Marine Pollution

Until recently the oceans with their vast area and volume have seemed a safe site for the disposal of wastes. Recent events are causing second thoughts. Over half the population of this country is crowded close to the shores, partly because of recreational and esthetic considerations. Increasingly, however, the nearshore ocean is the receiver of a multitude of toxic or offensive materials. We must exercise better stewardship if we are to enjoy our heritage.

The oceans contain 13×10^{23} grams of water. They receive from natural processes each year about 10^{16} grams of materials—mainly silicates but also substantial amounts of trace elements. In comparison to quantities of this size the contributions of man might seem small. However, mixing in the ocean is slow; surface waters are relatively isolated from the deeps. Man's wastes are dumped near shore and physical chemical and biological mechanisms act to produce substantial concentrating effects. Typical values of the concentration of mercury in the ocean range from 0.03 to 2.0 parts per billion. In contrast, the values found in tuna are in the neighborhood of 0.5×10^{-6} part per billion. The amounts of DDT found in commercial fishes testify even more convincingly to extremely effective concentrating processes. Similar processes are known to occur with other toxic heavy elements, but the extent of detrimental concentrations of organic substances in marine biota is less well established. We know that petroleum on the beach is offensive but have little information on the extent to which some of its constituents are concentrated in marine animals to their detriment.

Insufficiently treated human wastes are another source of damage to marine ecosystems. Lifeless zones have been created in the marine environment; there have been heavy kills of fish and other organisms. Shellfish have been found to contain hepatitis, polio virus, and other pathogens.

The coastlines of the United States with their associated estuaries and salt marshes are highly productive biologically. Many animals live their entire lives in that environment. Others must dwell there during crucial periods in their development. Marine pollution of various kinds has already seriously damaged the environment in some areas. The full extent of this damage is probably not known. Population studies are useful, but the population of a given species is influenced by many factors. Commercial fishes may be scarce because of disease, overfishing, or failure of a food supply. When it is discovered that a species is disappearing, the time is late.

Earlier warning could be provided by more intensive monitoring of chemical constituents of key members of the food chain, especially algae and fish. The items checked should include heavy metals, chlorinated organic compounds, and possible carcinogenic components of petroleum. Beyond monitoring we need far better knowledge of the extent to which potentially harmful molecules are concentrated or eliminated from various animals. In addition to chemical examination, searches for incipient pathological abnormalities should be conducted.

The recent measurements of mercury in tuna and of DDT in other fishes should warn us that we cannot count on the ocean as an almost infinite sink. We have awakened to the fact of very large concentrating effects, and we shall probably find more examples. Having been warned, we would be imprudent not to take action against heavy metal pollution. It would also be imprudent not to expand greatly a search for man-made and petroleum-derived chemicals in marine biota. At the same time, we should do whatever is necessary to decrease the amount of petroleum released to the environment and to regulate the discharge of raw sewage into the oceans.—PHILIP H. ABELSON

Sources used include *Ocean Dumping—A National Policy* (Government Printing Office, Washington, D.C., 1970) and *Waste Management Concepts for the Coastal Zone* (National Academy of Sciences and National Academy of Engineering, Washington, D.C., 1970).