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## INDIAN OCEANOGRAPHY IN PERSPECTIVE

R. RAGHU PRASAD

*Indian Council of Agricultural Research, New Delhi, India*

### ABSTRACT

The paper gives a brief review of the progress in oceanography in India since the middle of the nineteenth century when this important field of science had its beginning in this country. In order to make future planning more purposeful and for the proper growth of the subject, the need for a stock-taking and development of strong schools specializing in different aspects of oceanography is emphasized. The inescapability of a co-operative approach in oceanography, if substantial progress is to be achieved, is reiterated. The paper concludes with a tribute to Dr. N. K. Panikkar who has been the main architect in planning and organizing the many National Institutes dealing with oceanography, marine biology and fisheries.

THE middle of the nineteenth century saw the beginning of marine biological and oceanographical investigations along the coast of India. The interest and enthusiasm of the medical officers working on board the ships of the Royal Indian Navy in the marine environment sowed the seeds of oceanographic studies in this country. Subsequently with the appointment of Surgeon Naturalists on the staff of the Marine Survey Department an organized effort to gather knowledge of the conditions of life in our seas was started. The interest kindled by these Surgeon Naturalists gradually spread resulting in the establishment of marine biological studies in the Zoological Survey of India, the Fisheries Department and Government Museum, Madras, etc. Following these, universities began to evince interest in the study of marine life. With the setting up of the Central Marine Fisheries Research Institute the need for oceanographic investigations as an integral part of marine fisheries research was recognized. In the chronological order of events, the next landmark is the formation of the Marine Biological Association of India. Soon, the world community of oceanographers recognized the fact that Indian Ocean was the least explored and a co-operative effort to study this ocean, the International Indian Ocean Expedition, was organized. This was also prompted by the fact that it is one of the unique oceans subjected to the influence of monsoons. India actively participated in this and as a further step of recognition of this important field of study a full-fledged institute, the National Institute of Oceanography, was set up.

## A CENTURY OF OCEANOGRAPHIC RESEARCH

Beginning with a simple survey, India has been able to build up a sound base for oceanographic studies during the past ten or twelve decades. The popularity of this field of science is also reflected in the fact that some of the universities have established regular courses in oceanography and marine biology. During the last few years, there has been a noticeable increase in the number of trained marine biologists and oceanographers and one finds a steep upward trend in the number of publications coming out in this field. Investigations in almost all aspects of oceanography are being conducted by different organizations including universities. Physico-chemical, geological and geophysical studies such as bathymetry, temperature, currents, nutrients, thermodynamic conditions at the air-sea interface, sediments, faults and structural features of the ocean floor, magnetic and gravity anomalies, mineral resources, etc., and biological investigations dealing with marine flora and fauna in general, plankton, nekton and benthos are all being carried out at various centres.

As early as in the 1920s interest was evinced in the study of the fauna of the deeper waters around India. But after the work of the survey ship "Investigator" was discontinued in 1926 the addition to our knowledge of this was contributed mainly by various expeditionary vessels such as *John Murray*, *Galathea*, *Albatross*, *Xarifa*, *Vitiaz*, *Meteor*, *Anton Bruun*, *Akademik Knipovich* and others which have worked in this region from time to time. In very recent years the work of R. V. *Varuna* and one or two of the bigger vessels of the Indo-Norwegian Project has contributed to our knowledge of the fauna of the deeper water especially along the west coast of India. Ecological, physiological and developmental studies of selected animals have also been receiving attention but the nature of biological work in most of the Institutes continues to be, by and large, the conventional natural history type of a qualitative nature, while the experimental and quantitative approach are still very much lacking. Thus, no doubt, a fairly good knowledge of the fauna and flora is available but considering the bewildering assemblage of species in our waters and the need for a better understanding of these much more remains to be done.

Even though the country has an extensive coastline with good prospects for search of hydrocarbons, very little marine geophysical work has been done so far. Investigations relating to mineral exploration and marine geology have also been confined more or less to beaches, explanation of certain offshore phenomena and studies of marine samples collected from deeper regions by outside agencies, while geochemical investigations have been taken up only in very recent times. Recognizing the importance of these and allied disciplines there has been currently evidence of increasing attention being paid to these.

Oceans being the primary generator of much of the weather, the interdependence of meteorology and oceanography is leading to detailed investigations into the problems of ocean-atmosphere interactions. These investigations are of importance in a variety of fields such as agriculture, fisheries, offshore oil industry, marine transportation, etc.

Recently man has begun to wake up to a possible danger threatening his well-being as well as that of the future generations on this planet—the environmental pollution. Fortunately, pollution has not yet reached alarming proportions in India but this is evident in certain coastal areas and studies have been initiated in this direction.

Undoubtedly, there has been an overall increase in the study of the ocean and in the broad geographical zone in which the country is located we have made a mark in oceanographic research. But in view of the various proposals to intensify substantially the efforts to study the ocean an introspection and evaluation are called for to assess our achievements during the past century in relation to the effort and financial inputs. Elsewhere, oceanography in the last one or two decades has made rapid strides, but to us the horizon does not seem to widen. The development in oceanographic instrumentation has been spectacular, yet the Institutes in this country dealing with oceanography have neither ocean-going research vessels nor the many sophisticated equipments. The oceans are to-day a major area for the application of new technology and consequently the tremendous advancements in space technology are being increasingly made use of in oceanographic studies such as ocean temperature, pollution, ecology, fish resources and a host of other aspects with the help of earth-orbiting satellites. Several years back one of the leading scientists in this country is reported to have advocated 'oceanography without research vessels'. There might have been a tone of sarcasm in it, but it could be that oceanography now is moving in that direction although due entirely to technological advancements. Despite the spectacular achievements of satellite technology, to-day the concept of oceanography without research vessels may sound bizarre and it would be unrealistic to hope that the situation will change radically in the near future.

Another disturbing factor is that more than a century of oceanographic researches in this country have not led to the development of different schools specializing in particular aspects of oceanography and this has impaired the proper growth of the subject. This leads one to the inference that there is evidently an inadequacy of dynamic and dedicated leadership. Coupled with this is the bottleneck created by the prevailing cumbersome administrative and procedural methods thoroughly unsuited for the present day requirements of a science-oriented planning and development. For this the administration should be performance-oriented. The emphasis should be on action and results, and there should be a minimum of red tape. In the words of the Nobel Laureate,

Norman Borlaug, a stage seems to have come when "we need to develop a mutant strain of man who will have the enzyme cellulase in his gut which will thereby permit him to eat, digest, and grow fat on the mountains of paper and red tape that are being produced in ever-increasing abundance by the world's planners, bureaucrats and press." In recent years there has been a perceptible re-awakening to the importance and potential the oceans hold for our well-being but the problems facing the oceanographers are challenging and need a bold and relentless approach.

#### CO-OPERATIVE OCEANOGRAPHY

Oceans have always been a link between the nations and peoples. From mere highways of communication, oceans are now assuming greater significance to humanity as a whole. The wealth of the ocean in terms of living and non-living resources was the first to receive the attention of the nations. In recent years, the oceans have been considered as a common heritage and it is not only the nations with a sea-board that claim a right but the land-locked nations too feel that they should have a share of the oceans' vast riches. Present trends in oceanographic investigations have led to the realization of the dependence of man on his ocean environment. From weather through food, minerals, fuel, biomedicines, etc., man is depending more and more on the sea. With these ramifications and the increasing range of research in the field of marine sciences a stage has come when we have realized that no Institute or even no country alone will be capable of carrying out all aspects of oceanographic research necessary for making any tangible progress in the utilization of the ocean and the exploitation of its vast resources.

This concept of international co-operation in oceanography was first tried during the International Geophysical Year, 1957-58. This created a very favourable impact and achieved a good deal of successful results because this co-operation was not only in terms of participation but also in the sharing of new knowledge acquired about the global marine environment. Encouraged by this, the international co-operation in oceanography entered a new phase in 1961 with the establishment of the Inter-governmental Oceanographic Commission which was mostly responsible for the organisation of the 7-year International Indian Ocean Expedition. This international venture provided abundant and valuable information about the least known Indian Ocean. International co-operative efforts are now continued to work in the tropical Atlantic and the Kuroshio region.

At the national level too co-operative research programmes are being formulated and executed between organisations having common interests. One of the best examples of this is the California Co-operative Oceanic Fisheries Investigations organised about two decades back for studying resources of the California current system. In the United States it is not only the Governmental

and academic agencies that co-operate but the Federal, State and local governments, private industry, academic and other research institutions all co-operate and collaborate to contribute to the nation's progress. Consequently the progress has been substantial.

Proliferation of organizations, lack of co-ordination and co-operation, unhealthy compartmentalization, etc., have led to avoidable duplication, fragmentation and consequent retardation of progress of marine sciences in this country. In a country like ours there is an inescapable need for better camaraderie amongst scientific organisations in view of the fact that the overall budget for scientific and technological research and development is pitifully small compared to the host of problems to be solved. Therefore, there is little doubt for the need to create foundations of mutual confidence. That will be the only way to avoid needless suspicion and rivalry leading to wastage of huge resources.

Strangely enough, apprehensions have been expressed by some that co-operative investigations might affect the committed programmes of the participating institutes. This fear is unjustified and this attitude can be interpreted only as a facade to cover up the reluctance to participate in co-operative programmes. The illogicalness of this would be obvious if we analyse what the committed programmes of an Institute are. The ultimate objective of the work of any national institute should be to contribute to the betterment of the country and its people. Proceeding from this axiom it follows that the objectives of the institutes dealing with problems directly or indirectly related to a particular field of science cannot be divorced from the national objectives, as these are only pieces of a mosaic picture of the overall national goal. This brings up the most important and primary requirement, i.e., the need for identifying problems and assigning national priorities for each of these. Having done this, the programmes should be formulated in an integrated and co-ordinated manner, taking into account the possibility of maximum inter-institutional collaboration. Such collaboration apart from saving funds and ensuring better and fuller utilization of the existing facilities and manpower would break the communication barrier and promote cross-fertilization of ideas. Co-operative efforts do not in any way imply that participating institutes should sacrifice their individuality or they will cease to be discrete entities. Thus, separately and together we should strive to achieve our goal and, to borrow a jargon used by the musicians, the institutes should not aim at performing only solos but should also have tutti in which each institute makes its individual contribution towards a harmonious whole.

#### INDIAN OCEAN EXPLORATION IN THE SEVENTIES

We are now at the threshold of the Second Development Decade launched by the United Nations. Recognizing the need for greater knowledge of the oceans and their resources, international co-operative programmes such as the 'Global Ocean Research', 'International Decade of Ocean Exploration', 'Long-

term and Expanded Programme of Oceanic Exploration and Research', etc., have been formulated. In this context a long-term programme of ocean research for India also has been prepared by the Indian National Committee on Oceanic Research. These programmes heralded an important step towards providing a foundation of fundamental knowledge essential for the better use of the oceans. Working co-operatively the national programme of ocean exploration offers an excellent opportunity to share the responsibilities and results and we can turn the oceans to greater use and simultaneously gather the knowledge required to preserve the quality of the marine environment.

The sea is an untold storehouse of wealth, waiting for man's use. Considering the vastness of the problem of effective and rational utilisation of this wealth and the relatively limited resources for implementing a purposeful programme, the emphasis should be on the utilization of the ocean in order to produce the much-needed protein and mineral resources and weather forecasting. The Indian programme, therefore, aims at developing the scientific content of a long-term programme to study the Indian Ocean for a better management of the living resources, an assessment of the economic potential of the non-living resources and to develop the necessary capacity to predict oceanic conditions and control the marine environment to the extent feasible for the betterment of the economic condition of our people, especially of the weaker section.

#### A TRIBUTE

In the gigantic task of laying the foundation for a modern approach to oceanographic research in India, Dr. N. K. Panikkar, to whom this volume is dedicated on the occasion of his 60th birthday, occupies a pre-eminent position. His mission in life has been to put India in a prominent place in the oceanographic map of the world through a comprehensive understanding of the Indian Mahasagar. Apart from his valuable contributions in furthering the frontiers of our knowledge in biological oceanography and fisheries, he has been the main architect in planning and organizing the many institutes in this country dealing with oceanography, marine biology and fisheries. To him, the best tribute that we can pay on this occasion would be to re-dedicate ourselves to the cause of marine science and team ourselves to co-operate in the study of the seas around us to get the maximum benefit within the minimum possible time.