Traditional fishing in the Gulf of Thailand.

CHAPTER 19

The Oceans and Human Affairs

We close our review of life in the oceans by briefly outlining the ways the ocean has molded, affected, or influenced human cultures. Chapter 17 looked at our use of marine resources, Chapter 18 at how we are affecting the health of the ocean. Now we turn to the other side of the coin to see how the ocean has influenced us, a global issue with wide-ranging implications.

OCEANS AS BARRIERS AND AVENUES

Once upon a time, people believed that our planet was flat and that sailing beyond the horizon meant falling into the gaping mouths of sea monsters (Fig. 19.1). The peoples of the world were separated from each other by unknown continental masses or by the great expanses of uncharted waters. The oceans served as barriers between cultures. Even the few kilometers of channel that separates England from mainland Europe had an isolating effect and helped define and distinguish English culture. The cultures of Ireland, Madagascar, Japan, and other island nations were similarly affected.

Few people risked venturing beyond the horizon. There were, however, exceptions. For centuries Arab sailors regularly sailed across the western Indian Ocean. The Vikings crossed the North Atlantic during the ninth and tenth centuries, as did Basque whalers not long after. Polynesian double canoes sailed the great expanses of the Pacific, and Chinese sailors crossed the Indian Ocean and may have reached the easternmost shores of the Pacific. It was not until the fifteenth century, however, that the European voyages of discovery began to change the ancient and medieval view that the world was flat.

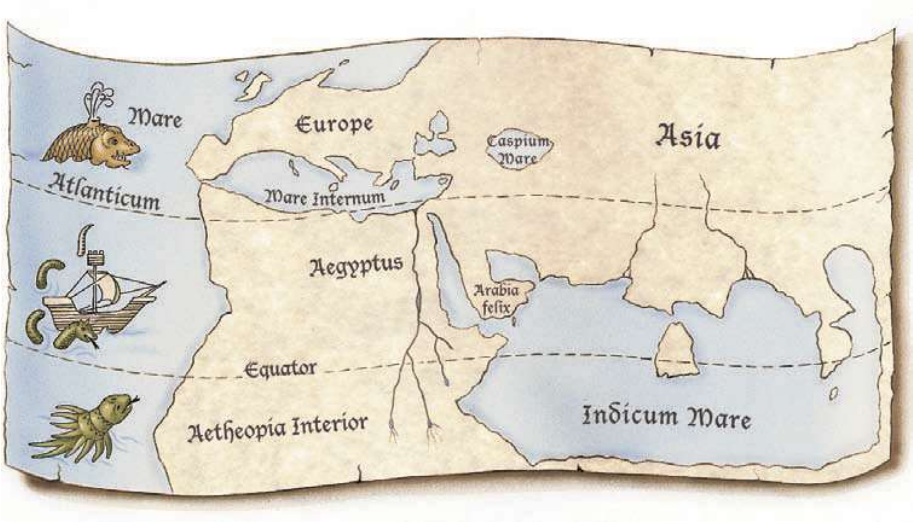


FIGURE 19.1 Fifteenth-century cartographers, greatly influenced by the geography of Ptolemaeus (second century A.D.), thought the earth was flat. Notice that, according to this map, circling Africa to reach India is impossible because the Indian Ocean is landlocked.

FIGURE 19.2 This giant containership, seemingly making its way across land, is actually crossing from the Pacific to the Atlantic Ocean by way of the Panamá Canal. New containerships, able to carry as many as 11,000 standard containers, are too big to fit through the canal.

The quest to discover new lands beyond the sea in Europe was pioneered by the Portuguese, who sailed around the southern tip of Africa and on to India by the late fifteenth century to take a share of the profitable spice trade (see "Tall Ships and Surface Currents," p. 50). Also looking for a shorter way to the Orient was Christopher Columbus, who first crossed the Atlantic in 1492. Unlike the Vikings, who landed in America centuries before, Columbus' "discovery" was soon known by everyone. Many other seaborne explorers followed, not all looking for spices (see "The History of Marine Biology," p. 2). Between 1480 and 1780, these explorers opened all oceans and, except for most polar regions, few coastlines remained unexplored. The oceans then became very powerful avenues of culture and commerce, war, and disease. Colonialism was carried across the oceans, and so were immigrants, slaves, religions, languages, traders, scientific discoveries, and ideas.

The oceans, which before the age of discovery and exploration helped effectively isolate the peoples of the earth, eventually became an avenue for change.

Today the oceans are vital freeways that link world economies by transporting raw materials and manufactured goods. Shipping remains the cheapest way to move large quantities of goods over long distances, so most international trade moves by sea. Globalization of economies has strengthened the growth of marine trade. Seaborne trade grew dramatically after World War II. It decreased by around 10% during the 1980s but only, because of a drop in crude oil shipments, which still accounts for the largest volume of seaborne trade. Businesses that deal in commodities such as iron ore, coal, and grain rely heavily on shipping. The enormous variety of goods being shipped has led to the development of vessels specialized in the transport of such exotic cargoes as liquified gas, livestock, and wine. A large percentage of maritime cargo now moves by large steel containers that are carried to the docks by trucks and lifted by cranes into giant containerships (Fig. 19.2). Cargo is then unloaded at the final destination without ever having been touched by human hands.

The oceans are no longer the avenue of choice for the transport of people, except for short distances along the coast. Jets now transport people between the continents, but large passenger ships have found a new life carrying tourists to sunny coasts.

Nowadays, the oceans are also connected by rubbish and pollutants. The oil from the Middle East, lobster tags from Newfoundland, shampoo bottles from Greenland, and ice-cream containers from Brazil that were washed ashore on a beach in Ireland bear witness to the sad reality.

OCEANS AND CULTURES

Our association with the ocean probably goes back to our early beginnings. It has been suggested that some of the early stages of human evolution were spent on the seashore and that our ancestors were coastal inhabitants who frequently waded in the water searching for food. The evidence for this, so goes the argument, is our scanty hair, a relatively streamlined body, and the presence of a layer of fat for insulation—adaptations also found in cetaceans! Most scientists dismiss this hypothesis. Nevertheless, the ocean undoubtedly influenced the human cultures that developed along coastal regions from prehistoric times.

FIGURE 19.3 Totem poles carved by the native inhabitants of the Pacific Northwest often include marine motifs such as halibut, killer whales, and sea otters.

Culture, which includes the components of the environment created by humans, is reflected in a multitude of ways. It encompasses objects like tools, ornaments, and dwellings and immaterial things like customs, institutions, and beliefs. An intimate relationship with the ocean has molded many cultures around the world. Some anthropologists refer to them as **maritime cultures.**

Excavations of prehistoric waste dumps and shell middens, the accumulation of leftover shells, give evidence of the importance of marine life as food and of the advantages of living near the seashore. Fishhooks were one of the first tools made by humans. Remains of fishes, sea turtles, seabirds, and pinnipeds are often found in prehistoric deposits. They have allowed archaeologists to describe the food habits, the diet changes, and sometimes the overexploitation of food resources by ancient cultures.

Humans then began to learn to fish using nets, traps, and other, more sophisticated techniques. The extraction and trading of salt was of tremendous importance, influencing the development of cities and states. Boats were subsequently improved, allowing fishers and salt traders to roam farther from shore.

Fishing was very important for many coastal Native Americans. Nowhere was this more evident than among the northwest coastal Indians that inhabited the Pacific shores from southern Alaska to northern California. Their livelihood depended to a great extent on salmon, marine mammals, shellfish, and other marine life. These coastal peoples knew the seasonal changes in abundance and the migration patterns of the species that fed them. Some tribes were even aware that **red tides** made mussels poisonous. Marine life also provided a basis for religious beliefs. The salmon, for instance, was for some tribes a supernatural being who took the shape of a fish and sacrificed itself every year to help humans. The fish spirits returned to their homes at sea to be transformed back into fish if their bones were thrown back into the water. Rituals were carried out to prevent salmon from being offended and thus refusing to return and swim up the rivers to be caught for food. Marine life also provided inspiration for wood carvings, such as totem poles (Fig. 19.3). Shells from abalone and other gastropods were used in making masks and ornaments.

The Inuit and other peoples native to the Arctic fished and hunted whales and other marine mammals from *kayaks,* one- or two-person boats made of seal or walrus skins, or *umiaks,* larger boats also made from skins. Native folklore is rich in stories of hunting incidents in which the hero is helped by spirits arising from the sea. Though native cultures have changed, some continue to follow traditional ways of fishing and hunting (see "Effects of Climate Change on Arctic Peoples," p. 427).

The Seri Indians of northwestern Mexico regularly used the seeds of eelgrass *Zostera* from the Gulf of California (see Fig. 13.15) as a traditional food source—the only known case of a grain being harvested from the ocean. Eelgrass is now harvested only occasionally by the Seri. Its flour is used to make a gruel that is flavored with honey, cactus seeds, or sea turtle oil. In the old days, toasted grains were used to cure children's diarrhea. The dry eelgrass was used as roofing and to make dolls. A deer or bighorn sheep scrotum filled with dry eelgrass made a ball for children to play with.

The early Polynesians, Micronesians, and other peoples of Oceania had the whole Pacific Ocean as their backyard. As a result, they developed extraordinary skills as navigators. Unlike Europeans, they were not afraid of the ocean. They settled the farthest reaches of the Pacific, from New Zealand and the Mariana Islands to Hawai'i and Easter Island. For this remarkable feat, they relied on double-hulled canoes that were carved from trees and secured with coconut fiber (Fig. 19.4).

The ocean and its creatures also provide images and symbols for the folklore and art of the peoples of Oceania (see Fig. 1.1). According to legend, New Zealand was discovered when Polynesian fishers pursued an octopus that stole their bait. The ocean has a chief role in their creation myths and other aspects of their mythology. In some cultures a giant clam is said to have been used in the making of heaven and earth. In others a great spotted octopus holds heaven and earth together. There are also countless stories involving marine life—tales of porpoise girls, pet whales, and shark gods falling in love with locals.

The sea helped mold many of the maritime cultures that developed in coastal regions around the world.

Red Tides Blooms of some dinoflagellates, cyanobacteria, and other organisms that discolor the water and produce toxins that, if accumulated in shellfish, cause *paralytic shellfish poisoning* in humans.

• Chapter 15, p. 331

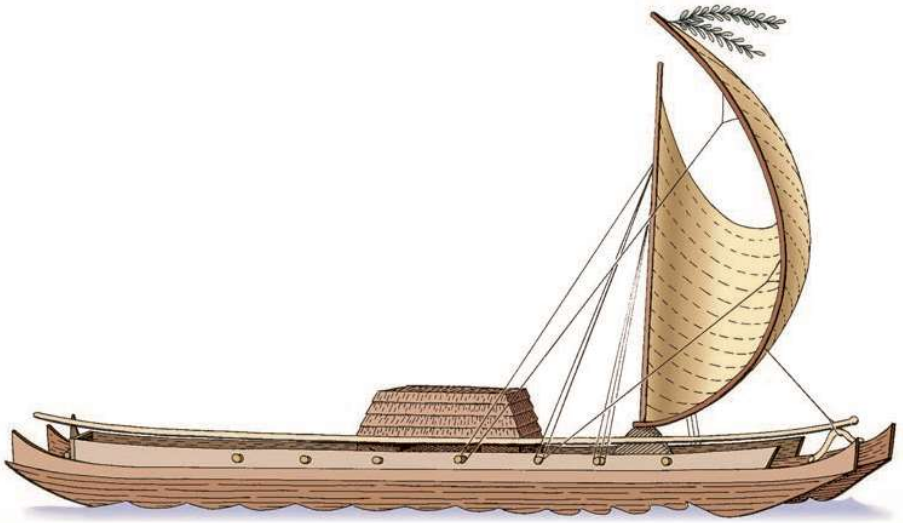


FIGURE 19.4 *Wa'a kaulua,* a Hawaiian double-hulled canoe.

FIGURE 19.5 The Romans often used marine motifs in mosaics to decorate floors and walls.

Ancient seafaring cultures also emerged in the Mediterranean and the Middle East. Egyptians, Phoenicians, Greeks, Persians, Romans, and other ancient mariners fished, traded, and made war with each other at sea. They were often inspired by the sea (Fig. 19.5). Many of their shipwrecks have yet to be discovered (see "Marine Archaeology," p. 425).

Fishing and commerce remained the basis of coastal economies in Europe during the Middle Ages. The Baltic Sea herring fishery, for example, was the livelihood of the Hanseatic League, a thriving federation of Baltic and North Sea ports. When the fishery collapsed in the fifteenth century, so did the league.

England, the Netherlands, and Portugal owed much to seaborne trade and sea power for their emergence as leading nations during the late Middle Ages and early modern times (Fig. 19.6). In many ways they followed the example of Venice and Genoa, the great rival seaports in Mediterranean trade. Fishing, trade, and naval power, in particular, began to play other important roles. By stimulating shipbuilding, they strongly encouraged exploration, science, and technology.

"Those who rule the sea rule the land" soon emerged as a motto of the emerging nation-states. Echoes of Lepanto, the defeat of the Spanish Armada, Trafalgar, Navarino, and other legendary sea battles still ring in our ears as heroic sagas. *The Influence of Sea Power upon History,* a book written in 1890 by the American naval officer and historian Alfred T. Mahan, emphasized the importance of sea power. This book was influential in persuading major powers to build modern fleets in the years before World War I. Mahan's predictions were quickly confirmed: In 1905 the Russian Empire was crippled when the Japanese sank their Pacific fleet. The Jutland, Midway, Coral Sea, and other World War I and II naval battles further proved the strategic importance of the oceans in modern warfare.

Since the birth of "gunboat diplomacy," nations have continued to use sea power to exert their influence by defending their local or global interests. Missile-carrying nuclear submarines, long-range bomber planes, and nuclear missiles have replaced battleships as a first-strike force for the superpowers. The control of sea lanes, critical to world economies, and the defense of oil, fishing, and other coastal resources will ensure the continuous importance of naval power for many nations.

In the meantime, many of the maritime cultures that managed to survive have been greatly modified and transformed. Only traces may remain of times when life depended on the cycles of the ocean and on the food caught from it.

Some maritime cultures still survive. The traditional knowledge, customs, and laws of these cultures are seen as valuable tools in protecting fisheries and biodiversity in local seas. Fishing villages of maritime peoples who are still faithful to a unique

FIGURE 19.6 Shanghai became China's leading port and the base for commercial penetration by the Western powers after the city was opened to unrestricted foreign trade in 1842. This 1860 drawing shows the great variety of ships and vessels used in the transoceanic and local trade.

Marine Archaeology

The discovery, salvage, and interpretation of humankind's cultural heritage that remains undersea is the aim of a relatively new field, **marine archaeology.** New tools, like scuba diving and remotely operated undersea vehicles, have allowed marine archaeologists to reveal secrets that had remained concealed by sediment at depths beyond our reach.

Marine archaeology as a modern science was born in 1960 when archaeologists excavated a 3,000-year-old ship off the Mediterranean coast of Turkey. Before that time, the chance recovery of sunken artifacts was occasionally carried out by sponge fishers, not by trained archaeologist-divers. Underwater digs have since been investigated around the world. The oldest so far seems to be that of a Bronze Age ship loaded with fascinating artifacts that sank off the southwestern coast of Turkey 3,500 years ago.

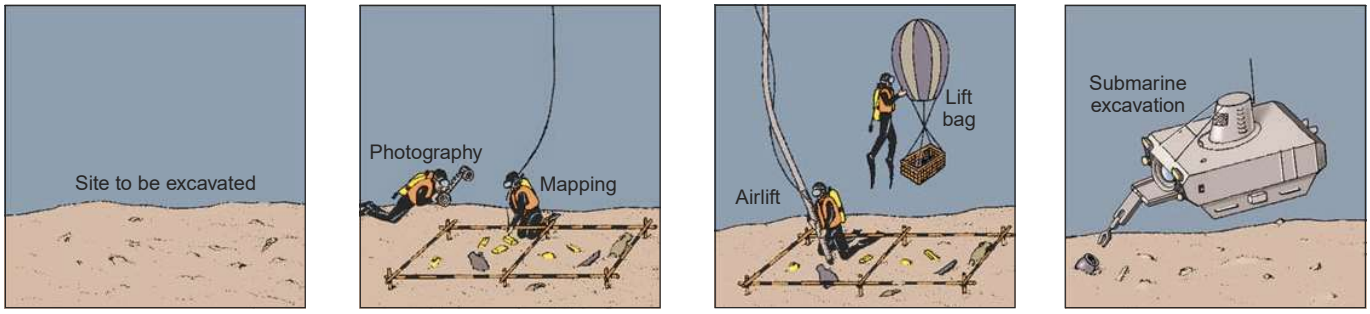
These underwater digs have provided invaluable information about ancient cultures: ship construction, life aboard ship, trade and discovery routes, and naval warfare. Tools, utensils, footwear, weapons, coins, and jewelry found on sunken ships have given us details of the products that were traded, food habits, and other aspects of everyday life.

Underwater sites may also yield art treasures, gold, and other valuables. Already a few priceless bronze Greek sculptures have been recovered from the Mediterranean. Some wrecks of Spanish galleons, as well as more modern ships, hide a fortune in gold, coins, and jewelry. The plundering of wrecks for valuables is a major problem because archaeologically significant sites may be damaged or dispersed.

Shipwrecks may be located by analyzing old documents and charts. Shallow-water wrecks have been discovered by divers attracted by half-buried hull fragments, an anchor, or a pottery amphora that stored olive oil or wine in better days. Underwater surveying of wrecks involves dives, underwater photography and television, air photography, and charting of the site using a grid system. More sophisticated techniques are also being used. Side-scan sonars use reflected sound waves to survey large sections of the ocean floor, whereas sub-bottom sonars can profile sites covered with sediment. A computer-controlled system called sonic high-accuracy ranging and positioning system, or SHARPS, provides archaeologists with three-dimensional maps of sites. A remotely controlled underwater vehicle sends live pictures to a vessel that beams them to a satellite in charge of relaying them to museums and institutions to be studied by experts. The image thus moves from the bottom to the water surface to space to land thousands of kilometers away in a matter of seconds!

Marine archaeologists are also involved in excavating towns and harbors that became submerged. They can provide valuable data on the economy and the use of technology of past cultures. Port Royal in Jamaica, which sank as a result of an earthquake in 1692, is an example of such a submerged dig. So is the now-submerged port of Cesarea Maritima, a Roman city on the coast of Palestine.

Sometimes sunken ships remain intact, as in the case of the *Vasa,* a Swedish warship that sank during its maiden voyage in 1628. It rested quietly in Stockholm harbor until 1961, when it was lifted whole from a depth of 33 m (108 ft). The wreck had been preserved by cold water and thick mud. Luckily, wood-eating shipworms were absent because of the low salinities of the Baltic. Another case is that of the *Mary Rose,* an English warship that sank in 1536. Its starboard half, the only surviving part, was raised in 1982 after yielding valuable artifacts. The turret and cannons from the *Monitor,* a Civil War ironclad that lies 67 m (220 ft) below the surface off Cape Hatteras, have been raised. Sections of the *Titanic,* which lies some 4,000 m (13,000 ft) under the sea, may be next!



Some techniques used by marine archaeologists.

livelihood and who depend on the ocean for their survival can be found throughout the islands of the Pacific and in isolated spots such as the coast of Labrador, the Faeroe Islands, and the island of Tristan da Cunha in the South Atlantic. Some have managed to survive along coasts no longer classified as isolated (Fig. 19.7). The Bajaus, or "sea gypsies," of the southern Philippines and North Borneo are boat dwellers who, like their ancestors, have followed a nomadic life at sea, fishing and diving for pearls. Korea's women divers still dive for edible marine life as a livelihood. The Kuna Indians of the Caribbean coast of Panamá literally cling to several hundred tiny offshore islands, some built out of coral and filled in by the Kuna themselves. And then there are the Dutch, a maritime people by tradition who still manage to inhabit land they have reclaimed from the bottom of the North Sea by using dikes and canals. A large portion of their densely populated country actually lies below sea level. Many modern societies still include fishers, fish and shellfish farmers, sailors, commercial divers, and other occupational groups that depend on the ocean (Fig. 19.8). As such, they are regarded as maritime subcultures.

The imprint of the oceans on humankind still survives in our daily lives in cultural elements that transcend food, commerce, politics, and war. The sea and its lore endures in the work of

FIGURE 19.7 Fishers and traders have used the traditional Arab *dhow* for centuries. These fishers in Tanzania, East Africa, are using a small, one-masted version. *Dhows* still sail between India and ports in the Arabian Peninsula, Red Sea, and East Africa along what is considered the world's oldest commercial sailing route.

FIGURE 19.8 Sailors like this man mending fishing nets in Malaysia belong to a maritime subculture that remains tightly linked to the rhythms of the ocean.

FIGURE 19.9 The *Gulf Stream* (1899), an oil painting by Winslow Homer, an American painter much influenced by marine subjects.

writers, painters (Fig. 19.9), and musicians such as Conrad, Melville, Hemingway, Neruda, Turner, Monet, and Debussy. The sea has even inspired architects (Fig. 19.10).

OCEANS AND RECREATION

Another legacy from the ocean is **recreation.** Rising standards of living and increased leisure time, particularly in the developed countries, have opened up opportunities for the recreational enjoyment of the ocean.

Practically anybody who can afford it can now fly to a faraway beach or take a cruise among once remote paradise islands. **Ecotourism** in spots like the Galápagos and Antarctica offers tours for divers and nature lovers. Catering to those seeking the sun and fun of the sea has developed into a giant tourist industry, one that keeps afloat many national and local economies. Whale-watching cruises now employ many fishers left without employment, and locals may opt to protect marine life they see as a source of income. In many areas, however, tourism has displaced fishing and other traditional activities and even endangered species like sea turtles. Water pollution is often a result of the extra millions of gallons of sewage generated by development. The destruction of habitats from the building of hotels and other facilities and the increase in the number of divers and boat traffic are other harmful side effects.

Recreation for many people revolves around water sports like snorkeling, scuba diving, sailing, water skiing, and surfing. Surfing alone is for some a way of life, a subculture of its own. Together with marine sports fishing (see "Marine Life as Items of Commerce and Recreation," p. 394), ocean sports provide relaxation and support a thriving recreation industry.

EYE ON SCIENCE

Effects of Climate Change on Arctic Peoples

Global warming (see "Special Report: Our Changing Planet," p. 231) is predicted to first and most harshly affect the peoples inhabiting the Arctic regions of the world. The anticipated increases in average temperatures and the subsequent reduction in sea ice will be particularly severe along the coasts of the Arctic Ocean, a region where the Inuit and other aboriginal peoples have carved out a precarious existence for thousands of years. The melting of Arctic sea ice is actually advancing at a rate faster than originally predicted.

The consequences of global warming are especially worrisome to the communities of the Canadian Arctic, a vast region of islands, glaciers, and fjords. The shrinkage and eventual disappearance of the coastal sea ice in many areas will lead to the loss of habitat to Arctic marine life like the polar bear, harp seal, and walrus, which are important sources of food, shelter, clothing, and tools for the Inuit. This change in marine life will severely disrupt traditional hunting by the Inuit. Also being affected are land animals like the caribou, which are also used for food and many kinds of implements. Warmer temperatures and the thawing of the permanently frozen soil are already damaging buildings and disrupting transportation. The loss of coastal sea ice will also increase exposure of coastal communities to storms. Ice melting may soon allow the opening of a Northwest Passage shipping route linking the Atlantic with the Pacific, a positive development for commerce but one that will threaten traditional ways of life and increase the danger of oil spills.

The vulnerability of the Canadian Inuit when facing the transformation of the Arctic environment has triggered concern about their future. A multidisciplinary research program, ArcticNet, was created to study not only the environmental costs of climate change in the Canadian Arctic but also of the socio-economic consequences to the Inuit. The program involves research teams from several Canadian universities and government agencies, Inuit organizations, and teams from Greenland, Russia, the United States, and several other European and Asian nations. ArcticNet also maintains oceanographic observatories in the Canadian and Siberian Arctic Ocean. Automated instruments record temperature, salinity, nutrients, phytoplankton biomass, and marine mammal vocalizations. A Canadian Coast Guard ship, the *Amundsen,* is transformed by ArcticNet into a floating clinic that visits coastal villages in the Canadian Arctic to study the health of the Inuit. Longitudinal studies in which the same patients are interviewed and examined every five years allow epidemiologists to document how the health of the inhabitants is impacted by climate change and modernization. A network of eight research stations is being created. The stations, which stretch from the northern limit of forests to as far north as Ward Hunt Island, a rocky spot 800 km (500 mi) from the North Pole, will allow long-term studies by scientists. Four of the stations will be owned by Inuit communities. The stations will also monitor global distillation, which is responsible for the high levels of pollutants from southern latitudes that condense in polar regions (see "PCBs and Other Toxic Organic Chemicals," p. 410) and a health hazard to Arctic inhabitants.

Perhaps the most serious problem for the Inuit is the availability of wildlife, which is expected to disrupt the preparation of traditional foods and lead to the use of alien foods, hence directly affecting health and at the same time bringing on cultural changes. The implication are being investigated by teams of researchers that gather data by interviewing Inuit hunters and elders. Its ultimate aim is to analyze the impact that landscape change may have on daily activities and how an alteration in the social benefits of hunting may lead to changes in the way of life.

For more information, explore the links provided on the Marine Biology *Online Learning Center.*

FIGURE 19.10 Architecture inspired and influenced by the sea: the *Itsukushima-jinja* shrine in Japan. Both the shrine and its famous gate, or *torii,* were designed to appear to float on water at high tide.

Recreational opportunities offered by the ocean influence the way many people spend their leisure time and those who depend on the tourist industry for a living.

PROSPECTS FOR THE FUTURE

It is impossible to predict what lies ahead for our world ocean. Optimists have visions of cities built underwater or on floating islands, food from mariculture, unlimited energy from the water and seabed, and no pollution to speak of. Most, however, are less confident. They point out that our impact on the marine environment will escalate as the world's population expands. Modern technology will lead to new means of exploitation, and for resources never imagined before. The prospects are therefore not

very promising. The destruction of habitats, pollution, and the extinction of species will certainly escalate if no drastic measures are taken. Perhaps even more alarming is the possibility of a rise in sea levels as a result of **global warming** (see "Rolling the Dice: Climate Change," p. 231).

The oceans, the heritage of all humankind, must be safeguarded to save them from overexploitation and pollution. This has been one of the aims of the **United Nations Conference on the Law of the Sea (UNCLOS),** the 1982 treaty that culminated many years of deliberations by the many nations that were represented. Only relatively few nations have ratified the treaty, though many have implemented some of the provisions of the treaty.

The treaty, for example, led to the establishment of the **exclusive economic zones (EEZs)** that extend a nation's economic interests 200 nautical miles (370 km) from the coast. This agreement has had significant consequences for the management of marine resources, particularly fisheries (see "Managing the Resources," p. 389). Nations owning tiny islands and reefs barely above high water can now claim large portions of the surrounding seabed, which may hold untold riches in oil or minerals. Such is the case of the Paracel and Spratly islands in the South China Sea, now claimed by several nations in the region. The treaty also allows free passage beyond a 12-nautical-mile (22-km) **territorial sea** around a nation's shores. Unimpeded surface and underwater transit is guaranteed through straits that fall within the territorial sea of one or more nations. This includes the straits of Hormuz (in the Persian Gulf), Bering, and Gibraltar, all of which have great strategic importance. The treaty also calls for nations to enact laws and regulations to prevent and control pollution. It also guarantees the freedom to undertake scientific research in the high seas.

The Third United Nations Conference on the Law of the Sea initiated a series of international agreements in an effort to define the use of the oceans by all nations. They included the establishment of exclusive economic zones.

Other international agreements have attempted to solve other problems. The **U.N. Conference on Environment and Development** at Rio de Janeiro, known as the Rio Earth Summit of 1992, is one example. It resulted in an agreement to preserve biodiversity on the planet (see "Biodiversity: All Creatures Great and Small," p. 215). One commitment was to protect the interests of the traditional fisheries of indigenous people.

From the early beginnings the oceans have influenced humankind by providing food and avenues of commerce and culture. It is clear, however, that the relationship has been reversed. The oceans are now being influenced by humankind—the destruction of habitats, pollution, overfishing, and the potential effects of global warming. Limited progress has been made, but the future of the oceans doesn't seem to be very bright after all. Is it too late to say, "Let's wait and see?"