Until recently, the oceans seemed so vast that no one could imagine humans damaging them. Now, however, a decade of scientific research shows that this view is mistaken. Human activities are degrading the oceans in numerous ways.

** The dominant view among experts is that burning coal and oil, including gasoline, is contributing to a warming trend in the atmosphere and the surface of the planet, including the oceans.

** As a result of global warming, according to the International Council of Scientific Unions and the World Health Organization, we should expect the sea level to rise because melting glaciers and ice caps will increase the amount of water in the oceans and because water expands as it grows warmer.[1] In fact, the average temperature of the oceans has risen about 1.8 degrees Fahrenheit this century and sea level has been rising, though not in a steady progression, since 1920.

** Recent studies reported in SCIENCE magazine indicate that the Pacific Ocean off the California coast is considerably warmer and consequently much less productive than it used to be. For example, the size and number of kelp have declined, in step with rising water temperature.[2] More ominously, during the past 40 years, the production of zooplankton (tiny floating animals) in the California Current has declined 70% as sea surface temperatures have steadily risen.[3]

** The species of animals inhabiting the tidal areas of the central California coast have changed during the past 60 years because of a northward shift in animal life in response to rising water temperatures.[4]

** As species have moved northward and zooplankton production has declined dramatically, the number of pelagic (ocean-dwelling) birds off the California coast has declined 40% since 1987, largely as a result of a 90% decline in the numerically dominant bird species, the sooty shearwater.[5]

** As populations of kelp, zooplankton and birds have declined off the California coast in recent decades, researchers have been documenting a loss of nutrients on the deep ocean floor. Here, in the cold darkness 2 miles or more below the surface, we find fish, snails, worms, slugs, barnacles, corals, crabs, prawns, sponges, sea anemones, brittle stars, sea cucumbers, sea urchins, feather stars and sea lilies in addition to untold numbers of zooplankton, bacteria and other creatures whose existence has never been recorded.

Because people experience the ocean floor at low tide when barren-looking mud flats emerge, we have the idea that the ocean bottom is bare. This is not the case. Tidal mud flats do not support much visible life because waves beat on them constantly, tending to break anything that grows large. But the floors of the ocean -- particularly along the continental shelves -- support abundant life. An estimated 10 million species inhabit the ocean floors, compared to 1.4 million known land dwellers.

Most of the food supply for these deep dwellers is produced in the upper ocean where sunlight is available to drive the basic process of photosynthesis whereby carbon, hydrogen and oxygen are made into carbohydrates, forming the first level of the oceanic food chain. Lowlights show that the surface-level food chain, including food plants, and animals and fecal matter, rain down on the ocean floor, providing food for those below.

Now however, these deep-dwelling species are in for trouble, according to a report published in SCIENCE magazine in May.[6] A seven-year study of nutrients raining down from the surface layers has documented a 50% decline in food reaching the deep floor. The culprit seems to be declining productivity in the upper ocean, caused by rising sea temperature. "If the food deficit continues, it is going to change the configuration of the deep-sea communities," says Kenneth L. Smith, Jr., of the Scripps Institution of Oceanography in San Diego, and an author of the recent report in SCIENCE. "Some species will die out while those that can survive on a very low food supply will either die out or be able to maintain themselves," he told the NEW YORK TIMES.[7]

** But there is still more bad news. About 10% of the corals in the world's oceans have already died because their watery home has grown too warm. Many more have become bleached, which is a step toward death for corals. If current conditions and trends persist, an additional 20% to 30% of the world's coral could be lost during the next century, according to James W. Porter, an ocean studies specialist at the University of Georgia.[8] Dr. Porter says "Corals are like the canary in the mine. They are telling us that the water where they live is becoming suboptimal for their existence."

In some parts of the world, the death of corals has reached alarming proportions. In the Seychelles (in the Indian Ocean off the east coast of Africa), 80% of corals have been lost.[9] Along the coast of Indonesia, 90% of corals are reported dead.

Fish do not eat corals, but many fish feed on crabs, clams, and worms that live among the coral, and coral provides protection for much of the swimming life in tropical oceans. So the loss of coral is a serious blow to oceanic ecosystems. "If there are no healthy coral, the fish won't be there," says Thomas F. Goreau, president of the Global Coral Reef Alliance in Chappaqua, New York.[9,10]

Corals are degraded not only by ocean warming, but also by bacteria and viruses released by humans. Since 1996 James W. Porter has observed a four-fold increase in disease at 160 coral sites along the coast of Florida. Almost none of the responsible pathogens (bacteria and viruses) have been seen before. They are "new to science," Dr. Porter says.[8]

** Humans are being affected too. One study found that nearly 25% of those who visit Florida beaches for swimming, windsurfing or boating become sick as a result. Huge colonies of viruses are being released into Florida's coastal waters by 1.6 million septic tanks, according to Joan B. Rose, a University of South Florida researcher. An estimated 20% to 24% of humans who encounter such viruses at the beach develop ear infections, sore eyes and throats, and respiratory or gastrointestinal disease. Some of the viruses detected in coastal water are associated with serious ailments, such as heart disease, meningitis and hepatitis. Viral infections cannot be cured by antibiotics. Most people recover from infections they get while swimming or boating in coastal Florida, but an estimated 1% of those infected remain chronically ill.[8]

Viruses with human origins are also found in shellfish, and not just in Florida. Studies in New York coastal waters have found up to 40% of the shellfish infected. Many of the viruses that can infect humans directly, or through contaminated shellfish, cannot be detected by routine monitoring, Professor Rose says.

** Humans degrade coral reefs in other ways. On May 16 this year the NEW YORK TIMES reported that a shrimp boat ran aground on a coral reef in the Caribbean Sea off the coast of Mexico, destroying 1300 square yards of reef. Mexican officials are reportedly seeking a $1 million fine from the owner of the boat. A cruise liner in 1997 reportedly destroyed 550 square yards of coral reef in the same area.[11] It doesn't take much to break a branch off a coral reef -- an anchor carelessly deployed from a pleasure boat can do it, or even a kick by a human diving or snorkeling.

Then of course there is modern fishing. The world's fishing fleet has doubled since 1970. New fishing gear (global positioning system [GPS] receivers, fish finders, and new kinds of trawls and nets) have made it possible to sweep the oceans like a vacuum cleaner, sucking up nearly everything that lives. A recent report from the Marine Conservation Biology Institute in Redmond, Washington, says modern fishing is comparable to forest clearcutting -- except that the wreckage caused by modern "factory trawlers" is hidden from
view. As a result of new fishing technologies, 13 of the world's 17 major fisheries are depleted or in steep decline. (See REHW #587.) For fish and for fishing, the future looks grim.

In sum, until governments take "sustainability" seriously and assert control over private corporations, the oceans seem likely to continue to deteriorate.

--Peter Montague (National Writers Union, UAW Local 1981/AFL-CIO)


[10] Global Coral Reef Alliance, 324 North Bedford Road, Chappaqua, NY 10514; telephone (914) 238-8788 or (914) 239-8768.


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