MIDDLE EAST: ISSUES IN MARINE ENVIRONMENT – AN OVERVIEW*

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GENERAL

The marine areas of the Middle East extend over 5 major marine basins: Levant Basin (Eastern Mediterranean), Red Sea, Gulf of Aden, ArabianSea, Gulf of Oman, and the Persian or Arabian Gulf. Although, in verygeneral terms, the issues in marine environment of the Middle East aresimilar to those of other seas, a closer examination reveals certainpeculiar features. Among them are the Suez Canal with its dense ship traffic, the huge amounts of crude oil, fuels, and petro-chemicals carried through the canal and other Middle East marine areas, the two semi-enclosed basins (the Red Sea and the Persian/Arabian Gulf), the peculiar tropical biotopes such as, e.g., coral reefs, and the inadequate regional and sub-regional cooperation in environmental matters, due to historical, political, and cultural reasons.

Numerous studies describe the environmental changes that have occurred throughout the Middle East during the last few decades (Ben-Tuvia, 1985;Ben-Yami and Glaser, 1974; Caddy, 1993b; Caddy and Oliver, 1996; Golikand Goldsmith, 1986; Inman and Jenkins, 1984; Nir, 1989; Vadiya and Shenuda, 1985). This includes the development and effect of polluted and eutrophicated areas, and the physical effect of engineering projects.

The main issues in the Middle East marine environment are:

(1) Pollution (municipal, industrial and agricultural waste and effluent) originating from densely populated areas with high population growth rate (particularly in the Southeastern Mediterranean) (Shehadeh and Feidi, 1996);

(2) Coastal erosion and other effects of engineering projects (Inman and Jenkins, 1984; Nir, 1989);

(3) The state of fishery resources and their exploitation (Caddy, 1933b, Caddy and Oliver, 1993);

(4) Conservation of marine and coastal biotopes and endangered species, and the biota migration through Suez Canal (Ben-Tuvia, 1978, 1985; Ben-Yami and Glaser, 1974; Russ, 19996);

(5) Oil spills;

(6) Pollution due to shipping.

MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL EFFLUENTS

These are the most common and major sources of marine pollution that may contain a great variety of nutrients, untreated bio-wastes with the accompanying bacterial and viral presence, pesticides and other toxins including heavy metals and other chemicals. They may be abnormally acid or basic for the marine environment into which they are poured. They may fuel interactive physical and chemical processes both existing in the system and unforeseen and awaken by the pollution. Such may be, e.g., synergistic creation or transformation of poisonous materials and re-accumulation of contaminants, with the resulting unpredictable and accumulative effects to which some species may be more sensitive than other (Patin, 1992). Areas particularly affected by this sort of pollution can be found along the coast of Israel and Gaza, the Nile Delta, the Gulf of Aqaba, and the Persian (Arabian) Gulf.

Some interests, often centered in developed, industrial countries, are looking for areas where anti-pollution legislation is either weak or not enforced to set up plants that would not be permitted in their own countries at low investment costs. There is at least one such example in the Haifa Bay, Israel.

MARINE AND COASTAL FISH FARMING

Coastal and marine fish farming, the latter being rather recent and otherwise beneficial though controversial development, are producing pollution which may be harmful to environment mainly in semi-enclosed bays and inlets.

Coastal fish farms effluents contain mainly nutrients, but also chemicals sometimes misapplied (Berg and Lavilla-Pitogo, 1996). Marine cage farming is usually introducing into its immediate environment waste feed and fish faeces. Other undesirable elements may include antibiotic and chemical residues from disease and parasite treatments. Marine fish farming development in the Red Sea (Shehadeh and Feidi, 1996) may create environmental problems, if sites are not well chosen and culture practices environment-friendly, especially with respect to coral reefs.

HOSTILITIES

Oil pollution resulting from separate accidents or hostilities, so far occurred mainly in the Gulf where the world's most dramatic, though perhaps not the most damaging oil spill was caused on purpose by the Iraqi government during the 1991 Gulf War. An estimated 11M barrels of crude were released into the sea and

quickly spread affecting and endangering hundreds of kilometers of mainly Saudi coastline. In cleaning efforts, an estimated 13% of this amount was recovered. Fortunately, and against some rather pessimistic forecasts, nature quickly restored the ecosystem and within 6 months the marine life thrived again. Multiple experience seems to indicate that the warm, tropical marine ecosystems are able to deal faster with oil pollution than the cooler ones, owing to both more intensive solar radiation and faster bacterial activity.

FISHERIES

Fisheries resources play important economic role, especially in the countries of the southern Arabian Peninsula and in Egypt. Although, some of these resources are currently under pressure of often excessive fishing effort and other anthroprogenic factors, none of them are currently considered seriously over-exploited, (Caddy and Oliver, 1996;Feidi, 1996; Sanders and Morgan, 1989). Since most of the fish stocks are straddling in waters of more than one country, international and regional fishery management are part of the issue.

The combined effect of intensive fishing activities and the progressive enrichment (eutrophication) due to run-off of nutrients and other polluting agents on fisheries in the semi-enclosed Mediterranean has accelerated over the last decade. This ongoing change is now a matter of concern to Mediterranean countries, in particular in view of the ecological calamity that in early 1990s befell the Black Sea and its fisheries, which evidently has been triggered and fed by man-made pollution (Zaitsev, 1993; Caddy, 1993; Ben-Yami, 1994) which combined with a devastating intrusion of an exotic predatory comb-jelly.

Coastal pollution and the resulting eutrophication are playing an ambivalent role respective fisheries in oligotrophic (poor in nutrients and of low primary production) seas. Stable and even growing Mediterranean fish landings can only be explained in the terms of man-made enrichment of its waters. Such enrichment is, for example, compensating for the reduction of nutrients supply by the Nile River since the Aswan High Dam construction, and apparently represents the main cause for the increasing landings in Mediterranean fisheries(Caddy, 1993b, 1996). The collapse of the 18,000 to 25,000 t/year seasonal sardinella fishery off the Nile Delta after 1964, when the Nile's nutrient-rich outflow was severely reduced, brought this fishery down to 550 t in 1966. Since the eighties, however, sardinella and other small pelagic catches in Egypt's Mediterranean waters keep growing and reached about 50% of the pre-Aswan period. Also catches of some demersal fish have grown significantly. These and other yield increases appear to be a result rather of anthropogenic enrichment than of the predominantly inadequate fishery management.

TOURISM DEVELOPMENT

Tourism development, most recently along the coasts of the Gulf of Aqaba (Gulf of Eilat) is a quite separate issue. Its environmental impact is often under-estimated, resulting in inadequate sewage treatment infrastructure. Often inadequate planning is due to the transitory character of the tourist population, and in spite of the fact that it may exceed by far that of the permanent residents.

From the point of view of environmental protection all projects involving massive increase of the density of coastal population in onearea, whether permanent or transient, should be treated as a single one. One way to assess the eventual damage and at the same time to set limits on the proposed development is: (a) to assess the existing contribution to marine pollution in terms of person/day/pollution factors; (b) to assess the maximum sustainable pollution intake throughout the affected marine area (approximate pollution carrying capacity - GESAMP, 1986;Krom and Cohen, 1991); (c) to determine the additional number of persons/day that the ecosystem affected can sustain without permanent damage to coral reefs, water transparency, etc., taking into consideration the existing and additional means of sewage treatment; (d)upon such determination, to allocate the allowable additional population among the various projects. In areas, such as the Gulf of Aqaba, such an approach would call for international cooperation.

CORALS

In the Middle East marine environment corals still abound and thrive. Coral reefs represent rather sensitive biotope, vulnerable not only to anthropogenic but also to natural causes. Pollution of any kind and coral piracy can bring about, directly or indirectly, as the straw that breaks camel's back, the death or degradation of a reef. Dead coral reefs are often found covered with sponge growth or algal turf, while multi-species bleaching of coral reefs, recently reported from the southern Persian Gulf (Dr. Roger Uwate - private communication), is the result of breakdown of the symbiosis between the corals and Zooxanthellae algae. Coral bleaching has been ascribed to several reasons, most often to warming of the seawater. Seasonal floods carrying sediment that overlays coral reefs is another natural cause for reef degradation. The question would marine reserves be the solution for saving coral reefs (Russ, 1996), is, therefore, an interesting issue.

POSSIBLE EFFECTS OF MARINE POLLUTION

Eutrophication which in seas with low natural productivity, such as Azov Sea and the Mediterranean, initially enhances marine organisms populations later may lead to major ecosystem damage with associated collapse of whole ecosystems. Pollution may reduce bio-diversity and cause harmful genetic changes, especially in the sensitive ecosystems of coral reefs in the Red Sea/Indian Ocean system and the brackish and hypersaline lagoons in Egypt. It may reduce water transparency due to algal and medusae blooms detrimental to other marine organisms and to the

tourist and recreational industry in coastal areas, in particular in the Levant Basin and along the shores of the Sinai Peninsula.

Another danger is the occurrence of heavy metals and other poisonous substances in marine food. Special attention must be paid to the presence in the run-off issued by the existing and developing industries in the area, especially such contaminants as mercury as to which effect on environment there is now little argument, and more problematic ones as, e.g., cadmium, (Enserink et al., 1991; Simpson, 1981; Talbot, 1989; Nogawa, 1984).

Countries of the Middle East have a joint interest in protecting their waters from pollution, in particular from non-biodegradable contaminants. They can be grouped by areas where joint regulation and enforcement would benefit all involved, as: (i) Eastern Mediterranean; (ii) Red Sea; (iii) Gulf of Aden, Arabian Sea and Gulf of Oman; (iv) the Persian (Arab) Gulf. In particular the last area is ecologically vulnerable and hence the importance of environmental protection throughout the whole Tigris-Euphrates river basin whose waters flow into the Gulf.

MIGRATION, BIO-DIVERSITY AND EXOTIC SPECIES

In some areas of the Middle East the native marine life, apart from being exposed to the stress of pollution and destruction of feeding and breeding habitats, has to bear the risks of competition due to intended or incidental introductions of exotic organisms, of freak blooms of exotic and local ones, and of diseases and their carriers, such as the new Noda virus which is the cause of viral encephalopathy in seabass, a fish cultured in the area, or the viruses that have been plaguing shrimp farms in Southern Asia.

Introductions and immigrations of exotic wild and farmed species may affect the bio-diversity in the marine ecosystem. This issue has been long actual in the Mediterranean where numerous migrants from the Red Sea, including several tens of fishes, have been continually settling in the Levant Basin in niches occupied by native species (Ben-Tuvia, 1978,1985; Ben-Yami and Glaser, 1974; Golani and Ben-Tuvia, 1989), and more recently also, for example, in the Gulf of Aqaba where the Mediterranean gilthead seabream raised by Israeli cage farmers in Elat already found its way into the wild.

COASTAL CONSTRUCTION

Environmental effects of coastal and other marine constructions are usually detrimental in biological and physical terms, to the coastline, low delta areas, and inshore biotopes, and only too often predictable but neglected. One reason is the

steady increasing prices of land and, hence, development load in heavily populated coastal areas. Also the actual and potential ecological damage due to major engineering projects influencing the flow of major rivers, especially with respect to the Nile-Suez Canal area and the Shatt-al-Arab, represent a major issue (Inman and Jenkins, 1984; Vadiya and Shenuda, 1985). One conspicuous example is the coastal erosion in Egypt in the wake of the High Dam construction at Aswan.

Harbours and marinas: Many harbours, marinas, and similar projects wrongly planned, both already completed and still in the planning stage have become or may yet to become ecological calamities. In Israel, these are the Ashdod harbour and the marina at Herzlia. Also the coast of Gaza is already heavily eroded due to the rather minor structures existing there, (Golik and Goldsmith, 1986). Any major construction, such as deepwater harbours, especially if based on sea walls/breakwaters protruding seawards, would most certainly substantially accelerate the coastal erosion, endangering not just the beaches, but also coastal roads and residential areas, (Nir, 1989). At such sites innovative solutions such as, e.g., offshore harbours connected with the coast by bridges allowing free flow of water may represent a more reasonable option.

SHIPPING

Pollution generated by shipping, notably oil tankers, (particularly along the shipping lines leading to and from the Suez Canal, the Straits of Baab-el-Mandab, the Gulf of Oman, and Shatt-al-Arab) contaminates both sea and beaches. It is partly caused by emptying and washing ships' bilges and oil and fuel tanks at sea, and partly by waste and litter, some of it of practically indestructible plastic materials, jettisoned by ships (Golik and Gertner, 1989). Much of this pollution arrives at beaches in the form of tar-like product and as ordinary garbage. Some marine animals swallow plastic bags, bottles and cups, rubber bands, etc., while other may wrap themselves up in them. Some die.

The Suez Canal alone is crossed by some 20,000 vessels, annually, that carry about 14% of the world's trade. This includes 2,500 tankers. The average amount of crude oil originating mainly from the Gulf, but also from local production, passing daily the Suez Canal is approximately 800,000 barrels. The Suez Canal has been deepened recently to the depth of 17.5 m, which makes it navigable for all but the largest oil tankers. The load of the oil traffic on the canal seems, however, to be subsiding owing to the increasing use of the Suez-Mediterranean Pipeline (SUMED) and to a much lesser degree the Trans-Israel Pipeline (TIP). This does not necessarily reduce the risk of contamination, because the oil to and from those pipes is carried by ships, and the operations of pumping into and from the pipes may in fact be increasing this risk.

The crude-oil load on the Suez Canal environment is also due to the local production centering predominantly on the Gulf of Suez basin. Further development of oil refineries and petro-chemical industries has been projected in Egypt.

FUTURE RESEARCH NEEDS AND COASTAL ZONE MANAGEMENT

In all areas, but especially, in enclosed and semi-enclosed bays, gulfs, and lagoons there is a need for "preventive" research and surveys, one objective being the assessment of their environmental capacity to absorb waste originating from human activities (GESAMP, 1986), with special attention to heavy metals and other poisonous substances. It should cover the water at all levels, the sediments and the flora and fauna, (Caddy, 1993). Routine monitoring and regular scientific research represent an essential condition for rational decision making and should be introduced in all marine areas to prevent unpleasant surprises, including environmental effects due to global warming (Everett, 1995) and ozone depletion (Baker, 1991) especially on sensitive ecosystems.

At the same time we should bear in mind the widely discussed limitations of environmental sciences, whether when it comes to the reliability of environmental capacity assessments (Krom and Cohen, 1991) or to forecasting of the influence of natural and man-caused changes on whole ecosystems and their separate components.

No doubt the worldwide movement towards integrated coastal zone management (ICZM) which appears more and more essential in view of the multiple users of coastal waters and beaches, and the associated resources, will arrive also in the Middle East. Coastal development and protection are largely a national issue which is mainly related to environmental degradation of shores, including coastal lakes and lagoons, mangrove areas, beaches, and coral reefs. This issue may become international where major coastal construction project in one country may cause beach degradation in another, or where pollution originating in one country is contaminating beaches and inshore waters of its neighbour.

CONCLUSION

In view of the fast rate of population growth, industrial and tourist development, and crude oil production and transportation, issues in marine environment whether of the usual sort or specific to the Middle East will increasingly require national attention and international cooperation among neighbouring countries. In some areas (Persian Gulf, Gulf of Aqaba, Southeastern Mediterranean) without such cooperation whole marine ecosystems may collapse. Efforts towards establishment or reinforcement of such cooperation, notwithstanding political situation, must continue and sub-regional meetings in the areas of: 1.Gulf of Oman and Persian/Arabian Gulf; 2.Arabian Sea, Indian Ocean, and Gulf of Aden; 3.Red Sea; 4.Levant Basin, might represent a good start to further such cooperation.

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