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COASTAL AND MARINE ENVIRONMENT

by

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Coastal and Marine Environment

Introduction

The Asian and Pacific region includes large portions of the Pacific and Indian oceans and comprises thereby one of the largest water masses of the globe. The predominantly oceanic region is partially surrounded by the Asian, Indian and Australian land masses which influence the ocean's weather patterns, water quality and primary productivity. The marine environment constitutes a major component of the natural environment and has many dynamic interactions with other components such as air, coastal land, inland waters and basins in the region. It plays a vital role in major bio-geochemical cycles involving the crucial life support constituents such as water, carbon, sulphur, phosphorus, oxygen and nitrogen. Furthermore, both rich and poor in the region rely on the coastal margins and the wider oceans for their sustenance, energy needs, livelihood and economic well-being, communication and trade.

Coastal and marine resources

Abundant coastal and marine resources have resulted in the concentration of a large majority of the region's population near the coast. Out of the 75 largest cities in the world, nearly half are in the Asia & Pacific region and more than half of these are situated on or very near the coast. By the year 2000, the number of people in coastal urban agglomerations in the region is expected to reach .3 million. The economic and employment prospects offered by coastal cities are substantial. A clear example of this is the movement of large numbers of people in the People's Republic of China from the inland rural areas to the newly designated special economic zones which are invariably on the coast. Such developments are making significant contributions to national economics and a decisive contribution to the development process. However, this development also has its environmental costs. The movement of people to coastal cities is leading to increased pressure on the coastal environment and its resources from increased domestic and industrial waste generation, increased dredging, increased discharges of agricultural chemicals, increased sediment loads, widespread mangrove clearance and erosion of coastlines.

Fisheries Resources

The Asia and Pacific region accounted for 47.3 per cent of the world's total fish catch in 1992. Among the world's top 15 nations in 1992, there were eight countries from the Asia-Pacific region: People's Republic of China, Japan, Thailand, Republic of Korea, India, Indonesia, Philippines and Democratic People's Republic of Korea.

However, this prosperous picture hides concern for the longer term sustainability of such resource utilisation rates. The FAO has reported that most traditional marine fish stocks have reached full exploitation. This means that increased fishing efforts are unlikely to produce equivalent increases in catches. Furthermore, the use of new and more efficient fishing methods, which might to some extent increase catch rates, would certainly cause overfishing and lead to an additional decline in sustainable fish populations.

Aquaculture and Coastal Agriculture

Aquaculture, the farming of aquatic organisms including shellfish, shrimps and plants, has a long-established and strong tradition in the Asian and Pacific region. The figures for 1992 are impressive - 16,785,900 tonnes or 87 per cent of the total world production.

Coastal areas also happen to have the most fertile land in the Asia-Pacific region and support a very large segment of the agricultural population. The draining of wetlands to generate areas for agriculture in the region was quite common in the past, although it still occurs in some countries in the region.

Mineral Resources

Significant hydrocarbon deposits are to be found in the Bay of Bengal, the Java Sea, South China Sea, East China Sea, Tasman Sea. Oil reserves are thought to comprise around 4,039 million tonnes, while gas reserves are estimated at 5,876 billion cubic metres.

Oil and gas production from offshore areas is currently undertaken off the west coast of India, the Gulf of Tongking, the Gulf of Thailand, east of the Malaysian Peninsula, off the coast of Northwest Borneo and off the west coast of Japan, in the Celebes Sea. Total oil production reached just over 134 million tonnes in 1990. The main oil and gas producers in 1990 were India and Malaysia respectively.

Sodium chloride, namely common salt has been extracted from seawater for thousands of years. It is estimated that some 6 million tonnes are currently produced annually and a large proportion of this is from saltworks in the Asian and the Pacific region. In addition to its use as a dietary and culinary additive, salt is also used commercially in large quantities. Over half the world's production of magnesium and two-thirds of bromide are extracted as salts from sea water.

Coral mining is of widespread practice in the Asian and Pacific region either as a source of building stone or as a source of cement. In many situations, such as oceanic islands or remote areas of larger countries, there are no alternative sources of building material and coral mining is unavoidable. This is in spite of its lack of sustainability in the long term and the direct and indirect impacts on the reef, commercial and subsistence fisheries and the tourism industry.

Maritime Transport

In the Asia-Pacific region, average annual quantities of sea-faring goods loaded and unloaded has been estimated at nearly 2,000 million tonnes. Over half of this total was dry cargo with crude petroleum and refined and other petroleum products as the other main cargo categories.

Japan with a total of 707 million tonnes, had by far the largest annual quantity of goods crossing its seas. Australia was next but well below half of Japan's tonnage, followed by the Republic of Korea, the People's Republic of China, Singapore and Indonesia.

Singapore, one of the largest ports in the region, is almost entirely man-made and, like Hong Kong, operates primarily as an entry port, exploiting its geographical position and building on its reputation for efficiency. The Port building of Singapore is rated as the world's busiest in terms of shipping tonnage with 678.6 million gross registered tonnes recorded as arriving and parting in 1974. Some 101,000 vessels call in at Singapore every year with about 800 being in port at any one time.

Australia, Philippines and Indonesia also have many ports which are located in natural harbours and bays. As for the Philippines and Indonesia, they are typical archipelagos where the sea provides the only means of communication between the numerous islands.

Port development and upgrading has been significant in the region over the past few years. While port development is inevitable use of coastal resources, the associated engineering works reclamation, coastal modification, maintenance dredging and similar activities tend to compound the environmental stresses due to urban and industrial development.

Tourism Resources

Coastal tourism appears to be on the increase throughout Asia and the Pacific. At Ban Dou Bay in Thailand, tourism volume has increased from less than 15,000 in 1980 to over 300,000 by 1987. In South Johore, Malaysia, planners are expecting 21 million day-trippers a year to visit a beach resort by 1995. These increases in visitor numbers are recognised as a potential threat to environmental sustainability and most countries are taking steps to address this through the coastal planning and management process.

Following a world-wide trend there is also a move in the Asia-Pacific region towards "eco-tourism", where natural resources such as parks and reserves are promoted for visitors while at the same time manage to ensure their protection. In Japan, attempts are being made to resolve the apparent conflict between marine park management and local fisherman by providing a share of income from tourism to the fishermen. It seems that there is a lot of potential for more protected areas to be set aside in the

coastal environments of the region and managed in a sustainable manner, without sacrificing their ecological integrity for the enjoyment of visitors.

Environmental Threats

In the last half-century, human impact on the sea has changed. Ships have become bigger, the potential for oil pollution has increased and offshore oil and gas have become worldwide business. Fishing has been transformed, new chemicals threaten our seas and there is growing demand for seabed mining. Fortunately, the world is also now more aware of the influence humans have on the sea and how the sea affects them.

Coastal and Marine Pollution

It is notable that over three quarters of the pollution entering oceans worldwide comes from human activities on land. Most nutrients, sediments, pathogens, persistent toxins and thermal pollution come from land-based sources, through rivers, direct discharge or airborne emissions. Even oil pollution, which is typically associated with tanker operations and accidents at sea, actually comes as much from land as from sea. Coastal waters in particular, which are less well mixed than areas farther from the shore, are under increasing pressure from environmental pollution.

River waters in the Asian and Pacific region are heavily contaminated by municipal sewage, industrial effluents and sediments, which form the most important source of pollution of the estimated total of 13.5 billion tonnes per year of sediment transported by the world's rivers, Asian rivers account for nearly 50 per cent although they constitute only 17 per cent of the world's total drainage area. Basically, this is the result of lack of sanitation and discharge of untreated industrial effluents into the rivers.

Municipal and industrial wastes are the most serious land-based pollutants entering the seawater through rivers or direct runoff. Most of the coastal cities in the region discharge their domestic and industrial wastes directly into the sea without any treatment.

The river waters also feed coastal zones with nutrients and chemical contaminants contributed by fertilisers and pesticides leached or washed off from agricultural land. Use of pesticides appears to be easing, especially in the developing countries of the region.

The marine pollution from sea-based activities in the Asia-Pacific region is largely associated with marine transportation and offshore mineral exploration and production activities. The Malacca and Lombok-Makassar Straits are the main shipping routes from the Indian to the Pacific Ocean. Incidences of accidental oil spills have been frequently reported along these routes. In the Straits of Malacca, for example, 490 shipping accidents had been reported over the 1998-1992 period, resulting in a considerable amount of oil spillage at sea. Some observations indicate that the marine oil pollution from land-based sources still seems to be relatively high compared to that from the sea-based sources.

Pollution originating from the above sources have in many case, resulted in serious damage to human health and to the value of coastal areas and have also had other socio-economic impacts. It has been reported recently that Australian coral zones are facing serious problems of sedimentations and declining water quality. Sediments in runoff from the land are altering estuaries and shores smothering marine life. Nutrients washed from farmland are causing excessive growth of algae, depleting the oxygen supply and destroying tropical corals.

Hong Kong is now facing a whole lot of problems concerning the deteriorating conditions in coastal waters. A significant impact in this regard is nutrient enrichment or eutrophication which has manifested in algae blooms. Occurrences of 'red tide', a toxic plankton bloom, has been an environmental problem of major concern in the coastal areas of the region.

The frequency of the appearance of red tide in Tolo Harbour, Hong Kong ranged from 2 in 1977 to 9 in 1994 with a maximum in 1988. The largest red tide, in terms of "infested" area was recorded in 1992 which covered nearly the whole of Hong Kong's eastern waters. It was caused by the algae *Noctiluca scintillans*, which created numerous patches of bright salmon pink water. When the algae

drifted ashore, it created glutinous putrid slimes that fouled beaches and killed fish. The People's Republic of China is also experiencing an increasing threat of red tide occurrence in its coastal waters. There were a total of 19 red tide incidents in 1993 and one of these resulted in the poisoning and killing of prawns over a 5,000 hectare extent. An outbreak of red tides in the Philippines in 1990 proved costly for the fisheries and shellfish industries.

Impacts of Aquaculture and Coastal Agriculture

Mangrove destruction for aquaculture has often triggered a cycle of coastal degradation. The felling of mangrove forests has resulted in the loss of protection from cyclones and storms, increased salinity from seawater incursions and greater evaporation and acidification of surface waters.

The impacts of agricultural activity on coastal and marine resources are also significant. For example, increased use of pesticides is helping in the transport of an estimated 1,800 tons of pesticides into the Bay of Bengal, where they appear as toxic residues in fish and shellfish. The liberal use of agricultural fertilisers on the other hand, enhances the productivity of coastal waters favouring organisms such as phytoplankton species that causes red tides and other similar problems.

Likewise, accelerated erosion caused by the misuse of steep marginal land for cash crops is having a negative impact on coastal geomorphology, increasing floods, smothering mangroves and silting coral reefs. Sedimentation from current land-use practices is also a problem in Malaysian waters where it is considered to cause more damage to fisheries than bacterial contamination. The situation is even more severe on the south coast of Java, where sedimentation is reducing the ground volume, shrinking the mangrove area and leading to overfishing.

Degradation of Specialised Ecosystem & Species

The mangrove ecosystems of the Asian and Pacific region are the most visible and most productive component of the coastal wetlands. Many coastal people in tropical and sub-tropical areas have lived, fished and hunted within mangroves for centuries, deriving from them valuable commodities such as timber, fuel, thatching and roofing materials, medicine and food. Of the 16.6 million hectares of

mangrove forests that are estimated to exist in the world, over 7.5 million hectares occur in the Asian and Pacific region. Of these more than 4 million hectares are found in Indonesia, which has the largest area of mangroves that exist in any single country of the world.

In addition to the traditional uses of mangroves which, by and large, were fairly sustainable, recent population and economic pressures have led to an over-exploitation of the trees themselves as well as the conversion of the wetlands they occupy. Mangrove wood is harvested for making charcoal, as a direct source of firewood, for the production of poles and other construction timber, for the extraction of tannin used in the manufacture of inks, plastic and glue and for producing wood chips which are used as raw materials for the production of rayon.

The greatest threat to mangroves in the Asia-Pacific region is the development of aquaculture. More than one million hectares of mangrove forests have been converted to aquaculture ponds which cause changes in drainage patterns, nutrient availability and the frequency of tidal inundation. This in turn adversely affects the mangrove forests' high productivity rates. The extent to which mangroves are being cleared is illustrated by examples such as in the Philippines where some 20,000 hectares have been destroyed and Thailand, where about 172,000 hectares have been cleared. In Vietnam, where some 36 per cent of the mangrove forests were lost during hostilities, further losses continue to accrue through conversion of mangrove forest for shrimp farming, agriculture, salt ponds and urban expansion.

Mangrove potential for tourism, education and research is also being increasingly explored in recent years. With care taken to ensure that adverse environmental impacts do not occur, properly managed mangrove forests can be developed to create awareness and to provide enjoyment through the use of boardwalks, and observation vantage points, visitor information centres and bird watching hides.

Coral reefs are among the world's most diverse natural ecosystems - the marine equivalent of tropical rain forests. Globally, there are about 600,000 sq km² of coral reefs. Of these, more than half are in the Indian Ocean with the rest evenly distributed between the Caribbean and the Pacific. The great

majority of coral reefs are therefore to be found within the Asia-Pacific region. These include the Great Barrier Reef, off the northeastern coast of Australia, which is about 3,000 km long and is one of the world's most diverse coral reef systems. In addition to its 500 species of corals, the Great Barrier Reef also supports about 2,000 species of fish.

Coral reefs provide a most effective protective barrier for beaches and other coastline from the continuous pounding of ocean waves. They also provide an intricate and complex habitat for a host of fish, molluscs, echinoderms and crustaceans. They comprise a number of organisms which, although not yet fully investigated, are very likely to possess genetic material of particular medicinal value. Coral reefs are also able to attract large numbers of tourists, which in many Asia and Pacific countries provide employment and an income for coastal people. Finally, the mining of coral can provide the raw materials for semi-precious jewelry, the limestone source for cement manufacture, the active filter material for septic tanks and building blocks for the construction of houses, jetties and other structures.

Many urban and industrial development activities pose a threat to coral systems through the discharge of domestic and industrial effluents, agricultural/aquacultural runoff contaminated with fertilizers and pesticides, dredging and reclamation activities with their high suspended sediment loads and other stresses which arise from high concentrations of population. Chemical pollution and increased sedimentation have been observed to cause "bleaching" in corals in the eastern Pacific. This condition is noted when the coral's symbiotic algae, which give coral its colour, abandon the coral due to environmental stress. Without these algae, the coral will eventually die. It is also expected that should sea temperatures rise due to global warming, this conditions will be exacerbated.

The importance of conservation of corals and the marine environment in general, takes on an added dimension as scientists are increasingly turning to the biodiversity of the sea in their search for medical cure and unique compounds. They have derived anti-leukaemia drugs from sea sponges, bone-graft material from corals, diagnostic chemicals from red algae, and anti-infection compounds

from shark skin and many more useful agents from other marine flora and fauna. As marine life is relatively less studied than terrestrial life, oceans are a vast new frontier for research.

Tourism and recreation can be both a boon and a bane for coral reefs. While undoubtedly creating a strong economic argument for the protection of coral resources, tourism and recreational activities can impose their own stresses and impacts. Construction activities which accompany most tourism developments such as hotels, beach clubs and marinas, have a range of direct and indirect impacts on corals. Furthermore, the pressures brought upon by large numbers of visitors can lead to continuing impacts such as physical damage to the reef through trampling, boat abrasion and removal of coral ecosystem souvenirs, discharge of untreated or partially treated sewage, operational leaks and discharges of hydrocarbons and waste dumping.

Over 90 per cent of the world's living biomass is contained in the oceans and new marine and coastal communities and species are constantly being discovered. Marine and coastal species include many that are rare, threatened and endangered, often as a result of habitat loss. Habitats are affected, both directly, such as by oil spills and ocean dumping and indirectly through activities such as waste disposal and abusive land use practices that send sediments and pollutants into rivers and then into the oceans.

Of all marine habitats, those in coastal waters are under the most pressure and coastal species in particular are at risk from pollution, dredging, dumping and other coastal alterations. Habitat loss often has an irreversible impact on a threatened species since it affects whole populations at once. The major threats to Asian wetland habitats, which include the coastal margins, are hunting, human settlements, agriculture, land degradation, water diversion and aquaculture development.

In addition to habitat destruction, several vulnerable marine species are affected by direct exploitation in the Asia-Pacific region. These include the whales, dugongs, birds and turtles which are threatened by poaching, pollution, tourism encroachment and accidental entanglement in fishing nets.

In the face of this threat and in recognition of the importance of these species, many countries have adopted legislation for the protection and conservation of these endangered species. For example, all turtles in Pakistan, India and Sri Lanka are now protected by law. 21 turtle resting beaches in Malaysia are declared as reserves and major seabird nesting islands in Indonesia, Philippines and Malaysia are classified as bird sanctuaries. At the international level, the International Whaling Commission (IWC) has declared the Indian Oceans as a marine sanctuary and UNEP has assumed the spearhead role under the Global Plan of Action for the Conservation, Management and Utilisation of Marine Mammals. These protective strategies have in turn led to increased public awareness for the need to conserve, protect and manage these vulnerable marine species.

Regional Cooperation for Coastal Zone Management

The Regional Seas Programme was initiated by UNEP in 1974 as a global programme implemented through regional components. The Programme focuses on a regional approach to the control of marine pollution and the management of marine and coastal resources. The Programme currently includes 13 functional centres with the participation of over 120 states and territories. The programme relevant to the Asia-Pacific region includes the East Asian Seas region. The East Asian Seas Regional Action Plan was originally adopted in 1981 by Indonesia, Malaysia, the Philippines, Singapore and Thailand. In 1993, a regional coordinating unit was established in Bangkok to function as the Secretariat and to coordinate the activities under the action plan. In 1994, five other countries from the region, namely, Australia, Kingdom of Cambodia, People's Republic of China South Korea and Vietnam also joined the programme by adopting a new revised Action Plan for the Protection and Sustainable Development of the Marine and Coastal Areas of the East Asian Seas region. The Coordinating Body of the seas of East Asia (COBSEA) remains as the decision-making organ of the Action Plan and meets annually to decide on its programme and budget.

Conclusion

Coastal urban agglomerations in the Asia-Pacific region continue to grow, contributing significantly to national and regional economies and making a decisive contribution to the development process. Unfortunately, this development is not without its environmental costs. The movement of people to

coastal cities is leading to increased domestic and industrial effluents, more areas of landfill, increased dredging, more mangrove clearance, more discharges of agricultural chemicals and increased coastal and estuarine sedimentation.

Until very recently, past efforts for the prevention and management of coastal and marine environmental problems in the Asia-Pacific region had focused mainly on problem identification with little or no effect on actual implementation of marine environmental management measures. With increasing pressure from population growth and accelerated economic development, there is a crucial and urgent need to move from information gathering to management and actions aimed at solving coastal and marine environmental problems.

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