Intergovernmental Oceanographic Commission
Workshop report No. 12

Report of the IOCARIBE interdisciplinary workshop on scientific programmes in support of fisheries projects

Fort-de-France, Martinique
28 November - 2 December 1977

Unesco

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N°	Title	Publishing Body	Language(s)
1	CCOP-IOC, 1974, Metallogenesis, Hydrocarbons and Tectonic Patterns in Eastern Asia /Report of the IDOE Workshop on/; Bangkok, Thailand, 24-29 September 1973, UNDP (CCOP), 158 p.	Office of the Project Manager UNDP/CCOP c/o ESCAP Sala Santitham Bangkok, Thailand	English
2	CICAR Ichthyoplankton Workshop Mexico City, 16-27 July 1974, (Unesco Technical Paper in Marine Science, No. 20).	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
3	Report of the IOC/GFCM/ICSEM International Workshop on Marine Pollution in the Mediterranean, Monte Carlo, 9-14 September 1974.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
4	Report of the Workshop on the Phenomenon known as "El Niño", Guayquil, Ecuador, 4-12 December 1974.	FAO Via delle Terme di Caracalla 00100 Rome, Italy	English Spanish
5	IDOE International Workshop on Marine Geology and Geophysics of the Caribbean Region and its Resources, Kingston, Jamaica, 17-22 February 1975.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
6	Report of the CCOP/SOPAC-IOC IDOE International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Suva, Fiji, 1-6 September 1975.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
7	Report of the Scientific Workshop to initiate planning for a co-operative investigation in the North and Central Western Indian Ocean, organized within the IDOE under the sponsorship of IOC/FAO (IOFC)/UNESCO/EAC, Nairobi, Kenya, 25 March - 2 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	Full text (English only) Extract and Recommendations: French Spanish Russian

Nº	Title	Publishing Body	Language(s)
8	Joint IOC/FAO(IPFC)/UNEP International Workshop on Marine Pollution in East Asian Waters, Penang, 7-13 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
9	IOC/CMG/SCOR Second International Workshop on Marine Geoscience, Mauritius, 9-13 August 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
10	IOC/WMO Second Workshop on Marine Pollution (Petroleum) Monitoring, Monaco, 14-18 June 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
11	Report of the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and adjacent regions, Port-of-Spain, Trinidad, 13-17 December 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
11 Suppl.	Collected contributions of invited lectureres and authors to the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and adjacent regions, Port-of-Spain, Trinidad, 13-17 December 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
12	Report of the IOCARIBE Interdisciplinary Workshop on Scientific Programmes in support of Fisheries Projects, Fort-de-France, Martinique, 28 November - 2 December 1977.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
13	Report of the IOCARIBE Workshop on Environmental Geology of the Caribbean Coastal Area, 16-18 January 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish

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REPORT OF THE IOCARIBE INTERDISCIPLINARY WORKSHOP ON SCIENTIFIC PROGRAMMES IN SUPPORT OF FISHERIES PROJECTS

Fort-de-France, Martinique, 28 November - 2 December 1977

1. Opening of the Workshop

The IOCARIBE Interdisciplinary Workshop on Scientific Programmes in Support of Fisheries Projects was held in the Hotel Batalière, Fort-de-France, Martinique, from 28 November to 2 December 1977.

Mr. Jorge Corredor (Colombia), Chairman of the Workshop, opened the meeting by welcoming participants and pointed out that the meeting had been convened in accordance with IOCARIBE recommendation I.1 (Annex I).

Professor F. Doumenge, Rector of the Academy of the Antilles and Guyana, Fort-de-France, Martinique, received the participants on behalf of the Government of France and the Department of Martinique. His speech is reproduced as Annex VII.

Dr. Robert R. Lankford, Regional Secretary of IOCARIBE, thanked Professor Doumenge on behalf of the IOC for his words of welcome and for the support given to the meeting by the French Government and the Department of Martinique. He referred in particular to the supporting efforts of the French Centre national pour l'Exploitation des océans (CNEXO) and the local organizing committee ably led by Professor Doumenge.

2. Administrative arrangements for the Workshop

2.1 Adoption of the agenda

The provisional agenda was adopted without modification (Annex II).

2.2 Election of the rapporteurs

Mr. Manuel Murillo (Costa Rica) and Mr. Luis Villegas (FAO/WECAF) were appointed rapporteurs.

2.3 Proceedings of the Workshop

The Chairman, addressing the participants, emphasized the importance of the question of how oceanography could help in solving the practical problems of immediate economic interest encountered by fisheries in the region, and requested the chairmen of the technical groups to see that that question was discussed. He made it clear that the economic and administrative problems that affect the functioning of the fisheries did not fall within the purview of the Workshop.

Dr. Dirk G. Troost, Associate Regional Secretary of IOCARIBE, recalled the history and objectives of IOCARIBE and stated that the principal objectives of the Workshop then being held were to relate mesological research to the productivity of fishery resources and to prepare specific programmes which would

make the relation between them clearer. He reviewed the preparatory work of the co-ordinating committee of the meeting, headed by Dr. H. R. Bullis, with Professor J. S. Kenny (then Chairman of IOCARIBE) and Drs. D. Atwood, J. Corredor, E. D. Houde and R. Molinari as members, and said that in convening the meeting the Secretariat of IOCARIBE was following the plans submitted by the co-ordinating committee. Dr. Troost especially stressed the financial support given by France as the host country and also by the National Marine Fisheries Service of the United States and by the IOC Trust Fund for the International Decade of Ocean Exploration (IDOE).

The Regional Secretary of IOCARIBE commented on developments and resolutions that had emerged from the tenth session of the IOC Assembly, recently held in Paris, which were of interest to the Association. He specifically mentioned the resolutions which proposed intensifying future IGOSS and GIPME activities in the region, and he also referred to various developments with respect to Training, Education and Mutual Assistance in the marine sciences (TEMA), including suggestions as regards regional seminars and shipboard training, as well as the possibility of increasing the number of members of IOCARIBE in 1978. Lastly, he stated that IOCARIBE's public image had improved and the future was promising. He asked the co-ordinating committee of the Workshop to provide the necessary guidance in order to ensure that the scientific proposals made were sound and feasible and that due consideration was given to their execution.

3. Papers presented by the Technical Groups

3.1 Technical Group I - Fisheries administration in developing countries

The technical group headed by Professor F. Doumenge began with the general report by Mr. W. Miller (Belize) on the importance of biological, economic (marketing) and cultural factors in the modernization of the small-scale fisheries of the developing countries. Effective fishery administration depends upon making the optimum use of the resource; this is difficult to do unless relevant scientific information is available. Funds for fishery research are a problem in the developing countries, however, since governments with limited funds are not disposed to carry on such research unless they are sure of tangible results. Mr. H. Wood (Trinidad and Tobago), the second speaker, then commented that much of Mr. Miller's report was equally applicable to his country and to the Lesser Antilles. He also spoke of the need to evaluate the feasibility of exploiting pelagic resources and some species which might be considered "new" in terms of local fishery activities, as for example cephalopods. Mr. Wood explained however that many of the fishery administration problems between developing countries were a matter of internal politics.

Among the problems which deserved special attention the following were mentioned: (a) evaluation of pelagic resources, particularly those species which have migratory habits; (b) elaboration of a regional code of rules for the rational exploitation of resources deriving from high-productivity ecosystems (mangrove swamps); and (c) the carrying out of studies on ciguatera (fish poisoning).

As regards pelagic resources, it was considered essential that any effort to stimulate the commercial exploitation of such species should be based upon scientific studies, in the carrying out of which IOCARIBE should play an important co-ordinating role. While it was true that problems relating to national regulations were beyond IOCARIBE's competence, the members of this technical group considered it obvious that fishery management, whose purpose was to bring about the efficient use of regional resources, necessitated a minimum of co-ordination and co-operation between member nations. The establishment of

regional bases to serve as a guide for fishery management was within IOCARIBE's competence.

So far as ciguatera (fish poisoning) was concerned, it was considered important for Caribbean specialists to have access to the results obtained recently by American (Hawaii), French (Tahiti) and Japanese research teams, which were the subject of a seminar organized in April 1977 by the South Pacific Commission (Nouméa). It was important to determine whether the ciguatoxins of the Caribbean were of the same type as those isolated in the tropical Pacific. It was consequently necessary to evaluate the role played by algae and the way in which toxins passed through the food chain. It should not be forgotten, in determining optimum use, that one of the aims of reaching that level was to improve the living conditions of fishing communities.

3.2 Technical Group II - Management and development of fisheries

Dr. H. J. Bullis (U.S.A.) and Dr. L. K. Boerema (FAO) read papers in the technical group co-ordinated by Dr. M. Bonnet (Martinique). Stress was laid on the need to distinguish between the development of fishing activities, which meant better use of the resource, and management of that resource in order to bring about sustained production through regulations in which socio-economic aspects as well as biological facts should be taken into consideration. In the matter of fisheries, the unknown factors usually had to do with the distribution and abundance of the resource, the early stages of development, natural fluctuations and their impact on fishery production, and other vital parameters.

In the IOCARIBE region there was obviously a need to adopt measures conducive to the management of the fishery resource. Unfortunately an appreciable number of stocks were already over-exploited, or nearly so. The principle that seemed to have been followed in fishery activity in the region thus far had been to fish a resource until it was exhausted and then turn to another under-exploited resource, so continuing the cycle. An obvious example of the need to manage resources was that of the green turtle, a species of great commercial value, the level of exploitation of which in the area was threatening the survival of the species. As regards shrimp fishing, there was sufficient information available to manage that resource but the same was not true in the case of crawfish and fish in general.

Even though other possibilities for the development of fisheries in the region had been identified (certain pelagic stocks along the north-western coast of South America, small coastal pelagic organisms, migratory pelagic forms and deep-water stocks), information needed for the promotion of such development was still lacking. The lack of data was critical in the case of coastal and migratory pelagic species.

In sum, it was recognized that, in order to manage resources and stimulate the opening up of new possibilities in the region, there was a need for a basis of oceanographic and fisheries statistical information, in the broadest sense, which was not yet available, and that IOCARIBE had a most important role to play in obtaining, processing and disseminating such information. From the discussions by the participants it emerged that oceanographers could assist substantially in the management and development of fisheries by carrying out research designed to gain more information about stocks now being exploited and those which were as yet exploited on a small scale, if at all. Such research would produce estimates of the abundance of fish stocks, which would be independent of the estimates made by methods that required the calculations of catches and the effort involved.

The subjects on which research was most needed for the management and development of fisheries in the region included the following: (a) the region-wide search for eggs and larvae in order to determine the existence of migratory movements of larvae and estimate the distribution and abundance of certain species; (b) studies on currents, in order to determine any migrations of larvae; (c) estimates of primary and secondary productivity, in order to determine fishery potentials of the region; (d) food chain studies; (e) studies on the environment, to be related to movements and amounts of migratory species; (f) studies on upwelling areas, in order to determine their contribution to the productivity of the zones in question; (g) regional survey of large migratory pelagic fish (Thunnidae) because of the potential offered by that resource for the development of fisheries in the Islands; (h) studies designed to determine the possibilities of restocking the turtle population, socio-economic factors being taken into account.

Participants expressed their concern about the over-catching of turtles, and asked that the meeting adopt a resolution recommending that the second session of IOCARIBE should take up the matter of failure to carry out measures designed to preserve the species (Recommendation 1). The meeting expressed the opinion that IOCARIBE should set up its own machinery to inform the countries of the region about tagging programmes being carried out and to request their collaboration in recovering and forwarding the tags to IOCARIBE. It was hoped that such a measure might help to increase the number of tags recovered.

3.3 Technical Group III - Biological productivity, food chains and evaluation of resources (including the elaboration of models and remote sensing)

The technical group co-ordinated by Dr. I. Goodbody (Jamaica) focused its attention upon the papers presented by Dr. E. D. Houde (U.S.A.) and Dr. A. J. Kemmerer (U.S.A.). An analysis of the statistics on fishery production reported for the Caribbean and the Gulf of Mexico in 1975, the approximate output of which amounted to only 2.2% of the world catches, showed that the probable causes of the poor production in that area were low basic productivity and the relatively undeveloped state of fisheries in the region. Primary production in the centre of the Caribbean and the Gulf of Mexico was less than 50 g C/m^2 a year; on the continental shelf, figures fell to between 100 and 1,000 g C/m^2 a year, and in upwelling areas the average figure was 200 g C/m^2 a year. Some 20% of that primary production was attributed to blue-green algae.

On the basis of productivity calculations and trophic relations, it could be estimated that the total fishery production of the region might be as high as 5.58×10^6 tons a year. A comparison of actual production figures (1.55×10^6 tons a year) with potential production (5.58×10^6 tons a year) indicated the need for scientific research which would lead to a more realistic evaluation of the production capacity of the system and also pointed to the need to stimulate the development of fisheries.

An evaluation of the ichthyoplankton and of biological productivity might play a significant role in research programmes designed to evaluate fishery resources. The carrying out of studies on ichthyoplankton in conjunction with basic oceanographic research would help to clarify the transport processes and the parameters which governed the recruitment of important fishery resources in the region. The planning of future searches for eggs and larvae should take into account: (a) the fact that most of the larval forms of the fishes of the area had been identified, but the identification of eggs was far from complete; (b) the high concentrations of larvae of myctophids and reef fishes present. Such larvae constituted a major food source for tuna. The physical mechanisms that explained why the larvae of reef fishes were found near the coast would have to

be determined; (c) the need to standardize sampling methods, especially the size of the net meshes used and trawling speeds, since the results of searches were often of little use for quantitative comparision owing to the methods used.

Another possible way of improving the use of the fishery resources of the region was to use special sensors. A number of cases of a high degree of correlation between detection by satellite and catches had been recorded. The LANDSAT system had been used successfully to identify optimum areas of fishing for menhaden and marlin. Such areas were determined on the basis of readings obtained by sensors capable of detecting colour and water turbulence. Considering that the above-mentioned system was designed for applications other than those in the field of oceanography, the future orbiting of satellites Nimbus G and Seasat in an effort to determine specific oceanographic characteristics such as colour, temperature, turbulence and other factors opened up vast possibilities for the increase of our knowledge about fishery resources. Though certain reservations were expressed concerning the usefulness of such studies for the small-scale fisheries of some island-states, it must be stressed that many other fisheries of the IOCARIBE region would benefit from the use of oceanographic data recorded by satellites.

Other points discussed by the meeting which should be considered in planning future oceanographic research were: (a) the importance of the contribution that mangrove swamp ecosystems, submarine meadows and reefs can make to fishery; (b) the influence of outside recruitment for certain local stocks; (c) the sociological implications of an improvement in existing fisheries in the islands. Generally speaking, it was recognized that IOCARIBE was important for the co-ordination of co-operative oceanographic research designed to increase our knowledge of subjects related to fisheries.

3.4 Technical Group IV - Physical and chemical oceanography (including the elaboration of models and remote sensing)

The discussions of the technical group co-ordinated by Dr. R. Molinari (U.S.A.) were preceded by introductory papers on the subject by Dr. W. I. Merrel (U.S.A.), Dr. D. Atwood (U.S.A.), and Dr. H. Hernández (Puerto Rico). In connexion with research subjects that might be dealt with by oceanographers, it was pointed out that they should be kept informed about points on which information was needed, in connexion with the organization and development of resources, so that they made it their object to elucidate such points. If oceanographers were so informed, they could direct their research activities towards those points and present their results in such a way as to be intelligible to people who were not familiar with the terminology used in the profession.

One point that should be taken into account in using the results of oceanographic work - for example, to determine how eggs and larvae were transported - was the great variability in the physical and chemical characteristics of the upper layers of the Gulf of Mexico and the Caribbean. Consequently it was hazardous to use average circulation schemes to determine the way in which eggs and larvae were transported. Another problem that should be considered regarding the use of oceanographic data to determine fishing potential was the fact that there was little information available on points related to fisheries - information about dissolved oxygen and the concentration of nutrients, for instance - and what there was did not apply to all the seasons of the year.

It was agreed that the factors which affected the productivity of the region included the following: (a) nitrogen fixation by certain blue-green algae; (b) the effects of large rivers and upwelling; (c) water masses of maximum

salinity; (d) the effects of islands. Nitrogen fixation by the blue-green algae Oscillatoria (species Trichodesdium) was very important because of their abundance and the rapidity of nitrogen fixation and photosynthesis. Another factor was the water from the Amazon and Orinoco rivers which was carried by currents to the Caribbean and which greatly contributed to the presence of water of low salinity during the autumn months. The system of currents in the Caribbean was a factor contributing to the occurrence of upwellings off Guyana, Venezuela, Colombia and Mexico (Yucatan), but the mechanism whereby waters in which there was little upwelling were found in places of considerable productivity in Venezuela was not yet clearly understood. One possible explanation of that apparent anomaly might be the presence of a large amount of detritus in those waters, which could cause the productivity. Another factor that was mentioned was the presence of maximum salinity waters between 100 and 175 metres; when that mass was associated with a marked thermal gradient, it might prevent the detritus from sinking. It had also been shown that a major source of nutrients on the shelf of certain islands was their transport by internal waves which reached those areas.

The problem of the apparent differences in the determination of the paths followed by currents, in accordance with the methods used, was discussed by the participants. It was stressed that currents determined on the basis of density measurements corresponded to average values which did not accurately reflect the variations between them. Scientists concerned with fisheries should indicate the degree of detail needed for the determination of the currents in space and time. In identifying the problems whose solution would contribute to the management and development of fisheries, we should not overlook the fact that we were dealing with two types of phenomena which were indeed regional in character but for which different methodologies had to be used. Some were phenomena which were common to the entire region (currents, distribution of eggs and larvae), and others were local phenomena which, although they were very similar in different areas (for example, circulation around islands), would, because of their variability, require more detailed studies over a smaller area.

It should not be forgotten that the problem of circulation around islands was of fundamental importance for an understanding of the phenomenon of the regeneration of local fish stocks from larvae. During the meeting it was suggested that more data on that subject should be obtained from the islands, and also data on the relations between certain physical and chemical factors and the magnitude and composition of catches, following the methodology used at present in Puerto Rico, where information recorded by fishermen was being used for that purpose. Furthermore, we should bear in mind that more information was needed about the distribution of plankton and the abundance of the component species in relation to the currents, in order to identify indicators; studies should be carried out in that connexion in future.

During the discussions it was suggested that IOCARIBE should: (a) initiate projects in an effort to understand the problems of the islands; (b) encourage mutual co-operation in carrying out oceanographic fishery research in the islands; (c) employ, for such research, the particular methodology followed in Puerto Rico, which exploited to the full the relation between fisherman and scientists; (d) finance study grants for students from the islands in the department of marine sciences at the University of Puerto Rico to be trained in subjects related to oceanography.

4. Report of the Executive Committee

Mr. Corredor informed the plenary meeting of the results of the meeting held by the Executive Committee. The subjects discussed were those covered in IOCARIBE recommendation I.1 (Annex I). Its main object was to put before the plenary meeting some general guidelines or norms for the planning of inter-disciplinary research programmes. Such guidelines should be viewed as suggestions that could be modified, revised or rejected.

The general lines of emphasis were the following: (1) a programme for the Lesser Antilles directed toward the solution of the problems of pot fishery, for which a solution should be sought through the co-operative efforts of biologists, oceanographers and fishery specialists; (2) another programme designed to solve the problems peculiar to fisheries in Central America, which in all likelihood differed from those of the Lesser Antilles; this programme should be realistic and practicable. In that regard discussion turned on the desirability of devoting attention to the catching of crawfish (Panulirus) and in particular to the lack of knowledge about areas of recruitment, a phenomenon which might be linked to other more general problems encountered by fisheries throughout the region.

Mr. Corredor stated that it was important furthermore to devote special attention to the study of upwelling areas and their relation to fishery dynamics; in that regard a recommendation might be drawn up for submission to IOCARIBE-II (Recommendation 4). It likewise seemed advisable to propose intensifying programmes for remote sensing (by satellite), with a view to its application to areas beyond those that concerned IOCARIBE; it was recommended that the Scientific Committee on Oceanic Research (SCOR) should form a working group on the subject.

With respect to the idea expressed by some participants that the suggestions made by the Executive Committee were acceptable because they were simple, in that their objectives proposed could be easily attained, it was remarked that the problems they dealt with were well defined, but not necessarily simple, either in the planning or in the execution of the research which they entailed. The plenary meeting then adopted the basic proposals of the Executive Committee, and agreed to form two working groups on programme development, having the following responsibilities:

Group 1: To prepare a proposal for an interdisciplinary research programme designed to provide information which would be applied to the management and administration of the fishery resources, both actual and potential, in the Lesser Antilles.

Group 2: To draw up a proposal for an interdisciplinary research programme to promote the fishing of crawfish (Panulirus) off the coast of Central America.

5. Statements on Information, Documentation and Data

Dr. J. Caponio, Chairman of the Joint FAO/IOC Panel of Experts on ASFIS (Aquatic Sciences and Fisheries Information System), described the nature and proposals of that international system, which was established in 1975. There were now ten input centres in different parts of the world. ASFIS provided services and issued publications, including: (a) Aquatic Sciences and Fisheries Abstracts (also available on magnetic tape); (b) Marine Science Contents Tables; (c) Conference and meeting schedule; (d) Thesaurus of terms of Aquatic Sciences and Fisheries; (e) World list of Aquatic Sciences and Fisheries Serial Titles; and (f) International Directory of Marine Scientists (1977). Dr. Caponio thanked the Chairman for the opportunity to inform participants about ASFIS, which might be of service in attaining the objectives of IOCARIBE.

With respect to the management of oceanographic data, Mr. T. Winterfeld gave a full account of the activities carried on by the United States National Oceanographic Data Centre (NODC) for the cataloguing of oceanographic information. The Centre also acted as a Regional Data Centre for IOCARIBE. In one way or another, the information obtained from the programme sponsored by IOCARIBE should be available to all scientists concerned in the matter; in that regard the Association might bear in mind the mechanisms for disseminating information in the most efficient manner possible, which had been identified for CICAR. In the last five years efforts had been made to develop a national centre for the exchange of data to assist countries which required such information. Mr. Winterfeld suggested that the way in which data were exchanged should be discussed; biological information was particularly difficult to process. In that regard he mentioned the experience of CICAR regarding data on zooplankton and phytoplankton: only one per cent of the information reported as having been obtained was actually submitted for processing. That problem should be a subject for special consideration by the plenary meeting.

Tnte. R. Steer Ruiz (Colombia) referred to the experience gained thus far by his country. The National Maritime Information Sub-System was organized to process three types of data: (a) administrative information; (b) bibliography and documentation (CECOLDO); and (c) information for the Colombian Oceanographic Data Centre. The system, which applied the NODC criteria, used an IBM 370 computer, and very soon was to acquire a micro-computer to process oceanographic information, with emphasis on physical and chemical data. Tnte. Steer informed the plenary meeting that Colombia would be pleased to make available to IOCARIBE the extra capacity of CECOLDO to process, at least at the beginning, the data generated from programmes developed in the region (Recommendation 2).

6. Plenary discussions on future IOCARIBE programmes

The Chairmen of both Groups submitted to the plenary meeting the basic proposals for interdisciplinary research programmes in the Lesser Antilles and Central America. Participants discussed in detail the various aspects of those proposals. A number of points were found to overlap, and it was recommended that it should be made clear which aspects were the responsibility of IOCARIBE and which came under the WECAF Project.

It was pointed out that the Member States of IOCARIBE in the region should make a special effort to raise the funds needed, since the Association now had no budget for programmes. Despite the generous offer of Belize to support the project for Central America by making its research ship available, the plenary meeting considered that it would be advisable for the second session of IOCARIBE to make a specific recommendation that an attempt should be made to find the ship-time needed for both programmes. Furthermore, the plenary meeting suggested that it would be advisable to try to obtain financial support from the Member States of IOCARIBE to pay the directors of the programmes.

The working groups later met again to work out in detail the plans for both programmes (Annexes IV and V).

7. Adoption of the report

The summary report, including six recommendations, was adopted.

8. Closure of the Workshop

The Chairman expressed his deep gratitude to Professor Doumenge for the excellent arrangements that had been made, and the motion was approved by all the participants. He thanked the Government of France for having acted as host to the meeting.

The Workshop was declared closed at 1730 on Friday, 2 December 1977.

ANNEX I

RECOMMENDATION ICOARIBE-I.1

SCIENTIFIC PROGRAMMES IN SUPPORT OF FISHERIES PROJECTS

The IOC Association for the Caribbean and adjacent regions:

Taking into account the designation of nine priority programmes for consideration for implementation by the Association and the fact that five of these programmes relate in varying degrees to the production of food from the sea to feed the people of the region, i.e.:

Priority	Programme
1	Management and development of marine fisheries in the Lesser Antilles and Central America
4	Ichthyoplankton survey
5	Upwelling studies
6	Circulation monitoring
9	Interdisciplinary Seminar relating appropriate environmental research (physical and chemical oceanography and sedimentation) to fishing stock productivity,

Recognizing that close co-operation and co-ordination between the Western Central Atlantic Fishery Commission of FAO (WECAFC) and IOCARIBE is an essential element in the suscessful implementation of several of the IOCARIBE programmes, and that the proposed programme in fisheries (priority N° 1) is only the first phase of a larger IOCARIBE effort,

Decides to modify the title of its first priority programme to read "The scientific basis for the management and development of marine fisheries in the IOCARIBE area" and that the first phase of this programme will be directed toward the Lesser Antilles and Central America as proposed by the ad hoc Group of Experts (Puerto Rico, March 1976) as their programme N° 13 and given first priority by IOCARIBE;

Requests that the IOCARIBE Secretariat plans and carries out as soon as possible, but not later than 30 November 1976, a joint mission with FAO to the countries of the Lesser Antilles and Central America which have not participated in CICAR to explain to them how IOCARIBE can be of use to them and to encourage their attendance at the IOCARIBE Workshop discussed below;

Instructs the Secretary IOC to approach FAO to discuss its participation in these programmes and the designation of an appropriate official to participate in this mission;

Decides to convene an interdisciplinary workshop in early 1977 in line with IOCARIBE priority programme N° 9, to consider priority items 1, 4, 5 and 6 above with the following terms of reference:

1) To identify the specific basic questions of interdisciplinary science in reference to the environmental processes fundamental to fish stock production;

2) To identify the data and information systems needed to define and quantify fish stocks in the IOCARIBE area leading to recommendations for development; and

3) To prepare specific programme plans for developing the scientific basis for the management and development of marine fisheries in the area selected first for this effort (Lesser Antilles and Central America), and specific plans for the ichthyoplankton survey, and for the upwelling and circulation studies on an IOCARIBE-wide basis (priorities 1, 4, 5 and 6 respectively), and to identify a project manager for each;

Decides to appoint Mr. Harvey Bullis of the U.S.A. as the Chairman of the Steering Committee for this workshop and empowers him, in consultation with the Chairman of IOCARIBE, to select the membership of this committee in consideration of the stated terms of reference;

Requests the Chairman of IOCARIBE and the Secretariat to provide assistance to the Steering Committee in convening this workshop; and

Requests further that IOCARIBE Member States explore the possibility of hosting this workshop and communicating any offers as soon as possible to the IOCARIBE Secretariat as is possible to support this workshop and the travel involved, particularly for scientists from the non-IOCARIBE nations who might not otherwise attend.

ANNEX II

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ANNEX III

RECOMMENDATIONS

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Rec. IOCARIBE-IW.3	Training, Education and Mutual Assistance in the marine sciences (TEMA)
Rec. IOCARIBE-IW.4	Upwelling programme
Rec. IOCARIBE-IW.5	Scientific programme in support of fisheries in the Lesser Antilles
Rec. IOCARIBE-IW.6	Scientific programme in support of fisheries in Central America

RECOMMENDATION IOCARIBE-IW.1

MARINE TURTLE PROTECTION

The IOCARIBE Interdisciplinary Workshop,

Taking into account that marine turtles are an important source of protein and that "tortoise" shell is of significant economic value in the IOCARIBE region,

Recognizing that many populations of marine turtles, particularly the hawkbills and green turtle, are now threatened by extermination through indiscriminate harvesting of adults, destruction of nested eggs, and elimination of nesting sites,

Further taking into account that turtle stock extermination is a problem which may be resolved and corrected through the application of existing and biologically sound practices,

Commends those nations which have taken necessary legal and administrative steps to protect local turtle populations;

Recommends that a total regional programme for the protection, rehabilitation and management of marine turtles be established through appropriate co-operation among such international organizations as IOCARIBE, FAO/WECAFC, the Gulf and Caribbean Fisheries Institute, the International Union for the Conservation of Nature and Natural Resources, etc.;

Strongly urges all governments within the IOCARIBE region to consider the ensuing programme for protection, rehabilitation and management with the view to implementing necessary legal and administrative measures to ensure the continued availability of marine turtle stocks within the region; and

Instructs the Secretary IOCARIBE to take the initiative in bringing this recommendation to the attention of appropriate international organizations and to inform the IOCARIBE Member States of subsequent development and action.

RECOMMENDATION IOCARIBE-IW.2

DATA AND INFORMATION

The IOCARIBE Interdisciplinary Workshop,

Considering the importance of providing existing data and scientific literature to participants in the selected programme,

Further considering the value of the provision of data and information to the conduct of TEMA efforts in the IOCARIBE,

Realizing that data and information obtained by participants in international co-operative ventures such as IOCARIBE must be made available for the future benefit of the scientific community in IOC Member Nations through the WDCs and UN information systems in accordance with IOC guidelines.

Noting with appreciation the offer of Colombia to gradually implement a Responsibl National Oceanographic Data Centre (RNODC) at the Centro Colombiano de Datos Oceanográficos (CECOLDO) in support of data processing and exchange in the IOCARIB region,

Requests the RDC IOCARIBE, in collaboration with the Joint FAO/IOC Panel of Experts on ASFIS, to compile an immediate list of references to recent scientific papers on the subject of spiny lobster and the relevant environmental factors affecting their recruitment;

Urges the Joint FAO/IOC Panel of Experts to consider the rapid development of arrangements whereby copies of needed scientific papers on the marine environment could be disseminated to scientific activities in the developing countries in the IOCARIBE region;

Reminds all participants to make every effort to transmit all data collected under IOCARIBE to the RDC IOCARIBE in accordance with IOC practices and in this regard;

Encourages the participants to contact the CECOLDO concerning assistance with the processing and computerization of BATHY and Nansen Cast, and associated chemical, data;

Looks to the WC/IODE to provide early technical advice on suitable data recording and exchange procedures for marine biological data in order to improve the flow of such data into the WDC system;

Instructs the Secretary IOCARIBE and requests the WC/IODE to work closely with FAO and FAO's WECAFC to ensure that there will be no duplication of efforts in systems for reporting scientific and fisheries data.

RECOMMENDATION IOCARIBE-IW.3

TRAINING, EDUCATION AND MUTUAL ASSISTANCE IN THE MARINE SCIENCES (TEMA)

The IOCARIBE Interdisciplinary Workshop,

Recognising that within many Member States of IOCARIBE, there is a serious deficit of trained scientific and technical manpower in the marine sciences,

Bearing in mind that Training, Education and Mutual Assistance in the marine sciences (TEMA) provides the basic structure to achieve a critical mass of human resources within developing nations,

Taking into account the report of the second session of the Working Committee for Training, Education and Mutual Assistance in the marine sciences (doc. IOC/TEMA-II/3) and its subsequent ratification by the IOC Assembly at its tenth session (doc. SC/MD/60),

Instructs the Secretary IOCARIBE, working in co-operatiion with research project leaders and principal investigators, to ensure that the TEMA concept be incorporated in the research programmes proposed by this Workshop.

RECOMMENDATION IOCARIBE-IW.4

UPWELLING PROGRAMME

The IOCARIBE Interdisciplinary Workshop,

Taking into account the need for interdisciplinary upwelling studies in the IOCARIBE area,

Bearing in mind that a specific request was made during IOCARIBE-I that problems relating to upwelling in the IOCARIBE area be considered by SCOR Working Group 36 in its deliberations,

Noting that such studies have been carried out in areas of major upwelling such as those off the coasts of Peru, U.S.A. (Oregon), North-west Africa and Mexico (Baja California) by the CUEA Programme of IDOE,

Noting further the special need for expertise not available in the IOCARIBE area in such studies,

Recommends that IOCARIBE designate a representative from the area to act as observer during meetings of SCOR Working Group 36;

Instructs the Secretary IOCARIBE, in consultation with the IOCARIBE National Associates, to identify a special task team to consider the objectives and needs of an interdisciplinary upwelling programme for the IOCARIBE area as soon as possible;

Requests the task team to consult with appropriate components of the CUEA programme and with IOCARIBE's observer to SCOR Working Group 36, prior to the formation of a research programme.

RECOMMENDATION IOCARIBE-IW.5

SCIENTIFIC PROGRAMME IN SUPPORT OF FISHERIES IN THE LESSER ANTILLES

The IOCARIBE Interdisciplinary Workshop,

Taking note of recommendation IOCARIBE-I.1, especially the need to prepare plans for developing the scientific basis for the management and development of marine fisheries in the Lesser Antilles, and specific plans for the study of ichthyoplankton,

Recognizing that the trap fishery in the Lesser Antilles is an important source of food and income for people in the region and that these fisheries are over exploited and in need of management,

Recommends that the scientific programme outlined by its Programme Development Working Group 1 (Annex IV) shall be adopted;

Instructs the Secretary IOCARIBE to take steps to assist the implementation and funding of this programme;

Instructs further the Secretary IOCARIBE to discuss with the WECAF Project and Commission implementation of the fisheries item outlined in paragraph 4f of the programme.

RECOMMENDATION IOCARIBE-IW.6

SCIENTIFIC PROGRAMME IN SUPPORT OF FISHERIES IN CENTRAL AMERICA

The IOCARIBE Interdisciplinary Workshop,

Taking note of recommendation IOCARIBE-I.1, especially the need to prepare plans for developing the scientific base for the management and development of marine fisheries in Central America,

Taking into account that, notwithstanding the fact that the spiny lobster fisheries in Central America are of socio-economic benefit for the region, the scarcity of information on the biology, behaviour and population dynamics of this important resource produces management programme without a scientific base,

Recognizing that fluctuations in the catch can be the result of natural changes in the stock or of an increase in the fishing effort,

Considering that on the other hand the impact of the larval recruitment and the migrations of the adult stocks are almost unknown,

Instructs the Secretary IOCARIBE to implement the programme that resulted from the deliberations of its Programme Development Working Group 2 (Annex V);

Considers it suitable to this end to contact the WECAF Project and Commission in order to solicit its action and co-operation with regard to paragraphs 4b and 4e with which it is concerned.

ANNEX IV

SCIENTIFIC PROGRAMME IN SUPPORT OF FISHERIES IN THE LESSER ANTILLES

1. Title of programme

Scientific studies for improvement of trap fishery management in the Lesser Antilles.

2. Members

Programme Development Working Group 1 of the IOCARIBE Interdisciplinary Workshop was made up of the following persons: I. Goodbody (Chairman), E. D. Houde (Rapporteur), D. K. Atwood, J. Bass, L. K. Boerema, H. R. Bullis, R. Camacho, D. Capone, A. I. George, M. Hernandez, W. J. Richards, T. Okuda, H. Walters, H. E. Wood.

3. Justification and background

The Group noted that its objective was to investigate how nearshore fish populations are controlled and what are the mechanisms of recruitment to the fish stock; to study the existing situation in the trap fishery of the Lesser Antilles and determine how scientific data may be used to assist rehabilitation and management.

Any efforts to rehabilitate and properly manage small island fisheries require in-depth knowledge of oceanographic factors that regulate reproduction, growth and recruitment of fish stocks. Such knowledge, when complete, should allow development of predictive ecosystem models necessary for long-term fishery management including changes caused by the fishery itself. Necessary information included:

a) Circulation patterns affecting movement of fish eggs and larvae;
b) The availability of nutrients and the mechanism of their supply;
c) The amount of primary productivity providing energy to the ecosystem.

Such information can only be gained through an intensive interdisciplinary programme co-ordinated with ongoing fishery programmes in the region, which will collect the appropriate data.

It was agreed that the basic study of the trap fishery and its management must be conducted in an overfished area, and that WECAF would need to make a major input in relation to fishery problems.

It was agreed that two main areas should be designated for the study:

a) St. Kitts-Nevis. In this area the trap fishery is well developed and over exploited, but the interpretation and oceanographic data will be complex.

b) St. Lucia. In this area the trap fishery is less well developed and there are immediate plans for the collection of fishery statistics. Recruitment data will be relatively easy to obtain because the oceanographic regime is apparently less complex.

An important question to be answered in both areas is whether recruitment depends on the local stock or does it originate from some other source. In both areas it is considered necessary to collect data on fisheries, ichthyoplankton distribution and abundance, water transport, nutrient chemistry and productivity.

A simple outline of the proposal and divisions of responsibility is given under paragraph 4 below.

4. Programme description

a) St. Lucia Project

1. Oceanographic (IOCARIBE)

a) St. Lucia Passage	a) Circulation b) Ichthyoplankton c) Chemistry, primary production, zooplankton.
b) St. Vincent Passage	a) Circulation b) Ichthyoplankton c) Chemistry, primary production, zooplankton.
c) Up-stream	a) Circulation b) Ichthyoplankton c) Chemistry, primary production, zooplankton.
d) Down-stream 1. Island wake 2. West of island wake	a) Circulation b) Ichthyoplankton c) Chemistry, primary production.

2. Fisheries (WECAF Project and St. Lucia Fisheries Department)

a) Catch/Effort (C/E) and assessment
b) Spawning season and fecundity
c) Nursery and recruitment information
d) Maximum sustainable yield (MSY) and optimum yield (OY)

b) St. Kitts/Nevis Project

1. Oceanographic (IOCARIBE)

a) Circulation
b) Ichthyoplankton
c) Chemistry, primary production, zooplankton

2. Fisheries (WECAF Project and local Fisheries Departments)

a) St. Kitts

1 - C/E and assessment
2 - Modify gear and methods
3 - Monitor C/E

b) Nevis

1 - C/E and assessment
2 - Monitor C/E and report assessment

The nature and type of data to be collected in each area is similar and is as set out in the following paragraphs.

c) Ichthyoplankton

Samples will be collected to determine horizontal and vertical distribution patterns and diurnal changes. Sampling will be undertaken upstream from the island, in the island shadow and to the west of the shadow. These will be related to water transport, nutrient chemistry, plankton and productivity.

Sampling must extend over at least one year at minimum intervals of three months. It may be necessary to increase the sampling effort during known seasons of fish reproduction.

Samples will also be used for total analysis of zooplankton and the potential food sources for fish larvae.

d) Water Circulation

A water-mass circulation study around the shelf of an island should consider the following environmental parameters:

1. Currents and net transport at different levels of the water column;
2. Tidal Variations;
3. Meteorological parameters (wind regime, precipitation and evaporation rates, etc.);
4. Wave regime;
5. Land drainage;
6. Bathymetric survey.

The investigation of the inter-relationship among these variables entails monitoring for at least fourteen continuous days during each season of the year. Measurements of the physical variables should be undertaken jointly with biological and chemical studies for the area.

Sophisticated measuring methods should be employed to prevent data loss and waste of effort. The methods suggested are as follows:

1. Use of current meter systems (monitoring, release units, etc.) (Eulerian measures);

2. Lagrangian tracking by means of radio, or theodolite-tracked drogues, dye patches, and surface drifting objects;
3. In situ meteorological and wave regime parameters monitoring buoys;
4. In situ tidal gauges;
5. Bathymetric surveys from small and large boats depending on closeness to the shoreline (portable recorders close to shore);
6. Wherever possible, data acquired by satellite remote sensing equipmnet should be obtained as a part of the programme. This will include wave spectra, surface winds and currents.

The methods of analysis will be as follows:

1. Spectral analyses of waves, currents and wind regime (computer programmes);
2. Correlation analyses of wind, currents, tidal variations by means of statistical and diagrammatic methods (for example: progressive vectorial diagrams).

This investigation is specifically designed to support biological data necessary to elucidate the fisheries problems or solutions being sought (net transport to determine distribution patterns of larvae).

e) Chemistry, productivity

In situ C^{14} uptake primary production measurements in Atlantic and Caribbean sides in and out of island shadow and on island shelf.

Coincident measurement of nutrient and biochemical parameters including

NO^-_3, NO^-_2, NH_4^+, PO_4 = SIO_4 = ATP

ATP (for total microbial biomass)
Chlorophyll (plant biomass)

Dissolved and particulate organic carbon
Dissolved and particulate organic nitrogen
Temperature
Salinity
Dissolved oxygen
Alkalinity
Nitrogen fixation

An oceanographic platform that will allow performance of amount of these analyses at sea will be essential.

Data on chlorophyll and sea surface temperature will also be acquired through satellite remote sensing systems.

f) Fisheries

The fisheries study will concentrate on an evaluation of the trap fisheries in the Lesser Antilles. Such evaluation can be based on estimates of catch, effort and area fished in the various islands as well as recruitment to the stock. Improved estimates would be obtained if it were possible to manipulate these fisheries. It is agreed that the WECAF Project should be requested to be the responsible agent for implementation of the programme.

The objective is to estimate the state of exploitation of the fish resources, in particular those caught in the trap fishery, and to estimate if there are any simple indices which can be used to estimate the state of exploitation for grounds for which little information is available, for islands in the Lesser Antilles with special emphasis in Santa Lucia, St. Kitts, Montserrat and Antigua.

The basis for this study will be a statistical sampling programme, designed by an expert in the field who also should ensure uniformity and standardization in the countries participating in the programme. The sampling programme should be designed to give sufficiently reliable results for a moderate cost and limited use of personnel. The UNDP/FAO/WECAF project could be requested to assist in the programme by providing a statistician.

The statistics should include catches by species or species groups, by fishing ground, some information on size composition, maturity, etc.

The data should be analyzed at regular intervals in order to follow and eventually modify the programme if necessary.

g) Training, Education and Mutual Assistance in the marine sciences (TEMA)

Every effort will be made to include scientists and students from the region in the conduct of the programme including field work, data collection and data reduction.

h) Time Schedule

It is estimated that two years will be required for planning and that the programme should aim to commence on 1 January 1980. The group noted that it was not necessary for St. Kitts and St. Lucia parts of the programme to be conducted simultaneously and it would be possible to operate the programme on a phased basis.

i) Finance

The principal financial requirement is support for ship time and for personnel. ISTPM (France), NOAA (U.S.A.) NSF-IDOE (U.S.A.), Sevastopol Hydrobiological Institute (U.S.S.R.), NERC (U.K.), Royal Navy (U.K.), National Marine Fisheries Service (U.S.A.), Canadian Committee on Oceanography (Canada) might all be approached for donation of ship-time.

5. Programme Manager

Dr. W. J. Richards was appointed as temporary Project Manager of the oceanographic part of the programme. It was agreed that the WECAF Project should be asked to nominate a suitable person to take responsibility for the fisheries part of the programme.

ANNEX V

SCIENTIFIC PROGRAMME IN SUPPORT OF FISHERIES IN CENTRAL AMERICA

1. Title of programme

Scientific studies in support of the management of the spiny lobster fisheries in Central America.

2. Members

Programme Development Working Group 2 of the IOCARIBE Interdisciplinary Workshop was made up of the following persons: L. D'Croz (Chairman), G. W. Miller (Rapporteur), A. E. Dammann, I. Galeano, J. E. Guzman, A. J. Kemmerer, L. F. Martinez, W. J. Merrel, R. L. Molinari, M. Murillo, A. Vasquez B. and J. Wickstead.

3. Objectives

The programme is directed towards the increase of scientific knowledge with regard to the spiny lobster which should be used as supporting information for an effective management of this resource. One of the main objectives of the programme is to determine if there exists only one stock or several separated ones. Determining this should provide the corresponding information for the recommendation of appropriate strategies regarding the spiny lobster fishery management for every country or for the whole region.

4. Programme description

The programme is made up of the following six activities:

a) Biochemical identification of the stocks. To that end specimens of spiny lobster will be sent to an appropriate laboratory for their biochemical identification.

b) Co-ordinated project for the tagging of adult specimens in order to ascertain the migration patterns in the area. The data obtained should be deposited for their analysis in an appropriate centre and at the disposal of all participants and other interested persons.

c) A pilot project in Belize to determine the net larval recruitment through an analysis of sampling quantities and techniques. Circulation studies should be executed and complemented with data from satellite remote sensing. Training in obtaining data through satellites as well as in general oceanography should be offered.

d) Studies on larval behaviour, which should include: identification, movement and transport mechanisms. These studies may be carried out in Panama and/or Costa Rica where basic facilities to that end exist. Training should be offered with regard to identification and general biology of the larvae.

e) A project of interviewing the fishermen in order to ascertain spawning maxima as well as aspects of the natural history of the spiny lobster. This project should be carried out together with the tagging project (b).

f) Compilation of a bibliography and available information on spiny lobster in the area and adjacent regions.

5. Programme Manager

Mr. G. W. Miller was appointed temporary Programme Manager with the purpose of implementing these studies in their first phase.

ANNEX VI

LIST OF PARTICIPANTS

ANEXO VI

LISTA DE PARTICIPANTES

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ANNEX VII

Welcoming address by Professor François Doumenge

Mr. Chairman,

On behalf of the French Government and the authorities of the Department of Martinique, it gives me great pleasure to welcome the IOCARIBE workshop meeting. Your choice of Martinique for its venue is an encouragement to those who, for many years, have been endeavouring, in a spirit of international and regional co-operation, to develop exploitation of the potential of the marine resources.

It is possible to hold this meeting at Fort-de-France thanks to the technical and financial assistance of the Intergovernmental Oceanographic Commission of Unesco, and thanks to the support of the Centre National d'Exploitation des Océans, in Paris.

Our special thanks are due to the Intergovernmental Oceanographic Commission for taking charge of the installation and operation of the simultaneous interpretation equipment and for contributing towards the travel and subsistence costs of many participants. CNEXO, for its part, has meet the local costs of the meeting and has sent an observer in the person of Dr. Reyss, a distinguished member of its scientific management.

The meeting is being held in the offices of the Vice-Chancellor of the Antilles-Guyana Centre and I must add a special word of thanks to my assistants for their work in preparing the premises and providing for the smooth running of the meetings and Secretariat services.

Many institutions interested in the development of the marine resources of the French departments in the American tropical zone are present here and will be collaborating in your work: the Maritime Affairs Authority is represented by the administrators of the islands of Martinique and Guadeloupe; the Institut Scientifique et Technique des Pêches Maritimes has delegated the directors of its two laboratories in Martinique and French Guyana; the Antilles-Guyana University Centre is represented by its professor in charge of the marine biology department; and the Institut National de Recherche Agronomique, of Guadeloupe, has also delegated a member of its management board.

On behalf of all these research institutes and the authorities of the French Departments of Martinique, Guadeloupe and Guyana, and on my own behalf, I thank you for choosing Fort-de-France as the venue for this workshop. I trust it will be profitable and enable the nineteen States taking part in IOCARIBE to achieve rapid and substantial success regarding better use of the potential of the marine resources of the whole Caribbean island region and of the seaboard of the American continent, from Central America to French Guyana.

François Doumenge

ANNEX VIII

LIST OF ACRONYMS AND ABBREVIATIONS

ASFIS	Aquatic Sciences and Fisheries Information System
BATHY	Bathythemograph
CECOLDO	Centro Colombiano de Datos Oceanográficos
C/E	Catch/Effort
CICAR	Co-operative Investigations of the Caribbean and adjacent regions
CNEXO	Centre National pour l'Exploitation des Océans
CUEA	Coastal Upwelling Ecosystems Analysis
FAO (of the UN)	Food and Agriculture Organization
GIPME (of IOC)	Global Investigation of Pollution in the Marine Environment
IDOE	International Decade of Ocean Exploration
IGOSS (of IOC/WMO)	Integrated Global Ocean Station System
IOC	Intergovernmental Oceanographic Commission
IOCARIBE (of IOC)	IOC Association for the Caribbean and adjacent regions
IODE (of IOC)	International Oceanographic Data Exchange
ISTPM (France)	Institut Scientifique et Technique des Pêches Maritimes
MSY	maximum sustainable yield
NERC (UK)	Natural Environment Research Council
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Centre
NSF	National Science Foundation
OY	optimum yield
RDC	Regional Data Centre
RNODC	Responsible National Oceanographic Data Centre
SCOR (of ICSU)	Scientific Committee on Oceanic Research
TEMA	Training, Education and Mutual Assistance in the marine sciences
UN	United Nations
WDC	World Data Centre
WECAFC (of FAO)	Western Central Atlantic Fishery Commission