

HUMAN USE AND OCEAN CIRCULATION

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Summary

From the beginning of recorded history, man has used the seas and the oceans in many ways. The huge body of seawater levels the Earth's temperature to meet the necessary living conditions and consequently supports countless lives. Without the oceans, life could not, in fact, exist. The oceans provide an inexpensive form of transportation and serve as a natural disposal site for various wastes. They are also a source of food and a potential storehouse of minerals and alternative energy, both of which are required for the sustainable development and use of our resources for this generation and for generations to come.

Human development requires various natural resources. However, the utilization of our oceans may deplete and devastate the marine resources and degrade the marine

environment. Major issues regarding the use of our oceans include the unsustainable use of marine resources. Cyanide fishing and dynamite fishing are typically destructive methods of catching fish. The loss of many sensitive habitats (e.g., mangroves, coral reefs), which are destroyed by urban, industrial and aquacultural development are other problems. Ocean circulation is a physical phenomenon and provides nutrient movement for the marine ecosystem. However, human activities, such as waste dumping, may change the natural processes and result in a cross-boundary impact. Moreover, coastal areas and the oceanic space are often suitable to meet a variety of human needs, which raises conflicts of interest amongst different potential users. An integrated ocean management will definitely be the major challenge concerning sustainable development in the future.

Thus, a consensus has been reached by many international and regional fora that the sustainable management of ocean uses should be encouraged. For example, the Asia-Pacific Economic Cooperation (APEC) declared the sustainability of the marine environment as one of three major policies to achieve regional sustainable development. Other international treaties (e.g., the United Nations Convention on the Law of the Sea) also thrust great responsibilities for the protection of the marine environment on to coastal states. An international mechanism responsible for fishing was proposed to conserve fishery resources while operating commercial fishing. Such initiatives illustrate that a wise use of the oceans and the sustainable management of the marine environment will go on being the theme of the 21st century.

1. Introduction

As stated earlier, the oceans and seas cover nearly 71% of the surface area of the Earth. They provide numerous benefits and functions to both mankind and the ecosystem. The oceans are also generally regarded as the place where life began. Without the oceans, life as it is known today could not exist. It is stated in Chapter 17 of Agenda 21, developed by UNCED that the marine environment, which includes the oceans and all seas and adjacent coastal areas, "...forms an integrated whole that is an essential component of the global life-support system and a positive asset that presents opportunities for sustainable development". Therefore, how to promote a wise and sustainable way of making use of the oceans while protecting the marine environment has been, and will continue to be, a major theme in international fora.

Throughout history, humans have been utilizing the oceans in many ways. It is well known that many people have traditionally and successfully used the oceans to earn their livings. For example, the Vikings chose the life of raiding, but they were active traders and experienced sailors in the ancient North Atlantic Ocean. Maritime countries such as Portugal, Spain and Holland expanded their influence in the Far East and obtained significant economic benefits from trade in the seventeenth century. Today, many harbor cities are developing prosperously due to the least expensive routes of transportation which the oceans provide. The countless coastal communities in the world have been heavily dependent on marine resources, especially seafood production. More and more coastal societies have also developed innovative approaches to widely utilize the marine environment and its abundant resources. As found in Canada, New Zealand and Okinawa (Japan), some fishing villages transformed their traditional fish

catch to include whale watching. Concurrently, ecotourism seems to be a promising business in those areas. However, unfortunately, the oceans are commonly used as dumping grounds for many wastes because of their strong assimilative capacity.

In addition to being a major source of protein, the oceans are one of the most important arenas that provide various minerals and alternative power. Scientists have been actively involved in exploring seabed minerals and extracting valuable materials from the seawater. With recent concern over the shortage of energy, many projects have been conducted worldwide to seek alternative power supplies from the oceans. This further illustrates that the oceans will be a new frontier in terms of the infinite potential benefits of marine resources.

However, many problems have been encountered worldwide because of human uses of the oceans. Marine pollution is but one instance. It has been degrading the quality of the marine environment as well as reducing its productivity. Many important habitats have been lost due to coastal reclamation projects for urban and industrial purposes. In this regard, the United Nations Convention of the Law of the Sea urges the coastal states to assume more responsibilities for the protection of the marine environment while still making use of the oceans. This section introduces human uses of the oceans in terms of living resources, non-living resources and spatial resources. The section also discusses the key issues related to the utilization of the oceans. It then goes on to discussions on sustainable management of the marine environment in the following sections.

2. Marine Living Resources

Resources mean any form of materials, goods and/or functions that are of use to mankind. Many coastal and oceanic resources play what may seem an intangible, but what is actually a very important role in the natural environment. For example, mangroves and coral reefs often stabilize the shoreline and provide habitats for fish and other wildlife. In general, marine resources can be divided into two categories. Namely, they are living resources and non-living resources. Traditionally, the living resources of the oceans, especially seafood, have provided a major source of protein. They will play an even more important role in providing human beings with nutrients when productivity of the terrestrial areas diminishes.

2.1. Oceans as a Source of Food

The oceans possess a vast richness of life. With their abundant plants and animals, they offer much potential as a source of food. According to the FAO, the total capture fisheries production in 1996 amounted to 94.6 million tons. As part of this, marine capture fisheries continued to account for more than 90% of world capture fisheries production, while the remainder came from inland waters. China, Peru, Chile, Japan, the United States, the Russian Federation and Indonesia (in that order) were the top producing countries in 1996. Fish production not only plays a key role in providing nutrients to mankind but is also vital to the local economies of the coastal states. In addition to fish, oysters, scallops and seaweed are also important seafoods of high economic value.

Mariculture, the farming of fish, shellfish, molluscs and plants in seawater, has recently become a promising business in many regions. Today, East Asia produces about two-thirds of all world aquacultural output. In some countries, up to 60% of the dietary protein comes from farmed marine organisms. Norway is the world's largest producer of sea-farm salmon, with an estimated yield of 150 000 tons in 1990. Cage farming is commonly used in Norway, China, Chile and Taiwan, where researchers have been actively developing mariculture. Worldwide, over 30 different species of seaweed are grown on marine farms. Korea and China each produce more than 250 000 tons of seaweed annually.

Scientific analysis has proven that many marine organisms are rich in protein, fat, carbohydrates and other nutrients. Plankton, the small-suspended aquatic organisms (plants or animals), serve as one example. *Phytoplankton* is the plant portion and *zooplankton* is the animal part, and both are known to be the basic food of many sea creatures. However, plankton may someday be harvested or cultured commercially as a significant food source on its own due to its rich nutrients.

2.2. Extraction and Synthesis of Useful Materials

The pharmaceutical industry can obtain significant benefits from the extraction or synthesis of marine resources. Throughout the world, many research projects have been focusing their efforts on the development of anti-carcinogenic medicines from marine resources, such as marine sponge and sea urchin. It can be expected that more and more useful materials can still be extracted or synthesized from oceanic organisms.

2.3. Potential Benefits of Marine Biodiversity

The marine environment is a diverse and complex ecosystem. Thousands of species and subspecies of wild plants and animals in the marine environment are closely linked with each other via the food chain and food web. Many living organisms contribute to these important biological interactions within marine and coastal ecosystems. Fish and waterfowls, for example, depend heavily on the supply of small living organisms from the oceans. Based on over a decade of experience in dealing with oil spills, biological treatments utilizing bacteria have recently been found to be the preferred method to clean up marine oil pollution, as opposed to the spray of dispersants. In this regard, there is a necessity to preserve the biological diversity of the oceans for their potential benefits to both future generations and the well-being of the ecosystem.

3. Marine Non-living Resources

In addition to their abundant living resources, the oceans are also rich in minerals, elements and energy resources. These non-living resources may be particularly important to areas which are short on natural resources. The various kinds of marine non-living resources can be divided in to four categories.

3.1. Oil and Gas

The continental shelves contain a significant proportion of the world's supply of hydrocarbons. Submarine reserves of oil and gas represent at least a third of the

estimated total world reserves. In the mid-1950s, the production of oil and gas from oceanic areas was negligible. By the early 1980s, oceanic petroleum production reached 14 000 000 barrels per day, or 25% of total world production. More than 500 offshore drilling and production rigs were at work in the 1980s. It is estimated that the potential offshore oil resources are about 2 000 000 000 000 barrels, or about half of the presently known onshore potential oil sources. The most notable storehouses of submarine oil and gas are in the Persian Gulf, Gulf of Mexico, North Sea and the northern Slope of Alaska.

It was once thought that only the continental-shelf areas contained potential petroleum resources, but discoveries of oil deposits 3 000 - 4 000 m, or deeper waters of the Gulf of Mexico, have modified this notion. It is now believed that the continental slopes and neighboring ocean-floor areas all potentially hold large oil deposits. This finding has increased the potential petroleum reserves of the ocean bottom.

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Biographical Sketch

Wen-Yan Chiau is an Associate Professor in the Department of Marine Environment and Engineering at National Sun Yat-sen University in Kaohsiung, Taiwan. After earning his B.Sc. in Urban Planning (1976) and L.L.M. (1980) in Taiwan, he was granted his M.A. in Urban Planning (1989) and Ph.D. in City and Regional Planning (1991) from the University of Pennsylvania. Dr. Chiau's expertise is in the field of environmental planning and management, especially in the areas of coastal zone management, wetland conservation, coastal tourism, ocean policy and environmental law. He is the author of the first book on coastal zone management in Chinese entitled, *Coastal Management: Theory and Practices*, published in November 2000. During his some 20 years as a planner and conservationist, he has served as both project manager and principal advisor on a wide range of projects related to the marine environment. In addition to giving lectures, conducting research projects and advising graduate students, he actively participates in related governmental affairs and serves as a member of various *ad hoc* governmental committees. Currently, he is a member of the National Council on Sustainable Development of the Executive Yuan (Cabinet), the highest-level agency formulating conservation and sustainable development policies in Taiwan. He is also concurrently an advisor for the Subcommittee on Sustainable Development of the Legislative Yuan (Congress), a reviewer of the "National Biodiversity Report" and vice coordinator of the committee on "National Oceans Policy". On a voluntary basis, Dr. Chiau contributes a great deal of his time to several NGOs in Taiwan. He is the president of Wetlands Taiwan and the CEO of the Foundation of Ocean Taiwan. As part of his active involvement in international matters vis-à-vis the marine environment, Dr. Chiau has been one of the representatives of the Chinese Taipei Delegation in the APEC Meetings of the Marine Resource Conservation Working Group since the sixth meeting in Sidney, B.C., Canada in 1994. He is an executive board member of the Asia-Pacific Environmental Council (AEC) and was responsible for organizing the sixth Asia-Pacific NGOs Environmental Conference (APNEC-6) held in Taiwan in 2002. APNEC meetings, held every two years, have been among the most important events for NGOs in the region.