

# Chapter 18: Ocean Resources and the Impacts of Their Use

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## 18.1 What Are Ocean Resources?

- The oceans provide humans with many resources, each of which has been exploited progressively more intensively during the last century. These resources include not only transportation, trade, fish, oil and gas, and minerals, but also recreation, aesthetics, pharmaceuticals, energy, and waste disposal. Conflicts between these various uses are increasing.

## 18.2 National and International Law Applied to the Oceans

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- Until only about 50 years ago, the oceans and their resources were considered to be free for all to use, except in a narrow (generally 3-mile, 5.6 km) coastal band around the land.

### **The Truman Proclamation**

- In 1945, President Harry Truman issued a proclamation that claimed all the resources out to the edge of the U.S. continental shelf. This prompted many other nations to claim similar jurisdiction over marine resources of their coastal regions often to a distance of 370 km (200 nm). However, there was no international agreement or law.

### **“Law of the Sea” Conferences**

- Increased use of ocean resources from beyond the coastal oceans led to decades of negotiations among nations to decide how these resources should be owned and managed. There was particular interest in who owned or could mine the manganese nodules covering much of the deep sea floor and found in the 1960s. These negotiations culminated in the Law of the Sea Treaty which was concluded in 1982.

### **The Law of the Sea Treaty**

- During treaty negotiations the Maltese ambassador proposed a principle that the resources of the oceans beyond the continental shelf should be considered to be “the common heritage of mankind.”
- The Law of the Sea Treaty has been signed by more than 150 nations and entered into force in 1994. The United States did not sign the treaty until 1994 and has not yet ratified it.
- The treaty has solved some issues regarding ownership of the oceans and their resources but leaves many other issues completely unresolved.
- The most important provision of the Law of the Sea Treaty is the establishment of 12-nautical-mile-wide territorial seas and 200-nautical-mile exclusive economic zones (EEZs) around coastal nations.

### **Exclusive Economic Zones**

- Within the territorial sea, the coastal nation has full sovereignty. However, within the EEZ, the coastal nation owns all biological and mineral resources but does not hold sovereignty.
- The rules for establishing boundaries between nations’ EEZs are complicated and many international conflicts today are concerned with disputes over such boundaries.
- A single small atoll can command an EEZ of 200,000 km<sup>2</sup> with all of its resources. About 35.8% of the world ocean lies within the EEZs of the world’s nations. The resources of the remainder of the oceans are still considered not owned by anyone.

- The United States has the largest total EEZ, approximately 7.5 million km<sup>2</sup>, larger than the country's land area.

## 18.3 Biological Resources

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### Fisheries

- Fish and shellfish are probably the most valuable ocean resource, especially in regions where seafood is the primary source of protein in the diet.
- Fish and shellfish resources of the oceans are severely stressed by overfishing. Many fisheries have totally collapsed after a target species has been badly overfished and most have not recovered. The fisheries for the majority of target species exploited worldwide are currently believed to be in decline due to overfishing.
- Fishers often catch nontarget species by the nonselective methods they must use. This bycatch is usually discarded but populations of nontarget species, for example, turtles and dolphins, have at least in some instances been damaged by such bycatch.
- Fishing contributes pollution to the oceans through lost fishing gear, oily boat discharges, and antifouling paints.

### Other Biological Resources

- Many species use chemical substances for defensive or offensive purposes, and many of these compounds may have pharmaceutical uses. Screening of species for such compounds is expensive and slow and has only just begun. However, several drugs derived from marine species are already in wide usage, including the AIDS drug AZT and the antiviral acyclovir, both of which were isolated first from sponges.
- The pharmaceutical potential of compounds isolated from marine species provides a significant resource, especially if the drug compound originally isolated from the marine species can be synthesized industrially. However, there is concern that some species may be overexploited if they are found to contain valuable pharmaceutical compounds that cannot readily be synthesized, requiring that the species itself be harvested to produce the drug.

## 18.4 Transportation, Trade, and Military Use

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- Uses of the oceans for transportation, for trade, and by the world's navies have been major activities for many centuries and these uses continue to grow. In 2004, an estimated \$700 billion in shipped goods were handled by ports in the United States alone and the cruise industry was valued at \$28 billion.
- As more vessels ply the oceans, releases of oily wastes, antifouling chemicals, and other wastes continue to grow despite major progress in implementing environmental controls on vessels during the past several decades.
- Marinas, docks, and many other facilities are constructed in or next to the coastal ocean to support these uses, and many such facilities have had adverse effects on the ecosystem or on other human uses such as recreation and aesthetics.
- Ocean vessel traffic also contributes to the introduction of non-native species to marine ecosystems.

## 18.5 Offshore Oil and Gas

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- Oil and gas are extracted from below the seafloor on the continental shelf and slope. In the United States the value of this resource is between \$25 and \$40 billion per year, comparable to the value of the fishing industry but far less than the value of ocean transportation of goods and cruise passengers.
- Muds used as lubricants in drilling, some of which are toxic, once were discharged to the water but are now reinjected into the seabed, at least in the United States.
- Drilling platforms have had an excellent safety record and only a handful of major spills have taken place from accidents on these platforms.

## 18.6 Methane Hydrates

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- Methane hydrate deposits have been found in many locations on and under the seafloor, especially near the base of continental slopes. These deposits are a potential source of very large quantities of clean-burning energy. However, their use in place of oil and gas would still cause the release of carbon dioxide to the atmosphere, contributing to the greenhouse effect. Also, methane, a very effective greenhouse gas, may be released to the atmosphere in significant quantities by any mining process.

## 18.7 Minerals and Freshwater

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- Manganese nodules and other seabed minerals are not currently exploited but, if and when they are, the mining activities will lead to habitat disturbance and may release contaminants.
- Several different minerals are mined from the seafloor, mostly in a few shallow water locations near the mouths of rivers, but other mineral resources such as hydrothermal mineral deposits may be commercially valuable in the future.
- Table salt and freshwater are produced from seawater in a number of locations. Although production of freshwater from seawater is energy intensive and expensive, this use is expected to grow substantially in the future as the Earth's scarce freshwater resources become more heavily used.

## 18.8 Recreation, Aesthetics, and Endangered Species

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- Recreation and aesthetic enjoyment of the oceans are among the most valuable ocean resources and are growing rapidly.
- Recreational boating and scuba diving have had severe impacts on some local ecosystems through anchor damage and incidental contact damage by swimmers and divers. Use of permanent moorings and restrictions on the numbers of allowed visitors or divers can alleviate much of this damage.
- All vessels release some amounts of oil and many still dump trash and garbage overboard.
- Awareness of the need to protect ocean ecosystems is growing but has led to a growing number of ethical and management dilemmas. For example, a dilemma is created when a valuable fisheries food resource is in decline because the population of a previously threatened or endangered predator species is allowed to recover to, or above, historical population levels.

## 18.9 Energy

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- Although there are vast amounts of energy associated with ocean tides, currents, waves, and thermal differences, the energy is dispersed and technologically difficult to harness. As a result, very little of this energy is harnessed for human use at the present.
- The only major ocean energy source now being utilized is tidal power. However, construction of a dam is thought to be necessary for efficient tidal power generation and this is unlikely to be acceptable in most locations where the tidal range is high enough to make tidal power generation economically feasible.
- Numerous different design concepts have been developed to generate power from wave energy and some have been tested in limited locations. Most designs would pose aesthetic issues as they would require a line of generators to be placed offshore along a coastline. Some recent designs alleviate this issue by placing the operative portion of the power generation device underwater, but questions remain about possible effects of the devices on marine biota and of the reduced wave energy on the coastline.
- Ocean current energy could be harnessed by placing turbines in areas where currents are strong and persistent but the turbines, like any power generation system placed in the oceans, would require protection from fouling and corrosion, which could release toxic compounds. Also, the turbines could interfere with the passage of marine organisms and, potentially, with regional climate if, for example, significant amounts of energy were extracted from a current such as the Gulf Stream.
- Energy obtained by using ocean thermal power conversion (OTEC) systems, which use the temperature difference between surface and deep water below the permanent thermocline, shows great promise, especially if they are used to generate hydrogen, which could be more easily transported ashore than electrical power. Potential environmental effects of OTEC include disturbance of the ecology by transfers of nutrients and microorganisms between the deep water and surface layer.

## 18.10 Waste Disposal

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- The oceans have been used for waste disposal for thousands of years. Many such uses have led to pollution problems and these uses are being progressively reduced in most parts of the world. However, some use of the oceans for waste disposal, such as for the discharge of treated sewage wastes, are essential, can be properly managed to eliminate pollution problems, and will continue to be valuable in the future.