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## Marine Scientific Research

In the Law of the Sea negotiations, which began in 1973, delegates have been more concerned with national pride, national rights, and national resources than with the "common heritage" concept. The most notable effect of the negotiations so far, after five long and difficult sessions, has been the movement toward increased coastal state jurisdiction through the very considerable extension of national boundaries seaward. Swept up in this move to a 200-mile economic zone is the question of jurisdiction over scientific research. Customary law clearly supports complete freedom for scientific research in the water column beyond the territorial sea. In the current Law of the Sea negotiations, however, proponents of the economic resource zone concept argue that authorization for all scientific research must go along with the regulation of the exploitation of fisheries and mineral resources from the zone. The 200-mile economic zone encompasses approximately 37 percent of the ocean area (Fig. 1).

Nature knows no artificial boundaries. Ocean phenomena do not stop at nation-

# The Marine Scientific Research Issue in the Law of the Sea Negotiations

Ocean Policy Committee of the  
Commission on International Relations NAS-NRC.

Almost a decade has passed since Arvid Pardo, the Maltese Ambassador to the United Nations, startled the diplomatic world by his proposal that the United Nations declare the seabed and its resources "beyond the limits of present national jurisdiction" to be "The Common Heritage of Mankind" and, thus, not subject to appropriation by any nation for its sole use.

This phrase, "The Common Heritage

of Mankind," rang throughout the world with great resonance. At the 25th General Assembly in 1970, after 3 years of debate, the United Nations formally adopted the concept of the oceans as "The Common Heritage of Mankind" and voted to convene, within 3 years, a Third United Nations Law of the Sea Conference to formulate an international sea law treaty that would translate this vital concept into reality.

This statement was drawn up for the Commission by Paul Fye, Woods Hole Oceanographic Institution; John Knauss, University of Rhode Island; Warren Wooster, University of Washington; and William Burke, University of Washington.

al boundaries, or stop at the edge of the continental shelf. Scientific curiosity does not cease as one moves from deep water to shallow water, or from one area of the deep sea into the economic zone. The importance of scientific research to a better understanding of the marine environment is axiomatic. Since marine scientific research yields knowledge of social utility, it is difficult to understand how any state can erect barriers that restrict mankind from learning what must be known about the ocean in order to optimize its use for the benefit of all.

Because ocean phenomena do not respect national boundaries, if an individual coastal state has control over marine scientific research projects in its zone, it can control the flow of benefits of that proposed research to neighboring states. Thus, the refusal of one state can deny the benefits of new knowledge to others. Four examples of present research programs follow:

*Example 1.* It is now generally accepted that changing patterns of ocean currents have a profound effect on our climate. It is believed that the causes of extraordinary cold or warm years, periods of drought, or extra heavy rainfall, can be traced back to the ocean. However, it will probably be many years before the complex set of interactions are sufficiently well understood so that it will be possible to make useful forecasts.

One area where the relationship may be less complicated, and thus the opportunity for useful forecasts may occur sooner, is the timing and intensity of monsoon conditions over India and Pakistan and their relation to the water temperature in the Arabian Sea which, in turn, is controlled by ocean currents along the east coast of Africa. Indian agriculture is dominated by the timing and rain content of the southwest monsoon. Successful forecasting of the monsoon requires an understanding of the ocean-atmosphere interaction, and monitoring of the ocean and atmosphere over much of the Arabian Sea. Achievement of the necessary understanding will require research and monitoring of ocean temperatures and currents off the coasts of Kenya, Somalia, South Yemen, Oman, Pakistan, and India. To the extent that undue restrictions are applied to marine scientific research in the western Arabian Sea, achievement of the capability to forecast the monsoon will be correspondingly delayed.

*Example 2.* The ocean floor off Northwest Africa is a region of rich biological productivity because cold, but nutrient-rich, water is "upwelled" from beneath the surface at certain times. The reasons

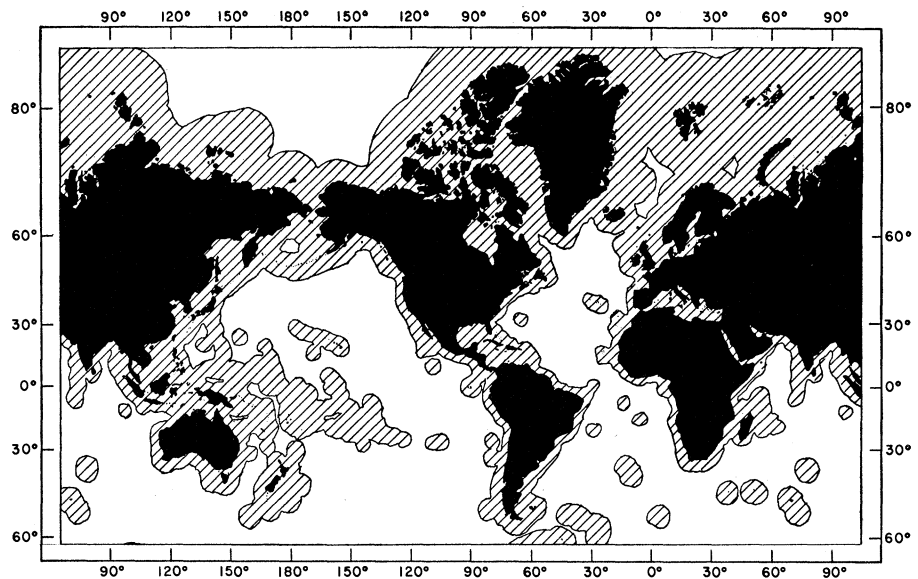


Fig. 1. The area of the oceans encompassed by a 200-nautical-mile economic zone. Redrawn from a chart published by the Office of the Geographer, U.S. Department of State.

for the occurrences of upwelling south of Dakar have perplexed oceanographers because the timing of the upwelling does not seem to coincide with the wind patterns that are usually associated with this phenomenon. Recently tentative interpretation of limited evidence suggests that the upwelling in these areas is controlled by complex wavelike subsurface ocean currents that radiate out from the equator in the Gulf of Guinea. This hypothesis is now undergoing preliminary testing in a cooperative program between scientists from the United States, France, and the Ivory Coast. If these tests are successful, the next step will probably require a large research program that will include oceanographic studies within the 200-mile economic zone of all of the coastal states along the Gulf of Guinea from Congo, Gabon, Equatorial Guinea, Cameroon, Nigeria, Benin, Togo, Ghana, Ivory Coast, Liberia, and Sierra Leone, as well as the coastal states that have the most to gain from such a study, which may include Guinea, Guinea-Bissau, Gambia, and Senegal. If, as the Revised Single Negotiating Text permits, a significant number of the coastal states surrounding the Gulf of Guinea refuse to sanction such studies, the program will be in grave difficulty.

*Example 3.* The most productive fishery in the world centers off Peru and extends to Ecuador and Chile. Periodically the oceanographic conditions that maintain this rich fishery change; cold, nutrient-rich water is no longer brought up from below and warm water moves in from the North. This condition is referred to as "El Niño." A major "El

Niño" such as occurred off the coast of Peru in 1972 resulted in a drastic reduction of the fisheries and concurrent economic loss. The ability to predict ahead and to prepare for a major "El Niño" is of great economic importance to Peru and to other nations.

Studies to date suggest that "El Niño" is not an isolated phenomenon, but that it is closely linked to changing wind patterns and ocean currents in the tropical Pacific. Thus the ability to develop a successful forecast of "El Niño" requires access to weather and oceanographic observations from the entire South Pacific area. In particular, it will require oceanographic observation from the economic zones of Colombia, Ecuador, and Chile, as well as Peru.

*Example 4.* A few years ago, the Woods Hole Oceanographic Institution made a series of studies along the continental shelf of West Africa. Permission was requested from all the necessary coastal states for the R.V. *Atlantis II* to perform the research. The primary purpose was to accumulate knowledge about the geologic history of the West African continental margin area and the geologic structure of the shelf. At the same time, the study provided some evidence about which shelf areas might be more likely than others to have oil and gas resources. Two coastal states refused to allow the Woods Hole ship to work on their continental shelf. Although the program was not a failure because of these two refusals, the results were incomplete and interpretations were more difficult. The problem is somewhat analogous to attempting to solve and then interpret a jigsaw puzzle

with a number of missing pieces. The larger the number of missing pieces the more difficult the task, and the more likely the interpretation will be wrong, even in those areas where the research was completed. An analogous program off the coast of East Africa and the Arabian Sea has never been carried out because of the negative response to preliminary inquiries from a significant number of states in the region.

## **Present Status of Marine Scientific Research**

As the protracted Law of the Sea negotiations continue, more and more coastal states are adopting restrictive positions concerning scientific research. In the past year the records of the U.S. National University Oceanographic Laboratory System, which coordinates the activities of the academic fleet, indicate that about half of the scheduled cruises for work in waters over which other nations claim control have been canceled because requests were denied, or have been hindered sufficiently to prevent the cruise from taking place. Some requests were never acknowledged; sometimes approval came too late for the program to be successfully conducted. At least 18 nations were involved in one way or another in inhibiting science in this way. It is believed that oceanographic vessels from other countries have suffered from a similar problem.

Unless there is a significant change in the Revised Single Negotiating Text during the next session of the Law of the Sea negotiations, it seems clear that these denials and hindrances will become even more numerous. The result will be that urgently needed research on pollution, fisheries management, and the understanding of climate, will not be undertaken in the economic zones of countries that are consistently difficult to deal with. No one should underestimate the importance of these areas. The 200-mile economic zones are the areas of major ocean currents, the regions where perhaps 90 percent of oceanic biological activity occurs, where the interaction of atmosphere and ocean in determining climate is most effective, where most of the world's undersea earthquakes occur, and where the answers to some of the most complex and challenging problems concerning the history of the earth are to be found.

The concern and unhappiness of the U.S. oceanographic community about the present state of affairs is manifest. This community has attempted to ex-

plain the problem in a number of international forums including the United Nations Law of the Sea Conference. Sympathetic as this community is to the real and honest concerns of many countries, we believe that it is in the interest of all countries to support the principle that the search for knowledge about the sea, openly conducted and freely disseminated, is to the benefit of all mankind and must be preserved with great care.

In the opinion of the oceanographic community, the essential objectives to be secured in any treaty concerning scientific research in the economic zone are the following:

- 1) To establish the right to conduct all research beyond the territorial sea (except for carefully specified and limited types).

- 2) To provide predictability in the response of the coastal state so that the planning and conduct of research are facilitated. Predictability must be assured in determining (i) whether a particular project needs consent, and (ii) whether consent will be granted. Criteria for these decisions must be specific, objective, and timely.

- 3) To secure protection for the researching state or organization against arbitrary or unreasonable restrictions resulting from differences in interpretation of conditions and obligations.

- 4) To ensure that the procedural provisions of the treaty provide predictability in the planning and in the conduct of research.

- 5) To maintain the traditional practice to publish and disseminate research results.

In return, the oceanographic community believes it should accept the following responsibilities:

- 1) To keep the coastal state fully informed concerning the nature, objective, schedule, and participants of the proposed research project.

- 2) To ensure the rights of the coastal state to be represented in the program.

- 3) To provide the coastal state with preliminary and final reports.

- 4) To share the data and samples.

- 5) To seek to provide the coastal state with assistance in interpretation of results.

The Revised Single Negotiating Text of the Third Committee provides for substantially similar obligations as proposed by the oceanographic community, but does not meet the five essential objectives. A brief explanation of the changes needed in the Revised Single Negotiating Text is attached.

In summary, under the Revised Single Negotiating Text the coastal state is in

complete control; its consent is required for all oceanographic research conducted in its economic zone or continental shelf. The Text leaves decisions regarding what research activities may be conducted and where they may be conducted, in significantly large areas of ocean space, to individual coastal states, and offers no assurance that the coastal state will respond in a predictable manner to proposed research programs. Even if the coastal state consents to the research activity, there is no assurance that the consent will not be withdrawn while research is being conducted. Even beyond these restrictions the Text goes so far as to permit the coastal state to prevent publication of certain research.

For these reasons many oceanographers feel that they would be better with no treaty than with the present treaty. The present treaty imposes a highly complex series of obligations on the researcher, but fails to provide for any right to conduct marine scientific research in the economic zone. Unless changes are made in the Revised Single Negotiating Text, the forthcoming Law of the Sea will cripple future marine scientific research which will be critical to the survival of the oceans and mankind.

## **Appendix**

Although conforming amendments are required in the Committee II text, the key articles in the Committee III text are 60, 61, 64, and 65.

Article 60 sets out a consent regime. Paragraph 1 states that "marine scientific research activities in the economic zone or on the continental shelf shall be conducted with the consent of the coastal State." Paragraph 2 of Article 60 states that "the coastal State shall not withhold its consent unless that project: (a) bears substantially on the exploration and exploitation of the living and non-living resources; (b) involves drilling or the use of explosives; (c) unduly interferes with economic activities performed by the coastal State in accordance with its jurisdiction; and (d) involves the construction, operation, or use of artificial islands, installations and structures . . . ." Article 60 must be modified so that the conditions under which the coastal state consent is required are clarified and so that the article supports evidence of a right to conduct certain research. Modifying this provision will secure the essential objective of the oceanographic community to establish the right to do all research beyond the territorial sea except for carefully specified and limited types.

Article 61 requires coastal state consent to publish or make internationally available the findings of a research project "bearing substantially upon the exploration of the living and non-living resources of the economic zone and on the continental shelf." This provision is harmful because it provides the coastal state the right to restrict or prevent publication of research results thereby denying to the investigator and to the entire international community the great advantages of established scientific practice and tradition.

This article must be deleted to meet the essential objective of publishing and disseminating research results.

Article 64 provides for a tacit consent regime. The Text requires 4 months of advance notification to the coastal state. The research may proceed with a research project unless, within 2 months of the original notification, the coastal state has communicated to the state or organization conducting the research:

1) the withholding of consent because the proposed research program bears substantially upon the exploration and exploitation of the living and non-living resources;

2) a statement to the effect that "the information provided regarding the nature or objective of the research project is inaccurate and does not conform to the manifestly evident facts"; or

3) a request for supplementary information "relevant to determining more precisely the nature and objectives of the research project."

Although the theory of tacit consent could be useful, the qualifications placed in this article on the theory render it virtually meaningless; for example, a coastal state may continuously request additional information. Only by revising this article can we maximize acceptable predictability in the response of the coastal state so that the planning and conduct of research are facilitated.

Article 65 authorizes a coastal state to stop a research project already under way. It says in effect that if the coastal state has reason to believe that the work of the researching state is different from what the researching state said it was going to do in its original notification, the coastal state can stop the program. Furthermore, the coastal state can also stop the program if it decides that the researching

state has not fulfilled obligations from a prior project. (For example, not providing reports and results of previous research programs in the area.) This draft article must be sharply modified so that the conditions under which cessation of research can be required are clarified and so that it provides acceptable predictability and secure protection for the researching state against unreasonable restrictions.

Oceanographers are pessimistic about how the Revised Single Negotiating Text will be interpreted and its potential effect on the conduct of marine scientific research. The following four scenarios exemplify the regime now proposed in the Revised Single Negotiating Text.

*Example 1.* The researching state sends notification to a coastal state about a proposed fundamental study on the dynamics of upwelling which it is planning in the coastal state's economic zone. Under paragraph 2, Article 60, the researching state assumes the coastal state cannot refuse consent. The coastal state replies with a statement that says in effect, come ahead, but in our view this research bears substantially on the exploration and exploitation of our living resources, and, therefore, does require our consent. Furthermore, we insist on clearing your publication after you have completed the research (Article 61). Such an action would effectively halt that research program.

*Example 2.* Same program, different coastal state; the coastal state continues to ask for more information under Article 64 until the upwelling season is passed. Such action effectively stops that research program.

*Example 3.* Same program, different coastal state; there is a major fishery in the upwelling area, and the coastal state responds to the no-

tification with a message which says in effect, we think the research program will disturb our fishing effort. Thus, consent is denied under Article 60, paragraph 2 (c) since the program will "unduly interfere with the economic activities performed by the coastal State."

*Example 4.* Same program, different coastal state; no problems are raised, and the program gets under way. However, as the ship pulls into the local port it suddenly finds that the program cannot continue until the researching state does more work in helping the coastal state in assessing the results of a different program done the previous year.

These four scenarios offer only a slight indication of the problem that could face the scientists. An international regime must be established that serves the world community interests in the oceans and its resources. The legal regime proposed in the Revised Single Negotiating Text, which enables coastal states to forbid, to control, or to halt marine scientific research in 37 percent of the ocean, is contrary to this interest (1).

#### Notes

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#### NEWS AND COMMENT

## NSF Science Education: Basic Issues Still Unresolved

The recently embarrassed and embattled science education directorate of the National Science Foundation (NSF) is getting a new head. The yet unannounced choice for assistant director for science education is reportedly F. James Rutherford, professor of science education and head of the division of education in the School of Education of New York University. The NSF post is a presidential appointment which requires Senate confirmation; the nomination is said to be in the works and is expected to be made public soon.

Rutherford's appointment seems unlikely to incite bitter opposition. He is regarded as something of a compromise candidate since he has solid credentials

as an educator, which will please that constituency, but is not identified as a member of the curriculum development clique, which might displease critics in Congress and out.

Rutherford in more ways than one has his work cut out for him. He will take over the science education job at an interesting time, since President Carter is expected to do something about his campaign pledge to create a Department of Education.

Rutherford will succeed Harvey Averch, who is moving into another assistant director's job as head of the directorate for scientific and technical affairs (STIA). The appointments are part of a series of moves by new NSF director

Richard C. Atkinson to fill top management jobs in the Foundation. Averch was shifted to the education directorate in 1975 at a time when NSF science education programs were under attack in Congress and Averch was perceived to be filling a troubleshooter's role.

The trouble was precipitated by former Arizona Congressman John B. Conlan, who began by criticizing an elementary school behavioral science course developed with NSF support (*Science*, 2 May 1975) and moved on to a general condemnation of NSF's pre-college curriculum programs and peer-review practices.

During his tenure, Averch engineered a major review of precollege programs, a revision of management procedures for curriculum development projects, and a reorganization of the directorate.

Science education programs are currently having a considerably quieter passage through the authorization process in Congress than they have had for the past 2 years. This may be attributable in part to Conlan's no longer being in Congress; he resigned his seat to run for the Senate