GUEST COMMENT

Intuition, Catastrophe, and Ocean Health

More than four decades ago, scientists in many countries recognized that the health of the oceans could be jeopardized by the promiscuous release of societal wastes. The initial concern involved artificial radionuclides from nuclear power-plants, whereupon investigations sought the maximum levels of these substances in waters and foods that would protect the health of the most exposed individuals. Regulations were accordingly established limiting the discards of these toxic substances to the atmosphere and to waters. They are continuously modified as new and better information becomes available, with the International Atomic Energy Agency playing a forceful role in this regard.

While the intuition of scientists has kept the amounts of artificial radionuclides in the oceans at safe levels, catastrophic events have also provided guidance for the maintenance of ocean health. The science and elegant prose of Rachel Carson, through her book *Silent Spring*, published in 1962, pointed out the disastrous effects upon non-target organisms of the widespread use of halogenated hydrocarbon pesticides, such as DDT, in agricultural and disease-prevention activities. Thus populations of some fish-eating birds had been brought to near extinction. As a consequence, a most sophisticated step was taken by the US Environmental Protection Agency in 1972 through the strong regulation of such substances with the goal of preserving the integrity of ecosystems. Many countries have subsequently taken similar action.

Other catastrophes have been the bases for restrictions on the flows of toxic substances to the marine environment. The novel epidemic of methyl mercury poisoning in the 1950s and 1960s, through the uncontrolled discharge of waste substances from a chemical plant to Minimata Bay, Japan, brought about many human mortalities and morbidities. The catastrophe identified mercury as one of the more notorious marine pollutants. A recent disaster involved tributyl tin, — one of the most effective anti-fouling agents introduced into marine paints — as perhaps the most toxic substance ever deliberately allowed to enter sea-waters. It brought about high losses of maricultured oysters in the Bay of Arcachon, France, when it leaked from the painted hulls of recreational vessels to the culture sites, deforming the organisms and making them inedible, so that the economic losses were high. This substance is now rigidly controlled in most countries.

As the twentieth century comes to an end, we can examine the potential marine pollutants that have been intuitively identified by the scientific community. They reflect the recent advances in environmental studies: the substances can be analysed at extremely low concentrations compared with several decades ago — at parts per million million million (American trillion) levels or less in sea-water. Their impacts upon organisms are often revealed by subtle and sophisticated biochemical techniques and by measures of reproductive successes.

The collectives of potential pollutants include: plant nutrients leading to eutrophication; plastics whose accumulation on the seafloor can bring about anoxia and hypoxia; environmental estrogens; algal toxins; and pathogens which can enter the human food-chain through the consumption of filter-feeding organisms.

The appropriate elucidation of these substances in the marine environment will require extensive laboratory and field studies. Most probably there will not be adequate financial and scientific resources to address all of these issues. How can scientific priorities be established? I submit that serious consideration be given to those pollutants that endanger human life, such as the algal toxins and pathogens. What strategies are available to reduce mortalities and morbidities from the consumption of filter-feeding organisms containing algal toxins and pathogens? The eutrophication problem has been well recognized for a decade or so. We are aware that oxygen-levels are declining in the bottom waters of the North Sea and of the Adriatic Sea. How will the present populations of organisms change as a consequence of such chemical alterations? Will commercial fishing suffer, with attendant economic losses?

The scientists who have posed these questions clearly need assistance from the social science communities — economists, sociologists, and lawyers, among others — in the formulation of policy. It is the responsibility of regulatory agencies to bring these scholars together.

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