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Workshop Report No. 29

WESTPAC Workshop on Marine Biological Methodology

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Unesco

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No.	Title	Publishing Body	Languages
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), 138 pp.	Office of the Project Manager UNDP/CCOP c/o ESCAP Sala Santitham Bangkok 2, Thailand	English
2	CICAR Ichthyoplankton Workshop, Mexico City, 16-27 July 1974. (Unesco Technical Paper in Marine Sciences, 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", Guayaquil, 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	English (full text) Extract and Recommendations also in: French Spanish Russian
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

No.	Title	Publishing Body	Languages
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 lecturers 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
14	IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and Adjacent Areas, Abidjan, Ivory Coast, 2-9 May 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French
15	CPPS/FAO/IOC/UNEP International Workshop on Marine Pollution in the South-East Pacific, Santiago de Chile, 6-10 November 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France CPPS Señor Miguel Bakula Secretario General de la Comisión Permanente del Pacífico Sur Vanderghem 590 Lima 27, Peru	English Spanish
16	Workshop on the Western Pacific, Tokyo, 19-20 February 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Russian

No.	Title	Publishing Body	Languages
17	Joint IOC/WMO Workshop on Oceanographic Products and the IGOSS Data Processing and Services System (IDPSS), Moscow, 9-11 April 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
17 Suppl.	Papers submitted to the Joint IOC/WMO Seminar on Oceanographic Products and the IGOSS Data Processing and Services System, Moscow, 2-6 April 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
18	IOC/Unesco Workshop on Syllabus for Training Marine Technicians, Miami, 22-26 May 1978 (Unesco reports in marine sciences, No.4).	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
19	IOC Workshop on Marine Science Syllabus for Secondary Schools, Llantwit Major, Wales, U.K., 5-9 June 1978 (Unesco reports in marine sciences, No.5).	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
20	Second CCOP-IOC Workshop on IDOE Studies of East Asia Tectonics and Resources, Bandung, Indonesia, 17-21 October 1978.	Office of the Project Manager UNDP/CCOP c/o ESCAP Sala Santitham Bangkok 2, Thailand	English
21	Second IDOE Symposium on Turbulence in the Ocean, Liège, Belgium, 7-18 May 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
22	Third IOC/WMO Workshop on Marine Pollution Monitoring, New Delhi, 11-15 February 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
23	WESTPAC Workshop on the Marine Geology and Geophysics of the North-West Pacific, Tokyo, 27-31 March 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Russian
24	WESTPAC Workshop on Coastal Transport of Pollutants, Tokyo, 27-31 March 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
25	Workshop on the Intercalibration of Sampling Procedures of the IOC/WMO UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-Ocean Waters, Bermuda, 11-26 January 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English

No.	Title	Publishing Body	Languages
26	IOC Workshop on Coastal Area Management in the Caribbean Region, Mexico City, 24 September-5 October 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
27	CCOP/SOPAC-IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Nouméa, New Caledonia, 9-15 October 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
28	FAO/IOC Workshop on the effects of environmental variation on the survival of larval pelagic fishes Lima, 20 April - 5 May 1980	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
29	WESTPAC Workshop on marine biological methodology	IOC, Unesco Place de Fontenoy 75700 Paris, France	English

PREFACE

In accordance with its terms of reference (Annex to Decision WESTPAC-I.10), the Workshop on Marine Biological Methodology focussed its attention on: (i) the review of the range of biological methods suitable for co-operative studies, with particular reference to their standardization, and the identification of those of greatest significance with regard to future projects in the WESTPAC region; and (ii) the possibility of improving the existing systematic knowledge of marine organisms in the region, a survey of the extent of present knowledge, and identification of those areas where improved information would be of greatest benefit to the region.

However, owing to the limited time available to the Workshop, it was not possible to carry out a critical review of the methodology and formulation of a workplan for the execution of the proposed programmes. Therefore, the Workshop appointed a Task Team for each of the two proposed programmes, and requested each to re-examine the projects recommended within the respective programme and, for those for which this had not been done, to recommend appropriate standard methods for their execution.

The final results of the Task Teams' work will be published later as a Supplement to this Report.

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Summary Report

1. Opening of the Workshop

The convenor, Dr Ichiro Yamanaka, Far Seas Fisheries Research Laboratory, Shimizu, opened the Workshop and welcomed the participants. Addresses of welcome were also given by: Professor Noriyuki Nasu, Japanese Representative for WESTPAC; Mr Taijiro Matsuura, Secretary General of the Japanese National Commission for Unesco; Mr George Kitaka, Assistant Secretary of IOC; and Professor Toshiyuki Hirano, Vice-Chairman of WESTPAC.

The texts of the welcoming addresses are given in Annex VI.

2. Appointment of Chairman, Co-Chairman and Rapporteur

The Workshop appointed Dr John Bunt, Australian Institute of Marine Sciences, Townsville, Australia, as the Chairman of the Workshop; Dr Takahisa Nemoto, Ocean Research Institute, University of Tokyo, Nakano, Japan, as the Co-Chairman, and Dr Brian Morton, Department of Zoology, the University of Hong Kong, as the Rapporteur.

Experts from the following WESTPAC countries and territories participated in the workshop: Australia, China, France (New Caledonia), Indonesia, Japan, Korea (Republic of), Malaysia, New Zealand, Philippines, Thailand, United Kingdom (Hong Kong), and the United States of America. Apologies were received from Dr S. Smith (U.S.A.) and Professor Koblentz-Mishke (U.S.S.R.).

The List of Participants is given in Annex III.

3. Adoption of the Agenda

The Agenda was adopted (Annex I).

4. Administrative arrangements

Mr Masahiro Nishio, Deputy Director, International Science Division, Ministry of Education, Science and Culture, acting as Workshop Secretary, briefly described the administrative arrangements for the Workshop and introduced the staff of the Secretariat.

5. Review of past studies and present knowledge on selected topics in marine biology in the WESTPAC region

Dr John Bunt, Chairman of the Workshop, reviewed the subject of marine productivity in the WESTPAC region. In accordance with Decision WESTPAC-1.10 and its Annex, the Chairman urged the Workshop participants to focus their attentions on the development of a work plan to:

(i) Examine the range of biological methods suitable for co-operative studies, with particular reference to their standardization, and to identify those of greatest significance with regard to future projects in the WESTPAC region.

(ii) Consider the possibility of improving the existing systematic knowledge of marine organisms in the region, survey the extent of present knowledge, and identify those areas where improved information would be of greatest benefit to the WESTPAC region.

The Chairman noted that the following items would form bases for discussion:

(a) Past studies of the relationship between seasonal and long-term variations in biological productivity, this forming the basis of variation in living marine food resources, with attention focused on the regional variations in nutrients, phyto-, ichthyo- and zoo-plankton.

(b) Identification of programmes which should be initiated at an early stage by WESTPAC, with an evaluation of their priority.

(c) Ways to achieve a standardization of methods relevant to the implementation of the proposed projects.

(d) International co-operation in education and training.

(e) Plans for future co-operative action.

(f) The preparation of recommendations. (The Recommendations are given in Annex II.)

Many participants read papers or gave presentations describing either recent developments in marine biological methodology or outlining possible co-operative research proposals for the WESTPAC region. Annex IV contains the titles of these papers and presentations, together with the names of the authors. Anyone interested in receiving a copy of a particular paper should write to the author directly at the address given in the List of Participants (Annex III).

6. Identification of major projects and appropriate methodology

The Chairman introduced this item of the agenda by suggesting that it might be convenient to discuss workshop research objectives separately as two major, yet intercalated, areas of study.

After some discussion of procedural matters relating to the final significance and co-ordination of the projects to be defined, the discussion on research objectives was commenced.

It was generally agreed that the project programme should first define areas where there was a proven need for improvement of systematic knowledge since taxonomic problems in the WESTPAC region are acknowledged to constitute an intractible barrier to co-operative and comparative research. It was further acknowledged that there remain great gaps in our knowledge of basic community structure and patterns of change. Secondly, it was agreed that there was a need to formulate projects in such a way that participation by scientists from each Member State was possible. Third, that a methodological protocol should be adopted which would allow participation by all Member States, but that there should also be incorporated into any such projects methodological techniques which would permit an overall advancement of scientific expertise. Fourth, it was acknowledged that not all such projects might have region-wide appeal, but that their formulation should express the concern for their implementation felt by the Workshop participants as a whole, while, nevertheless, allowing rather more limited projects (possibly as sub-regional co-operative studies) to proceed.

These guidelines being accepted there was general agreement on the division of the Workshop participants into two groups dealing with, respectively :

A. Coastal margin and benthic ecosystems

Chairman	Dr J. Bunt
Rapporteur	Dr B.S. Morton

B. Planktonic ecosystems

Chairman	Dr T. Nemoto
Rapporteur	Dr D.A. Robertson

It was agreed that each group would consider and recommend projects in relation to the following topics :

(i) Living communities.
(ii) Assessments of production.
(iii) Trophic processes.
(iv) Management objectives.

It was further established that each project should be justified in terms of suitability for regional co-operation and improvement of scientific knowledge, and should assess regional training requirements in methods best suited for regional co-operation, bearing in mind the need

for the intercalibration and improvement of local expertise. These items should, however, also be identified under Agenda Item 7 when problem areas have been identified.

7. International co-operation in research, education and training

The Chairman opened this item by inviting participants to strengthen the present bonds of co-operation within the WESTPAC region.

Mr G. Kitaka, Assistant Secretary of IOC, reviewed the role of IOC in the financing of training programmes in marine science as part of its global and regional research programmes. He explained that, apart from regular funds for training allocated by Unesco, IOC Trust Funds may be available to assist its developing Member States in general, but that usually such funds are donated with a particular programme in mind. In addition, assistance may be received through the Voluntary Assistance Programme (VAP) of the Commission through which a donor country may finance a particular approved request from a particular developing Member State. He concluded by drawing the attention of participants to the United Nations Interim Fund for Science and Technology for Development (IFSTD), executed by UNDP, which IOC Member States may be able to draw on in the near future.

The regional representative for Training, Education and Mutual Assistance (TEMA), Dr P. Menasveta, reviewed the role of this programme in WESTPAC training efforts, and suggested that the participants discuss training priorities so that submissions may be made to UNDP for financial assistance. In the near future a group of four consultants would visit countries in the central west Pacific region and, following upon their reports, meetings will be held to review and adopt such training programmes and subsequently submit a proposal to UNDP for funding.

The Chairman commended IOC to actively seek funds to assist WESTPAC in the fulfilment of its projects and further suggested that the participants seek assistance on as wide a range of training levels as possible. The representative for TEMA agreed with this suggestion but identified specific areas where training appeared, to him, to be necessary; e.g., the field of taxonomic problems with regard to zooplankton and coral productivity.

A number of participants reviewed training programmes offered by the Member States.

Speaking on behalf of the Ministry of Education, Science and Culture, Mr Masahiro Nishio (Deputy Director, International Science Division, Ministry of Education, Science and Culture) recalled the announcement made by Mr Taijiro Matsuura, Secretary General of the Japanese National Commission for Unesco, during his welcoming address, of the Japanese

government's contribution to the IOC Trust Fund of US$30,000 in the fiscal year 1981. He also pointed out that in addition to this contribution, the Ministry would consider favourably requests for funding of international co-operative research programmes drawn up by Japanese scientists in close co-ordination with marine scientists from other countries of the region.

The Chairman, on behalf of all participants, warmly thanked the Japanese government for their generosity and support of the WESTPAC programme.

The IOC representative also warmly acknowledged the generosity of the Japanese government but pointed out that the developing countries have a responsibility to contribute the greater portion of the effort with regard to the provision of funds required to train their own scientists. Any external funds should only be regarded as 'seed' money to initiate the various training programmes.

It was generally agreed that training programmes should be specifically linked to the priority projects that this Workshop identified. In addition, it was also generally agreed that training priority should be given to young scientists to enable them to participate more actively in international training programmes, seminars, symposia, conferences and workshops.

Professor S. Motoda, of Tokai University, gave a description of the CSK programme and of its results, especially with reference to the zooplankton collection housed at the Marine Biological Centre, Tokai University, Shimizu, Japan. He reported upon the activities of the centre and upon the present status of the CSK sorting service, the condition of the specimens, and the co-ordinating activities of the centre with regard to the loan of specimens for study by qualified scientists. He also briefly outlined the further activities planned by the sorting centre and, in particular, indicated that, through its involvement in the CSK sorting service, the centre would continue to serve major regional collaborative programmes initiated by IOC.

The Chairman thanked Professor Motoda for the services provided by the Marine Biological Sorting Centre.

Dr Ichiro Yamanaka, as observer for FAO/IPFC, reported upon the activities of IPFC and its Standing Committee on Resources Research and Development (SCORRAD). He further noted that the biological programmes of WESTPAC will be of the utmost interest to IPFC.

Mr Tadao Tatsuno, representing the Responsible National Oceanographic Data Centre for WESTPAC (RNODC-WESTPAC (NODC)), submitted a brief report on information retrieval and dissemination and data management. He gave a description of the methods of data submission as

recommended by the IOC Manual and Guides No.9 on International Oceanographic Data Exchange (ROSCOP and ROMBI). He further outlined the extent of the services offered by the RNODC, referring specifically to the achievements of the JODC in the CSK programme. He urged the Workshop participants to propose recommendations with regard to data exchange.

The Chairman thanked Dr Yamanaka and Mr Tatsuno for their reports, acknowledging the interest of SCORRAD and RNODC (WESTPAC) in the deliberations of the Workshop participants.

8. Future activity plans

Having reviewed the state of knowledge of marine ecosystems and living resources in the WESTPAC region and having considered future needs, present capabilities and opportunities for interactions and collaboration among the researchers of the region, the WESTPAC Workshop on Marine Biological Methodology adopted 13 Recommendations (Annex II).

Recognizing the need to proceed with the implementation of the recommended projects without delay, as well as the fact that the limited time available to the Workshop would not allow a critical review of the methodology and formulation of a work plan for the execution of the proposed programmes, the Workshop appointed a Task Team for each of the two proposed programmes, as follows:

Task Team for programme A:

Chairman	Dr Jin-Eong Ong
	Professor M. Horikoshi
	Dr E.D. Gomez

Task Team for programme B:

Chairman	Dr T. Nemoto
	Dr A. Fleminger
	Dr S. Sudara

It was agreed that each Task Team, working by correspondence, should examine the projects recommended within the respective programme and, for those for which this has not been done, recommend appropriate standard methods for their execution, copying all correspondence as appropriate to the WESTPAC correspondent for Marine Biology and Pollution and to the IOC Secretariat. The final results of the Task Teams' work should be sent to the IOC Secretariat before 31 May 1981.

9. Adoption of Summary report and Recommendations

The report and its recommendations were unanimously adopted.

10. Other business

There was no other business.

11. Closure of the Workshop

There being no further business, the Chairman thanked the participants for their careful attention to the proceedings of the Workshop and led the participants in offering formal appreciation to all of those associated with the organization of the Workshop and preparation of this report.

Annex I

AGENDA

1. Opening of the Workshop.
2. Appointment of Chairman, Co-Chairman and Rapporteur.
3. Adoption of the Agenda.
4. Administrative arrangements.
5. Review of past studies and present knowledge on selected topics in marine biology in the WESTPAC region.
6. Identification of major projects and appropriate methodology.
7. International co-operation in research, education and training.
8. Future activity plans.
9. Adoption of Summary Report and Recommendations.
10. Other business.
11. Closure of the Workshop.

Annex II

RECOMMENDATIONS

The WESTPAC Workshop on Marine Biological Methodology:

1. Recommends that the IOC Programme Group for the Western Pacific (WESTPAC) adopt the Summary Report of the Workshop and its recommendations;

2. Recommends that arrangements be made to ensure that research undertaken in WESTPAC is developed and integrated in a rational manner with early attention to establishing a sound foundation of basic knowledge of taxonomy, biogeography and the natural history of key species and of the living communities of the WESTPAC region;

3. Recommends that two major programmes be adopted for implementation through the authority of the WESTPAC Technical Correspondent for Marine Biology and Pollution. The two programmes are:

   A) Identification and characterization of the major biological communities and assessment of their inherent productivity in the coastal margins and sea bed of the WESTPAC region, together with investigations of the taxonomy, biogeography and natural history of key species and processes which sustain harvestable products.

   B) Delineation and assessment of zones of high pelagic and planktonic productivity in the WESTPAC region, with investigations of the taxonomy, biogeography and natural history of key species, characterization of their communities and of environmental and biological processes which maintain resources of value to man;

4. Recommends that, for the implementation of these programmes, IOC, through its normal administrative arrangements, invite Member States in the WESTPAC region to plan and execute each of the two programmes;

5. Recommends, recognizing the complexity of these undertakings, that each of the two major programmes incorporate a series of related projects, outlined in Annex IV, concerned with:

   - the living communities of the region;

   - assessments of production in each of the identified major communities;

- trophic processes of key importance leading to harvestable resources;

- research fundamentally relevant to resource management;

6. Recommends that samples accumulated by the above-mentioned programmes be archived in centralized, readily accessible institutional repositories or regional taxonomic centres as museum-quality collections for taxonomic-biogeographic study by specialists;

7. Recommends that, in identifying priorities, care be taken to avoid duplication, but building on international research already in progress or being planned within the region;

8. Recommends that to facilitate extensive and effective participation in all programme elements,

   a) wherever appropriate, IOC explore means to provide support through TEMA for training and education, exchange of views and other interactions essential for progress towards stated objectives;

   b) countries capable of providing specific assistance (e.g., sorting facilities, data storage, retrieval and exchange, etc.) be encouraged to accept responsibility for co-ordination in those respects;

   c) further, noting Decision WESTPAC I-17, by which the Responsible National Oceanographic Data Centre (RNODC-WESTPAC) was established for data management and exchange for the region, all participating scientists and agencies submit information such as ROSCOPs and ROMBIs, and other data to the RNODC-WESTPAC through the National Oceanographic Data Centre (NODC) or the Designated National Agency (DNA) system;

9. Recommends that, with respect to the identification, adoption and implementation of standard methods and procedures, direct responsibility be vested in planning and operating research teams. Nonetheless, attention is directed to advice on methods provided in this report and to the need to ensure that data collected is relevant in space and time to joint regional interests;

10. Recommends that appropriate institutions accept responsibility for gathering, analyzing, synthesizing and disseminating knowledge gained locally within the region, concerning the effects of environmental and biological impact in the marine domain and of practices demonstrably effective in controlling or eliminating undesirable consequences;

11. Recommends that, in view of the advantages to be gained from the use of remote-sensing techniques, IOC explore the feasibility of providing access as early as possible to satellite data for all countries participating in WESTPAC programmes and projects, and of training scientists in the use of such data.

12. Having given careful consideration to the question of future activities,

Recommends that, where feasible, participants in WESTPAC programmes continue to execute research already planned; and

13. Recommends that formal Task Teams be established as soon as possible to determine sampling and methodological protocols for all projects and sub-projects whose advance depends upon inter-calibration of methods and a regionally compatible data base.

Annex III

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Annex IV

RESEARCH PROJECT PROPOSALS

A. Coastal margin and benthic ecosystems

(I) Living communities

Project 1

A regional survey of WESTPAC shores and inshore benthic communities with reference to "key" characterizing species

Scientific background : It is acknowledged that there are substantial gaps in our knowledge of the communities characterizing the various shores and subtidal benthos of the WESTPAC region. Moreover, taxonomic problems in relation to these communities remain very great.

Objectives : This project would:

1) Concentrate on determining the species composition of defined shore and subtidal ecosystems.

2) Identify and attempt to resolve taxonomic problems, especially with regard to "key" characterizing species.

3) Investigate the reasons for short- and long-term changes in population structure for each identified shore or benthic assemblage.

4) Correlate patterns of community structure with long- and short-term changes in hydrographic conditions.

5) Over a period of, initially, 10 years, determine underlying causes of natural changes in population structure and species composition so as to make it possible to predict the consequences of unnatural environmental changes.

6) Make an atlas of shore and benthic community structure for the region.

7) Establish regional data and reference specimen collections.

Methodology : This project would involve:

1) The establishment of an exploratory programme to determine basic patterns of community structure on a regional basis.

2) The establishment of permanent shore and subtidal benthos transects to monitor patterns of community structure and change.

3) The establishment of standard methodological protocols for correlated water analysis.

4) Training in taxonomic discrimination and the curation of reference data and specimen collection.

5) The construction of a working list of experts willing to undertake identification of coastal biota and training in taxonomic discrimination.

Project 2

Studies of deep-sea benthic communities in marginal seas and near-coast regions

Scientific background : Studies of deep-sea organisms have a long history. Past surveys, however, have tended to be expeditionary in their approach. Recently, intensive study of deep-sea communities has developed in the Atlantic and the Eastern Pacific, but very little research has been done within the WESTPAC area. Now, studies of deep-sea communities are urgently required in connection with the exploitation of deep-sea resources as well as radioactive waste disposal.

Objectives : Inventory lists of deep-sea organisms of bathyal (200-3,000m), abyssal (3,000-6,000m) and hadal (6,000-11,000m) must be worked out to make any further analysis of deep-sea communities feasible. To clarify the community structure, the species composition, density of each species, type of statistical distribution, biomass, feeding habit and food web should be studied through quantitative, as well as qualitative, sampling. Biological processes such as reproduction, recruitment and mortality, as well as the growth rates of key species, should be studied to clarify community dynamics. This project will be co-ordinated with Project 15.

Methodology : The box corer with single or double spade is adequate gear to obtain undisturbed sediment samples, but the Smith-McIntyre Grab can be used in protected, calm waters. Deep-sea photography (stereoscopic) is useful for the census of epibenthic megalo-benthos, but beam

and other trawls, furnished with an odometer wheel can also be used for quantitative and non-quantitative sampling. A series of graded sieves of different mesh sizes should be used, and they must include at least 1mm and 0.5mm mesh sizes.

(II) Assessments of production

Project 3

Primary production in salt marshes, sea-grasses and macro-algae

Scientific background : This project recognizes that regionally there are few available data on the primary productivity of these important, attached plants.

Objectives : To assess primary production in different, mangrove, sea-grass, salt marsh and algae communities.

Methodology :

(i) Collect standing stock and primary production data on plants as selected representative study sites. Application of the marking method for primary productivity measurement is recommended. The possible application of satellite information should be utilized for standing stock estimates.

(ii) To provide a quantitative description of the animal-plant species interactions, and interactions between the plants and their physico-chemical environments.

(iii) Identify and model the energy and material flow within the plant ecosystems and their effects on other systems.

Project 4

Primary production in lagoons and estuaries

Scientific background : Frequently, a substantial component of primary production in ecosystems at coastal margins is due to the phytoplankton and benthic microalgae, as distinct from submerged and emergent macrophytes. Nonetheless, there exists little information on the magnitude of that primary production or on the way it varies with location in time.

Objectives : To assess primary production attributable to the phytoplankton and benthic microalgae in representative lagoonal and estuarine systems throughout the WESTPAC region.

Methodology : Similar methods to those which have hitherto been used in the open sea can be applied to coastal systems. They include a) the determination of the amounts of chlorophyll a; b) measurements of photosynthesis by the light- and dark-bottle method producing light-photosynthesis curves; c) measurement, by photometer or Secchi discs, of underwater illumination. The depths of the water layers involved can be similar to those of the open sea (0.5, 10, 20, 30, 50, 75, 100m) if the depth of water is great. If this is not the case, water depths can be measured metre by metre. The effects of the tide should be considered in such localities as estuaries and lagoons.

Project 5

Mangrove Litter Production in the WESTPAC Region

Background : Productivity figures on the mangrove ecosystems are sparse in the WESTPAC region. Yet, the collection of data for mangrove litter productivity can be achieved with relative ease and small expense.

Objectives : To obtain mangrove litter productivity values for various mangrove ecosystems in the WESTPAC region. To obtain above-ground mangrove productivity values in the WESTPAC region. To determine variation in productivity of mangrove ecosystems in the different regions of WESTPAC.

Methodology :

Traps: Either $1m^2$ or 2m x 2m traps can be used, depending on the density of the forest. Nets need only be about 10cm deep. Plastic-coated fibreglass nets of 1mm mesh work well. These can be held by galvanized wire (about 2mmø) frames. Such nets are collapsible and easily transported.

Number of Traps: This has to be statistically determined but experience has shown that in a homogeneous forest, somewhere in the region of 15 one-meter square nets are necessary to obtain a coefficient of variation of 10%. For a mixed mature forest, around 100 mesh traps may be needed to obtain similar precision. 100 traps may be too many to be conveniently handled so that it may be necessary to settle for a lower precision.

Treatment of Litter: Litter should be dried at $105^{o}C$ to constant weight. Leaf; twigs; buds, flowers, fruits and propagules and miscellaneous components should then be separated and weighed. If possible, different species may also be separated.

Drying at 40°C and 60°C is sometimes done, the advantage being the minimization of loss of volatile elements. The disadvantage is that, at these temperatures, water still remains in the sample.

Forest Floor Litter: The collection of forest floor litter (as opposed to trap collected litter) will be useful in determining export rate, decomposition rate and fixation (as peat). Sampling may be done in a random fashion using quadrats ($1m^2$ is suggested). The number of these required will have to be statistically determined.

Above-ground Standing Biomass/Productivity: By measuring the girth at breast height (GBH) or above the highest still root of a given area (0.2 to 0.5 ha) and if allometric relations are or become available, it will be possible to estimate standing biomass and productivity (if measurements are made annually).

(At present GBH/Above-ground Biomass regression for Rhizophora apiculata and Bruguiera parviflora are available. Similar regressions can be determined for other species.)

Project 6

Primary production in coral reefs

Scientific background: Coral reefs have been described as being among the most productive of the world's ecosystems. Estimates of gross primary production of coral reefs have yielded values between about 300-5,000 $gC/m^2/yr$. The wide range appears to have been due to the nature of the reef surface studied.

It should be borne in mind that primary production in coral reefs is due to a variety of photosynthetic plants including the phytoplankton, the fleshy macrophyters, the calcareous algae, the boring filamentous algae, the zooxanthellae, and the marine tracheophytes. The method used to estimate production should integrate the contributions of these components.

Objectives: To assess the primary production of coral reefs in various parts of the WESTPAC region taking into consideration seasonal variation.

Methodology: Various methods for measuring coral-reef primary production have been put forth in the fifth Unesco monograph on oceanographic methodology, Coral Reefs: Research Methods. While any one of these methods may be utilized, it is suggested that flow respirometry, which monitors changes in oxygen concentration in water flowing over a reef, be adopted. These studies should be repeated during various times of the year to detect changes in rates in the different geographic areas being studied.

(III) Trophic process

Project 7

Secondary Productivity of Coral Reefs

Scientific background: Productivity studies have been conducted sporadically on coral reefs in various parts of the world. These studies have generally been over short periods of time so that seasonal variations have not been investigated. On the other hand, exploitation of reef areas often occurs on a continual basis. It is therefore important to undertake research and monitoring studies over longer periods of time to assess the impact of removal of various reef biota for man's needs. Because of the diversity of geographical and physiographical features of coral reefs, attention must be directed towards a diversity of these areas.

Objectives: To assess the productivity of coral reefs using sustained fish yields as a guide correlated with assessments of coral removal upon fish stocks.

Methodology:

1. Fish yields: Fish biomass and yields, particularly of key species or groups, should be assessed by capture techniques such as traps and gill nets of standard specification for inter-comparability. Such data should be correlated with the condition of reefs, particularly living coral cover, and the morphology of the reefs. Yields from low islands must be compared with those from high islands and continental margins. This fish yield should be determined for the edible fish and for ornamental fish.

2. Coral harvesting: After characterization of a particular reef in terms of its component biota, experimental harvesting of selected coral species (and possibly other invertebrates) should be carried out. The effect of this on the fish community should be observed, perhaps in relation to the first part of this project (fish yields). Equally important is the monitoring of the recolonization and growth of selected coral colonies (and other invertebrates) to measure the resilience of the reef to stress, and hence to possible management techniques. In the experimental design, attention must be directed towards the size of coral communities since this parameter can influence recruitment. This study needs to be carried out over a long period, possibly five years as a norm.

Project 8

Mangrove Detritus

Scientific background: In terms of organic productivity, mangrove detritus undoubtedly contributes the biggest component to the mangrove ecosystem. A number of studies, notably the pioneering work of Heald (1971) and Odum (1971) have shown that the gut contents of a large number of fish species contain a high proportion of mangrove detritus, thus suggesting a link between mangroves and coastal fisheries. It is, however, not yet possible to state how significant this contribution is. It is thus not possible to answer such a question as "How much mangroves can be converted to aquaculture ponds without adversely affecting the coastal fishery?"

Objectives: To determine the significance of mangrove detritus in the food intake of inshore fishes.

Methodology: Studies to try to answer the question posed above will be complex and take time. Also, there can be a number of approaches. Studies like those of Heald and Odum, though tedious, are extremely useful - more so if it can be demonstrated that the detritus is actually digested and assimilated.

Another approach is to trace and quantify the pathways of mangrove detritus starting from mangrove litter. Questions like, how much is exported, how much is fixed (tied up as peat), how much is decomposed, as well as what changes in nutrient status occur as the litter breaks down and decomposes (including colonization by bacteria, fingi and other micro-organisms) need to be answered. Yet another technique is to look at the carbon isotope ratios of the various food sources (freshwater, estuaries, nearshore and off-shore input and mangrove litter) as well as of the fishes to determine which group the fish derive their nutrients from.

It will be necessary for a number of groups within WESTPAC to undertake this study, each using their own approach.

Project 9

Utilization of secondary production in mangroves, salt marshes, and sea-grasses, by fish and prawns

Scientific background: Secondary productivity in these ecosystems remains relatively uninvestigated and is difficult to determine because

of commercial harvesting. Utilization of these areas as nursery grounds for many commercially important species has long been recognized, but there are few detailed studies on this topic.

Objectives: To assess the utilization of production in mangrove, salt marsh, and sea-grass communities by larval and juvenile fish and prawns.

Methodology: Seasonal sampling with special reference to:

1. species composition
2. abundance and size composition by species
3. total biomass
4. diet.

Project 10

Food-web analysis

Scientific background: There is little information on basic food webs of inshore marine habitats in the WESTPAC region: this study aims at remedying this lack of information. The first stage in understanding trophic processes for any region is to obtain information on what each important species is eating. Although this study will never be complete, any information gained would be of frequent use for a variety of purposes. A catalogue of stomach-content analyses for local fish species would be a paper frequently referred to at any marine laboratory in the region.

Objectives:

1) To encourage fishery and coral-reef scientists in the WESTPAC area to collect data on the stomach contents of fishes in the standardized method described below.

2) To establish a regional information-gathering and dispersing centre at which information can be organized and presented occasionally as a report whenever enough information has been gathered to warrant this action.

3) To produce a series of keys for aid in identification of materials in stomach contents. Keys would be made for partially digested items or fragments of such materials as sponge spicules, polychaete jaws, mangrove leaves, etc.

Methodology: Collection of fishes for stomach content analysis. Fish should be collected for stomach content analysis by means of hand-spoons, nets, chemicals (rotenone, MS222, etc.) or by other means of immediate capture. If caught in traps, they may have eaten other organisms caught in the trap - an artificial situation - and they may have digested or excreted many of the contents of their stomachs before the trap was lifted. Fish caught on hook-and-line may tend to have empty stomachs or only bait in their stomachs.

Analysis of stomach contents: Standard length of the fish should be measured before the fish is dissected because the diets of most fish change with size. The stomach contents should be preserved almost immediately after collection in order to prevent further digestion or deterioration of the contents. As soon as standard length has been measured, the stomach could be removed from the fish and dropped in 10% formalin with a label containing the information about the fish, time, date and location of the collection. An alternative procedure could be to inject formalin into the stomach of an intact fish with a hypodermic syringe.

The stomach contents from each fish can be quantified by volume or area. For fish that feed on such material as filamentous algae, it is most practical to measure the relative portions of different species in the diet in terms of point-contact frequency (area). The contents of the stomach are spread thinly and as evenly as possible in a Petri dish or on a slide. The Petri dish or slide is then put under a dissecting microscope. Tallies are then taken of the species of the diet that appear under the cross-hairs of an ocular grid or micrometer. The proportions in the diet are assumed to be represented by the proportions of tallied encounters under the microscope.

If large, discrete items are found in the diet, then the items should be sorted into piles for each category of food and each pile should then be placed in a graduated cylinder about half filled with water. The volume of each category of food is then measured by the volume of water displaced.

The diets of each species of fish, of each size class, should be presented as proportions of each total stomach content because different units of measurement for different techniques would make the use of units rather awkward.

(IV) Management objectives

Project 11

Guiding principles in manipulating the productivity of natural ecosystems

Scientific background: Most advances in agricultural and pastoral practices on land are guided by carefully planned investigations in

established networks of experimental stations. Deriving maximal benefit from potentially manageable segments of the marine environment is a more complicated undertaking, yet attempts to provide guiding principles through controlled manipulation faced with uncontrolled interference have not yet been made. It is suggested that substantial advantage could be gained by setting aside appropriate tracts of inherently productive coastal margin ecosystems specifically to undertake investigations leading to enhanced resource harvest while preserving the essential character of the system.

Objectives: Within appropriately selected coastal-margin and coral-reef ecosystems, to undertake studies to determine the manner in which biological processes might be modified to human advantage while preserving essential ecological character. Further, to undertake controlled perturbation experiments so as to understand better the functions of these ecosystems.

Methodology: Precise methods cannot be specified. These will depend on processes and resources of interest and may also be expected to vary according to needs and capabilities throughout the WESTPAC region. Nonetheless, they should be designed to establish sound ecological principles of practical value.

B. Planktonic ecosystems

(I) Living communities

Project 12

Temporal and spatial distribution of zooplanktonic species characterizing ecological zones in the neritic province of the WESTPAC region

Scientific background: Tropical latitudes of the WESTPAC region support the largest proportion of the neritic waters relative to total area to be found in the world's ocean. The region's terrestrial and benthic biotas are known to be unusually rich in species, and their patterns of distribution indicate the presence of major biogeographic boundaries. Although apparently highly fertile, very little is known of the resident plankton communities and their changes in space and time.

Objectives: Widespread quantitative monitoring of common representative organisms across this region of evolutionary importance would generate essential baseline information about representative species and provide

the resources critical for planning more advanced studies on dynamic aspects of the pelagic ecosystem. In many WESTPAC nations the project may also serve as a training experience to introduce local scientists to field and laboratory research in biological oceanography.

Methodology: A field programme: Biweekly (or monthly) quantitative monitoring of zooplankton and standard hydrographic/meteorological features during a two- or three-year period at a small number of stations arranged along a transect between the coastline and the 100m isobath. Measurements and sampling should be designed to be carried out from a small motor-powered boat (roughly 5m or more in length). Quantitative plankton sampling should reflect day and night periods, be keyed to similar tidal conditions, and include separate tows for the sea surface and the subsurface water column. Basic environmental features to be monitored should include salinity, temperature, chlorophyll and standard meteorological observations.

Essential features to be standardized: Net and bridle design, towing speed, length of two, procedure for passing an oblique tow to the surface, procedures for washing catch to cod end and preservation of catch, chlorophyll determination and biomass measurements.

Species to be monitored: Quantitative analysis of larger, distinctive species characterizing various ecological zones within the neritic province. For example in copepods, species of the families Tortanidae and Pseudodiaptomidae and of the genera Acartia, Labidocera, Eucalanus, Undinula, Temora, Centropages and Euchaeta would provide a cross-section of herbivores, omnivores and predators. Other groups to be monitored should include species of Cladocera, chaetognaths, shrimp and phyllosoma larvae, cyprinid ostracods, mysids, euphausiids, fish eggs and fish larvae.

Recommended location of transects: The WESTPAC region is characterized by large-scale longitudinal and latitudinal gradients of environmental and biotic change. Therefore, success of this programme will be proportional to the number of transects that are monitored along east to west and north to south axes. Poorest known areas of special interest are as follows: western Pacific large oceanic islands and archipelagos (e.g. Guam, New Caledonia, Palau), continental areas (e.g. eastern Australia near Sidney, Brisbane and Townsville; northern Australia near Darwin and off Port Hedland), eastern Papua New Guinea (Port Moresby and Lae), western Irian Jaya (e.g. Nautilus Strait, Aru and Kai Archipelagos), Andaman Sea, Gulf of Thailand, Singapore, South China Sea, East China Sea, Yellow Sea, Sea of Japan, Indonesian localities such as Kalimantan, Java, Sulawesi, Halmahere, Ambon, Bali, and Philippine localities off Panay, Mindanao, Negros, Cebu and Luzon.

Remarks: The following two projects are also recommended, given reasonable success of the monitoring programme:

1. Samples accumulated by the above-mentioned programme should be archived in a centralized, readily accessible institutional repository or regional plankton centre and curated as a museum-quality collection for taxonomic-biogeographic study by specialists.

2. Provisions should be made to prepare and publish a regional atlas on the quantitative distribution in time and space of key species and biomass of ichthyoplankton, zooplankton and phytoplankton across the WESTPAC region.

Information from the monitoring studies and contributions from specialists studying the archived collections will generate knowledge and fill the wide gaps in our understanding of the distribution and diversity of marine plankton in the Southeast Asian Archipelagos and across the WESTPAC region.

Project 13

Communities in isolated water masses in the boundary areas of the WESTPAC region

Scientific background: Ocean gyres and eddies at the shelf-oceanic interface have been recognized as locally important areas of biological production.

Objectives: In this project it should be possible to determine not only the autecology of the important species but also the synecology of the whole community within a rather short period; e.g., less than 2 years. Gyres or eddies are often formed in the boundary areas, which also support productive fishing grounds mainly due to the physically formed patchy distribution of plankton. This study will include not only general marine biological studies but also treat the gyres and eddies as special laboratory models. The fate of organisms including the micro-distribution of plankton and nutrients should also be studied.

Methodology: Frequent visits by the research ship to isolated water masses possessing gyres and eddies, or locating a sea-anchored drifting station in the water mass will be needed. Continuous monitoring of the position of these eddies and their changing characteristics can be accomplished by satellite observations. The investigative methodology can be essentially identical to other investigations of standing crop and plankton production. In addition, micro-sampling of the organisms using appropriate methods (e.g., continuous plankton recording and nutrients) should also be undertaken.

Project 14

Relative contributions of neritic and oceanic plankton communities to production in the WESTPAC region

Scientific background: The regions of WESTPAC vary greatly in their productivity. The relative productivity of a coastal region can be correlated with the degree to which the region supports an extensive neritic community. Development of a highly productive neritic community depends upon high nutrient input and suitable physical factors to maintain the community in the coastal region. Important factors which will vary in the region include: coastline exposure; bottom topography; terrestrial influence; upwelling and coastal currents.

Objectives: Determination of the relation between the physical environment and the development of the neritic community.

Methodology: This study can be accomplished by the use of onshore-offshore transects of zooplankton samples and physical measurements in regions of diverse physical influence. Most of these samples will be available from the efforts to develop a regional atlas of zooplankton in the WESTPAC area.

From these zooplankton samples, key species will be identified and classified into nearshore, neritic, and oceanic categories. A more complete analysis could be conducted if the distribution of phytoplankton, nutrients, primary productivity, and currents were also measured.

Analysis can be extended to microzooplankton and neustonic plankton where appropriate samples are available.

(II) Assessments of production

Project 15

Monitoring of seasonal and year-to-year variations in standing stock and biological production

Scientific background: There is a need to investigate seasonal changes in production of oceanic systems, on a long-term basis.

Objectives: We require study of the interactions between the hydrosphere and the atmosphere especially with regard to pelagic ecosystems

to allow prediction of plankton blooms. Also important are measurements of some aspects of the phytoplankton and zooplankton population with regard to their incluence upon the survival of young fishes. The acquisition of field data is also necessary for the interpretation of satellite images. This is presently hampered by a lack of ground-truth data.

Methodology: These long-term surveys have to be done at a fixed station and at least every two weeks. Attempts will be made to extend observations along transects, and as far as possible to allow a study of the influence of the oceanic changes on the neritic ecosystems. The transects made by the Japan Meteorological Agency are a good example of such operations.

For the monitoring of the conditions of the ecosystem of the surface of all the WESTPAC area, the collaboration of ships of opportunity is necessary.

Project 16

Ecological studies of primary and secondary production in the WESTPAC region

Scientific background: Assessment of primary and secondary production in the sea has received a good deal of attention in the past; however, further development of studies on various aspects of phytoplankton and zooplankton ecology in different ecosystems continue to be required, especially in frontal zones, convergences, divergences, upwelling areas and in relation to island mass effects. Estimation of the biomass and production of all the main planktonic groups: bacteria, nanoplankton, microphyto- and microzoo-plankton, net zooplankton and nekton is required in relation to the fluxes of the main nutrients.

Objectives: Estimation of the fluxes of organic matter at all levels of the food web, for a better understanding and prediction of variations in fisheries yields.

Methodology: There is a range of methods employed for measuring primary and secondary biomass and production. Nonetheless, it is recommended that, whenever possible, methods outlined by SCOR Working Groups and Unesco monographs on oceanographic methodology be used in this study. It is recommended that all the data obtained by other methods be accompanied by a full description of the procedures used. It would also be useful to identify the principal components of primary and secondary producers. Remote-sending data should be employed as appropriate and feasible.

Remarks: It is recommended that continuing seasonal investigations should be maintained to detect variations in biomass and production.

(III) Trophic processes

Project 17

Formation, degradation and transport of non-living organic particulate matter in the pelagic system

Scientific background: It is likely that a close relationship exists between the epipelagic and deep-sea communities. The interesting possibility has been pointed out that seasonal fluctuations in the primary productivity may affect the breeding periodicity of deep-sea plankton, micronekton and benthic animals. An understanding of the mechanisms of formation, degradation and vertical transport of non-living organic matter in shallow layers is necessary to improve a definition of the deep-sea ecosystems.

Objectives: The estimation of downward flux of sinking particles and analysis of their organic content should be the principle objectives of this study.

Methodology: Sample sinking particles by mooring sediment traps at different depths. Sampling of deep-sea plankton, micronekton and benthos by large nets, trawls etc. Suspended-particle levels at different depths can also be determined by water bottles.

Project 18

Marine organisms and biological processes in the deep-sea

Scientific background: Most biological work in the WESTPAC region has, so far, been done in the upper few hundred metres of oceanic and shelf waters. Our understanding of the important communities in the deep-sea communities is very poor. It is thus necessary to increase fundamental knowledge of biological structures and processes in the deep sea. With increasing interest in the deep sea and with the possibility of exploitation of renewable resources, a better knowledge of these deep-water communities is essential.

Objectives: In this project, the emphasis is on describing life histories, and the distribution and trophic relationships of organisms in the deep-sea system. The hydrographical affinities of these organisms will be investigated. The role of bacteria in decomposition and the nutrient cycles should also be investigated.

Methodology: This study would be carried out by field surveys and laboratory experiments. For these purposes, standard methods should be developed for each community. This deep-sea study should concern itself with the epipelagic community in order to improve our understanding of the structure and function of the whole deep-water ecosystem. This project will be co-ordinated with Project 2.

Project 19

Ecological analysis of spawning areas and larvel distribution of important fish

Scientific background: Important fish-spawning areas and seasons are usually characterized by high primary and secondary productivities and particular hydrographical and biological characteristics. Some characteristics may have opposing influence on the survival of larval fishes. For example, coastal upwelling enhances future productivity but can also transport larvae into unfavourable offshore regions. Analysis of environmental characteristics of spawning areas in a region as diverse as WESTPAC will enable comparisons which could further our understanding of the relative importance of these factors.

Objectives: Definition of spawning areas and dynamics of eggs and larvae will allow assessment of the practicality of conducting ichthyoplankton surveys as a means of adult stock size measurement.

Methodology: The initial definition of fish-spawning areas and times can be accomplished with the sampling design proposed for development of an atlas of zooplankton in WESTPAC. Standard oblique tows with a Bongo net are most appropriate. Additional samples with a neuston net are desirable as are samples of the extreme nearshore environment. The methods for quantitative ichthyoplankton surveys are exhaustively treated in a manual by Smith and Richardson (1977).

Annex V

PRESENTATIONS

Scientists who wish to receive more detailed information should contact the authors (see Annex III):

General

J.S. BUNT (Australia): Marine productivity in the WESTPAC region.

Primary productivity and plankton studies

Y. DANDONNEAU (New Caledonia): Temporal variations in sea surface chlorophyll concentrations in the equatorial Pacific between 165°W and around 95°W (1978-1980).

J.H. SHIM (Republic of Korea): Methodology of primary production measurement in regional oceanography.

Y. ARUGA (Japan): Primary productivity studies in the Western North Pacific.

M. ANRAKU (Japan): Estimation of primary and secondary productivities in the waters adjacent to Japan.

A. FLEMINGER (U.S.A.): Plankton sampling strategy for calanoid copepods in the WESTPAC region.

S. NISHIDA (Japan): Distribution of oithonids (Copedoda, Cyclopoida) in the WESTPAC region.

Y. MORIOKA (Japan): Long-term and seasonal variation of zooplankton biomass in the Japan Sea.

A. TANIGUCHI (Japan): Present knowledge of microzooplankton in the Western Pacific Ocean.

C. BIRKELAND (U.S.A.): Design of apparatus and sampling programme for demersal plankton.

Y. SUGOMORI, S. TAKEUCHI, J. OKUMURA (Japan): Image analysis of CZCS for chlorophyll concentration measurement.

X. NING (China): Recent studies on marine biological aspects of some regions in the China Sea and adjacent waters.

A. DESSIER (New Caledonia): Zooplankton sampling by merchant ships. The surface copepod populations in 1979-1980.

Benthic and intertidal communities

M. HORIKOSHI (Japan): On the study of benthic community and biomass - their regional distribution and vertical distribution within bottom sediments.

B.S. MORTON (Hong Kong): Base-line studies on benthic communities of Indo-west Pacific coasts - a co-operative research proposal.

S. SUDARA (Thailand): General survey on the condition of the coral reef along the east coast of the Gulf of Thailand.

E.D. GOMEZ, H.T. YAP (Philippines): Coral reef productivity in the WESTPAC region - Problems and methods.

J.E. ONG (Malaysia): Biological production process and dynamics of the mangrove ecosystem - methodology.

A. HATTORI (Japan): Biological production and nutrients recycling in the seagrass beds.

Fisheries and Mariculture

M. EIDMAN (Indonesia): The effects of using onion bags and water layers on the number of bivalves spats collected in Lima Islands, Banten Bay waters.

T. WATANABE, T. OKUTANI, S. ITO (Japan): Distribution and abundance of eggs and larvae of warm-water migratory fish with special reference to stock assessment on these data.

A. TOMOSADA (Japan): Transportation of mackerel eggs and larvae by the Kuroshio.

D.A. ROBERTSON (New Zealand): Ichthyoplankton research in New Zealand and its relevance to IOC-WESTPAC programmes.

R.D. METHOT (U.S.A.): Utilization of daily growth increments in otoliths for ecological studies of larval fish.

Annex VI

WELCOME ADDRESSES

1. By : Dr Ichiro Yamanaka
Convener of the Workshop

Distinguished Participants, Ladies and Gentlemen:

It is my honour to welcome you in convening the WESTPAC Workshop on Marine Biological Methodology here in Tokyo.

I am much obliged to the kind co-operation of each member country in letting you, the distinguished scientists in the field of marine biology, attend the Workshop. I also manifest my deepest thanks to the co-operation of the IOC Secretary and the Japanese National Commission for Unesco for each logistic arrangement of the Workshop, and, in particular, for the attendance of Dr George Kitaka, Assistant Secretary of IOC at the Workshop, whose advice will be doubtlessly most valuable.

At the Fourth CSK Symposium held in February 1979 in Tokyo, various recommendations were proposed for the future research in marine biology and living resources. They were taken up for discussion in the following WESTPAC Working Group Meeting, which resulted in the Decision 1-10 which required, in short, firstly to select the suitable projects for the initial stage of WESTPAC, and secondly to find out adequate methodology which should be adopted for those projects. For such purposes, the first two days of the Workshop will be spent for the open symposium to review the past and present knowledge obtained in marine biological studies in the region, and the latter part will be spent for discussion among assigned members for discussion for selecting projects, their approaching methodology and preparation of relevant recommendations.

I hope the Workshop will establish a significant guideline not only for initiating the biological aspects of WESTPAC, but also for marine science in the whole world in connection with the urgent problems that is to provide us with basic knowledge on the measurement concerning rational management and utilization of marine food resources.

I hope, Distinguished Participants, that you may enjoy the meeting and your first stay in Tokyo to your hearts' content.

Thank you very much.

2. By : Dr Noriyuki Nasu
Japanese Representative for WESTPAC

Ladies and Gentlemen, distinguished scholars and guests to participate in the WESTPAC Workshop on Marine Biological Methodology, it is my great honour to welcome you on behalf of the Japanese Committee for the Intergovernmental Oceanographic Commission.

It is needless to say how important the results of your Workshop will be because your recommendations will be forwarded to the Working Group of WESTPAC in September of this year for implementation.

It is also my great pleasure to welcome Dr Kitaka of the IOC office of Unesco to make this Workshop successful.

Furthermore, I would like to appreciate the preparation for this Workshop being carried out by the convener Dr Yamanaka and his Japanese colleagues with the staff officers of the Ministry of Education, Science and Culture of the Japanese Government.

Again, I would like to express my hearty welcome to all of you.

Thank you.

3. By : Mr Taijiro Matsuura
Secretary-General, Japanese National Commission for Unesco

Distinguished Participants, Ladies and Gentlemen,

On behalf of the Japanese National Commission for Unesco, I have great pleasure and privilege in welcoming you to the WESTPAC Workshop on Marine Biological Methodology, which we have a privilege of hosting again in succession to the two WESTPAC Workshops on Marine Geology and Marine Pollution which took place here in this Hall in March 1980.

Throughout the thirty years' history of our membership in Unesco, the Japanese National Commission for Unesco has continued to support co-operative studies in marine sciences as one of our major concerns in performing our mission as a Member State of both Unesco and IOC.

The Japanese government itself is giving a higher priority to the promotion of marine research activities in its overall planning of science and technology development. On the part of the Japanese National Commission for Unesco, I should like to express our readiness to co-operate with all the participating countries in pursuit of various scientific objectives proposed in the WESTPAC programme. By way of our other contribution to the WESTPAC programme, the Japanese government has taken the initiative in budgeting US$30,000 for our fiscal 1981 Fund-in-Trust for WESTPAC. We are now waiting for the approval of this budget by our National Diet.

In this respect, I should like to express my sincere wish for the fruitful conclusion of this WESTPAC Workshop which, I believe, is an important step for a successful operation of marine biological research projects in the WESTPAC programme.

Before concluding, let me express my deep respect and appreciation for the leadership and generous support of IOC, represented by one of its Assistant Secretaries, Dr Kitaka, and for the co-operation of all the participating Member States and scientists in making possible our organization of this international meeting.

Thank you.

4. By : Mr G. Kitaka
Assistant Secretary of IOC

The Secretary-General of the Japanese National Commission for Unesco, Vice-Chairman of WESTPAC, the Convener of the Workshop, invited participants, Ladies and Gentlemen:

On behalf of the Director-General of Unesco, Mr Amadou Mahtar M'Bow, and on behalf of the Chairman and Secretary of the Intergovernmental Oceanographic Commission, I am pleased to welcome you to this Workshop on Marine Biological Methodology which has been organized by the Japanese government with the co-operation of the IOC.

The Workshop has been convened in fulfilment of one of the decisions of the First Session of the Programme Group for WESTPAC which was held here in February 1979. Since that time, two other Workshops have been successfully organized here in Tokyo, and it is the hope of the IOC Secretariat that, like those before it, this Workshop will produce useful and concrete recommendations.

Again on behalf of the Director-General of Unesco and the IOC Secretariat, I would like to conclude by thanking the Japanese government for its moral and material support to the Workshop, the Japanese National Commission for Unesco and Dr Yamanaka for their excellent arrangements which have enabled us to convene this Workshop.

Thank you, Ladies and Gentlemen.

5. By : Dr Toshiyuki Hirano
Vice-Chairman of WESTPAC

Ladies and Gentlemen,

On behalf of the WESTPAC Chairman, Dr Aprilani Soegiarto, I have great pleasure in welcoming all participants from the member countries to the WESTPAC Workshop on Marine Biological Methodology.

It is needless to say that marine biology is one of the major fields of study among the ocean sciences and it is very important, as it provides basic knowledge to the efficient utilization and proper management of the marine living resources. In this connection, it is worth recalling that, besides the project on the Climatic Changes and the Ocean, which at present is one of the major projects of the IOC, the Eleventh Assembly, in 1979, passed a resolution on Ocean Sciences in relation to Living Resources (OSLR). I also notice that a draft report on the Ocean Sciences in relation to Living Resources was made by a group of four scientists appointed by the IOC last October and this report is being circulated among the member countries before submission to the Commission prior to the Twelfth Session of the Assembly in October 1982.

I think this Workshop will be deeply related to such activities of the IOC. The outcome of this Workshop, in which future plans and

proposals of the programme are to be discussed, will be submitted to the Second Session of the Programme Group of WESTPAC, scheduled to be held in September this year. It is our ambition that this attempt may be developed into a co-operative study project including field surveys on Marine Biology and Ocean Sciences in relation to Living Resources in the near future in the WESTPAC region. And, at the same time, it will be as promising and useful as any other project undertaken by the IOC, such as OSLR.

As Vice-Chairman of WESTPAC, I would like to express my sincere gratitude to Dr Ichiro Yamanaka, convenor of this Workshop, for the excellent arrangements and to the Japanese government and the officials concerned for hosting this Workshop at this Asia Centre in Tokyo where the past two Workshops on Coastal Transport of Pollutants and on Marine Geology and Geophysics of the Northwest Pacific were held last March.

I hope this Workshop will achieve all its purposes and wish you all success.

Thank you.