On the third meeting of the LMR-GOOS Panel

Warren S. Wooster
University of Washington
School of Marine Affairs
3707 Brooklyn Avenue NE,
Seattle, WA 98105-6715, U.S.A.
E-mail: wooster@u.washington.edu

Dr. Warren S. Wooster is an oceanographer who studies interactions between climate variations and marine ecosystems. He is a professor emeritus at the School of Marine Affairs, University of Washington, in Seattle, and Co-Chairman of the Living Marine Resource Panel of the Global Ocean Observing System. His earlier academic appointments were at the Scripps Institution of Oceanography (1947-1973) and the University of Miami, and he has been at the University of Washington since 1976. Dr. Wooster was Secretary of the Intergovernmental Oceanographic Commission (1961-1963), President of the Scientific Committee on Oceanic Research (1968-1972) and of the International Council for the Exploration of the Sea (1982-1985), and the first Chairman of PICES (1992-1996). He continues to be involved in PICES as the Chairman of the Advisory Panel on Continuous Plankton Recorder survey in the North Pacific, member of the MONITOR Task Team and the National representative for the CCCC Implementation Panel. A detailed biography of Dr. Wooster can be found in PICES Press Vol.5, No.1 (January 1997).

The Living Marine Resource Panel of the Global Ocean Observing System (LMR-GOOS) held its third meeting in Talcahuano, Chile, on December 8-11, 1999. (Reports on the first and second meetings can be found in PICES Press, Vol. 6(2), 7(1) and 7(2).) GOOS, a global international program led by UNESCO's Intergovernmental Oceanographic Commission, is planning the monitoring of the world ocean with a view to provide useful now-casts (descriptions) and forecasts of ocean conditions of value to users of the ocean and its resources. The climate module is most advanced, followed by panels concerned with the coastal ocean and the health of the ocean. Planning of the living marine resource component has been slow to develop, largely because apart from sampling related to fish stock assessment, there are few routine observing programs of biological variables.

This LMR meeting was the first to be held in the southern hemisphere, by chance (!) during the austral summer. The first days were devoted to a review of relevant activities, including those of the PICES MONITOR Task Team, and of progress on initiatives taken at earlier meetings. Several ongoing programs were proposed for inclusion in the GOOS Initial Observing System. In the North Pacific, these included the monitoring aspects of the California Cooperative Oceanic Fisheries Investigations, observations on Station P and Line P west of British Columbia, and the Japanese and Korean LMR monitoring programs. Two programs under development in the PICES region were identified as LMR-GOOS pilot projects. The first is a Continuous Plankton Recorder survey recommended by the MONITOR Task Team of the PICES CCCC Program. This will start in March 2000, with five lines per year from Alaska to California, and one from Vancouver Island to the Bering Sea. The second project was proposed by Mexican colleagues who have initiated a study of Biological Action Centers (BACs), highly productive coastal regions along the west coast of North America. Successful implementation of LMR-GOOS will require use of existing databases, and the Panel initiated a review of those for selected ecosystem components - marine mammals, sea turtles, sea birds, zooplankton - not well covered in fishery databases such as those compiled by the Food and Agriculture Organization (FAO). Steps were proposed to promote the development of meta-databases for these components, and the help of PICES in this venture will be welcome.

The following comments on the general problem of monitoring related to living marine resources are taken from the draft report of the Talcahuano meeting. The output of a practicable monitoring system might include routine information on the time and space variability of the surface layer physical conditions (e.g., T, S, wind forcing, circulation), primary production (derived from remotely-observed surface color), and community structure of larger zooplankton (from CPR), plus irregular information on the abundance and distribution of higher trophic levels (from observers and from fishery data). Using this output, a centralized mechanism for data compilation and analysis should be able to provide useful now-casting. Monitoring systems for the open ocean, the coastal ocean, and inshore will differ significantly in the frequency of observations in time and space and to some extent in the variables observed. These differences will reflect the nature of the time and space gradients of these properties as well as the uses to which the data will be put. In order to obtain a useful description of the variability, sampling frequency will normally increase in passing from the open ocean to the inshore. While the physical variables of interest will be much the same offshore and inshore, the numbers and types of necessary biological observations will also increase towards inshore. The demand for products, and hence the funding, of monitoring systems can also be expected to be greatest inshore. Therefore, it seems appropriate to speak in general terms of three nested monitoring systems.

The open ocean system extends shoreward to where presence of the coastal boundary is felt, generally to the edge of the continental shelf. The coastal ocean system then extends from there to the inshore system where terrestrial influences tend to dominate. These boundaries fall roughly at about 200 miles and about 3 miles from the land-sea boundary. Note that continuity in space between observations can be provided in two dimensions by remote sensing and in one dimension by underway recording or by towed devices. At fixed locations, continuity in time can be provided by recording devices.

In all monitoring systems for LMR purposes, there is a need for information on the atmospheric forcing, ocean velocity field, and distributions of temperature and salinity at the surface and in the surface layer. Such information is also required for monitoring of ocean climate and health of the ocean. In addition, biological studies also utilize information on the distributions of dissolved oxygen and of nutrient substances such as inorganic compounds of nitrogen, phosphorus, silicon, and iron. For assessment of living marine resources, a case might be made for quantitative sampling at all trophic levels from bacteria to whales. The problem is to select from these possibilities the most cost-effective suite of observations that will yield information of direct value to users of living marine resources. An ocean basin would be overflown by satellites measuring sea surface height, winds, temperature, and ocean color. Surface weather would be reported by voluntary observing ships reporting to the World Meteorological Organization (WMO) network. On transects selected to cross major features of circulation or of changes in properties (e.g., ocean fronts), selected merchant and research ships would tow plankton recorders and drop expendable BTs at appropriate intervals (e.g., hourly). In a minimal system, other ecosystem components and conditions, from top predators and commercial finfish down to phytoplankton and nutrient chemistry, would be observed opportunistically at irregular intervals.

A composite picture at quarterly intervals could be built on the framework provided by the satellite data and transect observations, with the irregular biological data inserted where applicable. This analysis, which would provide the basis for elaboration of useful products, would be made at appropriate basin-scale regional analysis centers.

Part of the problem is to transform data resulting from feasible monitoring schemes into useful products, now-casts and forecasts of the state of marine ecosystems of interest and their living marine resources. Methods for this transformation largely remain to be developed. To produce forecasts will require the use of models relating knowledge of the present state of the ecosystem, including the history of its development and rate of change, with the production (including recruitment and growth) of species of interest. Development of such models is a necessary ingredient of research (e.g., GLOBEC) that supports the development of GOOS. As in the case of now-casting, data compilation and analysis is a necessary function of regional analysis centers. The analysis of data resulting from the LMR components of GOOS will require bringing them together with relevant data from other sources in a description of the changing regional ecosystem of concern and of the processes causing the changes. The compilation and interpretation of data in a holistic analysis of an ecosystem is an essential element of a monitoring system.

It is proposed that such analyses be made in regional analysis centers, where scientists of appropriate disciplines from participating countries would undertake the work. Work in these centers could also serve a central role in capacity building. Such an analysis center would receive climate, oceanographic, and fisheries data from national and international sources, and on a regular basis would prepare descriptions of the current state of the ecosystem and recent and longer term changes therein, including climate forcing, ocean physical conditions and circulation, and abundance and distribution of various biological components of the system. To the extent that available data and understanding of the system permitted, forecasts would be made of probable future conditions of these same ecosystem components. The products of the now-casting and forecasting analyses would be regularly provided to participating countries and organizations and would be made widely available on the web. Results of the analyses would also be used for improving the observational system. As a first step in the development of regional analysis centers, it was proposed to request several organizations, including PICES, to initiate discussions of design and possible implementation of such centers in their regions of interest. These discussions should include assessment of present exchange arrangements for climate, oceanographic, and fisheries data relating to those regions.

The LMR Panel will have its fourth meeting in Honolulu in early May 2000. It is anticipated that before the end of 2000, this panel will be amalgamated with panels on the coastal ocean and on the health of the ocean, and planning for this merger will take place in mid-May. It will be a challenge for the LMR Panel to ensure that the needs for monitoring living marine resources are preserved in the planning of the unified panel.