GUEST EDITORIAL

Conservation Concepts for the Seas and Coasts

If we had been fish, we might have named our planet 'Sea' instead of 'Earth'. We would have seen that it is made up of coral reefs, seagrass beds, and fields of sea-ice, with outer borders of mangroves and estuaries—and, only as an aside, the land. But we are giant terrestrial mammals and have conceived our planet as a wide range of terrestrial environments, leaving a oneness to the sea. Lately in our history, oceanographers and marine biologists have described many boundaries and many habitats within the sea; but the conservation community remains primarily landlocked. For example, the 1981 UNESCO poster exhibit 'Conserving the World's Ecosystems' identifies a host of terrestrial realms, biomes, and provinces, while leaving the 70% of Earth that is marine without texture! This terrestrially-based 'world' view is responsible for a large measure of the relative neglect of marine conservation and of the fundamental differences between land and sea that influence conservation of both biota and habitats.

The seas not only cover over two-thirds of our planet's surface, but also comprise Earth's dominant climatic force, without whose heat-regulating characteristics life on Earth could scarcely exist. This is not merely due to the seas' great mass of water, but also because of their intricate physical and biotic subdivisions. The Earth must be understood as a living system which maintains a unique atmosphere— *see* J. E. Lovelock, *Gaia: A New Look at Life on Earth*, Oxford University Press, New York, NY, USA: xi + 157 pp., 1979—even though such a concept recognizes that the Earth is subdivided, land and sea, into the mass-and-energy-processing units which constitute ecosystems. There can be little question that the global comprehension of ecosystems is a *sine qua non* of humanity's sustainable development*.

How might marine ecosystems and the interdependencies of land and sea be recognized? The science of oceanography is little more than a century old. Only very recently have satellites allowed us to perceive the true patterns of surface temperature, the waxing and waning of polar sea-ice, the extents of river run-off and coastal fronts, oceanic eddies, sea-surface topography, and chlorophyll concentrations on a synoptic, regional basis. Our 'textbook' understanding of marine and coastal ecosystems has not necessarily been proved incorrect, but it has been shown to suffer from much misleading oversimplification.

Unfortunately, the relative inaccessibility and complexity of marine systems places formidable obstacles in the path to further understanding. This is partly because of the great difficulty and expense of research in the hydrosphere, and partly because of the complexity of physical and biotic interactions in the sea's three-dimensional space and between the sea and land. A vast diversity of life-forms exists in the sea, where food-webs tend to be more complex than on land (aquatic food-chains commonly have more trophic levels than do terrestrial ones). Marine ecosystems are usually not delimited by rooted vegetation; their boundaries are mobile in time and space—a feature that has obscured boundaries and has implied a relatively uniform sea. But we now know that the sea is highly 'structured', and we are also beginning to recognize that portions of it interact so strongly with terrestrial environments that we are forced to reconsider the land–sea dichotomy which we have visualized in our ignorance (*see* B.P. Haydon, G.C. Ray & R. Dolan's 'Classification of Coastal and Marine Environments', *Environmental Conservation*, **11**(3), pp. 199–207 with 6 maps, 1984).

The 'Coastal Zone' and the 'Marine Revolution'

More than half of humanity lives in the 'coastal zone'. This zone is popularly taken as a narrow boundary between dry land and wet ocean, but on geological and biological grounds we must note that it includes the extents of the continental plains and continental shelves, comprising a part of Earth that totals one-and-a-half times the size of Africa! Life apparently originated in coastal seas, and there are entire segments of Earth's biota that live nowhere else; moreover, estuarine and anadromous fishes and hosts of invertebrates depend on coastal, land–sea interactions. The global carbon cycle has as its greatest 'sink' the continental shelves and slopes, and within the coastal zone occurs the greatest biological productivity on our planet. Is this zone a mere borderland, or may it be better perceived as a transitional ecotone where land and sea meet? Or may we go a step further and say that it consists of a major subdivision of Earth in its own right, equal to uplands and open oceans? There is probably no consistent answer to this last question, it being largely a matter of the perspective of the user. But it is worth asking.

Sixteen years ago I proposed the title of the 'Marine Revolution' to characterize the age in which we now live (G.C. Ray, 'Ecology, Law, and the "Marine Revolution"', *Biological Conservation*, **3**(1), pp. 7–17 and fig., 1970). For the first time in the history of our human species, technology now allows us to exploit (or, alternatively, to conserve) the entire globe—from pole to pole and to the depths of the oceans. Yet, we are still fundamentally hunter-gatherers of the seas and coasts. We cannot yet 'manage' marine or coastal ecosystems

* Cf. the editorial 'Mind Your Ecosystem!' in our issue of last Winter (*Environmental Conservation*, **12**(4), pp. 291–2, 1985), and various subsequent presentations.—Ed.

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analogously to forests or farms. This places us in a dilemma, vividly expressed a century-and-a-half ago by Lord Byron: 'Man marks the earth with ruin,—his control stops with the shore'. Scientists and managers alike know how difficult predictive management models are to construct and to test, but land-use practices are advanced to a state in which we can at least take steps to rebuild some ecosystems. Can we imagine the 'management' of a coastal water-mass? We are still at the stage of attempting to prevent beaches from eroding—with little success, I might add—and scarcely have any grasp of multiple-species fisheries management.

The imposing challenge of the Marine Revolution is to place human activities within the context of *knowing* the seas and coasts and their processes. We cannot continue to make naïve assumptions that land-derived models will suffice. This is as true for conservation as for development. The Law of the Sea is a case in point. It delimits the Exclusive Economic Zone as 200 nautical miles (370.4 km) from land; this cuts across many natural biological and physical boundaries in quite illogical ways. It can be made to work only by the exertion of extraordinary goodwill. Nevertheless, we can only count it as a major advance in that it does place accountability for a large portion of marine-resource use and abuse squarely in the laps of individual nations. Another example may be drawn from conservation. Marine parks and reserves still are predominantly based on land-derived models, with little emphasis on the size, phenology, and natural boundaries, of marine and coastal systems (*see* R.V. Salm & J.R. Clark's *Marine and Coastal Protected Areas: A Guide for Planners and Managers*, IUCN, Gland, Switzerland, pp. xiii + 302, 1984). I do not wish to criticize the present emphasis on 'protection' or recreation, but merely desire to emphasize that marine park and reserve implementation is perilously incomplete.

Need to 'Think Wet'

The World Conservation Strategy is especially suited to serve as a goal for national actions within the Exclusive Economic Zones. It requires that conservation should accompany development at every phase, with particular attention given to protection of ecological processes, biological diversity, and sustained use of resources. This will, increasingly, require emphasis on dedicated science to a degree that is still little appreciated by society at large. The challenge is apparent; if we cannot 'manage' marine and coastal ecosystems—that is, manipulate them according to our desires—then we must acquire new knowledge of them and conduct ourselves accordingly. A significant part of our dilemma is that society is driven by short-term economic and political thinking in which science finds little place. However, we absolutely require knowledge derived from science to make decisions that will stand the test of time, and especially for the seas and coasts over which we have so little control. Unfortunately, conservation often shares this short-term, crisis-oriented, rearguard basis, which hardly bodes well for its oft-cited goal of 'sustainable development'.

Long-term programmes in which knowledge provides the basis for action are notoriously difficult to instigate. This is as true for conservation as for the rest of society. We hear much of the merits of 'biological diversity', of 'conservation biology', and of the importance of establishing 'protected areas', etc., but the struggle to inculcate these concepts into the mainstream of decision-making and economics has barely begun. Also, our terrestrial bias has the consequence that discussions of these topics are often peculiarly out of touch with the special characteristics of marine biota and their ecosystems. 'Coastal-zone management' is dominated by planning for beach-erosion control, recreation, pollution, or very near-shore development (including protected-area establishment), but is too rarely taken in the comprehensive context mentioned above.

One problem of giving coastal and marine conservation the attention it deserves rests in large measure with our 'out of sight, out of mind' mentality—no one really lives *in* the sea. I believe that it rests even more with a general perception of lack of urgency. After all, the tropical forests are demonstrably being cut, but the seas are still viewed widely as overflowing with untapped resources. This is in stark contrast to the world-wide decline in *per caput* fishery yields and rapidly increasing world-wide coastal pollution and habitat destruction. To date, marine conservation has been epitomized by symbols, such as the saving of endangered species of whales—to which we, as large vertebrates, easily relate. 'The whale' is an important symbol, but the survival of whales is less tied, in the long-term, to direct exploitation than to understanding how anthropogenic stresses alter oceanic and coastal ecological processes.

It is time for the public, for conservationists at large, and for decision-makers in general (which is all of us!) to begin to 'think wet'. This involves expanding our perspectives to include the preponderant portion of this planet's surface, with as much emphasis on plankton as on whales, and as much on the coastal zone as on tropical forests. Unless this mental adjustment can be made, much more than whales may soon be at risk, and before we even know what happened.

G. Carleton Ray, *Research Professor*
Department of Environmental Sciences
University of Virginia
Charlottesville, Virginia 22903, USA.