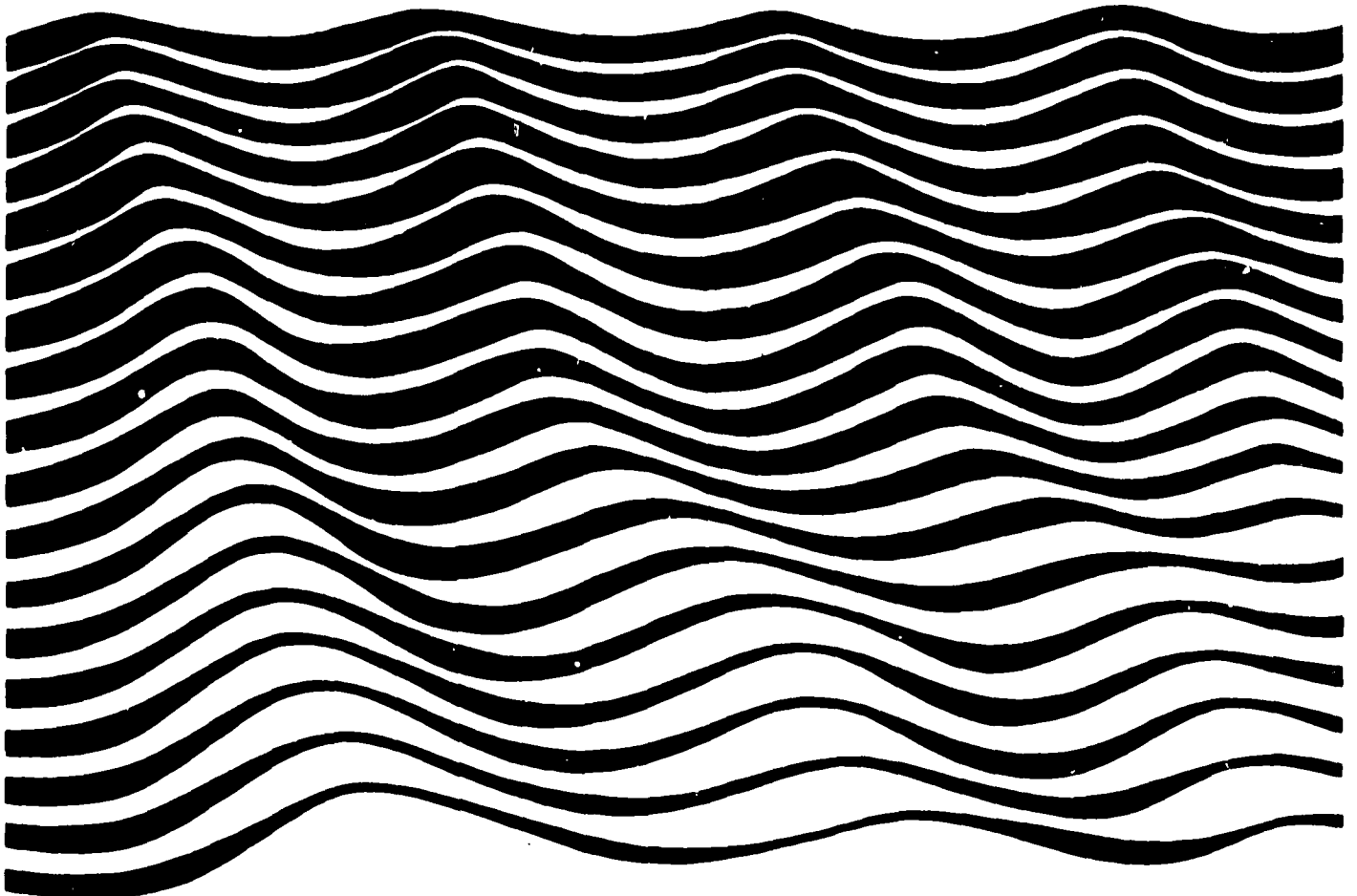


# **Coral reef management in Asia and the Pacific: some research and training priorities**

Report of a Unesco workshop held  
in Manila, Philippines  
21-22 May 1981



Unesco, 1982

# UNESCO REPORTS IN MARINE SCIENCE

No.	Year	No.	Year
1	1977	10	1980
2	1977	11	1981
3	1979	12	1981
4	1979	13	1981
	1979	14	1981
6	1979	15	1981
7	1979	16	1981
8	1979	17	1981
9	1979		
<p>1 Marine ecosystem modelling in the Eastern Mediterranean Report of a Unesco workshop held in Alexandria, Egypt, December 1974. English only</p>		<p>10 Development of marine science and technology in Africa Working Group of Experts sponsored by ECA and Unesco, Addis Ababa, 5-9 May 1980 Available in English and French</p>	
<p>2 Marine ecosystem modelling in the Mediterranean Report of the Second Unesco Workshop on Marine Ecosystem Modelling English only</p>		<p>11 Programa de plancton para el Pacífico Oriental Informe final del Seminario-Taller realizado en el Instituto del Mar del Perú, El Callao, Perú, 8-11 de septiembre de 1980 Spanish only</p>	
<p>3 Benthic ecology and sedimentation of the south Atlantic continental platform Report of the seminar organized by Unesco in Montevideo, Uruguay, 9-12 May 1978 Available in English and Spanish</p>		<p>12 Geología u geoquímica del margen continental del Atlántico sudoccidental, Montevideo, Uruguay, 2-4 de diciembre de 1980 Spanish only</p>	
<p>4 Syllabus for training marine technicians Report of an IOC/Unesco workshop held in Miami, Florida, 22-26 May 1978 Available in Arabic, English, French, Russian and Spanish</p>		<p>13 Seminario Latinoamericano sobre enseñanza de la Oceanografía Informe final del Seminario organizado por la Unesco en São Paulo, Brasil, 17-20 de noviembre de 1978 Spanish only</p>	
<p>Marine science syllabus for secondary schools Report of an IOC workshop held at United World College of the Atlantic, United Kingdom, 5-9 June 1978 Available in Arabic, English, French, Russian and Spanish</p>		<p>14 Marine science and technology in Africa: present state and future development Synthesis of Unesco/ECA survey missions to African coastal states, 1980 Available in English and French</p>	
<p>6 Organization of marine biological reference collections in the Mediterranean Arab countries Expert meeting held in Tunis, 20-23 September 1978 Available in Arabic, English and French</p>		<p>15 Fishery science teaching at the university level Report of a Unesco/FAO workshop on university curricula in fishery science, Paris, May 1980 Available in Arabic, English, French, Russian and Spanish</p>	
<p>7 Coastal ecosystems of the southern Mediterranean: lagoons, deltas and salt marshes Report of a meeting of experts, Tunis, 25-27 September 1978 Available in Arabic, English and French</p>		<p>16 Marine and coastal processes in the Pacific: ecological aspects of coastal zone management Report of a Unesco seminar held at Motupore Island Research Centre, University of Papua New-Guinea, 14-17 July 1980 English only</p>	
<p>8 The mangrove ecosystem: human uses and management implications Report of a Unesco regional seminar held in Dacca, Bangladesh, December 1978 English only</p>		<p>17 The coastal ecosystems of West Africa: coastal lagoons, estuaries and mangroves A workshop report, Dakar, 11-15 June 1979 Available in English and French</p>	
<p>9 The mangrove ecosystem: scientific aspects and human impact Report of the seminar organized by Unesco at Cali, Colombia, 27 November - 1 December 1978 Available in English and Spanish</p>			

Published in 1982 by the United Nations Educational,  
Scientific and Cultural Organisation,  
7, place de Fontenoy - 75700 Paris  
Printed in Unesco's Workshops

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## PREFACE

Unesco Reports in Marine Science are designed to serve specific programme needs and to report on developments in projects conducted by the Unesco Division of Marine Sciences, including those involving collaboration between the Division and the Intergovernmental Oceanographic Commission, particularly in the field of training, education, and mutual assistance in the marine sciences.

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## INTRODUCTION

The Workshop on Research and Training Priorities for Coral Reef Management in Asia and the Pacific was held in conjunction with and during the last two days of the Fourth International Coral Reef Symposium at the International Convention Centre, Manila, Philippines, in May 1981.

Plans for the workshop were initiated at an informal planning meeting (Hawaii, 2-3 July 1979) for the related Unesco Seminar on Marine and Coastal Processes in the Pacific, and were further discussed during this seminar, which took place in Papua New Guinea in July 1980. Unesco approved the convening of the workshop as part of its "major inter-regional project for research and training leading to the integrated management of coastal systems".

The organizers of the International Coral Reef Symposium kindly agreed to schedule the presentation dealing with management during the first three days, and consequently the sixty-one papers presented during the symposium section "Reef and Man" (see Annex I) provided additional background and review information applicable to the workshop.

Twenty participants from eleven countries (see Annex II) participated in the workshop, which was chaired by Dr. R. T. Tsuda of the University of Guam. Dr. Tsuda also assisted Unesco in preparing the meeting. In addition, several symposium participants attending the workshop made valuable contributions to the discussions. The programme of the meeting is given in Annex III.

## SUMMARY

During the first morning of the workshop, the participants considered the general aspects of the following objectives : information needed for better coral reef management, research programmes for obtaining this information, and training for executing the research programmes.

The main problems with respect to information, research and training relative to coral reefs were considered to be especially of an institutional character. There are very few well-established coral reef research centres in the region, and co-operation among the institutions with activities in this field is limited, which in turn limits the focus of funding. Local manpower development should be given the highest priority. Research activities should be based on the country's needs and management problems, and in this respect traditional knowledge and management practices concerning coral reefs and their resources should be taken into account. Detailed research and training requirements for the various countries were considered by a working group during the meeting.

At the meeting it was felt that sound management of coral reefs and their resources is hampered, not only by legal and enforcement aspects, but also by the fact that research results and management experiences from elsewhere are not easily available to planners and decision makers. Hence, the participants welcomed the proposed preparation of a coral reef management handbook directed towards middle and upper-level managers. A tentative outline for such a handbook was presented in plenary by Dr. R. A. Kenchington of the Great Barrier Reef Marine Park Authority, Australia, and further discussed by a working group during the meeting.

During these discussions, brief summaries were presented concerning the activities and co-ordinating role of the Programme Group for the Western Pacific (WESTPAC) of the Intergovernmental Oceanographic Commission, as well as concerning the UNEP action plans for the East Asian Seas, and for the South Pacific (SPREP). The meeting urged that the related activities under the various programmes be closely co-ordinated to ensure optimum involvement of the limited manpower and resources available.

### Research and Training Priorities

The participants of the working group on research and training priorities relative to coral reef management, co-chaired by Drs. J. L. Munro and T. Piyakarnchana, presented their views on a number of specific items concerning coral reef matters in their country, such as: research priorities; priority fields for training and education and preferred methods; estimated number of present coral reef scientists and of trained coral reef workers needed in five years; and desirability of a national coral reef committee.

The various country needs as proposed by the participants are summarized in Annex IV. The participants at the meeting from the countries with a more developed marine science infrastructure, i.e. France (French Polynesia and New Caledonia), Australia and the U.S.A. (Guam and Hawaii), offered aid in the field training and the loan of specialists. This exchange of coral reef researchers and managers would enhance the co-operation among institutions and their scientists engaged in coral reef related activities in the Asian and Pacific regions.

The working group recommended a network between relevant institutions to support and strengthen research and training activities relative to coral reef management in the Indo-Pacific region, and the corresponding Recommendation adopted by the workshop is given in Annex V.

In its discussions the working group recalled a similar network approach among the various institutions in the tropical Pacific with marine or marine-related activities. This approach was recommended by the Unesco Seminar on Marine and Coastal Processes (Papua New Guinea, July 1980) to facilitate the execution of specific studies and the providing of advice and training on a regional basis.

The majority of the participants felt either that a national coral reef committee was not needed or that their present committee on oceanography or marine sciences was sufficient. If necessary, a sub-committee could be established under the present committee. The participants of the Maldives and the Trust Territory of the Pacific Islands did not feel such a committee was necessary. The participant from Thailand felt that a national coral reef committee was needed. The existing committees in each of the developing countries, which could also cover coral reef matters are as follows :

Northern Mariana Islands

Coastal Resource Advisory Committee

Papua New Guinea

National Mangrove Committee  
(a parallel Committee on Coral Reefs  
could be established)

India

National Committee on Oceanography

Philippines

Marine Science Committee

Indonesia

National Committee on Marine Research

Malaysia

The Marine Science Committee of the  
National Council for Scientific  
Research and Development.



The need for a regional coral reef site for use in long-term monitoring and a site for intercalibration of coral reef methods was favoured by some of the participants. Others felt that a site in each country would be more advantageous since this would eliminate the competition for the regional site among the countries. This topic should be addressed again at a later date after some of the recommendations from both the above-mentioned seminar in Papua New Guinea and the present workshop have been implemented.

### Coral Reef Management Handbook

The working group on the handbook, co-chaired by Drs. R. A. Kenchington and M.W.R.N. De Silva, used the tentative outline for the handbook presented during plenary as the basis for comments and discussions. Much discussion centered on the topic of "human impacts on coral reefs" as listed in the tentative outline, in view of Dr. B. Salvat's information on the planned activity of the Coral Reef Committee of the IUCN<sup>1</sup> Survival Service Commission and Commission on Ecology. This Committee is to produce 24 pamphlets on "human activities causing damage to coral reefs", in non-specialized language for decision makers and the wider public. The meeting considered this activity as an important contribution, and decided to restrict the handbook's introduction to about 25 pages - covering the value and man's use of coral reefs - to be followed by a large technical section. A number of refinements of the outline for the technical section were discussed and agreed upon by the participants, e.g. the relative importance of items like resource survey techniques, economics of reef uses and traditional rights.

A recommendation on the handbook was prepared by the group and adopted by the meeting together with the final version of the outline (see Annex V).

<sup>1</sup> IUCN - International Union for the Conservation of Nature and Natural Resources.

ANNEX I

PAPERS PRESENTED UNDER SECTION "REEF AND MAN"  
OF THE IV INTERNATIONAL CORAL REEF SYMPOSIUM

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Subsection 1. Fisheries

- A. C. Alcala and T. Luchavez. Fish yield of the coral reef surrounding Apo Island, Negros Oriental, Central Visayas, Philippines.
- V. D. Albaladejo and V. T. Corpuz. A market study of the aquarium fish industry of the Philippines.
- W. Craik. Recreational fishing on the Great Barrier Reef.
- W. Craik. Surveys of coral trout in the Capricornia section of the Great Barrier Reef Marine Park.
- R. Galzin and A. Mauge. Traditional fishery in Futuna and its dangers - Horn Archipelago, Polynesia.
- G. A. Heslinga. Growth and maturity of Trochus niloticus in a land-based mariculture system.
- R. E. Johannes, G. S. Helfman and J. M. Leis. Stock boundaries of reef and lagoon food fishes.
- S. Katnik. The effects of fishing pressures on some economically important fishes on Guam's reef fishes.
- N. Marshall. Exploring the applicability of the Edaphmorphic Index concept to estimating the fisheries potential of coral reef environments.
- M. Mastaller. Feasibility and evaluation of methods for drying reef fishes.
- G. S. McIntosh, Jr. Artificial reefs as fishery management tools in the United States.
- D. K. Oda and J. D. Parrish. Ecology of commercial snappers and groupers introduced to Hawaiian reefs.
- D. Pauly and J. Ingles. Aspects of the growth and natural mortality of exploited coral fish populations.
- S. Ralston. Estimation of the age of tropical fishes using the density of daily growth increments.

Subsection 2. Environmental Stress

- S. S. Amesbury. Effects of turbidity on shallow-water reef fish assemblages in Truk, Eastern Caroline Islands.
- A. Antonius. Coral reefs under fire.
- B. R. Best, R. D. Braley, J. A. Marsh and D. B. Matlock.  
Effect of chlorine on some coral reef phytoplankters and invertebrate larvae.
- B. E. Brown and M. C. Holley. The influence of tin smelting and tin dredging of the intertidal reef flats of Phuket, Thailand.
- J. A. Carey. Nickel mining and refinery wastes in coral reef environs.
- H. Chansang, Boonyanate and M. Charuchinda. Effects of sedimentation from coastal mining on coral reefs on north-western coast of Phuket Island, Thailand.
- C. Dejoras and B. Kendall. Tubbataha, view of unspoiled reefs in the Sulu Sea.
- S. J. Dollar. Storm stress and coral community structure in Hawaii.
- R. Galzin. Some effects of coral sand dredging in the lagoon of the 'Grand cul de sac marin' (Guadeloupe-French West Indies).
- R. W. Grigg and S. J. Dollar. Coral reef pollution: A major spill causes negligible impact.
- N. K. Khristoforova and N. N. Bogdanova. Environmental conditions and mineral composition of seaweeds from coral islands of the Pacific Ocean.
- K. Konishi and T. Tanaka. Secular variation of radiocarbon concentration in seawater: Sclerochronological approach.
- D. S. Marszalek. Effects of sewage effluents on reef corals.
- D. S. Marszalek. Impact of dredging on a subtropical reef community, southeast Florida coast, U.S.A.
- R. F. McLean. Post-hurricane rampart changes on Funafuti Atoll: Re-surveys of 1976, 1978 and 1979.
- H. Mergner. Man-made influences on and natural changes in the settlement of the Aqaba reefs (Red Sea).

- O. Naim. The influence of the extractions of sand and coral material on the populations of little fauna associated with the algae on the fringing-reef in French Polynesia.
- S. Neudecker. Growth and survival of scleractinian corals exposed to thermal effluents at Guam.
- J. C. Quigel and J. W. McManus. Investigation of drillings and production effects on closely situated corals, offshore Philippines.
- B. Raymond. Bombs, dredges and reefs - Florida and the Caribbean.
- S. V. Sheveiko. Life forms of coralline algae as an environmental indicator on reefs.
- S. Sudara. Condition of the coral reefs in Thailand and the potential usage in the future.
- A. Szman-Froelich, R. Adams, T. Hoehn, V. Johnson, J. Parker, J. Battey, J. Smith, E. Fleischmann, J. Porter and D. Dallmeyer. The physiological effects of oil drilling muds on the Caribbean coral Montastraea annularis.
- J. T. Tilmant and G. P. Schmahl. A comparative analysis of coral damage on recreationally used reefs within Biscayne National Park, Florida, U.S.A.
- B. von Bodungen. The Bermuda inshore waters investigations (BIWI) - An environmental study in a subtropical coral region.
- W. J. Zolan and R. Clayshulte. Influence of dredging and lagoon filling operations on water quality.

Subsection 3. Resource Management and Marine Parks

- R. A. Armstrong. A study of a Puerto Rican coral reef from 1963-1980 using aerial photoanalysis.
- M. W. Best. Present status of the coral reefs in the Spermonde Archipelago (South Sulawesi, Indonesia).
- R. H. Bradbury and R. Reichelt. The reef and man: Rationalizing management through ecological theory.
- A. S. Cabanban and A. White. Marine conservation program using non-formal education at Apo Island, Negros Oriental, Philippines.
- P. G. Castaneda. The municipal coral reef park in the Philippines.
- P. J. Davies. The use of geological data in reef management.

- T. J. Done, R. A. Kenchington and L. D. Zell. Rapid, large area reef resource surveys.
- M. Gawel. Marine resources developments planning for tropical Pacific Islands.
- E. D. Gomez et al. Status of Philippine coral reefs.
- R. W. Grigg. Coral reef resource management: A five-year research program in the Hawaiian Archipelago.
- G. Kelleher. Research needs for coral reef management planning.
- G. Richard, R. Bagnis, J. Bennett, M. Denizot, R. Galzin, M. Ricard and B. Salvat. Geomorphology biology and socio-economy of the Futuna marine ecosystem (Horn Archipelago, Polynesia).
- J. S. Ryland. Reefs and tourism in southwest Viti Levu.
- R. V. Salm. Ecological determinants of core and buffer zone boundaries in coral reef reserves.
- B. Salvat. Preservation of coral reefs: Scientific whim or economic necessity? Present and Future.
- B. Salvat. Utilization and trade of coral reef molluscs in French Polynesia, past and present.
- J. H. Schroeder and D. H. Nasr. Man versus reefs - Man for reefs in the Sudan.
- A. Soegiarto. The development of marine parks system in Indonesia.
- K. Venkataramanujam, R. Santhanam and N. Sukumaran. Coral resources of Tuticorin (S. India) and methods of their conservation.
- S. W. Wells. International trade in corals and shells.
- L. D. Zell. Physical constraints for management and interpretative activities on the Great Barrier Reef.

## ANNEX II

### WORKSHOP PARTICIPANTS

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ANNEX III

A G E N D A

Thursday, May 21, 1981

- Morning :                   -           Introductory remarks
- General discussion on research and  
  training priorities
- General discussion on outline of  
  coral reef management handbook
- Afternoon :                 -           Meeting of working groups :
- Group 1 : Research and training  
  priorities
- Group 2 : Coral reef management  
  handbook

Friday, May 22, 1981

- Morning :                   -           Continuation of working group meetings  
  and drafting of recommendations
- Afternoon :                 -           Discussion and finalization of  
  recommendation in plenary
- Closing remarks.



ANNEX IV

RESEARCH AND TRAINING PRIORITIES RELATIVE  
TO CORAL REEF MANAGEMENT OF DEVELOPING  
COUNTRIES REPRESENTED AT WORKSHOP

1. Trust Territory of the Pacific Islands (includes Republic of Palau, Federated States of Micronesia, and Marshall Islands).

Research priorities: inventory of baitfish and reef fish; environmental monitoring.

Priority fields of training and education required: survey and mapping techniques, ichthyoplankton, training of technicians and teachers.

Methods of training and education: undergraduate and graduate fellowships, training courses for technicians, visiting scientists.

Number of coral reef scientists:

1981 - none

Needs in 5 years (1986) - 14 (two scientists per district).

2. Commonwealth of the Northern Mariana Islands

Research priorities: population dynamics of commercial reef species, impact of pollution and reef degradation.

Priority fields of training and education required: Systematics and ecology of coral reef organisms, survey and mapping techniques, sedimentation, socio-economic aspects of coral reef fisheries, training of technicians.

Methods of training and education: undergraduate and graduate fellowships, training courses for technicians, visiting scientists.

Number of coral reef scientists:

1981 - 3 (fisheries)

Needs in 5 years (1986) - 25 (includes marine technicians).

3. Papua New Guinea

Research priorities: coral reef surveys presently underway.

Priority fields of training and education required: coral reef fisheries.

Methods of training and education: study grants and off-island fellowship.

Number of coral reef scientists:  
1981 - 3 (fisheries)  
Needs in 5 years (1986) - 30

4. India

Research priorities: domestic sewerage and dredging.

Priority fields of training and education required:  
expertise available but concentrating on aquaculture;  
survey and mapping technicians, reef ecology, fish  
egg and larval specialist.

Methods of training and education: national and international  
study grants (short term, i.e., 3-month duration) and  
fellowships (long term, i.e., longer than 12 months).

Number of coral reef scientists:  
1981 - 5 (taxonomy, reef fish biology and conservation).  
Needs in 5 years (1986) - 40-50.

5. Maldives

Research priorities: resource inventories of reef organisms,  
stock surveys of reef fish and baitfish.

Priority fields of training and education required: systematics  
of reef organisms, reef ecology, fisheries sociology.

Methods of training and education: training fellowships and  
undergraduate scholarships.

Number of coral reef scientists:  
1981 - 0  
Needs in 5 years (1986) - 20.

6. Philippines

Research priorities: survey and mapping, reef conservation and management (sociology, parks and education), long-term reef fisheries.

Priority fields of training and education required: training of technicians, reef ecology, fisheries, sociology, plankton.

Methods of training and education: training courses, visiting scientists and study grants.

Number of coral reef scientists:

1981 - 20

Needs in 5 years (1986) - 50 (need more M.Sc. and Ph.D., with academic work abroad and theses work in Philippines).

7. Indonesia

Research priorities: resource inventories including environmental parameters, pollution and reef degradation.

Priority fields of training and education required: survey and mapping techniques, systematics, ichthyoplankton, reef ecology, socio-economic aspects, management and environmental education.

Methods of training and education: short-term courses, long-term visiting scientists, fellowships of academic degrees, international and regional grants.

Number of coral reef scientists:

1981 - 70 (taxonomy, fisheries, oceanography, sediments and geomorphology)

30 (pollution)

Needs in 5 years (1986) - 120 (coral reef research)  
60 (pollution)

8. Thailand

Research priorities: survey and mapping; long-term research on reef management, e.g., impact of dynamiting; taxonomy and ecology.

Priority fields of training and education required: survey and mapping techniques, reef ecology, coral taxonomy, interdisciplinary methodologies.

Methods of training and education: international and regional grants, visiting scientists, travel to conferences, fellowships for advanced degrees, training courses, workshop on taxonomy of reef organisms.

Number of coral reef scientists:

1981 - 10 (none are experienced taxonomists)

Needs in 5 years (1986) - 25 scientists and managers  
30 technicians (at B.S. level).

9. Malaysia

Research priorities: survey and mapping; reef quality assessment in terms of

- a) biological richness as indicated by species diversity,
- b) extent of damage as indicated by percentage of dead corals and the possible cause of damage.  
i.e. Acanthaster.
- c) economic value as indicated by its exploitation for fisheries, tourism and for other purposes: evidence to indicate reefs as nursery and breeding ground.

Priority fields of training and education required: systematics of invertebrates including corals; marine park management, training of technicians.

Methods of training and education: regional training courses on taxonomy and park management, short-term visiting specialists to carry out teaching and practical courses (6-month duration).

Number of coral reef scientists:

1981 - 5 including 3 Malaysian nationals (reef surveys, ichthyology, invertebrates, sediment pollution).

Needs in 5 years (1986) - 20 scientists and managers  
(six marine parks 30 technicians  
anticipated in 1983).

RECOMMENDATIONS

1. Coral Reef Research and Training Programmes

The Unesco Workshop on Research and Training Priorities for Coral Reef Management,

RECOGNIZING

the urgent need for support of coral reef research and training programmes in Oceania, Southeast and South Asia;

RECOMMENDS

that cognizance be taken of the recommendations made by the Unesco Seminar on Marine and Coastal Processes in the Pacific, held at Motupore Island Research Center in Papua New Guinea in July 1980;

that a network be established between the various institutions in the tropical Indo-Pacific engaged in marine research;

that Unesco assists in the co-ordination of the network and seek funds for the promotion of post-graduate research and technical training in coral reef related topics and for sponsoring research activities which will serve to overcome common problems in coral reef research, such as the standardization of techniques for reef surveys;

RECOMMENDS FURTHER

that Unesco arrange for the drafting of a regional project proposal from extra-budgetary sources for research and training in coral reef management in Southeast, South Asia and Oceania drawing on the recommendations of the Unesco seminar at Motupore Island, the Action Plans of the East Asian and South Pacific Regional Seas Programmes of UNEP, and other relevant reports.

## 2. Coral Reef Management Handbook

The Unesco Workshop on Research and Training Priorities for Coral Reef Management,

### RECOGNIZING

the desirability of states in Oceania, Southeast and South Asia sharing their knowledge of the management of coral reefs;

that work is proceeding in various international fora on the preparation of informational material on coral reef management, and hence the need to avoid duplication of work carried out under the aegis of different agencies;

that there is an urgent need for a handbook on coral reef management;

that Unesco is regarded as the most appropriate international agency to support and assist in the co-ordination of the preparation of such a handbook;

### RECOMMENDS

that a handbook on coral reef management be prepared and disseminated in Oceania, Southeast and South Asia;

that the handbook be directed towards middle-and upper-level managers in the above-mentioned regions;

that the handbook be prepared according to the outline below;

that Unesco supports and assists in the co-ordination of the preparation of the handbook as an urgent project, with the aim of publication by 1982;

### Handbook Outline

1. Introduction (25 pages)
  - 1.1. Value of coral reefs
  - 1.2. Man's use of coral reefs
2. Approaches to Management
  - 2.1. Legislation
  - 2.2. Zoning
  - 2.3. Periodic restrictions
  - 2.4. Catch constraints
  - 2.5. Flexibility of plan

3. Resource Survey Techniques
  - 3.1. Satellites
  - 3.2. Aerial photography
  - 3.3. Field survey
  - 3.4. Information processing
4. Use Survey Techniques
5. Economics of Reef Use
6. Involving Reef Users
  - 6.1. Traditional rights
  - 6.2. Concessions
7. Field Management
  - 7.1. Surveillance
  - 7.2. Enforcement
  - 7.3. User and public education
  - 7.4. Staff training
8. Monitoring Techniques
  - 8.1. Reef conditions
  - 8.2. Levels of use
  - 8.3. Review of plan
9. International Cooperation Arrangements
  - 9.1. International organizations (Unesco, IUCN, SPC, UNEP, etc.)
  - 9.2. National agencies
  - 9.3. Requesting assistance
10. Bibliography.