La mer 32: 103-106, 1994
Société franco-japonaise d'océanographie, Tokyo

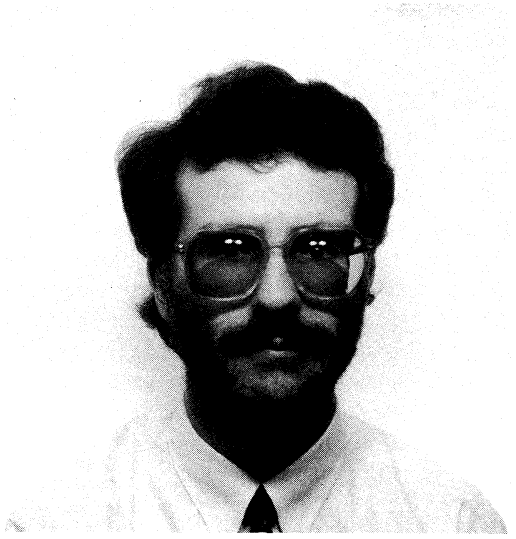
Article special n° 10

Bioethics, Water and the Environment*

Darryl R. J. MACER**

Bioethics, or biological ethics, looks at ethical decisions we make concerned with life, and in simple terms it could be called love of life (MACER, 1994). In this sense, love means to try to avoid harming life, and to try to do good, while respecting the life of individuals (autonomy) and of all lives (justice). Considering that life is dependent upon water, and living organisms are made of up to 90% water, could we say bioethics is love of water? Despite the apparent closeness, I know of no paper exploring "bioethics and water", or oceans. This is more surprising given the dependence of human health, and the life of almost all organisms, on the provision of clean unpolluted water. The problem is one of words, as part of the concept may already be familiar, but words can help build concepts and it may be timely to introduce the term bioethics more into ocean science.

The relationship of ocean science to medical bioethics is suggested by the concept of the "health of the oceans". This phrase was the title of a UNIP Regional Seas report (GESAMP, 1982), produced by the Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP). The idea of monitoring the health of the oceans was found in several reports in the 1970's, and the concept is now well established. The "normal" state of the ocean is difficult to define, as it will be changing with time, however, we can certainly find some "unhealthy" phenomenon in the oceans (関・小池, 1993). The GESAMP group continues to act as an international group monitoring the health of the oceans, in addition to the many private environmental groups, and national authorities. It is a constructive way of thinking to use the word health, and we could consider the committee to be among the "Bioethics Committees" of the world in their mandate.



Historically there has been even longer connection with environmental bioethics. Among the first major international laws protecting the environment is the Law of the Sea, which looks at the problem of protecting the global commons. This is an issue of justice, as well as responsibility to protect nature and the environment. It became a forerunner to the more recent global conventions on protection of the ozone layer, biodiversity, and efforts to prevent increases in greenhouse gas emissions which contribute to global warming. We also have national laws reducing pollution, and preserving rivers, lakes and marine parks.

Food

Many wars have been fought over the issue of food, and perhaps the most global human ethical problem in the world is uneven distribution of food and inability to pay for it. Human uses of the marine environment for food include management of wild stocks, and controlled marine culture. From the oceans, 71% of the world's surface, only 1% of the foodstuffs are

* Received May 10, 1994
** Institute of Biological Sciences, University of Tsukuba, Ibaraki, 305 Japan

harvested, in 1990, 93 million tonnes were harvested. Aquatic food proteins are an important source of animal protein. Unlike other types of food harvesting, which are largely based on planned agriculture, only about 30% of the world's fish catch is from cultured areas. This depends on species, shellfish are among the species that are obtained largely from planned aquaculture, but fish like tuna are almost entirely from the use of international ocean resources. Overfishing, overuse of resources, has many documented cases, and is a bioethical issue.

How can we ethically control overuse of resources? Most maritime nations have declared 200 mile limits within which they claim prior rights to exploit marine resources, including fish. Therefore national policies are very important, but because most fish, and the water they live in, move over much greater areas, international fishing strategies are necessary. One way is to enact quotas, a given number of fish of each species that should be caught. Quotas were introduced to North Atlantic fishing since 1970.

Global influences are being recognised which require global bioethics. For example, natural variations in fish population are primarily related to the population of plankton on which they feed (and human action). The algal productivity varies greatly, with winds, sea currents, and climatic involvement which affects the ocean currents. Increased fish catches of Atlantic cod, from the fifteenth century, have been associated with warmer climatic periods. Temperature also affects biological organisation of the ecosystem, and global warming can be expected to change not only these patterns but rainfall, affecting the land too. Unintentionally, humans have begun global ecoengineering, and are now considering intentional changes to combat these. For example, there was recently an experiment to add iron into the ocean to fertilise phytoplankton production, which could halt carbon dioxide, however it was shown to be impractical if the iron sinks, as it invariably seems to (KERR, 1994).

One of the more controversial issues is that of animal rights. Bioethics attempts to balance rational ethical arguments rather than religious ones, the difference being that rational arguments should appeal to data that can be scientifically validated whereas religious arguments are those which can not be tested. This means that modern animal rights arguments are based on arguments including: pain is bad, so to cause pain is bad, therefore we should at least minimise pain if we are killing; or consciousness of the self allows interests in the individuals' future, and it is not good to interfere with such an individual. When in doubt we should minimise the chance that the species we use can think, so we should try to use species that either think less, or don't think. If we take this to the logical conclusion, we should eat more fish than mammals. These two arguments go beyond, but complement, the general value people place on nature, or the value people place on saving endangered species. I do not think that there is greater worth just because something can be scientifically tested, for example, unrewarded love is recognised as a good thing but it is not a scientific idea. The reason we try to use rational arguments is that they can sometimes be more culturally independent.

In practice, bioethics would say that we should develop methods of fishing that cause less pain, that allow species to continue existence for their own sake as well as ecological stability, the ones that are the most cost effective in both economic and environment aspects, and be species selective in fishing. For example, the use of long drift nets was criticised for the nonselectivity of species caught and the low efficiency of catch versus killed fish, despite there short-term economic benefit. There is much room for progress in development of fishing methods that cause less pain, in the same way that methods for killing land animals have been improved.

Perhaps the most controversial issue is whaling. What began as environmental protection of endangered species, in the formation of the International Whaling Commission (BUTTERWORTH, 1992), has shifted focus into the issue of animal rights. The key point for scientific input into this debate therefore may no longer be the stability of the populations, but the question of how much whales think - neuroscience. Rather than entering the debate in this paper, I would make the point that the people in the countries

opposed to resumption of whaling are not really interested in the environmental stability, but in whether whales can "think". They argue that if they can "think", we owe them more duties than we do to animals that do not. This is the standard used for protection of human "rights", and bioethics would say we should be consistent regardless of species. This issue therefore has some further scientific questions beyond the current research on population stability. Although most of the human genes will be sequenced by 1995, allowing comparison of conserved genes with other species over the next few years, full understanding of the thinking process will take a few more decades with the project to define the key neuronal connections of the human brain. Currently half of the genes are thought to be expressed in the brain, and most are conserved in so-called "higher" animals.

Pollution

Human activity is becoming the main cause of ecosystem changes in the world. We can see the effects of human activity everywhere in the world, from atmosphere to oceans, from poles to the tropics and from the depths of the oceans to the highest mountains. The concept of stewardship is required to maintain a sustainable way of life, and a healthy world. Environmental problems may be able to be traced back to the beginning of civilisation, but are getting worse with the global scale of air and water pollution, the introduction of new chemicals, and the still growing human population. Much damage is unintended and unforeseen, such as the acidification of lakes in Scandinavia and Canada from the acid rain from the burning of carbon fuels. Restrictions on the release of sulfur and nitrous oxides has reduced the level of these acid residues, showing that pollution can be controlled. While sulfur dioxide emissions have fallen, the acidity of rain has actually remained high in polluted areas, due to parallel reduction in the basic cations (contributed by particulate matter) in the atmosphere that neutralise acid rain (HEDIN *et al.*, 1994). There still needs to be further reduction in pollution if acid rain is to be avoided.

Pollution could be defined as the appearance of some environmental quality for which the exposed community has inadequate information and is thus incapable of an appropriate response (CAIRNS and LANZA, 1972). Pollution can also be defined as the introduction by humans, directly or indirectly, of substances or energy into the environment resulting in deleterious effects as harm to living resources, hazards to human health, or hindrance to particular activities. The oldest method of pollution "control" that has been used is the principle of infinite dilution of wastes. Water is historically one of the substances in which wastes are diluted, perhaps why it has the associated spiritual meaning of holiness and purity. Increased industrialisation usually means increased production of wastes and potential pollutants. In the ocean, substances including carbon dioxide, cadmium, arsenic, lead and mercury are all disposed of in greater quantities than the natural fluxes can cope with. Under conditions of stress, the species diversity of communities is greatly reduced, and the result is that the system becomes much less stable (ODUM, 1971). The most effective control is to eliminate production of the pollution, at least to decrease the levels to what natural cycles can cope with. If it is not possible, treatment of the pollutants and/or the consequences, is necessary in many cases before substances suitable for recycling or dilution can be released.

Other examples of pollution include eutrophication in waters that have enriched nutrient content which support excessive algal photosynthesis. The degradation of these algal results in oxygen depletion of this water, which has the secondary effect of killing fish and also a foul taste. Increased temperature lowers the oxygen concentration of water, which makes the ecosystem more susceptible to stress. Wastes include municipal sewage, animal wastes and agricultural fertiliser runoff. To solve this problem these nutrients must be removed before such wastes are released into the water. In 1970 the animal population in the USA was estimated to be 564 million head, which produce the waste equivalent to 2 billion people. Water tends to be the ultimate sump for waste, and we are dependent upon the natural ability of ecosystems to cleanse waste and produce clean water. It is ironic that the economic benefits of natural actions are usually of no value in economic

equations.

The effects of pollution can be immediate, such as the sudden death of a large number of fish, or more prolonged such as defective development and reproduction. The level of PCBs in some marine animals exceeds the health standards set by some national authorities, but there are no known cases of human sickness from the consumption of animals and fish with these substances. However, seals may have suffered reproductive damage as a consequence of the level of PCBs (GESAMP, 1982, 1990). The bioethical issue is that we should try to avoid harm, and attempt to understand the consequences of the direct and indirect effects of our action in a complex ecosystem.

Human relationships with water

In conclusion we have a deep and eternal relationship with water. The first relationship we have is dependence. The estimated annual global use is 4340 square km of water (POSTEL, 1992), and by the year 2000 about 70% of the world's population will be living close to the ocean. The dependence is both indirect, and direct. Beside the obvious ethical issue of just distribution of resources, which affects human relationships in the biosphere, there are further relationships between people and water.

Water has spiritual images of cleansing, purity, being used in most religions. People may also have sociobiological fondness for water, as with other parts of the environment. It is an advantage biologically to like water, and an advantage to value nature. Water appears to be refreshing for soul as well as body. An International Bioethics Survey was performed in 1993 in ten countries of the world, Australia, Hong Kong, India, Israel, Japan, New Zealand, the Philippines, Russia, Singapore and Thailand (MACER, 1994). Questionnaires included open-ended questions of what image people had of "life", "nature", and selected issues of science and technology, biotechnology, and genetics. One of the common themes seen in the comments and pictures of nature and life was water, especially rivers and ocean sunsets, with ponds containing birds, fish and other animals. This data confirms that water is a common image of nature.

Water has deep meanings for people, and by exploring this relationship we may not only understand more the relationship between living organisms, people and the environment, for aquaculture, fishing, and enjoyment, but also we may understand more of ourselves. In the global age we live in, the question of the common oceans and the required diplomacy, provides very important precedents and lessons for future global planning. It also provides a precedent for protecting biodiversity that is increasingly being recognised on the land too. It offers some hope that people can make the types of decisions that are necessary for thinking with international eyes, as does the spirit of international cooperation seen in the history of oceanographic research.

References

BUTTERWORTH, D.S. (1992): Science and sentimentality. Nature, **357**, 532–534.

CAIRNS, J. Jr. and G.R. LANZA (1972): Pollution controlled changes in Algal Protozoan communities, pp. 245–272 in Water Pollution Microbiology, R. MITCHELL (ed.), Wiley-Interscience, New York.

CUSHING, D.H. (1981): Fisheries Biology. A Study in Population Dynamics, 2nd ed. Univ. Wisconsin Press, Madison.

GESAMP (1982): Emigration of fish: a change in opinion. La mer, **23**, 1–5.

GESAMP (1990): The State of the Marine Environment, United Nations Environment Programme, Geneva.

HEDIN, L.O., L. GRANET, G.E. LIKENS, T. Ad. BUSHAND, J.N. GALLOWAY, T.J. BUTLER and H. RODHE (1994): Steep declines in atmospheric base cations in regions of Europe and North America. Nature, **367**, 351–354.

KERR, R.A. (1994): Iron fertilization: A tonic, but no cure for the greenhouse. Science **263**, 1089–1090.

MACER, D.R.J. (1994): Bioethics for the People by the People. Eubios Ethics Institute, Christchurch.

ODUM, H.T. (1971): Environment, Power, and Society. Wiley, New York.

POSTEL, S. (1992): Last Oasis: Facing Water Scarcity. Norton, Washington.

関　文威・小池勲夫（編）（1993）：海に何が起こっているか．岩波ジュニア新書195，岩波書店．東京