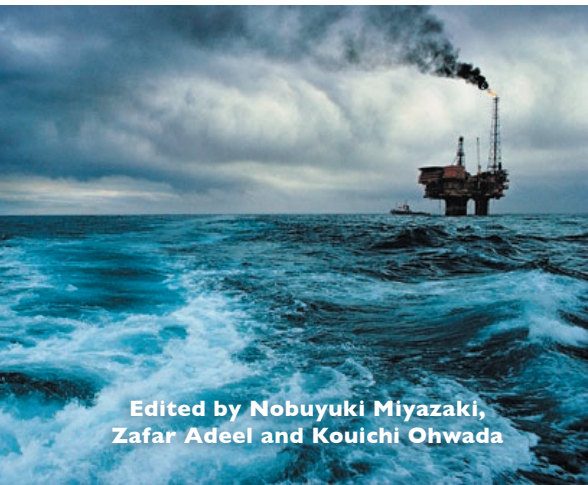


WATER RESOURCES MANAGEMENT AND POLICY

MANKIND

and the

OCEANS



**Edited by Nobuyuki Miyazaki,
Zafar Adeel and Kouichi Ohwada**

Mankind and the oceans

Edited by Nobuyuki Miyazaki, Zafar Adeel, and
Kouichi Ohwada



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Overview of the global marine and coastal challenges

Zafar Adeel and Nobuyuki Miyazaki

Introduction

The earth is frequently referred to as the blue planet, an indirect reference to how the globe appears from space; the blue colour obviously imparted by the oceans and seas circumscribing the world. In addition to imparting the blue colour, oceans govern a vast majority of the processes on the earth, including the hydrological cycle, the solar energy balance, the global nutrient cycle, the biological food chain, and the global and regional climate patterns. It is estimated that there is about 1,386 million km³ of water on earth (Korzoun, 1978; Shiklomanov, 2000); about 97.5 per cent of this amount is seawater and only 2.5 per cent is freshwater. This huge volume of water, when linked to the very large input of solar energy (at the rate of 240 W/m²), becomes the “boiler room” for the global climate (Voituriez and Jacques, 2000). Ocean currents are also generated as a result of the uneven distribution of solar energy. These processes, when combined, result in the distribution of water and nutrients that in turn drives the global biological cycles.

These natural physical, chemical, and biological ocean-driven processes have a great impact on human society and the various ecosystems. In addition, a vast majority of human activities are directly or indirectly dependent on oceans, including shipping and transportation, fisheries and food supply, recreation and tourism, and offshore exploration for minerals and petroleum. Therefore, understanding the oceanic processes as well as the living resources contained therein is critical to our survival.

It is ironic that by the time the United Nations Convention on the Law of the Sea (UNCLOS) came into force on 16 November 1994, marine and coastal areas were under threat from various anthropogenic factors (Borgese, 1998). This volume highlights some of these factors, focusing on regional and national case studies. The emphasis is also placed on finding approaches that can help remedy the impacts of anthropogenic factors.

Outline of the book

This volume is divided into three broad sections. Part 1 focuses on human activities related to the marine and coastal environment. It provides insights into our fundamental understanding of the relationship between human society and the ocean, and the drivers behind the “Mankind and the Oceans” concept. Part 2 of the book addresses marine environmental problems in various areas in the world, and reviews the current knowledge of pollution and biological impacts by hazardous chemicals like organochlorine compounds, organotins, and heavy metals. These specific case studies help us visualize the overall impact on various species and ecosystems. Part 3 addresses the current status of biodiversity and environmental problems in the Black Sea and the south-western Atlantic Ocean. The current problems of biodiversity and environment in typical enclosed- and open-sea areas are discussed.

In Part 1, Doumenge highlights the close relationship between marine pollution and high coastal human densities and related economic activities, while discussing some anthropological problems like overfishing and tourism pressures. He insists that establishing a global policy framework is critical in order to manage the sea resources efficiently. To observe such a policy framework on a regional scale, Handa summarizes the international activities of marine scientists undertaken with Japanese initiatives. A particular focus of these initiatives is on understanding the global biogeochemical cycle of bio-elements, mainly focusing on carbon and the likely changes. A more global view is presented by Uitto and Adeel, who discuss the importance of management for global marine resources through a coherent effort by international organizations. They introduce the activities of the United Nations University (UNU) on marine environment and demonstrate the utility of international networks to achieve integrated coastal resource management.

More localized examples of policy and management approaches are also included in Part 1. Okaichi and Yamada explain the environmental conditions for the Seto Inland Sea, Japan, where the coastal area has been remarkably polluted by industrial activity since 1955. They provide an overview of the environmental management approaches for this enclosed sea, while highlighting the cooperation of domestic and international bodies.

In Part 2, Zhou presents the recent environmental problems of pollutants and excess nutrients, such as inorganic nitrogen, inorganic phosphorous, and oil, in the

coastal waters of China. He also describes the legal provisions and measures to prevent, reduce, and control pollution of the marine environment from land-based sources. Prudente *et al.* present monitoring data of organotin and organochlorine compounds in green mussels collected in the coastal areas of Thailand, the Philippines, and India during the period 1994–1997 – this effort is part of the International Mussel Watch Programme. They suggest that organotin contamination levels in Asian developing countries are lower than those in more developed areas and that coastal areas in the Asia-Pacific region are still being polluted by organochlorine compounds. Nakata *et al.* report high accumulation of organochlorine compounds in Baikal seals, estimate the transfer rate of the chemicals from mother to pup, and suggest the species has a high risk of toxic impact by coplanar polychlorinated biphenyls (PCBs). Similarly, O’Shea reviews the current state of knowledge on contaminants (organochlorine pesticides, metals, and butyltins) accumulated in about 80 species of marine mammals that inhabit the Pacific Ocean. He stresses the importance of improved coordination and planning of contaminant studies for understanding future trends and impacts of contaminants on marine mammals of the Pacific Ocean. Ross reports several virus-associated mass mortalities of marine mammals, and reviews studies on possible links between mass mortalities and chemical contaminants, immunotoxicity, and these outbreaks of disease. He warns that environmental contaminants will continue to present a risk to the world’s marine mammals, even well into the twenty-first century.

In Part 3, Ozturk and Ozturk introduce the characteristics of the Black Sea in terms of its geology, oceanography, and biodiversity. They discuss threats to the biodiversity resources in the Black Sea posed by the fisheries industry, eutrophication, pollution by hazardous chemicals and alien species, and coastal degradation. Bastida *et al.* report characteristics of marine biodiversity of the south-western Atlantic Ocean with the due consideration of oceanographic features, and discuss the main environmental problems due to overfishing, increased contamination, and human use of inshore habitats.

Summary of key findings

Anthropogenic impacts

The various contributors to this volume repeatedly emphasize that we need to understand better the cycling of materials and nutrients in the oceanic systems. For example, Doumenge (Chapter 2) makes the point that fisheries the world over are adversely impacted by over-exploitation of stocks – resulting in bankruptcy for fisheries industries in many places. Ironically, more aggressive fishing approaches to cope with the depleted stocks lead to worsening of the situation. A solution to these problems can perhaps be found through focused research,

including modelling of marine systems as demonstrated in the Japanese examples in Chapter 4 by Handa.

Land-based sources of pollution, such as industrial effluents, untreated municipal sewage, and runoff from agricultural areas, are the biggest threats to the coastal areas. In China, for example, pollution monitoring has clearly shown that environmental pollution in the coastal zones in the vicinity of river mouths and sewage outlets is particularly severe (Zhou, Chapter 6). In the Bohai Sea this has led to a complete collapse of the local fishing industry and numerous cases of red tide. Monitoring of shellfish for pollutants in the Asian region confirms that the trends of pollutant input into the coastal area are continuing (Prudente *et al.*, Chapter 7).

Eutrophication in coastal waters and the occurrence of harmful algal blooms (e.g. red tides) are another poignant reminder of the human impact on coastal areas. Okaichi and Yamada (Chapter 3) show that eutrophication in the Seto Inland Sea is a result of excessive influx of nitrogenous and phosphorus compounds, together with other organic pollutants discharged from manufacturing plants and cities along the coast.

Enclosed and semi-enclosed seas provide a good opportunity to observe directly the impacts of land-based pollutants. The examples cited in this volume, such as the Seto Inland Sea, the Black Sea, and the Bohai Sea, clearly demonstrate the adverse impacts on species through pollution. These seas provide clear examples of the impacts of unwise fishing practices, where the local fish stock can be depleted beyond recovery. For example, the number of fish species available in the Black Sea for sustainable commercial use has gone down from 27 in the 1970s to six (Ozturk and Ozturk, Chapter 11).

Species at risk

A number of species are identified as being at risk from man-made pollutants and intrusion into their habitats. In this list, mammals are quite prominent as they typically sit at the top of the food chain. The species discussed in this volume include:

- pinnipeds: Baikal seals (*Phoca sibirica*); northern elephant seals (*Mirounga angustirostris*); northern fur seals (*Callorhinus ursinus*); California sea-lions (*Zalophus californianus*); harbour seals (*Phoca vitulina*); and Mediterranean monk seals (*Monachus monachus*)
- whales and dolphins: minke whales (*Balaenoptera acutorostrata* and *Balaenoptera bonaerensis*); striped dolphins (*Stenella coeruleoalba*); Dall's porpoises (*Phocoenoides dalli*); and La Plata dolphins (*Pontoporia blainvillei*)
- dugong (*Dugong dugon*) and sea otter (*Enhydra lutris*).

The impacts on these mammalian species highlight the status of marine pollution as well as serving as an indicator of potential adverse impacts on marine ecosystems and the human food supply.

Strategies for the success of the “Mankind and the Oceans” concept

Conservation of marine and coastal species and ecosystems is at the heart of the “Mankind and the Oceans” concept. Sustainable utilization of these “ecosystem services” for human society is central and essential for the successful implementation of this concept. A number of human activities, particularly where industry and commerce rely directly on marine resources, have to be redesigned in a manner such that the needs of the local communities are met and their traditions are preserved. This clearly needs the involvement of local communities in planning, development, and implementation of any management strategies.

Development of sustainable fisheries is perhaps the most important element of a successful “Mankind and the Oceans” paradigm. A number of approaches for controlling the fisheries sector have been implemented; these include regulations against overfishing through setting quotas and licensing, restrictions on gear, limitations on fishing seasons and areas, and so forth (Doumenge, Chapter 2). However, these approaches have met with only limited success, particularly in developing countries. One has to dig deeper to see the underlying problems of poverty, lack of alternative livelihoods, and, often, a lack of political will to enforce these measures. This means that a change in our approach towards marine resource management is needed. This could include newer concepts like marine ranching and farming, which are introduced by Doumenge in this volume.

Another key element deserving our attention is the interface between land and ocean: the coastal zones. Special attention must be paid to the management of coastal resources and the integrated coastal zone management approaches that have evolved over the years. Their successful implementation still requires the following elements (adopted from Doumenge, Chapter 2):

- involvement of local communities and presence of political will
- a well-defined planning horizon and time period
- close interlinkages with national development planning
- clear and easy-to-follow guidelines for resource managers
- clear institutional arrangements, including laws and legislation
- monitoring and assessment for success of strategies.

It is important to point out that the collective experience of coastal management, as described by Okaichi and Yamada (Chapter 3), can serve as a useful tool in the implementation of integrated coastal zone management approaches. Management and minimization of land-based sources of pollutant and nutrient influx to coastal areas must be a central element in such approaches.

Scientific research, coupled with comprehensive monitoring and assessment, is fundamental and essential to the success of any strategies devised for the management of marine and coastal resources. A number of key research issues have been identified by contributors to this volume. Most importantly, the need to

understand the impact of pollutants and coastal development on various marine and coastal ecosystems is highlighted by many contributors. Incidences of mass mortality of marine organisms and occurrences of harmful algal blooms are of particular concern throughout the world. Research presented here suggests that significant changes to our lifestyle, and to industrial and agricultural practices, may be needed to counter these adverse effects in the future.

The international community can play a key role in developing relevant institutions, focusing the research agenda, and providing human and financial resources for implementation of proven strategies, as argued by Adeel and Uitto (Chapter 5). As the problems facing marine and coastal ecosystems are without any arbitrary boundaries, so must our actions be. Only by working together in partnership can we hope for success of the concepts that underlie the notion of “Mankind and the Oceans”.

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The oceans cover more than 70 percent of the Earth's surface and play an important part in our lives by controlling climate and weather conditions; hosting shipping, transportation, recreation and tourism; and providing us with food, minerals and petroleum. The relationship between mankind and the oceans has been crucial since prehistoric times. With the growth of the human population, especially in coastal zones, there is a growing threat to oceans from land-based activities such as industrial effluent, municipal sewage, and runoff from agricultural areas, as well as antifouling agents used on ships and aquaculture nets, and the excessive exploitation of fish stocks.

This book contains important and fascinating evidence of the role of the oceans in mankind's survival in the twenty-first century. It focuses on regional and national case studies and emphasizes approaches that can help remedy our impact on the oceans. It contains a lot of valuable information on the ocean environment, including controversial issues such as fish stock depletion rates, plus the conservation of ecosystems and biodiversity, and constructive suggestions for future directions.

The oceans belong to us all and we are equally responsible for the wise utilization and protection of their bountiful resources. *Mankind and the Oceans* is a useful tool for policymakers, resource managers, graduate and undergraduate students, scientists and all other people concerned about the role and future of our oceans.

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