Committee VI
Global Enviromnental Problems
149

Draft-for Conference
Distribution Only

Discussion Paper

by

Michael G. Norton
First Secretary (Science)
British Embassy
Washington, D.C., USA/UK

on

P. Kilho Park's

WORLDWIDE POLLUTION OF THE OCEANS

The Twelfth International Conference on the Unity of the Sciences
Chicago, Illinois November 24-27, 1983

WORLDWIDE POLLUTION OF THE OCEANS - DISCUSSANT COMMENTS BY DR M G NORTON

The subject of this session reminds me of a magazine cover picture I saw while in Canada in 1969. It comprised a gravestone on which was inscribed 'The Oceans - born ca 2 billion years BC, died 1977'. The article inside was entitled 'Death of the Oceans' and postulated the collapse of primary production as a result of increasing quantities of man-made toxic substances entering the ocean. This was symptomatic at that time (in the run-up to the 'environmental' decade of the 70's) of a widespread perception of impending global marine pollution problems. These concerns formed part of those addressed at the Stockholm Conference on the Global Environment and subsequently led to international agreements to control marine pollution such as the London Dumping Convention. Well, the oceans have certainly lasted beyond 1977 and still look as if they have a few years to go - it is thus interesting to see how our present perspective differs from those alarming ones of 10-15 years ago.

Dr Kilho Park drew our attention to the dynamics of the ocean systems which are capable of assimilating and processing vast quantities of material of natural origin from land run-off and atmospheric fallout. I would like to also emphasise the characteristics of the living ecosystems which are such an essential component of life on earth. Marine ecosystems have been riding out the changes in the earth's climate through billions of years and were the origin of the terrestrial life whose impacts we are now discussing. Present day ecosystems offer a range of species capable of exploiting various combinations of substrate, temperature, depth, food source etc that the ocean can offer. Boundaries are ill-

defined in the ocean, thus response to change can be rapid. Life will start to colonise a new surface (whether a rock or ship's hull) overnight, disturbed sediment after a storm will be quickly resettled, since the systems have evolved to adapt to such changes. Individual species may increase or decrease, but overall productivity will tend to be determined by the exploitable energy and food inputs to the system. The discovery of novel life forms along the deep sea volcanic vents shows how adaptable marine organisms can be in exploiting any source of energy (light has been replaced by thermal and inorganic chemical energy sources).

The natural marine ecosystems are not therefore the fragile systems envisaged in the article mentioned at the beginning of these comments, but resilient and adaptable assemblages of organisms able to exploit a wide variety of ecological niches. Fisheries studies have shown that while individual species of fish may go through spectacular population growth and collapse (depending on success of spawning, predation, temperature, currents etc) over all biomass will be much more stable except, of course, where man intervenes by overfishing. The system is also highly dependent (as Dr Park has shown) on the input of materials from the land via rivers for many of the essentials in maintaining a productive system (organic detritus, nutrients etc). Man's activities this impinge on a system that is both flexible and opportunistic and accustomed to responding to a wide range of different environmental conditions and inputs.

On a global scale Dr Park has shown how the ocean receives much material from natural sources. Some of this is life supporting, some life

threatening. The system exploits the former and has mechanisms for mitigating the effects of the latter as can be seen by the fact that disaster does not follow from the inputs of large quantities of metals which are toxic in other circumstances. How do Man's efforts look when compared against this natural flux? As you know, he has made a mess of a number of estuaries through discharges of sewage and industrial wastes which have resulted in the depletion of estuarine species or species with an essential part of their life cycle in estuaries. Some coastal areas have also been affected - more by contamination than by depletion of species. Oil spills still make the headlines occasionally and marine litter is widespread. So let us look to see how far we have made these and other problems into ones of a global scale.

Twelve years ago, the London Convention was concluded to place controls on waste disposal in all the world's oceans. At that time, different wastes were assigned to prohibited, strictly controlled and permitted categories according to the perceived threat they posed to the marine environment and man. It is instructive to see how these lists look today and how many problems have subsequently arisen that the authors of the convention did not foresee.

Substances listed in Annex I comprised those perceived as posing the greatest threat to the oceans. Mercury and Cadmium were listed due to the fatal consequences of localised pollution in Japan. Subsequent experience has shown that these metals can continue to pose public health problems in local areas where fish and shellfish accumulate high concentrations, but that more widespread effects have not been

detected, nor are any anticipated in view of the fact that anthropogenic inputs are still relatively small compared with natural fluxes. Effects have been limited to bays or inshore coastal waters and have proved controllable by restrictions on discharges to the water body concerned.

Oil pollution - particularly from catastrophic loss of cargo - has proved to be devastating locally and, in some cases, effects at a range of over 100 miles can be found. Additionally Dr Park has pointed out that it is possible to find residues of degraded oil throughout most of the ocean regions used for transport. Nevertheless, the major effects have been limited to the immediate vicinity of spills and the ocean has proved capable of dispersing and degrading large quantities of oil via natural processes - often more effectively than with dispersants. While oil continues to pose a major threat locally therefore, it is not currently a threat to the global marine environment.

The Convention included organohalogen compounds due to their persistence and tendency to accumulate in marine organisms. These are representative of classes of compounds discussed by Dr Park (xenobiotics) for which natural degradative and removal processes have not necessarily evolved in the oceans. Contamination by these substances has been shown to be global at the level of analytical detectability and regional at levels which could be of concern from the viewpoint of protecting public health and the wellbeing of some marine species (particularly mammals). These are the nearest we have come to having a global pollution problem, and further vigilance and controls on these types of compound are warranted.

The final prohibited material in the Convention is 'high-level' radioactive waste. Dr Park has shown how global contamination has already

occurred as a result of atmospheric tests and how the oceans already contain a large amount of natural activity. Nevertheless, controversy surrounds the current use of deep water sites in the North Atlantic for low-level waste even though the present quantities disposed are very small compared to natural background levels and fallout sources. This may reflect concern that the long half-life of some radio-isotopes may raise the possibility of regional if not global contamination if substantial changes in disposal practice were made. Careful prediction and modelling are thus needed before it can be determined how far the role of the ocean in radioactive waste disposal can be expanded. In this case however, there may be a further option of using the natural stability of the deep ocean sediment sinks as a means of isolating materials with long half-lifes from the living marine environment and man.

Outside of Annex I, the Conventions also mention substances requiring 'special care', including metals such as zinc, arsenic, copper and lead and toxic substances such as cyanide. None of these has subsequently proved to present other than local pollution problems. In the case of the metals, all are common within the marine environment and effective sequestering and removal processes exist to make field effects significantly less harmful than might be predicted from laboratory experiments.

The remaining substances mentioned in the Convention include those which are part of the natural marine environment but which may still exercise an adverse effect via large inputs or due to the location of the input. Organic carbon (particularly associated with sewage) has had a detrimental effect on bays and estuaries and some localised areas in the coastal zone. So too has the removal of silts via dredging and the

disposal of spoil. Nutrients have enhanced the primary productivity of some areas where other factors (eg light) are not limiting. Changes in species composition of the plankton have also occurred and such inputs have also contributed to eutrophication (or hypertrophication). Although primarily restricted to enclosed water bodies, such effects have been detected on a regional basis in some coastal waters and have had very damaging consequences as illustrated by the 1976 anoxia event off the eastern coast of the USA described by Dr Park.

My conclusion from the above synthesis is that, on evidence to date, controls to avoid serious degradation of coastal zones will ensure adequate protection of the global oceans for most substances naturally present in the oceans. Xenobiotic substances may also be controlled on this basis, but may require an additional degree of control in view of their potential for persistence and transport over long distances. What we must do, therefore, is ensure that controls on coastal pollution are enacted as nations increase their coastal population and industries, and that measures already taken by many countries remain effective. We also need to continue the global programs which have been set up by such organisations as the United Nations Environment Program and the International Council for the Exploration of the Seas to monitor the distribution of metals and persistent synthetic compounds, as well as to continue to support the controls on direct inputs to the ocean under the London Dumping Convention and other international agreements.

So where are the global ocean problems of tomorrow? Not necessarily in the traditional sense of marine pollution, because I share Dr Park's faith that 'humanity' will continue with its success at controlling

traditional sources of marine pollution so as to avoid global problems. We are however, as Dr Park has pointed out, whether knowingly or unknowingly, increasingly relying on the ocean to provide global stability as man increasingly widens the scale of his impact on land and in the atmosphere. The oceans comprise 2/3 of the earth's surface and the interaction between their surface and the atmosphere is becoming one of the key factors in limiting the build up of atmospheric pollutants. It allows acidic aerosols (both man-made and naturally occurring) to be neutralized, and can be both a source and sink for atmospheric carbon dioxide. Its behaviour as concentrations of CO2 rise will be crucial in determining the global effects of greenhouse gases.

Thus, even though the oceans appear to be surviving threats perceived decades ago, it is even more important to understand global oceanic processes and their buffering capacity as they are increasingly called upon to moderate the effects of man's activities.

15th November 1983