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Opening Address: The Sea and Its Resources, June 25, 1973

Invited Paper: The International Ocean, June 28, 1973

by

Harris B. Stewart, Jr.  
Atlantic Oceanographic and Meteorological Labs  
National Oceanic and Atmospheric Administration  
Virginia Key, Miami, Florida, U.S.A.

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## THE SEA AND ITS RESOURCES

Opening address on the first day of the AAAS Session "The Sea and Its Resources", Mexico City, Monday, June 25, 1973, by Dr. Harris B. Stewart, Jr., Director, Atlantic Oceanographic and Meteorological Laboratories, NOAA, Miami, Florida, U.S.A.

My great personal friend and colleague the late Wibb Chapman once said that the people of the world can be divided up into land people and ocean people. Most of you here today are, in fact, ocean people; whereas the major decisions about our ocean are generally made by land people. I believe this really is the crux of the problem we face today in our dealings with the ocean and in our attempts to understand the ocean and its resources. We as ocean people are trying to identify the resources of the ocean and determine how they can be most wisely used for the benefit of mankind. Most of us as ocean people are absolutely and totally dedicated to the sea. Many of us divide our time between the excitement of learning about the ocean and how it works, its dynamics, its populations, its many and interesting interactions with the atmosphere above and the earth beneath. And, the rest of our time seems to be devoted to convincing the land people that the ocean is important and that its resources and their recovery are most important for the general benefit of mankind.

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Today and the following three days will be devoted to papers on the sea and its resources. These are fascinating topics and, as you know from reading the program, you have an outstanding list of participants who will bring to you the results of their research and of their thinking on this subject. Dr. Augustin Ayala Castanares and Dr. Arthur E. Maxwell have assembled a distinguished group of speakers, and I personally am quite looking forward to listening to them. It is my hope that I will receive information from these sessions which I can then use when I return to the United States to try to convince my own government of the importance of increasing our support for the understanding of the sea and its resources. I would hope too that those from the other countries represented here will be able to take back to their own countries a new feeling for the importance of the sea and its resources, a new enthusiasm and vigor for promoting these activities, and a new dedication to the basic principle that the sea is extremely important for mankind and that we, the ocean people, must continue our fight to educate the land people on the need to get on with the tremendous task of increasing our understanding and utilization of the sea and its resources.

The overview papers today by the Chairman of each of the sessions to follow tomorrow, Wednesday, and Thursday will provide introductions to the more detailed papers on resources

and their management in the coastal zone, the ocean and weather, mineral resources, living resources, and the conduct of ocean affairs. In the time allotted me, I would like to highlight briefly each of the areas that will be covered in detail by the subsequent sessions - set the stage, if you will, for the speakers who will follow.

In the United States an area considered as the coastal zone has of late received tremendous attention. Not only is the coastal zone the area where the sea and the land meet, but more importantly it is the zone where the sea and man meet, and therefrom derive a good number of problems. You can use a coastal estuary as an open sewer that flushes itself in a halfhearted way twice a day; but if you do, do not expect the swimming to be as pleasant as it was. You can dredge your estuaries for navigation and can seal off the shoreline with concrete bulkheads and fill in the mangrove swamplands behind them; but if you do, do not expect the sport and commercial fish that spend part of their life cycles in the mangrove shallows to be as abundant as they once were. So the problem is one of man's conflicting uses of his coastal resource and the working out of means whereby valid value judgments made by the land people can be based on the understanding of the coastal zone's many interrelated processes - and understanding that must be supplied to them by the ocean people.



For many years the meteorologist studied the atmosphere right down to the surface of the sea and stopped, while the oceanographer studied the ocean right up to the surface and stopped. During that period, there was considerably more interaction between the ocean and the atmosphere than there was between the oceanographer and the meteorologist. Fortunately this has changed over the years, and both meteorologists and oceanographers are turning more and more attention to the fascinating and complex exchanges that take place through the surface of the sea. This research will in time form the basis for improved weather forecasts, for increasing our ability to predict the path of destructive storms such as the hurricanes that annually rampage through the Caribbean and the Gulf of Mexico, and will provide the actual numbers that are needed by those working with numerical models for computer simulation both of hurricanes and of the larger global circulation in both the ocean and the atmosphere. Satellite observations have been of great assistance in this work, and it is still the imaginative and capable researcher that will make the real contributions to our understanding of the complex air-sea interaction and the role it plays in the dynamics of both the atmosphere and the ocean.

Although the problems resulting from the complex uses of the ocean in the nearshore area are demanding more and more time and effort from ocean people in those countries where the

population surge has resulted in heavy coastal concentrations of people and industry, and although the ocean is the major driving force for our global weather, still most of the land people when they think of the resources of the sea think of minerals and food. For too long a time the press was full of phrases like "the untapped treasure troves on our continental shelves" and "we can feed the world's starving millions from the protein in the sea". In short, the glamor of the potential mineral and living resources of the sea received considerably more attention than did the hard work of evaluating these resources and removing the scientific, technical, legal, economic, and institutional barriers to their effective recovery. But the glamor era is over. The time has come to survey and map our continental shelves geologically and geophysically, to sample and analyze our shelf sediments, and to continue our investigation of the potential mineral resources of the deep sea. The Deep Sea Drilling Project sponsored by the United States National Science Foundation has provided new insight into the nature of the upper crust beneath the sea and has advanced considerably the technology that will be needed for deep-sea recovery of seabed resources. But there are still scientific, technical, and legal battles that must be fought and won before we can realize the full potential of the so-called non-renewable resources of the sea.

It is without a doubt the living resources that command the attention of more researchers than any other aspect of the resources of the sea. The present problems in marine fisheries are related mainly to the tasks of assessing and monitoring the resource and then of working out the international agreements and other mechanisms that will assure wise allocation, conservation, and management of the resource. We need better catch and effort statistics, we need a better understanding of the reasons for the many observed fluctuations in the populations of commercially important species, we need to know much more of the relationship of the fish to their environment, and we need to know more of the life histories of the organisms themselves. We need to learn how to breed better varieties of fish, to control predators and pests, and how to breed and raise fish in controlled environments. The land people will provide the markets if the ocean people can provide the fish and living resources to them at a cost that allows everyone along the line to make a profit and still have a desirable end product available to the final consumer at a price that is competitive with other sources of protein.

"Oceanography" - or "oceanology", as it should more properly be called - is the science that studies the ocean. But as we have come to realize that it takes more than just scientists studying the sea to utilize effectively its resources, the term

"ocean affairs" has come into vogue. Recently, for example, the United States has formed an Ocean Affairs Board under the National Academy of Sciences. Ocean affairs covers the full spectrum of relationships among those concerned with the ocean, its study, its resources, and their use. It entails such things as the organization, conduct, and management of research, the legal aspects of the sea, the development of oceanographic capabilities, international cooperation, and the translation of research results into improved uses of the sea, operations at sea, and recovery of marine resources. It is ocean affairs that ties the ocean people in with the land people, and it is a facet of any consideration of marine resources that can not be ignored if marine research is to have benefits to anyone other than the researcher himself.

The sea does have great wealth. But it is not an easy wealth to recover. It is, however, a wealth that we must understand and utilize with considerably more effectiveness than we have in the past. The task is a big one and will require the cooperative efforts and support of the many maritime nations and of both the ocean people and the land people.



## The International Ocean

by

Harris B. Stewart, Jr., NOAA Atlantic Oceanographic and Meteorological Laboratories, Virginia Key, Miami, Florida, U.S.A.

For delivery June 28, 1973, at the meetings on The Sea and Its Resources during the American Association for the Advancement of Science meetings in Mexico City

As those of you know who have spent time at sea, it is a big ocean. It covers nearly two thirds of planet Earth. As man has learned to orbit himself in space about his planet, he has become more aware of the fact that we live on a water planet. This really is Planet Ocean, the water planet. Because the oceans cover so much of our Earth, it is important that we who live on the relatively dry one third of this planet develop cooperatively a much better understanding of that watery other two thirds.

Over the past several days, you have heard of the many reasons we should understand the ocean much better than we now do. These include the management of the resources of the coastal zone, the improvement of weather forecasting, the recovery of the sea's mineral resources, and its vast living resources. In today's tight budgetary climate, I suppose that we have to justify the expenditure of national treasure in terms of solving today's practical problems. Thus, we tend to think of marine

research only as a means for recovering resources, of improving forecasts, removing the spectre of pollution, national defense, and other such practical things. I would submit to you today that there are two other reasons for studying the ocean, reasons that your own budgetary people would probably not consider very important, but I do, and most of the world's ocean people also do.

The first of these other reasons is the simple satisfaction of man's innate curiosity about the world around him. Even as a small boy will turn over a stone just to see what is under it, so too will man continue to be curious about his world-girdling sea and the processes and life within it. This is good, this curiosity, and I contend that any society that ignores the intellectual challenges to concentrate strictly on satisfying its requirements for creature comforts is doomed. This is indeed a valid reason for so many of us to have devoted our professional lives to understanding the ocean, but it is hardly sufficient justification for the bureaucrats and administrators that must account for the expenditure of public funds.

The second of my other reasons for studying the ocean that is appealing to those of us who do, but is generally as poorly received by the budgeteers as is the pure satisfaction of curiosity, is the sheer pleasure of international cooperation. For the oceanographer, international cooperation is ever-exciting.

It is fun. In the past three years, I have been Chief Scientist on two cruises aboard the NOAA ship DISCOVERER which were actually little United Nations afloat. SCOR Working Group 15 working on the international intercalibration of methods for measuring photosynthesis at sea brought to the DISCOVERER scientists from Japan, Germany, Russia, France, Australia, Scotland, Denmark, and Norway. We were all on the same ship at the same time, and our late night informal sessions in the wardroom were exciting and productive. Regardless of the relationship your government might have to his government, when the two of you are talking science over hot coffee on a ship in the middle of the Caribbean Sea, the things that unit you as people and as scientists seem much more important than the things that might divide you as nations. I think that all of us ocean people know this feeling of international camaraderie that pervades the community of ocean scientists. It is a comfortable aspect of marine science that oceanographers know but that is probably known by few other sciences and certainly not by most of those in positions of national importance relative to international affairs. But, like the satisfaction of curiosity, you can not convince these that control the budgets that international cooperation is important and requires funding just because the oceanographers themselves enjoy it.

For the budget people, we must rely on the other valid reason

for international cooperation in marine science, and that is that no nation can by itself ever hope to learn all about the sea or to understand its processes. We really need each other if we ever are to develop our oceanic understanding to a meaningful level. That this is a viable mechanism was proved by the Interantional Cooperative Investigation of the Tropical Atlantic some ten years ago, or ICITA as it was known. The International Indian Ocean Expedition - IIOE - proved it again in 1964. In 1974 we will prove this concept again with the GARP Atlantic Tropical Experiment - or GATE. Even now we are proving it with CICAR - the Cooperative Investigation of the Caribbean and Adjacent Regions.

For the American countries, both Latin American and North American, CICAR has been an interesting exercise. In CICAR we somehow never got around to delineating a scientific problem that needed international cooperation to find a solution. The mission of CICAR as we interpreted it was to increase our understanding of the Caribbean Sea and the Gulf of Mexico, their physical oceanography, fisheries, biology, geology, marine chemistry, and meteorology. I believe that we have done this. As the field phase of CICAR developed, it became evident that there were four major areas where international cooperation was needed. These were 1) field operations, particularly where synoptic or multi-ship projects were involved, 2) data exchange



among the participants, 3) planning, and 4) education and training.

In geological and geophysical investigations, there is no requirement for synoptic observations as there is in physical oceanographic operations, but it is necessary to know where the other fellow is working, how his lines might augment yours, and how your competence and his might be merged to do a better job scientifically. This worked well in CICAR, and in particular the geophysical cooperation among the U.K., the Netherlands, and the United States resulted in considerably more knowledge of the Antilles Arc than if each of us had tried to work by himself. It was, however, in physical oceanography that CICAR proved again that cooperation in marine science really pays off. In a series of so-called CICAR Survey Months, as many ships as could be there occupied standard sections set up by the International Coordination Group for CICAR. Probably the Standard Section extending from Cabo San Antonio, the western tip of Cuba, across the Yucatan Channel has received the greatest attention, and we will know considerably more of the complex circulation pattern of the northwestern Caribbean, Yucatan Channel, and the Gulf of Mexico with its Loop Current because of the high degree of international cooperation involved. In the second CICAR Survey Month (April-May of 1972), for example, some nine ships and two aircraft were making standard observations along

the CICAR sections. Included were the Colombian vessel, SAN ANDRES, the Cuban FOTON, the Mexican VIRGILIO URIBE, the Netherlands LUYMES, the U.S.A.'s ALAMINOS, GULF STREAM, and VIRGINIA KEY, and two Soviet ships, AKADEMIC KURCHATOV and VASSILY GOLOVNIN. That is true international cooperation in marine science, and I suspect that when the analysis of all the data is complete and the results are studied, we will find that these CICAR Survey Months have provided a quantum jump in our knowledge of the circulation of the Caribbean and the Gulf of Mexico.

CICAR data exchange has been handled through the U.S.A. National Oceanographic Data Center and biological samples through the recently established Mexican Biological Sorting Center (Centro de Preclasificacion Oceanica de Mexico). Although both centers have had some difficulty in getting the scientists to submit their data and samples, this has been no more than any other data center normally encounters, and these both have worked well. International planning has been the third area where international cooperation was essential. This included settling on standard nets and procedures for collecting eggs, larvae, and juveniles, agreeing on the CICAR Standard Sections, establishing standard formats for data reporting, establishing a standard CICAR biological station, and the establishing of a system whereby each country informs all the others of its planned work so that

additional cooperative arrangements can be made.

Finally, the area of education and training was one where international cooperation was needed. Here it was primarily a case of the bigger nations with more and larger ships helping in the education and training of scientists from smaller countries with less sea-going capability. On NOAA-Carib, for example, the NOAA Ship DISCOVERER carried out a three-month cruise specifically for the education and training of marine science students and faculties from the Caribbean nations. Some 401 Latin American and Antillian students and scientists worked aboard the DISCOVERER for periods of from one day to two weeks. On NOAA-Carib, as the cruise was called, scientists from each of the six countries involved prepared their own research and training plans and then carried them out aboard the DISCOVERER with assistance from the small staff of U.S.A. specialists aboard. UNESCO provided some \$2,000 to assist the visiting scientists to defray travel expenses to and from the ship, and the United States provided the ship and assistance aboard; but other than these items, each section of the trip was planned and carried out by scientists from the CICAR countries themselves. Taking part were scientists and students from Mexico, Jamaica, Puerto Rico, Trinidad and Tabago, Venezuela, and Colombia. I personally feel that this "wet-deck level" type of education and training at sea is an important aspect of international cooperation that has too often been overlooked in

the past.

While I have this podium and this audience, there is no better time to bring up one item of potential international NON-cooperation about which I am personally most concerned. This is the question of freedom to do research at sea. However, it appears that as the discussions go on internationally, the internationalists are talking less about freedom of research and more and more about the limitation of research, and as an oceanographer, this bothers me. Within another nation's territorial seas, it is becoming increasingly difficult to obtain official permission to do oceanographic research. I might point out, though, that this is not a new problem. When the H.M.S. CHALLENGER made her historic oceanographic voyage in the last century, she ran into this exact same problem with -- if my Brazilian colleagues in the audience will excuse me -- Brazil. Stewart and Henderson in their recently published book of sketches of the CHALLENGER Expedition (Stewart, Harris B., Jr. and J. Welles Henderson, "CHALLENGER Sketchbook, B. Shephard's Sketchbook of the H.M.S. CHALLENGER Expedition, 1872-1874", Philadelphia Maritime Museum, Philadelphia, Pennsylvania, U.S.A., 1972) include a quote from the journal of one of the ship's officers, Sub-Lieutenant Lord George C. Campbell (Campbell, Lord George C., "Log-Letters of the CHALLENGER", MacMillan & Company, New York; U.S.A., 1877) describing the ship's experience in trying to survey and collect



on and around the Brazilian island of Fernando Noronha in September of 1873:

"On Sept. the 1st we arrived at Fernando Noronha, a pretty green little island from whose wooded hills shoot here and there grey pinnacles of rock. One of these in particular is of curious shape and a thousand feet high. The island belongs to Brazil, and is used as a convict settlement, there being now thirteen hundred convicts, who live in little wooden huts, which, with barracks for two hundred soldiers, prisons, and an ancient fort, make up the cheery settlement.. The Governor, on being visited by the Captain, appeared to be much puzzled by us. 'Was that the English flag? Were we a man-of-war?' and other curious questions. He was evidently confused and perturbed in spirit because we did not salute, and our explanation that we had only two guns, produced all the more confusion as to how we could be a man-of-war. However, he was very civil, gave us leave to do what we liked, and offered to lend us horses. But next morning he had changed his mind, would allow no survey to be carried on, even refusing leave for the naturalists or anybody else to rummage the island in search of butterflies, beetles, and plants! What sinister motive was ascribed to us this Brazilian governor alone can say, for officers from other ships have never been vetoed before. So, as there was nothing to be done, we left in dudgeon, of which I was mighty glad, as it

was a stupid little place, and the original intention had been to stay there ten days or so."

As an oceanographer, I would of course like to see fewer restrictions on carrying out oceanographic research even inside another Coastal State's Territorial Sea, but I am most concerned about the possibility of having restrictions imposed on research ships outside the Territorial Seas in what may eventually become a Resource Zone or some other internationally recognized portion of the sea over which the Coastal State may be able to exercise certain exclusive rights and restrictions. This subject is even now being hotly debated internationally prior to the Law of the Sea Conference, and I would like here today to add my small voice on the side of those who contend that the benefits of fuller understanding of the global sea accrue to all nations and that the basic research at sea that leads to this knowledge must not be hindered.

Those Coastal States that contend that basic oceanographic research will certainly lead to resource exploitation seem to forget that it has been the one-hundred years of unfettered oceanographic research that have provided sufficient knowledge of the sea to indicate something of the resources that are there and that in fact enabled them to take this highly protective stand.

As ocean scientists, it is incumbent upon us to alert those international policy makers within our own countries to the dangers inherent in the restricting of oceanographic research in those waters seaward of the Territorial Seas. The currents of the sea and the life in the sea recognize no man-made boundaries, and the ocean scientists who seek to understand the magnificent complexities of the processes and the life within the sea should not be hampered in their search for understanding these processes. So I would urge you today to become involved as marine scientists in preserving the freedom of ocean research for the benefit of all. I would also urge you on your return to your own country to try to convey to your nation's policy makers the importance of maintaining man's ability to sail the seas in search of knowledge and the shortsightedness of imposing any restrictions on oceanographic research outside Territorial Seas.

In conclusion, I would like to quote from a speech last March by Dr. Philip Handler, President of the National Academy of Sciences in the United States before the United Nations Law of the Sea Subcommittee III on the Peaceful Uses of the Seabed and the Ocean Floor. I quote:

"It is my belief that the small risk taken in the process of fostering trust among us is far less hazardous than that entailed in institutionalizing unwise regulations. Happily, the

vast stretches of the ocean are available in which to start a new experiment in the political behavior of mankind. International cooperation has not been the principal characteristic of most historical agreements and treaties concerning the land portion of the earth -- except for the noble example of Antarctica. But it can and must be the basis of man's use and enjoyment of the oceans. Let us investigate the oceans together and let us promote the resultant knowledge as rapidly and in as many ways as possible for the benefit of all men, everywhere. In so doing, we may yet fulfill man's highest aspirations for the world ocean."