

## **PERTURBATIONS IN THE MARINE ENVIRONMENT AND THEIR IMPACT ON LIVING RESOURCES**

### **Professor Baruch Kimor**

Faculty of Agricultural Engineering  
Technion-Israel Institute of Technology  
Israel

It is a special pleasure and privilege for me to be invited to contribute to the Fourth International Conference on the International University for the Bio-Environment (I.U.B.E.), sponsored by the B.I.O. My opinions are those of a life-long practicing marine biologist who moved into this field from general studies in agronomy and biology preceded by some basic training in law and economics. It is perhaps this unusual combination of disciplines during the formative years of my career that enabled me, later in my life, to connect scientific research and personal involvement in the quality of the environment with the appropriate national and international organizations within which these activities and aspirations could be promoted and implemented. Yet I am neither a diplomat nor a politician, and whatever I have to say is in the way of calling your attention to some data and information on a number of case histories affecting the marine environment in which I was personally involved. It is possible, however, to generalize from individual case histories affecting the quality of the environment and its impact on living resources to broaden regional and even international boundaries, as long as the principles governing the nature of such perturbations are properly understood and correctly assessed.

The topic that I wish to discuss is the effect of large and small-scale human activities on marine ecosystems, the former with lasting effects and generally irreversible; the latter more limited in time and space and potentially reversible, if appropriate steps are taken in time through adequate surveillance and preventive or remedial measures.

Let us look at two of the largest engineering projects in modern times which profoundly affected the biological oceanography and the fisheries potential of the eastern Mediterranean. One is the opening of the Suez Canal in 1869 linking the Red Sea with the eastern Mediterranean, the other the completion and activation of the Aswan High Dam in 1965. The first project was aimed at shortening navigation links between Europe and the Far East, the second was prompted by the need to expand the area under intensive irrigation for agricultural use in the Upper Nile Valley through the retention of the periodic Nile floods which used to run into the Mediterranean during the pre-Aswan period.

In regard to the Suez Canal, as in the case of other interoceanic canals elsewhere in the world, the physical connection accomplished at the time of the completion of the project was followed by a lag period lasting some fifty years, with only a moderate rate of migration of biota between the two marine environments. This trend continued at an accelerated rate in subsequent years, mainly in a northerly direction, and affecting chiefly fast-swimming fishes and macro-invertebrates. Some of the fish species of Red Sea origin which penetrated into the Levant Basin of the eastern Mediterranean proliferated in the new environment and established stable populations, often at the expense of closely related native species. This was the case with the red mullet and the hake, which were gradually displaced by the goatfish and the lizardfish, respectively, of Red Sea origin.

While the population changes generated by the Suez Canal migration were not particularly harmful to the eastern Mediterranean fisheries, the major ecological changes induced by the Welland and Erie Canals linking the Atlantic Ocean with the Great Lakes in North America resulted in disastrous effects to the local trout fishery. This was due to the penetration of voracious predators, such as the lamprey eels and alewives, from the ocean through the man-created waterways. In this way, the thorough study of the ecological aspects of the Suez Canal migration carried out in Israel over a five year period, starting in 1967 under the auspices of the Smithsonian Institution in Washington D.C., served as a model for other areas, including the projected sea-level Panama Canal still under consideration.

The immediate ecological impact of the activation of the Aswan High Dam on the Nile River in 1965 was an almost sudden collapse of the sardine fishery in the Nile Delta, from an estimated 15,000 to 20,000 tons a year to a mere few hundred. This was due to the retention of the nutrient-rich Nile waters estimated at about  $43 \times 10^9 \text{m}^3$  together with some 140 million tons of suspended solids which used to have a fertilizing effect on the food chain off the Nile Delta. Not less impressive and disastrous was the acute coastal erosion following the activation of the dam due to the stoppage of beach nourishment brought about by the fine sediment fraction carried by the Nile waters.

On a more reduced scale in space and time is the damage to the coastal environment of maritime states as a result of eutrophication. This is caused by the uncontrolled release of untreated domestic, industrial and agricultural wastes either directly into the sea or via waterways. These wastes, rich in plant nutrients, primarily inorganic and organic compounds of nitrogen and phosphorus, frequently bring about heavy phytoplankton blooms resembling red tides which are, at times, highly deleterious to marine life either by direct toxicity of certain algal species or by a state of anoxia which often occurs under such conditions. This danger is particularly critical in enclosed coastal seas such as the Mediterranean, the Baltic and certain parts of the North Sea, and the well-known Seto inland Sea, among others, with only limited connection

to the open water of the ocean to allow for a water exchange within a reasonable period of time. The environmental management of such enclosed seas served as the principal topic at the International Conference bearing this name-EMECS '90 at Kobe, Japan-to be followed by a second one in the United States in less than two years' time.

Prospecting of the sea bed for oil and gas, whether by dredging, drilling or underwater explosions, is also a cause of widespread damage to the living resources at all trophic levels. The debris generated by dredging on the continental shelf can bring about a so-called "blanket effect" on the fauna and flora of the affected areas due to increased turbidity and a concomitant drop in photosynthesis of both attached and free-floating vegetation. Underwater explosions are known to cause severe damage not only to adult and larval stages of fishes of commercial importance but also to invertebrates, mainly crustaceans, which form an important segment of the pelagic and demersal food chains.

A concerted monitoring program based on a fully coordinated international effort is necessary in order to properly assess the actual and potential impact of all such human activities on the living resources in their natural habitat. It is only by quality control of the data obtained within the framework of such an international effort by uniform technologies and free exchange of information among the participating nations that proper assessment, possible prediction and actual recovery in case of acute damage to the environment can be achieved. Education at the primary, secondary and university levels should be an essential tool in this direction. It is in this field that the B.I.O. and the proposed International University for the Bio-Environment can serve as a catalyst in the realization of these worthy efforts.

### References

1. Ben-Tuvia, A., (1973) "Man-made changes in the eastern Mediterranean" in *Copeia* 2: pp. 254-275.
2. Aron, W.I., Smith, S.H., (1971) "Ship canals and aquatic ecosystems" in *Science* 174, pp. 13-20.
3. Aleem, A.A., (1969) "Marine resources of the United Arab Republic". *Stud. Rev. Gen. Fish. Coun. Medit.* 43, pp. 1-22.

---

**Professor Baruch Kimor's** life-time work has been dedicated to Mediterranean Planktonology, for which he was awarded the Tregouboff Prize by the French Academy of Sciences, in 1991. Born in Romania but living in Israel, his career has included teaching at the Israel Institute of Technology (where he was one of the founding members of the Lowdermilk Faculty of Agricultural Engineering), the Department of Oceanography at the Hebrew University of Jerusalem, and at the Interuniversity Institute in Eilat, The Red Sea. On an international level, he has frequently worked on behalf of UNESCO and SCOR (Special Committee for Oceanic Research), serving as first chairman for the UNESCO- sponsored Advisory Council for all oceanographic sorting centres in the world. He has also served as a member of the Group of Experts on the Preservation of Materials in the Marine Environment, sponsored by the OECD. He has also undertaken extensive research both in California and Germany. He has published widely and frequently spoken at international conferences, recently on the topic of the Impact of Man-Induced Perturbation on Marine Ecosystems.