingency plans are more specific in nature. These are usually relatively short and are often compared to an aviation preflight check list, which during the early moments of a spill, can be quickly scanned and followed to guide the proper actions.

The Plan aims to establish a system for responding immediately to, and coordinating the actions required for, the protection of the Saudi marine and coastal environmental from the effects of spilled oil making full use of the available resources both regionally and internationally to do this. This entails mobilizing and coordinating all of the available equipment, manpower and expertise to combat spill situations. It is also aims to honour the Kingdom's obligations assumed under the various regional and international agreements entered into by Saudi Arabia for the protection of the marine environment.

The following authorities are required to undertake pollution prevention, protection and combating activities within marine and coastal areas using facilities they have acquired for the purpose :

1. Ministry of Defense and Aviation (PME and the Royal Navy)
2. Ministry of Interior (Frontier Force)
3. Ministry of Petroleum and Mineral Affairs
4. Ministry of Industry
5. Ministry of Municipal and Rural Affairs
6. Saudi Port Authority
7. General Organization for Distillation of Saline Water
8. Royal Commission for Jubail and Yanbu
9. Any other authority having marine or coastal facilities

Each of these authorities must appoint a responsible person to lead the response activities in each facility or area controlled by them.

In addition to the responsibilities it shares with other designated agencies under this plan, PME is also required to prepare, disseminate and monitor the implementation of policies, regulations and procedures for combating and preventing pollution.

4.4.2 Environmental Impact Assessment (EIA)

Since 1985 it has been a requirement under Saudi Arabian law that any new industrial development or private project, must undertake an environmental impact assessment (EIA) before obtaining other approvals or permits. The EIA study must be based on the current PME regulations and standards with the objective of minimizing impacts on the environment.

This requirement also satisfies obligations taken up under agreements with the Gulf Cooperation Council (GCC) and the Arab Environment Council.

5 INTEGRATED COASTAL ZONE MANAGEMENT

5.1 Proposal for ICZM in Saudi Arabia

Saudi Arabia's coastal zone is rich in a variety for natural, commercial, recreational, ecological and esthetic resources of immediate and potential value to the present and future well-being of the Kingdom. Unprecedented economic development which has taken place within the Kingdom has created increasing and competing demands upon the lands and waters of the coastal zone. Such demands, for population growth, economic development, including industry, commerce, residential development, recreation, extraction of mineral resources and fossil fuels, transportation and navigation, waste disposal, and harvesting of fish and shellfish and other living resources, have impacted on living marine resources and wildlife, increased nutrient inputs, brought about permanent and adverse changes to ecological systems, decreased open space for public use, and caused pollution of ground water resources and shore line erosion.

These changes are not in the best interests of the Kingdom because they may lead to economic inefficiencies, waste, and loss of the use of coastal resources to present and future generations. In light of these competing demands for coastal resources and their potential for undesirable effects, there is an urgent need to protect and manage coastal resources.

In order to accomplish this task and ensure that future expansion of the Kingdom's economic and urban centers is carried out in a sustainable manner, current national, provincial and municipal institutional coastal management arrangements need be strengthened and coordinated. The key to more effective utilization of coastal land and water resources is the clarification of responsibility for their management in a manner that will provide responsibility and authority for management to the level of government (national, provincial or municipal) that can most effectively implement necessary management activities.

This will require cooperation among all affected interests. If successful, cooperation and coordination provided for in PME's proposed coastal zone program will lead to development of land and water use programs for the coastal zone and unified policies for dealing with land and water use decisions of more than local significance.

All of these individual programs must be coordinated nationally in order to avoid conflicts in coastal management activities and achieve the optimal long term interests of the Kingdom, both economically and environmentally.

5.1.1 Basis for a national CZM plan

The Kingdom of Saudi Arabia is an Islamic Sovereign state. Its religion is Islam, and its constitution is the Holy Quran and the Prophet's Sunnah[3]. In this regard, justification for coastal zone management can be found in the teachings of Islam which ordained that mankind should thrive and inhabit the earth as the primary function. Accordingly, utilization of the natural and environmental resources of the Kingdom has been ascertained with the purpose of satisfying man's current requirements without tampering with the abilities of

[3] Kingdom of Saudi Arabia Basic System of Governance, Chapter One.

future generations to fulfill their needs from the same resources[4]. In this regard the Kingdom of Saudi Arabia, in its Basic Rules has stated that "The government shall endeavor to conserve, protect and develop the environment as well as to prevent pollution."[5] Such protection should be accomplished through coordination of environmental activities as well as integration of environmental impact assessment into the development process. These activities are listed as key environmental issues in the Fifth Development Plan. Coastal zone management implements both of these directives.

The need for "Binding Coordination" among government agencies involved in environmental management has been further identified in PME's Operational Plan under the Fifth Development Plan.[6] A major PME objective in this regard is the completion of regulatory frameworks for PME and for environmental coordination at the national level. This should clearly identify the responsibilities of agencies involved in the field of environmental protection together with their interrelations and their role in the development of the Kingdom. PME's efforts to establish "Binding Coordination" in coastal zone management matters through development of a National Plan for Integrated Coastal Zone Management in the Red Sea and Arabian Gulf is further set out in the PME Operational Plan.[7]

In addition to its obligation to present and future citizens of the Kingdom, Saudi Arabia is signatory to a number of regional and international agreements and protocols which call for the development of a plan for the management of coastal resources. The Kingdom is signatory to two key regional agreements which prioritize coastal zone management. The first of these is the Kuwait Regional Convention on the Protection of the Marine Environment (1975) and the related Kuwait Regional Convention for Cooperation on the Protection and Development of the Marine Environment from Pollution (1978) with its Protocol Concerning Regional Cooperation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency (1978). The second is the Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (1982) and its Protocol on Marine Pollution Resulting from Oil Exploration Activities in the Arabian Gulf Region (1989), as well as the ROPME Protocol for the protection of the marine environment against pollution from land based sources (1990). Other relevant agreements signed by the Kingdom include the 1954 International Convention for the Prevention of Pollution of the Sea by Oil (and its amendments); the United Nations Convention on the Law of the Sea (1982); the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989); and the Montreal Protocol (and amendments) on Substances that Deplete the Ozone Layer (1992). [8]

Other agreements under consideration place further obligations upon the Kingdom to institute programs of planned environmental management. These include : the International Plant Protection Convention (1951); the Convention on the Continental Shelf (1958); the Convention on Fishing and Conservation of Living Resources of the High Seas (1958); the Protocol Relating to Intervention on the High Seas in Cases of Marine

[4] From the Agenda 21 Report, A Comprehensive Study Undertaken by the Preparatory Committee on the Implications of Agenda 21 for the Kingdom of Saudi Arabia. Detailed analysis of the Islamic basic for environmental and coastal management can be found in Environmental Protection in Islam. PME, / IUCN. 1993.

[5] Kingdom of Saudi Arabia. Basic System of Governance. Article (32). Council of Ministers Resolution No. 157 (Dated 20.11.1411 H) also sets out "The National Plan for sea pollution protection".

[6] Ministry of Planning 1410 AH. Fifth Development Plan. pp. 392-3.
Ministry of Planning 1411 AH. Fifth Development Plan: Operational Plan, Meteorology and Environmental Protection Administration. Section 5.1

[7] Ibid. Section 3.0-Ibid. Section 2.2.6.

[8] Reference National report to the United National Conference on Environment and Development (1992, pp. 82 and 83).

Pollution by Substance Other Than Oil (1973); the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (1971); the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972); Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973); the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships (1974).

Saudi Arabia also participates actively in Regional and International organizations which are concerned with the protection of the environment. These include the United Nations Environment Programme (UNEP), World Health Organization (WHO), United Nations Food and Agriculture Organization (FAO), World Meteorological Organization (WMO), United Nations Educational, Scientific and Cultural Organization (UNESCO), the Regional Organization for the Protection of the Marine Environment (ROPME) in the Arabian Gulf, the program of the Environment for the Red Sea and Gulf of Aden PERSGA), the relevant organizations working under the Arab League, the Gulf Cooperation Council and the Gulf Area Oil Companies Mutual Aid Organization.

Under the direction of the Custodian of the Two Holy Mosques, the Ministerial Committee for Environment (MCE)[9] has undertaken to develop a plan of action for the Kingdom's implementation of Agenda 21 which is a set of principles for environmental responsibility which was developed at the 1992 United Nations Conference on Environment and Development. It seeks to provide guidance which would enable the Family of Nations to enter the 21st century in a sustainable relationship with the natural environment. Specific references regarding the need for coastal zone management as well as the need for national and regional coordination can be found in chapter 17A of Agenda 21 published by the UNCED Secretariat.

The Agenda 21 subcommittee[10] of the MCE identified the need for a national program of coastal management as a priority activity, specifically through development of national plans for the management of coastal zones and resources in accordance with existing regulations in coordination with relevant agencies and list the uses of these zones in the territorial waters of the Kingdom with particular emphasis on environmental considerations"[11]

5.1.2 Requirements for integrated coastal zone management

There appear to be seven requirements for the successful formulation and implementation of a system for coastal zone management in Saudi Arabia, namely:

- Formulation of appropriate institutional arrangements to promote the wise and sustainable use of the nation's coastal land and water resources, including resolution of current conflicts among competing use needs.

[9] The MCE, established by Royal Decree 5/B/5635 (dated 14-4-1410 A.H.) is the highest institutional authority in the Kingdom for environmental matters, especially in the establishment of national environmental policy and strategy. The MCE is chaired by HRH The Second Deputy premier and is composed of concerned Ministers from the Ministries of Foreign Affairs, Interior, Finance and the National Economy; Petroleum and Mineral Resources, Agriculture and Water, Municipalities and Rural Affairs, Industry and Electricity, Health, Planning; the President of KACST and the President of PME who serves as the MCE Secretary General.

[10] The Agenda 21 Committee is constituted with representatives of the Ministries of Agriculture and Water, Municipalities and Rural Affairs, Petroleum and Minerals, Health, Industry and Electricity, Planning, Finance and the National Economy, KACST and PME.

[11] Agenda 21 Subcommittee of the MCE. 1993 A comprehensive study undertaken by the preparatory committee on the Implications of Agenda 21 for the Kingdom of Saudi Arabia.

- Training of staff within the PME, other agencies and local authorities with jurisdiction over and/or responsibility for coastal areas and resources
- Improving the information on coastal environments (habitats/ecosystems) that generate economically, socially and environmentally important resources at the local, national and international levels.
- Planning and management guidelines that will help to establish wise and sustainable use of coastal ecosystems
- Planning and management guidelines for the location, design and management of activities that require coastal locations and access to coastal land and water resources
- Formulation of a basic Coastal Zone Management Plan by PME and then operational local area coastal zone management plans by sectoral agencies with responsibilities for the planning and management of development and conservation activities
- Increased public awareness of the importance of coastal land and water resources to their economic and social welfare

5.1.3 General policy for coastal zone management

Effective management of coastal resources will require that the national government should assist sectoral agencies, provincial governments and municipal authorities with the development of coastal zone management programs for their respective areas of jurisdiction.

The role of the national agency with responsibility for coordination between local coastal zone management programs would center on ensuring that the goals and objectives of these programs (Local Area Coastal Zone Management Plans) are consistent with national policy as determined by the Ministerial Committee for Environment or by Royal Decree.

In this regards, individual Local Area Coastal Zone Management programs should have as their priorities the following goals:

(A) Resources of the coastal zone should be preserved, protected and developed in a manner that provides the maximum benefit for this and all succeeding generations

(B) The development and implementation of management programs should achieve wise use of land and water resources of the coastal zone, giving full consideration to ecological, historic, esthetic and spiritual values as well as to the needs of economic development. These programs should at least provide for :

- The protection of natural resources, including sharms, coral reefs, beaches, dunes, islands, fish and wildlife and their habitat, within the coastal zone
- The management to minimize loss of life and property caused by improper development in flood-prone, storm surge, geological hazard, and erosion-prone areas and in areas of subsidence or which will become inundated through sea-level rise, and salt water intrusion, and destruction of natural protective features such as beaches, dunes, wetlands, coral reefs and islands
- Protection of groundwater resources from pollution and saline intrusion resulting from poorly planned and managed coastal development
- Priority consideration being given to coastal-dependent uses and orderly processes for siting major facilities related to national defense, energy, fisheries development, recreation, ports and transportation, and the location, to the maximum extent practicable of new commercial and

industrial development in or adjacent to areas where such development currently exists
- Public access to the coasts for recreational purposes
- Assistance in the redevelopment of deteriorating urban waterfronts and ports, and sensitive preservation and restoration of historic, cultural and esthetic coastal features
- The coordination and simplification of procedures in order to provide for expedited government decision-making for the management of coastal resources
- Coordination with national agencies which are affected by decisions
- Assistance to support comprehensive planning, conservation, and management of living marine resources, including planning for the siting of pollution control and aquaculture facilities within the coastal zone

(C) In areas where conflicts between multiple uses endanger economic efficiency and/or natural resources, the preparation of special area management plans is encouraged. Special Area Management Plans provide for increased specificity in protecting significant natural resources, environmentally sensitive areas, areas of special potential for coastally-dependent economic growth, areas with significant natural resources, and areas in which development may be hazardous for property or life, and improved predictability in governmental decision making

(D) All levels of the Kingdom's Coastal Zone Management Plans should implement actions and policies established in regional and international agreements to which the Kingdom of Saudi Arabia is signatory

5.2 Indicative Coastal Zone Management Plan

The draft Indicative Coastal Zone Management Plan for the Kingdom of Saudi Arabia will emphasize the responsibilities of each of the Kingdom's government agencies to plan for, and implement management plans for the areas of the coastal zone which lie under their jurisdiction. These plans are referred to hereafter as Local Area Coastal Zone Management Plans.

Implementation of National Coastal Zone Management will emphasize co-ordination of the Agency Operational Coastal Zone Management Plans in order to ensure that each management program is consistent with the Kingdom's national environmental policy as outlined in Section 4 of this document. The elements of this plan are described in the following sections.

5.2.1 Definition of the Coastal Zone

Until such time as the limits to jurisdiction for local and special area coastal zone plans are set out, the term "coastal zone" shall be considered to include the coastal waters (including the lands therein and there under)[12, 13] and islands contained within the coastal waters,

[12] These would include the "Territorial Seas" which are defined under Article 4 of Royal Decree No. 33 (Dated 27/7/1377) as extending beyond the inland waters towards the sea up to 12 nautical miles. Articles 8 of the same decree establishes a "Contiguous Zone" which may extend an additional 6 nautical miles "for the implementation of the Kingdom's laws pertaining to security, navigation, financial and health purposes."

[13] Certain aspects of responsibility have been previously established by Royal Decree 7/505/M (dated 28.3.1406) which established that, while PME has responsibility for environmental protection within the

including transitional and intertidal areas, salt marshes, wetlands and beaches. The zone extends seaward to the outer limit of the territorial sea of the Kingdom of Saudi Arabia. The zone extends inland from the shoreline to the extent necessary to control shore lands, and inland area, the use of which have a direct and significant impact on the coastal waters and resources.

5.2.2 Duties of PME as the national coastal zone management agency

The duties of PME as the national coastal zoned management agency are as follows :

- Establishment and staffing of a Coastal Zone Management Program within PME
- Drafting of the basic Coastal Zone Management Plan and procedures for its implementation.
- Establishment of agreements with related agencies with environmental responsibilities who will be involved in the preparation and implementation of Local Area Coastal Zone Management Plans
- Approval of monitoring of Local Area and special area coastal zone management plans
- Coordination of environmental research activities so as to obtain scientific research results necessary for coastal zone management decision-making
- Establishment of environmental standards for the coastal zone
- Establishment and implementation of an Environmental Impact Assessment Process under which coastal projects and local area and special area coastal zone management plans will be reviewed in order to mitigate impacts upon the environment and ensure economic efficiency
- Ensure consistency of the Kingdom's coastal management activities with its obligations under international treaties and protocols
- Approval of monitoring programmes and review of amendments to Local area coastal zone management plans
- Serve as implementing agency for the national contingency plan for combating marine pollution by oil and other hazardous substances[14]
- Implement a program of exchange of environmental data through establishment of a centralized database and system of data exchange with other government agencies involved in coastal zone management
- Undertake (in cooperation with other agencies involved with coastal zone management) a program of Public Awareness of the value of coastal resources and the need for coastal zone management[15]
- Serve as Secretariat for a National Coastal Zone Advisory Committee.

Territorial Sea of the Kingdom, the Seaports Authority has responsibility within port facilities and the Ministry of Agriculture has responsibility for fishery matters including registration of fishing boats.

[14] Under the terms of the National Contingency Plan for Combating Marine Pollution by Oil and Other Hazardous Substances, PME has been directed to "formulate a national policy for oil pollution control in the Kingdom's Marine Environment". The national contingency plan was enacted by Royal Decree (7/B/13307 on 22/7/1411H).

[15] The importance of improved public awareness in achieving the goals of Agenda 21 has been repeatedly cited in the report of the Agenda 21 Committee (op. cit.) Active programs of Environmental Public Awareness are currently undertaken by PME, the NCWCD, Ministry of Agriculture and Waters, Saudi Aramco and the Royal Commission for Jubayl and Yanbu. PME recent Saudi Environmental Awareness project SEAP), undertaken under the Ministry of Defense and Aviation Economic Offset program, has brought considerable private sector involvement into the area of environmental public awareness. A need remains for coordination of these efforts and coordination of these efforts and integration of these efforts and integration of environmental awareness into the Saudi educational system.

5.2.3 Duties of other Government Agencies, and Provincial and Municipal Government in the preparation of Local Area Coastal Zone Management Plans

- Establishment, staffing and funding of a coastal zone management program
- Clarification of basis and authorities under which coastal zone management authority will be implemented
- Preparation of local area coastal zone management plans which shall include:
    1. Guidelines on priorities for action in coastal zone management
    2. A planning process for protection of and access to coastal resources and for siting of economic activities in the area of jurisdiction
    3. An inventory of coastal resources and activities within the coastal zone of the relevant area of jurisdiction

5.2.4 Protection, Rehabilitation and Enhancement of Coastal Resources

A Coastal Resources Rehabilitation and Enhancement Program will be established whose function will be to reverse the environmental deterioration which has occurred within the coastal zone. The general goals of the Programme are :

- Conserve, protect and enhance coastal fish and wildlife and their habitats and facilitate balanced development of this nation's natural resources
- Seek to mitigate the losses of coastal fish and wildlife and their habitats

Implementation of the program will emphasize the need to continue the compilation of the inventory of the Kingdom's coastal environment and the categorization of coastal areas as to their importance for wildlife. A process will also be established whereby impacts from economic activities are mitigated through:

- Avoidance of impacts through environmental impact assessment and planned siting of economic activities
- Mitigation of unavoidable impacts through the construction of replacement habitat or construction of new habitat
- Development of guidelines to assist project developers in implementing development without undue damage to wildlife habitat[16]
- Monitoring of the above activities

Such a program is described in the report of the Agenda 21 Committee which calls for increased efforts to inventory and assess natural resources by carrying out "studies to determine areas of significance including degraded areas and natural processes within them" and "protection and conservation of particular ecological areas through implementation of national regulations with the aim of combating desertification and protection of biodiversity". The Agenda 21 Committee recommends that the Kingdom "Conserve important protectorates and restore those with environmental defects to their pristine nature". Specific recommendations for such a program in the coastal zone of marine protectorates and habitat restoration can also be found in the recommendation to "Conserve important protectorates (in Marine and Coastal areas) and restore those with environmental defects to their pristine nature".

[16] One such example of guidelines is the Ministry of Agriculture and Water. 1993. Guidelines for management of mangroves in Saudi Arabia. By Prof. P. Singer. The Regional Organization for the protection of the Marine Environment has also developed preliminary guidelines for landfill operations to serve as the basis for national guidelines for ROPME Members States. (ROPME, 1989).

5.2.5 Fishery Management

The Ministry of Agriculture and Water has authority for fishery management as set out under Royal Decree M/9/27/3/1408 which also sets out a moratorium for filling of submerged lands overseen by the Ministry of Agriculture and Water and the National Commission for Wildlife Conservation and Development.

In a report, the Agenda 21 Committee calls for "Conservation and management of living marine resource in the Economic Zone as well as other areas within the Territorial Waters of the Kingdom; and to "Evaluate potential of living marine resources including available, partially, utilized and unutilized species." In this regard the Kingdom should "Implement strategies for the sustainable utilization of living marine resources." Furthermore, in order to more fully understand the relationship between coastal activities and fishery resources, a National Fishery management plan shall be developed and a technical and operational capability will be established within the Ministry of Agriculture to carry out both planning and implementation activities described above.

5.2.6 Establishment of a system of marine protectorates

A system will be developed for the management of previously identified[17] environmentally sensitive areas. The system will include the preparation of special area management plans. In addition, coordination will be achieved between the various agencies involved in the management of coastal protected areas.

Sites Recommended for Coastal Protected Areas on the Red Sea

Hamaydah beach*	Yanbu City Conservation Area*
Al Muwailah	Jeddah
Sharm Zubayr Coast*	As-Shuaiba*
Wejh Ban*	Sham Wasm
Sharm Yanbu*	South Jizan Beach Tiran Islands*
Mastura Beach*	Sharm Dunygh*
Ras Ilatiba*	Al Hassini/Libanah Islands*
Farasan Archipelago*	Sharni Habban/Munaibira Coast*
Khor Amiq & Raqa	Salt Marsh*
Khor Al-Wahla	Abu Duda Lagoon
Ras Suwayhil	Ra's Al-Tarfa
S.Sharm Zubayr	Shib Al-Liqa
Qalib Island Chain*	Sharm Yahar
Marsa umm Misk	Um Lajj*
Sharm Al-Kharran/ Mersa as sarraj*	Ra's Abu Madd*
M. Usaila/Tawil	Qishran Coastal Areas & Mersas*
Qunfidah Beach	Haramid Island
Khor Nahud	Marqa Island
Oreste Point	Farasan Bank*
Maqna Beach	Khawr Latwad
Ghubbat Bal'aksh*	Shib Kabir
Ras Baridii	

*** Originally included in 1984 EPCCOM list of environmentally sensitive areas**

[17] NCWCD. 1993. A plan to protect Ares in Saudi Arabia, PME 1991, Coastal Zone Management Requirements for the Kingdom of Saudi Arabia, Volume 7.

5.3 Barriers that need to be overcome

Before Saudi Arabia can have an effective Integrated Coastal Zone Management System there are certain barriers that will need to be overcome. The most salient of these barriers are discussed below.

5.3.1 Authorities management

Some authorities which have management responsibilities for some coastal areas are still trying to make their own decision on planning and development in isolation and without any regard to the environmental impacts or management considerations. They will need to be convinced of the merits of working with other agencies, sharing experiences and responsibilities, to achieve a more effective integrated approach.

5.3.2 Reclamations

Land reclamation processes, with or without permits, continue to have a huge impact on environmentally sensitive areas thus threatening many coastal natural resources which are essential components of the marine food web. As a result the fish catch yields and reserves are being adversely affected.

Reclamations are also affecting monitoring programmes and hindering access to the coastal fringe in times of emergency. These practices act as a barrier to rational coastal management and they must stop and become the subject of a comprehensive assessment.

5.3.3 Environmental damage

In big coastal cities such as Jeddah, major development projects have been implemented without due consideration of the environmental consequences. Rehabilitation of damages is either impossible or very costly or could even lead to an increase in environmental damage. Environmental considerations must be part of the development planning process to ensure that impacts are avoided or at least minimized.

5.3.4 Public awareness

Awareness of environmental issues and sensitivity to environmental values are generally quite low across all sectors and walks of life. Due to their lack of environmental awareness some government agencies are implementing or approving for implementation, development proposals which are harmful to the coastal environment. It is therefore a high priority to raise their awareness as well as to demand an EIA study for their development proposals. This barrier must be removed before Saudi Arabia can expect to have effective management of its coastal zone.

6 LESSONS LEARNT

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