

Report from  
SCOR Working Party on Fishery-Oceanography.

The SCOR Working Party on Fishery Oceanography was appointed by the President Dr. George F. Humphrey, pursuant to action taken by SCOR at its Monaco meeting in November, 1961.

In a letter, dated 23rd November, 1961, to the members, Dr. Humphrey stated:

"Early this year, SCOR received suggestions for the formation of two new working groups, namely -

"Location and Investigation of New Fisheries Resources" and  
"Oceanographic Estimation of the Size and Distribution of Oceanic Living Resources."

These suggestions are symptomatic of the increasing attention being given to the interaction between the fisheries and oceanographical fields of research. This attention has been evident at the many intergovernmental oceanographic meetings held in 1960-61, and particularly at the recent meeting of the Intergovernmental Oceanographic Commission.

SCOR has discussed these proposals for working groups over the past few months and decided at its recent meeting in Monaco to establish a working group on "Fisheries Oceanography" with the following terms of reference:-

1. To discuss and define the subject of fisheries oceanography.
2. To state what fisheries oceanography has accomplished.
3. To state what fisheries oceanography should be trying to accomplish.
4. To state what progress is needed in other sciences so that the aims set out in 3 can be attained.
5. To communicate the statements listed above, through SCOR to interested laboratories and organizations.

Additional items could be added by agreement with the Chairman, but there should be no overlap with the functions of bodies such as FAO, ICES, etc.

SCOR chose the above terms of reference because its members had noted that during the discussions of the meetings previously mentioned, there was much confusion concerning the nature, accomplishments, and aims of fisheries oceanography. On the one hand the term was used to include all of fisheries science, on the other to denote a restricted use

of a small part of physical oceanography. SCOR felt that before any attack could be made on the problems envisaged in the original working group suggestions, it was necessary to examine some of the basic considerations involved.

SCOR felt that it could make a contribution by bringing together a small group of workers in diverse fields so that the different viewpoints could be recorded, discussed, exemplified, and put together for the benefit of inter-governmental bodies, laboratories, and individual workers. Such action would assist further work by SCOR and other bodies.

On behalf of SCOR I ask you to take part in this project which will extend over a year and involve correspondence, attendance at a meeting (probable in Europe), and much thought. Your expenses would be paid by SCOR. Others who have been approached are:

Dr. Bjerknes, University of California, U.S.A.  
Dr. Chapman, Van Camp Foundation, San Diego, U.S.A. (Chairman)  
Dr. Cushing, Lowestoft Fisheries Laboratory, U.K.  
Dr. Dickie, Fisheries Research Station, Canada.  
Dr. Davies, Oceanographic Institute, Durban, S. Africa.  
Dr. Popovici, Special Fund Project, South America.  
Dr. Rass, Institute of Oceanology, Moscow.  
Dr. Rollefsen, Institute of Marine Research, Norway.  
Dr. Uda, Tokyo University of Fisheries, Japan.

It is intended to ask relevant international bodies to nominate people to participate in the correspondence and the meeting.

I hope that you will find the thought of this work interesting and stimulating and that you will tell me that you are willing to participate."

Dr. Dickie was unable to serve because of prior commitments. Prof. Dr. Adolph O. Eückmann, Director Institut für Fischereibiologie, Hamburg, was subsequently added to the Working Party by Dr. Humphrey.

During 1962 there was considerable correspondence among the members of the Working Party on the terms of reference set down by Dr. Humphrey in appointing the group. Members additionally solicited the views of workers in marine science to the number of more than 500 in various countries. The correspondence which thus resulted has been gathered into two volumes of Comments on Fishery Oceanography. These have been distributed to members of SCOR and to members of the scientific community who contributed views to the Working Party, as well as some few others who were interested in the subject.

The Working Party met in Bergen, Norway at the invitation of Dr. Gunnar Rollefsen, the Director, Institute of Marine Research, from 10th to 14th September 1962. Members of the Working Party who attended were:

Prof. Dr. J. Bjerknes, University of California, Los Angeles, California;  
Dr. W.M. Chapman, Van Camp Foundation, San Diego, California;  
Dr. D.H. Cushing, Fisheries Laboratory, Lowestoft, England;  
Dr. David H. Davies, Marine Biological Association, Durban, Natal  
Union of South Africa;  
Dr. Gunnar Rollefsen, Institute of Marine Research, Bergen, Norway;  
Prof. Dr. Michitaka Uda, Tokyo University of Fisheries, Tokyo, Japan.

Prof. Dr. Bückmann was unable to attend because of illness, but sent in his stead Dr. G. Hempel, Institut für Fischereibiologie, Hamburg, Germany, who participated fully in the deliberations of the Working Party. Dr. Theodore S. Rass, Academy of Sciences, Moscow, U.S.S.R. and Dr. Popovici, National Institute of Marine Resources, Lima, Peru, were unable to attend the Bergen Meeting because of previous commitments.

The Working Party was assisted in its work at Bergen by the following observers: Prof. Dr. Trygve Braarud, University of Oslo, observer from the Norwegian National Committee of SCOR; Dr. Jens Eggvin, Institute of Marine Research, Bergen, observer for the International Council for the Exploration of the Sea; Mr. Roy Jackson, Director, International North Pacific Fisheries Commission, Vancouver, British Columbia, Canada; Prof. Dr. Håkon Mosby, University of Bergen, observer from the Norwegian National Committee of SCOR; Dr. T.R. Parsons, Office of Oceanography, UNESCO, Paris, France; Dr. Birger Rasmussen, Institute of Marine Research, Bergen, Norway; Dr. Mario Ruivo, Fisheries Division, FAO, Rome, Italy; and Mr. W.C. Tait, International Atomic Energy Agency, Vienna, Austria.

After a first day of general discussion the Working Party considered the definition of Fishery Oceanography. It is defined as follows:

**Fishery Oceanography** is the study of the living resources of the sea using those aspects of oceanography (including biology, physics, chemistry, geology, and meteorology) that affect their abundance, availability and exploitation.

Objectives of Fishery Oceanography include:

1. The assessment of the distribution of living resources of the sea;
2. The prediction of the abundance in time and space of presently used living resources of the sea;

3. The estimation of the maximum sustainable yield of presently used individual living resources of the sea;
4. The estimation of the exploitable production of individual stocks under natural and man made conditions and of the living resources of the world ocean as a whole;
5. Investigation of means of increasing the exploitable production of the living resources of the sea and means of protecting them from natural and man made disaster; and
6. The prompt publication of these findings.

The Working Party did not have time in which to adequately describe what fisheries oceanography has accomplished. Attention is directed to the letters of Davies, Cushing, Uda, and Sette, in particular, in the two volumes of comments on fishery oceanography, to much else include in the other correspondence in those volumes, to the letters from Uda and Bückmann attached hereto, and to the excellent historical account of Norwegian Fishery Research by Rollefson in "Havet og våre Fisker" published by J. W. Eides Forlag, Bergen, Norway, and obtainable in English translation at the Institute of Marine Research, Bergen.

Much discussion was entertained on the subject of trends of inquiry that might be emphasized to further the objectives of fishery oceanography. This discussion is summarized as follows:

1. Much advantage can be expected from a more extensive and continuous inquiry into the dynamic and thermal relationships between atmosphere and ocean, not only in local areas of investigation, but on a wider regional basis and when possible even on a world-wide basis as soon as means for doing this are perfected. Intensification of operational research in interaction at the air-sea interface is required per se and also for the purpose of studying the variations in the marine biota, to the end that the effect of departures from normal in the atmosphere can be followed in their effects on the ocean and its marine life.

It was noted that prediction of events in the ocean, even months ahead, from an intensification of study in relation to atmospheric phenomena is not presently promising, but that an intensification of such studies in the present can be expected to be fruitful, at least in aiding in the elucidation of past events.



- 2 To aid in efforts as outlined in (1) synoptic charts of atmospheric pressure and its deviation from normal are needed and should be available to workers in fishery oceanography quickly at regular and brief intervals. The international organization that is to represent the interests of fishery oceanography should seek contact with the World Meteorological Organization (WMO) with the aim of obtaining meteorological services as outlined above on a world-wide and/or regional basis.
3. WMO and its regional subdivisions would also be able to supply quickly the observations of sea surface temperature gathered by radio from the world ocean in either tabular or map representation ( examples: North Atlantic maps distributed by the Marine Division of the British Meteorological Office and the U.S. Naval Hydrographic Office; North Pacific maps distributed by the Japanese Meteorological and Fishery Agencies and by the U.S. Bureau of Commercial Fisheries Biological Laboratory at San Diego.

Attention is drawn to the experimental work of Tokai University, Japan, in drawing information by radio from vessels at sea and rebroadcasting to ships at sea at five and ten day intervals by facsimile chart the collated information of several meteorological, oceanographical and fishery parameters and, moreover, to the experimental daily charting of bathythermograph traces in the North Atlantic by the U.S. Naval Hydrographical Office. It should be particularly noted that ICES since 1959 has a sub-Committee working on the organization of telegraphic communication of observations serving fishery oceanography. An international code for this purpose has been devised and adopted by the Council in 1961. Experiments with the use of the coded messages have been carried out by the Institute of Marine Research, Bergen.

The desirability of exploring the extension of these communication techniques on broader scale and to other parameters is stated. Amongst these may be considered storm surges, wave and wind conditions, depth of mixed layer, salinity, plankton volume or other appropriate primary productivity index, catch per unit of effort in certain wide-ranging fisheries, variation in location of water mass boundaries, etc.

4. In respect of the changes in abundance and availability of demersal stocks a better understanding and forecast, where possible, of the hydrographic events close to the sea floor at the fishing grounds is highly desirable.
5. Other possible services by WMO for the benefit of fishery oceanography might include the introduction of regular observations in physical, chemical and biological oceanography on board the stationary weather ships.

6. There is great need for improving the instrumentation for making observations at sea not only from research vessels but from larger fishing vessels and other shipping. The necessity is pointed out of procuring by mass production salinometers, current meters, bathythermographs, devices such as Hardy continuous plankton samplers, or devices for measuring pigments in intake water, and the like, so that sturdy, simple, cheap dependable instruments of this nature can be put into broader use.

There is required the development of instrumentation for the quantitative assessment of living resources in different habitats and at different trophic levels. Attention is directed particularly to concentrations of organisms in the scattering layers in various parts of the world ocean.

The work being done in several areas on production of a cheap, sturdy, dependable buoy from which several meteorological and oceanographic parameters can be continuously recorded is pointed out as a field requiring even intensification of present effort. The high desirability of developing instrumentation for the continuous recording of biological parameters on such installations is emphasized.

7. Attention is directed to the great, growing, and continuous need for inter-calibration studies of instruments, methodology and techniques in all of these fields of measurements between individual workers, laboratories and expeditions to the end that resulting measurements will be fully comparable on a world wide basis.
8. Much additional attention must be given to taxonomic studies in all divisions of the biota but particularly at present to phytoplankters, zooplankters, fish and fish-eggs and larvae. The production of comprehensive well illustrated monographs is a desideratum.
9. Emphasis requires to be given to studies of the principles of the mechanism of biological productivity in the sea. Both theoretical and experimental studies in this field require to be broadened and intensified. It is noted that much of the experimental study required cannot be practically done in situ but will require to be undertaken in laboratory and that there are few places in the world where adequate facilities for undertaking laboratory experiments in this field are available except of a most primitive sort which, for the most part, are not suitable for such work.

10. Lying at the base of much frustration in the elucidation of fishery problems is a profound ignorance of the physiology of the key organisms. As an example it is frequently hypothesized that the success of year classes, and the resultant success of the fishery, is dependent upon events during the first stages of the fish's life even, in some instances, during the first hours after spawning or of hatching. In the absence of detailed knowledge of the physiological requirements of the very young larvae little progress can be made in this vital area of understanding. For this work, again, laboratory facilities of a higher order of sophistication than most which are presently available will be required, as well as teams of specialists in different disciplines.
11. The center of fishery oceanography is understanding the factors affecting the abundance of populations under study. This boils down to understanding the factors affecting recruitment, growth and mortality. Much progress has been made in the field of population dynamics, but the present simple models require development.

Two directions are possible. The first is the extension of Riley's methods to evaluate the transfer of energy between trophic levels and the establishment of the links between these levels. The second is the development of the models evoked by Beverton and Holt, Schaefer and others to take into account the biotic and abiotic factors in the environment. Ultimately the two approaches will combine.

At the same time is needed a combination of field and experimental work to test and retest such models in order that they may be perfected and adjusted to different sorts of populations and conditions. What is wanted, in fact, is the development and application of concepts in dynamic ecology to these vital problems of recruitment, growth and mortality as they affect the populations under study.

12. It was repeatedly noted that the complexity of the problems involved in fishery oceanography increasingly call for a team approach to their solution in which specialists from different disciplines would be required working in close collaboration. Attention was directed to the growing role of behavioral, or even fish psychology, research as an element of such teams.

Aside from this brief summary of aspects of fishery oceanography requiring intensification, the reader's attention is directed to the voluminous correspondence in the volumes of Comments on Fishery Oceanography and particularly to the letters from Uda, Rass, Cushing, Davies, Sette and Blackburn

The Working Party, lastly, turned its attention to problems involved in liaison among workers in fishery oceanography and the rest of the scientific community investigating the sea and the atmosphere.

The necessary breadth of the field of fishery oceanography as noted in the definition given above requires the closest possible liaison between workers in it and among them and all other investigators of the ocean. The Working Party considered these needs at several levels.

A. Within the United Nations family of specialized agencies.

The Working Party discussed the genesis of the Intergovernmental Oceanographic Commission, the sub-committee on Oceanography of the Administrative Committee on Coordination of ECOSOC, and the relationships among UNESCO, FAO, WMO, IAEA, etc. While realizing the fiscal and diplomatic difficulties involved it was felt that the high desirability, from the viewpoint of the different scientific disciplines involved in inquiry into marine problems, of preventing any splitting of those disciplines, and the equally high desirability of continuously simplifying the machinery for liaison among them, lent emphasis to the ultimate desirability of having an organization devoted solely to ocean problems standing independently among the specialized agencies of the United Nations family.

B. Intergovernmental regional, or particular fishery, commissions and organizations.

It was realized that governments require, and probably will continue to require, commissions or organization of a regional, or geographically and politically restricted, nature quite outside the United Nations family, to attend to particular problems occurring among them growing out of high seas fisheries of common concern. It was noted that continuous attention must be given to liaison among these and the international agencies in order that the scientific work undertaken under both sorts of regimes will go smoothly and efficiently. It was also noted that continual attention should be given to the possibility of simplification of such intergovernmental apparatus. It was suggested that the time might be approaching when some coalescing of this structure might be profitably considered.



C. Scientific advice to the present Intergovernmental Oceanographic Commission.

The Working Party reviewed the interaction on this question between various elements at the First meeting of the Intergovernmental Oceanographic Commission and Resolution 1 of that meeting. It was informed by the observer from FAO that FAO Fishery Division would announce the establishment of its Advisory Committee on Marine Resources Research during the course of the forthcoming second meeting of IOC, and it was told the proposed composition of ACMRR. It considered the broad field of responsibilities which SCOR had aside from its advisory responsibility to UNESCO. It considered the broad field of responsibilities which ACMRR would have in its relations with FAO aside from fishery oceanography as herein defined.

Accordingly it adopted the following recommendations:

1. That SCOR reconstitute its membership so that fishery oceanography and marine biology may be better represented for the purpose of improving SCOR's ability to serve the whole scientific community concerned with the ocean.
2. That a committee be formed consisting of not more than 15 members for the purpose of advising the IOC on the scientific aspects of ocean research. The composition of the Committee should be derived from the Scientific Committee on Oceanic Research of the International Council of Scientific Unions and the FAO Advisory Committee on Marine Resources Research approximately on an equal basis.
3. That the above recommended joint scientific advisory committee to IOC invite the intergovernmental fisheries commissions and regional organizations to send observers to participate in its meetings and keep them informed of its activities.
4. That in prosecution of its broad international cooperative programs in oceanic research IOC use the existing machinery of such regional commissions and organizations to the extent that it finds practical and appropriate.

5. That SCOR, IOC and ACMRR give particular and continued attention to liaison among marine meteorologists and other ocean research workers.

The Working Party on Fishery Oceanography extended particularly warm thanks to the Institute of Marine Research, Bergen, to its Director, Dr. Gunnar Rollefsen, and to other staff-members, for the cordial welcome, the fine facilities provided, and the excellent atmosphere in which its deliberations could be conducted, all of which lent pleasure as well as effectiveness to the meeting in Bergen.