

Intergovernmental Oceanographic Commission

**MARINE SCIENCE AND OCEAN SERVICES  
FOR DEVELOPMENT: UNESCO/IOC  
COMPREHENSIVE PLAN FOR  
A MAJOR ASSISTANCE PROGRAMME  
TO ENHANCE THE MARINE SCIENCE CAPABILITIES  
OF DEVELOPING COUNTRIES**

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## C O N T E N T S

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## FOREWORD

The last Session of the Third United Nations Conference on the Law of the Sea held in Jamaica, April, 1982, adopted the Convention on the Law of the Sea, including the Resolution "on Development of National Marine Science, Technology and Ocean Service Infrastructures". (Resolution IV; Annex VI, adopted by the last session of UNCLOS). The Resolution, inter alia, recommended that

*"all competent international organizations within the United Nations system expand programmes within their respective fields of competence for assistance to developing countries in the field of marine science technology and ocean services and co-ordinate their efforts on a system-wide basis in the implementation of such programmes, paying particular attention to the special needs of the developing countries, whether coastal, land-locked or geographically disadvantaged".*

It also recommended that

*"the World Bank, the regional banks, the United Nations Development Programme, the United Nations Financing System for Science and Technology and other multilateral funding agencies augment and co-ordinate their operations for the provision of funds to developing countries for the preparation and implementation of major programmes of assistance in strengthening their marine science, technology and ocean services".*

The Unesco/IOC Comprehensive Plan for a Major Assistance Programme to Enhance Marine Science Capability of Developing Countries (hereafter called Comprehensive Plan) intends to respond to the spirit and objectives of this Resolution.

The idea for the establishment of this Comprehensive Plan was first initiated by the Working Committee for Training, Education and Mutual Assistance in the Marine Sciences (TEMA) at its Third Session held in Buenos Aires, Argentina (April, 1980). The Working Committee for TEMA discussed in detail the future implications of the new ocean regime, resulting from the deliberations that had been going on at that time at the Third UN Conference on the Law of the Sea (UNCLOS). The Working Committee noted with grave concern the ever-widening gap between the need for data and knowledge and the capability for acquiring it in developing Member States in the field of marine science and engineering technology and recognized the expected implications of the new ocean regime to national and international ocean affairs and thus to the role of the Commission. It further noted that the programmes of TEMA and of the Unesco Division of Marine Sciences are not of a sufficient magnitude to bridge the gap, and the results of UNCLOS call for urgent action in order to provide scientific and technological manpower required by the developing Member States. Acting on the Recommendation of the Working Committee for TEMA (Recommendation TEMA-III.1), the Executive Council at its Thirteenth Session held in Paris, (June, 1980), by Resolution EC-XIII.15, decided to establish a

Comprehensive Plan to enhance the marine science capabilities of developing Member States so that they are able to achieve their national goals in marine affairs and to participate fully in global, regional and sub-regional programmes of the Commission.

The Fifteenth Session of the Executive Council held in Paris, (March, 1982), having reviewed the Draft Comprehensive Plan instructed the Secretary to prepare a companion document on modalities for its implementation (Resolution EC-XV.5). The Draft Comprehensive Plan together with the guidelines provided in the document on modalities for its implementation was finally adopted by the Twelfth Session of the IOC Assembly held in Paris, November 1982. Later, the Executive Board of Unesco, at its 116th Session, by Decision 7.1.5, commended the Comprehensive Plan and invited the Director General to mobilize the extrabudgetary resources for the regional and sub-regional projects called for by this Unesco/IOC Major Assistance Programme.

In order to facilitate easy reference to the two Documents adopted by the IOC Assembly, namely, "Marine Science and Ocean Services for Development: A Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of Developing Countries originally issued as Doc. IOC/EC-XV/8 Annex 5 Rev.) and "Modalities for Implementation of a Comprehensive Plan for a Major Assistance Programme to Enhance Marine Science Capabilities of Developing Countries" originally issued as Doc. IOC-XII/8 Annex 10) are reproduced in this document as Part I and Part II respectively.

MARINE SCIENCE AND OCEAN SERVICES FOR DEVELOPMENT: UNESCO/IOC  
COMPREHENSIVE PLAN FOR A MAJOR ASSISTANCE  
PROGRAMME TO ENHANCE THE MARINE SCIENCE  
CAPABILITIES OF DEVELOPING COUNTRIES

PART I

THE COMPREHENSIVE PLAN FOR A MAJOR ASSISTANCE



SUMMARY

1. Substantial assistance is necessary to developing Member States of IOC and others to improve their capabilities in marine science and related aspects because:
  - a) Extended maritime jurisdiction by coastal states has created a situation where self-reliance in marine science is needed to ensure that their new rights, especially to control resource exploration and exploitation, and the conduct of research, can be exercised and that they can benefit from this new situation for socio-economic development.
  - b) Diversification of ocean uses and the evolution of national goals in marine affairs call for flexibility in the use of available national facilities and skills in order that they are able to respond to an array of problems.
  - c) Increasingly, effective scientific input to development activities calls for multidisciplinary and interdisciplinary research with multiple applications.
  - d) Negotiations concerning access by others to zones of national jurisdiction make it in the interests of both developing coastal states and researching industrialized states wishing for access that there be competent scientific bodies on both sides. A similar argument applies to the transfer of marine technology.
  - e) While improvements have been made in recent years, helped especially by the efforts of Unesco through IOC and the Division of Marine Sciences - as well as by other UN organizations members of ICSPRO through development projects, scientific research and in the training of marine scientists and technologists, the number of specialists, available in the majority of countries are still small, often below the level needed for self-reliance (in all relevant disciplines) and not self-renewable in the sense that universities and research institutions are not sufficiently diversified or experienced to provide adequate specialized education and research training.
  - f) Although far more facilities and skilled personnel are now available in many developing countries than 10 years ago when the UN invited IOC to develop and to co-ordinate a Long-term and Expanded Programme of Oceanic Exploration and Research (LEPOR), the infrastructures in those countries remain in many cases weak, so that it is not always easy to make full and effective use of available research capacity, nor to seek guidance and to judiciously apply assistance in strengthening that capacity.

- g) Increasingly countries will, again as a result of jurisdictional changes in the ocean regime, find it necessary to take active part in bilateral and multilateral arrangements to ensure effective use and conservation of shared resources and to deal with major oceanic phenomena having bearing upon their economies.
- h) Countries are faced at the political level with the need to formulate marine policies for development and management of large new areas of territory under state control, and this calls for substantial inputs of scientific information and oceanographic data and thus for proper formulation of national marine science policy.

Improved capability involves strengthening of marine science infrastructures, including increases in quality and numbers of research institutions, researchers, vessels, etc., to ensure that facilities and manpower are efficiently used, that national and international support is obtained for strengthening them, and to ensure that the scientific community is able to contribute effectively to formulation and execution of marine policy. Strengthening of this organizational infrastructure includes establishment of appropriate relations between it and the other national bodies concerned with science policy, scientific research, science services, marine affairs, higher education, public information and technology transfer.

2. It is therefore desirable for each state, according to its specific needs, customs and governmental structure, to possess a mechanism for co-ordination and stimulation of marine science internally and to interface with other national infrastructures as indicated above as well as with international organizations concerned with marine science, ocean services and technology.

The essential characteristics of such a mechanism are detailed in the document; they include: management of some funds; representation of all relevant governmental departments, universities and research institutions as well as scientific disciplines; in order to implement policy a degree of control over, and access to, national marine data and information systems and common facilities; advice on giving or withholding formal agreement to marine scientific research activities under the consent regime in areas under the states' jurisdiction; a competence to advise on the formulation of ocean policies and goals; as well as authority to assure the participation of specific scientific groups and facilities in agreed international programmes. A model for such or a key component of more complex arrangements is a high level national oceanographic co-ordinating body (NOC), which might also become the national corresponding body for IOC and other Unesco activities in the field of marine sciences.

It is argued that for self-reliance in the long-term, the national marine science community must become critically numerous and diversified and that this goal can be promoted by regional pooling of some facilities and activities and by intensive regional collaboration.

Further, developing countries should be involved in basic as well as applied marine research, rather than merely being beneficiaries of the eventual application of scientific discoveries, and they need assistance in this regard.

3. Assistance to States emanating from bilateral and international sources to the ends envisaged, including funds which could be under the control of NOCs or other appropriate national bodies should be channelled through the projects associated with the regional and sub-regional research programmes of Unesco and its IOC. These funds should supplement those made already from the national marine scientific activities and the contributions of those countries to regional activities. It is expected that these latter, because of new conditions created by extensions of jurisdiction, may be numerous and frequently bilateral or trilateral among neighbouring states.

The regional/sub-regional projects on marine science and ocean services for development would, together, constitute the core of the Comprehensive Plan. Each regional/sub-regional project should act as a lever for development of national capabilities, aiming at self-reliance in the management of marine affairs. The regional projects would directly assist the participation of States in regional/sub-regional research programmes and hence lead to improvement in national infrastructures, but they would also help define the need for and scope of national assistance projects by which national marine research and ocean services capabilities could be substantially increased and strengthened. Both the regional and national projects would, it is proposed, be funded by UNDP, the financing system envisaged in the Vienna Plan of Action and other international and national sources, acting singly, collectively, or through a joint fund to be established. Special arrangements are needed for small states, particularly island states, with emphasis on joint possession and operation facilities. These activities would be funded through sub-regional projects and in such cases might be executed by a Joint Marine Science Commission.

4. UNESCO is particularly invited to play a leading role in this historical process and among other factors, use the mechanisms available for it. IOC, as an autonomous body within Unesco and acting as a joint specialized mechanism of the organizations of the UN system, part of the ICSPRO Agreement and now as representative of a wide spectrum of states' interests, is the appropriate body to continue development of the Comprehensive Plan it has itself launched and to take the key role in the promotion and coordination of such a plan. The Unesco Division of Marine Sciences is, equally, the appropriate body to design and execute assistance projects within the framework of the Comprehensive Plan, the purpose of which is to strengthen overall marine science capability, particularly by infrastructural development, in developing Member States of IOC and Unesco.

A strategy for implementing the Comprehensive Plan for a major assistance programme would be:

- a) Unesco through the IOC to provide the intergovernmental input required to develop the Comprehensive Plan from this outline;

- b) the Secretariat of IOC, the Unesco Regional Offices for Science and Technology (ROST), in consultation with the Division of Marine Sciences and the participating countries concerned to develop a system for compiling and systematically up-dating country profiles in marine sciences for Member States, the profiles to include relevant background information on the state of marine affairs and their place in national development plans, as well as factual information about research needs, programme facility and manpower. This would facilitate the identification of requirements to provide a scientific base for attaining national goals;
- c) Member States, with the assistance of Unesco and IOC, to identify their requirements concerning ocean affairs and related research including those arising from the bilateral and multilateral ocean activities they are or expect to become engaged in;
- d) representatives of Member States participating in Unesco and IOC regional subsidiary bodies and programmes, assisted by the Unesco and IOC missions and through other appropriate means to formulate specific regional projects and Unesco and IOC to prepare, negotiate and execute the projects;
- e) the Unesco and IOC meanwhile to approach funding agencies to secure their agreement to the principles of the plan before projects are submitted for funding. Regional/sub-regional projects may be funded by a single agency, but the magnitude of the funding needs for the development of national self-reliance in marine science may call for formation of a consortium of funding agencies.

## INTRODUCTION

The Comprehensive Plan is based on a strategy in which the present level and forms of assistance by Unesco and its IOC would be complemented and expanded through the development of projects aimed at enhancing national capabilities of Member States in marine sciences and ocean services. This would enable them to achieve national goals as well as to participate in the international co-operative programmes relating to those activities, particularly those undertaken in the framework of IOC. The complexity of the problems confronting the developing countries in the field of ocean affairs as well as the expression of views made by them in various fora and at the Third Session of the United Nations Conference on the Law of the Sea (UNCLOS) call for a new strategy and a comprehensive plan of international assistance, adequately funded, to complement the efforts made by the countries themselves and of the international organizations concerned so as to minimize the gap that exists between the developing countries and highly industrialized ones. This need was recognized in the Resolution adopted by the Twenty-first Session of the General Conference of Unesco (Resolution 2/06) held in Belgrade (23 September to 28 October 1980), which reads as follows:

*"The General Conference, considering the importance of the new ocean regime emerging from the decisions of the Third United Nations Conference on the Law of the Sea, and its implications for Member States and for the relevant international organizations in regard to opportunities for development and the responsibilities arising therefrom, which make it necessary further to extend marine scientific records and international co-operation at national, regional and global levels,*

*"Recommends that the Director-General give special attention in this transition phase to the need to strengthen the inter-governmental programme in the marine sciences and ocean services in order to assist Member States, in particular developing countries, to cope with the demands placed on them in connection with the new ocean regime from the Third United Nations Conference on the Law of the Sea".*

Within the United Nations System, Unesco is responsible for education and science in general and for the marine science and its technology in particular which is executed through its IOC and the Division of Marine Sciences. It is therefore logical that Unesco assumes its leadership in the area of marine sciences. The IOC Working Committee for Training, Education and Mutual Assistance in the Marine Sciences (TEMA), an intergovernmental body within the UN system, at its Third Session held in Buenos Aires, Argentina, April 1980, having reviewed the progress achieved at the UNCLOS and having taken into account the adoption by a number of coastal states of national legislation which are also contributing to the establishment of the new ocean regime, focussed its attention on their expanding needs in the field of ocean science and ocean services. The Working Committee recommended to the Executive Council "to consider developing a

plan of major assistance to enhance marine sciences capabilities, especially of the developing countries". Such a plan was envisaged to deal with marine sciences and ocean services in their broadest sense of ocean space as a whole and thus covering in an integrated manner the coastal zone and offshore areas as well as interphases with land, atmosphere and bottoms.

The Resolution EC-XIII.15 adopted by the Executive Council at its Thirteenth Session held in Paris (23-28 June 1981), (see Annex I), recognizing the importance of marine science and technology to rational use of the oceans and their resources, calls for such a Comprehensive Plan of major assistance to be developed. Also in this context, the Resolution on "Development of National Marine Science, Technology and Ocean Service Infrastructures" which was adopted by the Third United Nations Conference on the Law of the Sea, at its eleventh session, held on 30 April, 1982 (Resolution IV; Annex VI), and the Resolution 37/66 of 3 December 1982, by which the United Nations General Assembly welcomed the adoption of the Convention and the related resolutions, are indicative of the considerable importance attached by the developing states to the role of marine science and technology as a decisive component of development activities. The Resolution also calls, *inter alia*, for the developing countries to establish national priorities as well as institutional arrangements at national levels and urges international sources to help foster national capabilities in the field of marine science and technology. Furthermore, the recent study,<sup>±±</sup> prepared by the Secretary General of the United Nations, in his capacity as the Secretary General of UNCLOS, in response to a directive emanating from the Resolution 35/116 entitled "Third United Nations Conference on the Law of the Sea" adopted by the General Assembly of the United Nations, highlighted the future opportunities and obligations of the Member States as well as the needs of countries, especially developing ones, for information, advice and assistance under the new legal regime, including the fields of marine science and technology as well as of related ocean services within the concept of integrated ocean space as a whole.

In the light of the contemporary events referred to above, a promotion of the Comprehensive Plan requested by Resolution EC-XIII.15 seems timely and appropriate. The Plan relies on the accumulated experience of Unesco through IOC, the Division of Marine Sciences, the Division of Operations as well as its Regional Offices in Science and Technology, which offer a solid base for the formulation, development, promotion and implementation of project proposals for assistance to Member States when necessary, in cooperation with other Member Agencies, under the ICSPRO Agreement and with other UN Organizations.

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<sup>±±</sup> "Study of the Future Functions of the Secretary-General Under the Draft Convention and on the Needs of Countries, Especially Developing Countries, for Information, Advice and Assistance under the New Legal Regime."  
Prepared by the Secretary General, in his capacity as Secretary General of the Third United Nations Conference on the Law of the Sea.  
(Doc. A/Conf.62/L.76; 18 August 1981: United Nations Third Conference on the Law of the Sea)

1. GENERAL REVIEW OF MATTERS POSED IN RESOLUTION: EC-XIII.15

The Executive Council at its Thirteenth Session assumed that:

Member States of the Commission have, or will have, explicit "national goals in the field of ocean affairs";

achievement of such goals, by developing states, calls for transfer of knowledge and technology;

adequate national research capacity is a prerequisite for effective transfer of knowledge and technology;

strengthening of marine science infrastructure is necessary (though not, of course, sufficient) if defined national goals are to be achieved;

States' participation in global, regional and sub-regional research programmes - specifically, but not exclusively, in the programmes of the Commission itself is a means to contribute to the achievement of their national goals;

such participation, and other forms of international co-operation in marine affairs, can only be effective if both national marine science facilities and infrastructure are adequate. That is to say, international participation and co-operation are means to national ends, rather than ends in themselves.

Reference to goals implies that some procedures exist for formulating them. Since few countries have yet formulated explicit goals through a systematic process, it is reasonable to ask why this should now be expected. The answer lies in developments in technology, and in law, which interact. The application of modern technology, driven primarily by economic demand and guided by political opportunity, has greatly intensified and diversified man's use of the ocean and its resources. The inevitable consequences are requirements for planning and decisions on widened scales - so that development is harmonious and continuous - and needs to resolve conflicts in use of the sea. Current changes in the law of the sea have resulted in the assumption by states of rights and duties with respect to vast areas of ocean. It has also led to creation of frontiers where none existed before and the lengthening of ocean frontiers between states. Extended national jurisdiction over areas which contain most of the known living marine resources and substantial proportions of the non-living resources has opened up possibilities for increased benefits to coastal states from the exploitation of those resources, and opportunities for protecting and enhancing them. But it has also increased the potential for conflict between different uses which can only be avoided by state action. Increase in marine areas under national jurisdiction has multiplied both the opportunities for bilateral and multilateral co-operation and the possibilities for resolving issues internationally. This is especially so to the extent that resources are shared between states, in the sense of being geographically continuous - as are some mineral resources - or of being mobile, as are living resources closely related to water masses. In order that States may avail themselves of opportunities, as well as avoid conflicts of interests it is desirable that

their "national goals in the field of ocean affairs" be harmonized as far as possible. Such harmonization, as the formulation of goals themselves, is of course, essentially a political task. But execution of both these tasks will be facilitated if they are approached with a background of sound and relevant scientific knowledge, and especially if such knowledge is fully shared, and has been acquired co-operatively.

Acquisition of new relevant knowledge requires trained manpower, ships, laboratories and equipment. These are necessary but not, however, sufficient. It must equally be ensured that existing facilities and people are put to effective use, that where necessary they grow, and that essential services are available for them. For example, new scientific knowledge is built upon existing knowledge, and successful research calls as much for access to scientific literature and data as to ships and laboratories. The arrangements, within the country, which are made to ensure best deployment of people and facilities, to ensure provision of scientific services and to promote requisite growth of research capacity are what we mean here by the marine science organizational infrastructure. The infrastructure is, in brief, the set of institutional arrangements which are necessary for, and which serve, nourish and support the conduct of marine science. It does not include the actual research facilities.

The effective application of relevant scientific knowledge also calls for specific organizational arrangements. These arrangements are also regarded here as part of the marine science infrastructure - the outward-looking face. Further, strong national infrastructures are also needed in the field of marine science, not only to ensure that scientific knowledge is acquired and brought to bear on the achievement of national goals, but also to assist in the formulation of those goals. Only in that way can it be assured that, inter alia, the goals take account of the natural ocean phenomena, and the nature and limits of resources insofar as these are known, as well as of the uncertainties and gaps in such knowledge so that the goals are in that respect realistic. This means that marine science infrastructures must effectively interface with national bodies responsible for drawing up and implementing marine policy, which are themselves parts of the national overall policy-making machinery.

In the technically more advanced countries, marine science institutions have historically come into being in an ad hoc manner. Later, infrastructures have evolved in an attempt to co-ordinate these, to influence governments and to facilitate international co-operation. We should not expect this historic process to be repeated in the countries which are now attempting to become self-reliant in marine science. There the infrastructure, while it obviously cannot exist in a vacuum, may be an important instrument for creating the basic research capacity. This is particularly true where substantial external assistance is sought for that purpose. Without a suitable infrastructure external assistance can lead to inconsistent development which neither optimizes the use of national resources of manpower



and funds for scientific purposes, nor serves best the attainment of national goals. In recognition of this, the rather restricted interpretation of the term organizations "infrastructure" in this report should not be seen as unduly narrowing the tasks of IOC and the agencies providing international aid, but rather as directing attention to the provision of a tool to be used, in a second stage, to promote orderly and substantial growth in research capability and self-reliance in this field.

As used here, the term "marine science" refers particularly to the natural sciences - physics, chemistry, geology, biology - as directed to marine systems including their interfaces with land atmosphere and sea bottom. However, if scientific advice to government is to be most effective in contributing to achievement of national goals in marine affairs, it is evident that it must include reference to the social sciences and to technology. The infrastructural development on which we are here focussing attention must accordingly include arrangements for promoting and interpreting studies in economics, engineering, sociology and other relevant fields and to allow adequate interface amongst them.

Lastly, it should be realized that countries - including some of the more technologically advanced developing countries - which already have a considerable marine science capacity and perhaps a more or less adequate infrastructure, are finding that in order to cope with the new situation created primarily by changes in the law of the sea, they need to selectively strengthen their research capacity and to fundamentally reorganize their marine science activities and infrastructures.

## 2. MARINE AFFAIRS IN THE NATIONAL CONTEXT

The priorities of national goals in the field of ocean affairs will be determined in the context of overall national priorities regarding economic, cultural and political questions. Priorities to be given to marine science will necessarily take account of these policy priorities but will usually be determined within the context of overall national science policy, so that the marine science infrastructures referred to in the Executive Council resolution will interface with (or even be part of) the national science policy machinery. Equally, provision of adequate national capacities in marine science and ocean services, with respect both to manpower and physical facilities as well as to organization, cannot be disassociated from the problems of development of national scientific capacities generally. This dependence of marine science on general scientific capacity is what makes the role of Unesco central in the marine field, because, at the international global level, it is concerned with the broad problem of self-reliance in science and education.

Furthermore, the existing national arrangements, are exceedingly diverse, as is the range of scientific capacity. The scientific and technological gap, and the corresponding differences in the strengths of infrastructures, are as wide, between the least and the more advanced of the developing countries as between the latter group and the industrialized

countries. This wide range of national situations complicates the development of a comprehensive Plan and means that the outline of such a plan must be expressed in very general terms.

3. PROVISIONS IN THE CONVENTION ON THE LAW OF THE SEA REGARDING  
THE CONDUCT OF MARINE SCIENCE

The application of Part XIII of the Convention of 30 April 1982 offers opportunities for comprehensive strengthening of the marine sciences in developing countries. Article 243 recognizes the need for "...studying the essence of and the interactions between phenomena and processes in the marine environment", and for the integration of scientific efforts to this end and ...the creation of favourable conditions ..." for such research. Further, Article 244 recognizes that "strengthening of autonomous marine scientific research capabilities of developing states" is one of the elements of the necessary favourable conditions. The more developed countries, wishing to collaborate in a broad spectrum of activities, clearly have a direct interest in the strengthening of autonomous facilities of the other states. This applies with respect to the existence both of a sufficient number and variety of trained scientists and of national structures that provide a focus for collaborative arrangements.

The Convention grants extensive, though conditional, rights to coastal states regarding not only the authorization of, but participation in, research conducted by others in exclusive economic zones and on continental shelves. One aspect of the strengthening of marine science infrastructures is to allow developing coastal states to be able to evaluate objectively applications and the advantages of such participation and to implement it so as to yield greatest benefit to themselves. This calls for creation of national scientific structures with the power and the capacity to make decisions regarding the characteristics of authorized research activities, the nature of participation and the utilization of the results. The "consent regime" spelled out in Section 3 of Part XIII also calls for different criteria to be applied to research projects depending upon whether they are for exploration of natural resources or not. Such distinction will, in practice, call for considerable scientific understanding on the part of the coastal state involved.

The Convention on the Law of the Sea pays strict attention to the relation between scientific research and the exploration of resources. Consideration must be given to this matter in the formulation of the plan called for by Resolution EX-XIII.15. A purpose of "autonomous capability" is to enable states to conduct scientific research which will lead to:

- a) evaluation of resources under their complete or partial jurisdiction, or which are accessible to vessels under their jurisdiction;
- b) conservation of renewable resources so that sustained benefits can be obtained;
- c) effective management of maritime operations by their own vessels or other platforms, and by other vessels within zones under their jurisdiction as well as operations by their vessels within international zones.

These imply surveillance and monitoring arrangements, all of which require science based techniques and procedures.

Central to all these objectives is the universally recognized need to maintain the qualities of the marine environment so that a multiplicity of benefits may be ensured for all time; this ranges from a concern for endangered species of animals and plants to maintenance of the overall chemical balance in the sea and of the sea's biological productivity. A wide spectrum of scientific knowledge is required in order to cope with the threats to marine resources resulting from conflicting uses of the sea and the coastal zone. Rational management of ocean space can only be achieved on the basis of an ability to discriminate between natural environmental changes, and those caused by human actions. The problem is at least as great for developing as for developed countries and experience shows that developing countries cannot depend only on data analyses provided by the more oceanographically advanced states. They need to be directly involved in the necessary research to identify and measure natural phenomena.

The term "resources" is not defined in the Convention. Most attention has been given to living resources on which fisheries depend, to oil and gas deposits and to metalliferous minerals. The definition of exploration, under the LOS, will inevitably be shifting, and its application at any time, will call for perception and mutual understanding. The study of the ocean bed by H.M.S. Challenger in the last century, which led to the discovery of manganese nodules, was not specifically planned as "resource exploration", and mapping of the thermal structure in the sea might in the future be identified as "exploration" for a source of energy.

New ways of using the sea, which rely on scientific advance, will be of as much value to developing as to developed countries. Some of these are consequences of increases in the price of fossil fuels; examples<sup>±±</sup> (see below). Such developments call for a variety of scientific activities both for developing new equipment and for monitoring and predicting the ocean surface and winds so that optimal use can be made of the new technologies. Other examples could be cited of likely developments from which countries should not be excluded solely by virtue of their present weaknesses in the marine sciences.

Although extensions of national jurisdictions over exclusive economic zones and continental shelves provide at this time the strongest impetus for the strengthening of the marine sciences by developing countries, the possibilities of their participating actively in the peaceful investigation of the common heritage of mankind - the seabed and ocean floor and subsoil thereof beyond the limits of national jurisdiction - must not be overlooked. Article 143.3 of the Convention on the Law of the Sea not only gives all states the right to carry out such research, and encourages participation in international programmes, but requires that programmes be developed by appropriate international organizations (of which Unesco and its

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<sup>±±</sup> The progress achieved in Ocean Thermal Gradient Energy Conversion (OTEC) and in harnessing tidal waves and in the improved designs of large and small sail and sail assisted vessels for surface transport and for fishing and oceanographic observations.

IOC is presumably the most important) "for the benefit of developing states and technologically less developed states". Furthermore, it is to be ensured, inter alia, that these programmes of scientific investigations are such as to strengthen the research capabilities of such states. Some of the more advanced developing countries which have made progress in certain areas of marine research may be considering such participation, but be in need of assistance in preparing for it.

The effective transfer of marine technology to developing coastal states is of prime importance to them particularly in situations when scientific research or any other activities relating to utilization of resources are being carried out by other states both within and outside their areas of national jurisdictions.

The Convention on the Law of the Sea is specific in this regard. Part XIV refers to a number of actions, the implementation of which calls for effective national marine science infrastructure. Thus, Article 268 provides for direct or indirect action by states regarding the development of technology, the acquisition and exchange of information and the development of appropriate infrastructures to facilitate transfer. Marine science is involved in this matter in two distinct aspects, as is evident from Article 269 which deals with measures to achieve the basic objectives. The first aspect is the technology (i.e. the methods, instruments and "platforms") for conducting scientific investigations in the marine environment. The second aspect is the scientific basis for the technology of marine resource exploration and exploitation, and in general the peaceful economic use of the ocean, protection of the marine environment and conservation of its resources. As regards the first aspect, this must be seen as an intrinsic part of the promotion of marine science, and no need for special, separate arrangements can be foreseen, beyond possibly the conduct of seminars, etc. as provided in Article 269c. With respect to the second aspect, however, the fostering of favourable conditions for technology transfer mandated by Article 266.3 seems likely to involve the creation of appropriate and corresponding mechanisms within donor and recipient states. If this surmise is correct, then the national marine science infrastructures will need to interface with those mechanisms. Little more can be said about this until it becomes clearer what form such interfaces will take and also what types of structures will emerge within the Seabed Authority to handle its responsibilities under Article 274, which deals with marine scientific research projects undertaken in the EEZ by or under the auspices of international organizations.

4. IMPLICATIONS OF THE UN CONFERENCE ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (UNCSTD)

In the discussions which resulted in Resolution EC-XIII.15, the Executive Council acknowledged the close link of the UNCSTD, and the law of the sea negotiations, with the movement towards a new international economic order. Most of the general proposals in the Vienna Programme of

Action, resulting from UNCSTD, are applicable to the study, use and management of the marine environment. The assumption of jurisdiction by developing coastal states over large sea areas and the included resources while the new law of the sea was being negotiated gives, however, an immediacy to those general proposals in the present context.

Section 3 of the Vienna Programme of Action, and especially paragraphs 39-43 dealing with institutional arrangements, are particularly important when seen in conjunction with the UN General Assembly Resolution 34/218, operational paragraph VI, establishing the UN Financing System for Science and Technology for Development. The Vienna Programme emphasizes the need for a comprehensive network of scientific agencies within countries; the development of an endogenous scientific and technological base; the performance of international functions by national centres for research and training located in developing countries; and participation in regional and sub-regional projects, especially in the sense of mutual assistance within regional groupings of developed countries.

It appears that the Financing System is planned to, in financing activities to strengthen endogenous capacities, concentrate on activities which are complementary to existing bilateral multilateral development programmes, and supportive of the national efforts. The Interim Fund, as the launching phase of the Financing System, would promote co-operative arrangements through which: a) developed countries can support the effort of the developing countries to help themselves; and b) developing countries can give each other mutual assistance at regional, sub-regional and inter-regional levels.

#### 5. NECESSITY FOR REGIONAL CO-OPERATION

Although all coastal states have local problems which require marine scientific research for their solution, they also have problems which can only be resolved by investigations on a wider geographical scale. Over the years, a pattern of international co-operative programmes has emerged and procedures for planning and implementing these have been worked out by groups of states. In parallel with this development, global co-operative programmes in the field of ocean science and ocean services have been launched. As the number of developing states involved in, especially, regional programmes has increased, so have these regional programmes increasingly been directed toward solving problems addressing to transnational oceanic phenomena of particular interest to those states. All developing coastal states, if they are engaged in marine science at all, are involved in various forms of international co-operation. Because of the nature of the marine environment, and the history of its use, some advanced countries are also participating in most of these programmes, even in regions to which they are not coastal. Inevitably the more advanced countries have contributed a large share of the effort to acquire relevant knowledge; many of the developing countries, on the other hand, have obviously, difficulty in contributing substantially to these enterprises. Moreover, co-operative programmes are mutually beneficial, especially to the developing countries in so far as they provide excellent opportunity for interaction and for strengthening

of national infrastructures in various disciplines of marine sciences both in coastal and offshore waters.

Most international co-operative programmes require action at the regional level through provision of co-ordinating secretariats, regional data centres and some common research facilities. Most of the effort is, however, undertaken by the participating states. Usually, each state takes a specific share, geographically, in the investigations. In addition, selected national units will commonly perform international functions for the duration of the programme and sometimes after it. This often calls for international funding to strengthen them. Financial help can make a substantial contribution to such programmes when provided through regional/sub-regional aid projects for the particular purpose of strengthening the participation from the developing states in such way that their national capabilities in marine science are permanently enhanced.

## 6. NATIONAL MARINE SCIENCE ORGANIZATIONAL INFRASTRUCTURES

### 6.1 Functions and Features of Organizational Infrastructures

In the previous sections, several features of effective organizational infrastructures have been identified:

- a) Interfaces with national arrangements concerned with policy and planning of ocean use and of science generally;
- b) Interfaces with the corresponding organizational infrastructures in other countries, both directly and through international organizations, both governmental and non-governmental;
- c) Set of relations with marine scientists and their institutions and the physical facilities which they use;
- d) Relations with the national arrangements for general storage, retrieval and analysis of scientific and technical information, because the acquisition and use of such data are crucial to modern development processes (including the utility of science as a creative activity);
- e) Effective relations with the universities and other national institutions of higher education (including the training of technicians as well as the formation of research workers and engineers) are vital in the developing countries, where education and training at all levels now receive such high priority in national policies.

These relationships are illustrated in a general way in Annex IV. For marine science to contribute as effectively as it could to the achievement of national goals, all the elements labelled therein are necessary and all the relationships indicated must be in order. In particular, the marine science infrastructures must at all times be appropriate to the corresponding facilities and to the national goals with respect to ocean affairs. The organizational infrastructure should be effective in directing funds and encouraging recruitment into the marine sciences, and the resulting growth

of facilities and manpower should lead to its strengthening. The particular characteristics of marine science will determine, in part, the characteristics of the required organizational infrastructure.

Firstly, marine science is essentially both interdisciplinary and multidisciplinary. The multidisciplinary aspect is particularly true with respect to applied research: studies aimed at improving knowledge about resources, whether renewable or non-renewable, typically involve several of the classical disciplines all working more or less independently.

Secondly, interdisciplinary work is characteristic of much marine science. Examples are the interface of ecology and the mathematics of population dynamics in fisheries research, and of meteorology and marine physics and chemistry in the study of the dynamics of the ocean surface. Thirdly, because of the large scale of many marine processes and very many areas of the sea under national jurisdiction, a large part of marine science involves international co-operation of a more substantive kind than the normal international exchanges in science. Participation in ocean science and services activities at regional and global levels is expected from all countries which may benefit from these, but the focus of co-operation, especially by developing countries, is among neighbouring states and among coastal states at the sub-regional level. It should also be emphasized that results of marine scientific research can be used for multisectoral and intersectoral application.

Nuclei of specialized research institutions in fisheries, and in other fields have now been established by many developing countries. There are, however, serious problems of costs and manpower in ensuring the critical numbers of specialists in each discipline for all relevant disciplines to flourish within such institutions. It would be beneficial if a broader marine science base could now be constructed in such countries. This could facilitate multiple applications to an array of problems in ocean affairs of research in the major disciplines. Such countries could also benefit from the creation of a co-operative network that would eventually be self-sustaining, and would be able to turn their attentions to different marine problems as ocean policies evolved. Furthermore, since science thrives on inter- and intra-disciplinary interactions it makes sense, where the numbers of scientists are small, for their activities to be structured so as to foster such interactions. This calls for appropriate arrangements within nations and also between neighbours and within regions, since one cannot envisage, for most of the developing countries, self-reliance in all relevant disciplines at the national level for many years to come. Somewhat paradoxically, the weaker the country is in science, the greater is its need for efficient organizations infrastructures and for substantive international co-operation and assistance. These conclusions concerning the interactions between deployment of scientific manpower, apply to the utilization of vessels, computers and other expensive equipment.

Arrangements to bring about, within the countries, concerted action by the scientific community, and to enhance its contribution to the achievement of national goals in marine affairs, and optional use of available means, should therefore:

6.1.1 Marine Science Policy

- a) advise on the formulated execution of marine research policy and ensure that there is an adequate flow of funds for ensuing activities;
- b) be such that the scientific community has a significant voice in defining the national goals in marine affairs, as well as a role in achieving them; this calls for appropriate links with government bodies concerned with development planning, with science policy, and with technology transfer;

6.1.2 Co-ordination, Scientific Research and Development

- a) assist access by marine scientists to appropriate tools; this calls for pools of common physical facilities co-ordinated through mechanisms to supplement those available and operated by particular departments of government, universities or private institutions - common facilities might include vessels and other platforms, computer systems, data banks, specialized documentation collection and retrieval system;
- b) bring together marine scientists of various disciplines - this involves links with operational departments of government and other bodies employing marine scientists for applied research;
- c) assist access by marine scientists to specialists in other fields of science and technology whose advice and assistance may contribute to progress of marine science;
- d) stimulate marine research and provide for organization of co-ordinated investigations necessary for achievement of national goals;
- e) co-ordinate the formulation, execution and evaluation of those marine research programmes that involve international co-operation particularly those following within the framework of Unesco and its IOC;
- f) facilitate collaboration of marine scientists from one nation with those in other nations and provide means for their effective participation in the activities of international organizations (global, regional, sub-regional);
- g) be associated, as necessary, in negotiations with other states which might give opportunities to improve national self-reliance in marine science - for example in the granting of fishing rights within the Exclusive Economic Zone (EEZ) or in the drawing up of joint ventures or other bilateral fisheries arrangements, opportunity could be taken for the



developing country to secure not only direct economic benefit but also assistance in training of scientists, use of available platforms, provisions of data and documents, and so on;

- h) ensure that the results of marine scientific work are applied to development, being taken into account by government and industry in their decisions and enterprises; this calls for competence to interpret scientific results for relaying them to political and administrative authorities, as well as to special interest groups such as industrial organizations, trade unions, and similar non-governmental bodies;

#### 6.1.3 Information and Data Service

- a) assist access by marine scientists to relevant information and data processing systems, and ensure their adequate participation in the elaboration and operation of those systems; to ensure the timely publication of scientific results;
- b) ensure that there is a rapid and effective flow of information about programmes, facilities and research results within the national scientific community;
- c) ensure that the public is informed about marine science in general and its contribution to economic and cultural development, and in particular about the national activities (including, of course, national participation in international programmes);

#### 6.1.4 Training, Education and Transfer of Relevant Technology

- a) encourage training and education of marine scientists, engineers and technicians within the research establishments - this calls for strong links with the national university/college system;
- b) encourage the employment and retention of adequate numbers and quality of trained personnel;
- c) advise on scientific aspects of transfer of marine technology.

It is evident that these functions (and possibly others not listed) cannot all be fulfilled by a simple local arrangement. The actual mechanisms will differ widely from one country to another. In the larger developing countries, or those which are already quite advanced in marine science, arrangements are likely to be quite complex. In smaller, intermediate or

less developed or countries weaker in marine sciences, a first step might be the creation of a single body, in accordance with the spirit of the IOC Assembly Resolution X-19 which "Recommends that Member States improve their national structure in marine science by giving serious consideration to establishing National Oceanographic Committees or equivalent bodies, if they have not already done so". The establishment of a high level national oceanographic co-ordinating body, herein called NOC, would be a fundamental step towards improvement of a national machinery in the field of ocean affairs. The members of the Commission would mainly be persons with scientific competence including some currently engaged in research and some actively involved in science education, in information exchange and data processing, and in marine technology transfer. Its composition would be multi-disciplinary with respect to the marine sciences and it must represent the relevant ministries, universities and research community. Its terms of reference would be broad enough to encompass all likely applications of marine science and ocean services to national development. The NOC should have to catalyze and encourage research development in preferred directions.

In each country the question will arise as to the dependence of a NOC from superior bodies - possibilities include the national science research councils, the Ministry of economic planning, the Unesco National Commission, any agency established at high government level for marine policy and the government department with a particularly strong interest in marine affairs. It is recommended that the NOC as here conceived would serve as the national body responsible for contact with marine science programmes of Unesco and its IOC and with other international organizations concerned with marine science, as well as non-governmental bodies such as SCOR and ECOR, and would maintain liaison with national bodies responsible for contact with international organizations. Special arrangements should be made to maintain adequate interactions with the national counterparts for non-governmental organizations such as SCOR and ECOR.

The NOC as described above is presented here as a minimum level of arrangement necessary to provide effective co-ordination and support for growth and development of marine science nationally. In this regard some states have gone much further in setting up more elaborate structures such as the Ministry of Sea in France and the Department of Ocean Development in India. In some cases an interministerial body represents the interest of various governmental sectors having interest in marine affairs and requiring the adequate marine scientific and ocean services input both for development and management of marine resources and environment such as in Sri Lanka (e.g. National Aquatic Resources Agency) while in others this is achieved through establishment of a Commission under the National Agency for Scientific and Technological Research formed by representatives of a governmental department concerned and some selected senior scientists in their capacity as experts of recognized competence in marine science as in the case of Portugal. Yet in other instances such a body is under the Unesco National Commission because of the integrated nature of programmes of IOC and the Unesco Division of Marine Sciences.

7. RELATION OF REGIONAL ACTIVITIES TO NATIONAL CAPACITY

In response to Resolution EC-XVIII.15, with the strengthening of marine science and ocean services infrastructures, the need for continuing growth in marine science personnel and research facilities in developing countries must be emphasized. Much progress has been made in recent years in many developing countries, although more facilities and a greater number and diversity of skilled and creative personnel are still required. Research thrives in an atmosphere of constant intellectual stimulation, and in Member States with small marine scientific communities there is always the danger that isolation will lead to stagnation. International and regional co-operation can contribute to the solution of this problem. This was one of the reasons for the proposals to establish on a permanent basis regional sub-commissions of IOC. Regional research programmes on scientific problems or phenomena of common concern to all Member States of the region lead to scientific stimulation across national borders. A lasting strengthening of marine science capabilities depends on a continuous renewal and expansion of scientific manpower, as well as on a general awareness of the value of marine science. States must therefore be enabled eventually to educate their own marine scientists in national education institutions. This is a long-term objective in many areas of the world, and in short- and medium-term the needs may be met by pooling of research and educational facilities in defined regions, strengthened by experts provided by international organizations. Provision of the scientists' tools - laboratories, ships, equipment, libraries and information systems, etc. - is also a continuing process, changing with the direction of research emphasis and with available technology. The long-term continued support for strengthening and expanding the research facilities is the responsibility of individual states in accordance with their defined national goals. However, just as for scientific personnel, full participation in marine scientific activities requires a minimum critical mass of facilities. A rational build-up of national facilities taking advantage also of the agreed regional research co-operation is thus desirable and calls for assistance.

8. INVOLVEMENT OF DEVELOPING COUNTRIES IN BASIC RESEARCH

Such basic research has progressed very rapidly and had important scientific and practical results. There has been a tendency over the years to lay considerable emphasis on the so-called "applied" research in developing countries, while basic marine research has been pursued on the whole by the more technically advanced states. Examples of the interdependence of basic and applied research are the deep sea drilling programmes that revealed the processes of plate tectonics and the implications of that for knowledge of mineral location; applications of ecological modelling theory to the somewhat intractable problems of multi-species exploitation in fisheries; the revelation by basic oceanographic exploration of unexpected "resources" of brines and metalliferous suspensions; the plankton investigations in the Southern Oceans which revealed the distribution and enormous abundance of krill. All these discoveries and results, and more besides, are of potential benefit to developing countries. They should be assisted to the point of being able to participate actively in future basic research and not be merely the passive recipients of benefits. A strengthened marine science infrastructure should serve this end.

## 9. OUTLINE OF A PLAN FOR A MAJOR ASSISTANCE PROGRAMME

### 9.1 General Approach

From the discussion in Section 2 it is obvious that marine science and ocean services capabilities of developing states can be enhanced through active participation by them in well-defined national, regional and global programmes. A major programme is needed simultaneously to assist in building up facilities and trained and experienced personnel, and in strengthening national organizational infrastructures. External assistance in the former respect has generally been limited. Particular universities or other educational and research institutions have been helped, specialized laboratories have been built and ships acquired. Initially little or any attention has been paid to organizational infrastructures. It can be imagined that advice by consultants from more states that have faced these organizational problems would be useful in certain cases. This would call for some funds, but hardly for a comprehensive plan for major assistance. In any case, while it is always useful to share experience, the strengthening of national infrastructures, in any field, calls for an intimate knowledge of the local culture and traditions, of the qualities of available people, and of related national arrangements regarding policy, science, information, participation in international affairs which cannot be available to foreign experts.

The solution proposed is that the major comprehensive plan of assistance required to expand and improve marine science ocean services facilities should be channelled through, or at least managed by, a high level national oceanographic co-ordinating body (NOC) which in turn would be strengthened in the process of exercising the responsibility of planning and utilizing such assistance. Under the comprehensive plan assistance would be made available to regional and sub-regional projects as defined in the respective project documents with the aim of benefiting all participating states in the fulfilment of their national goals.

The comprehensive plan envisaged would consist of a number of regional/sub-regional assistance projects. Each such project would ensure full national participation and would be associated with a corresponding international research activity principally those developed by states through existing Unesco and IOC mechanisms. Some of these activities would be co-operative investigations under the sponsorship of IOC.

It is envisaged that the assistance projects would be funded by a combination of multi-lateral and bilateral agencies. Expenditure of the funds provided under them would be utilized in accordance with the instructions on the IOC regional mechanism in the case of the IOC-

sponsored activities. While a certain proportion of the funds for each project would be earmarked for regional services, including the personal services of the project manager and any internationally recruited staff, most of the funds would be made available through the high level national oceanographic co-ordinating body or equivalent bodies of the developing countries, for the special purpose of enhancing the national capabilities and thus the contributions of those countries to the regional activities as spelled out in the project documents. These funds would supplement funds made available directly from national sources. They would assist the NOC in bringing available expertise and facilities to bear on the regional activities, and they would also help in creating new specialized facilities and skills which would remain available for future national and regional activities. Executed in this way it would be expected that the regional projects would help define the need and create the basis for national assistance projects to be funded by UNDP, the Financing System of the Vienna Programme of Action, and other major sources of financial assistance.

The success of certain regional activities will depend partly on the effectiveness of the global services being developed by IOC; some of the funds from the assistance programme will need to be earmarked for use in improving the effectiveness of regional components of such services.

## 9.2 National Commitment

It is essential that the governments make a commitment to developing marine science and ocean services capacity in order to achieve national objectives. This will permit a closer consultation between Unesco and IOC and the countries, at their request, at all stages of planning, identification of requirements, follow-up of assistance projects and of their implementation.

Countries for which the ocean including coastal zone represents a potential source of economic benefit need to define or improve the formulation of marine science policy relating to their national goals in the field of ocean affairs. This would provide the basis for the future development or strengthening of infrastructures in the fields of marine science and ocean services and related training and educational activities.

Even though some countries may have established a marine science policy, there is an urgent need in many of them for improving inter-ministerial co-ordination by strengthening national mechanisms, such as the National Oceanographic Commission, referred to earlier in this document. This should contribute to the formulation of marine science policy and to its effective implementation through national utilization and optimization of the available national resources.

### 9.3 Regional Priorities

If the execution of the assistance programme is to become an effective lever to strengthen national infrastructures, priority should be given to those regional activities, of whatever scale, that involve multidisciplinary research, and are expected to provide new knowledge which will find a wide variety of applications in ocean affairs. By the same token, priority would be given to regional activities regarding which the participating countries have more clearly defined their policies, and for which therefore the application of science could be expected to be particularly useful.

Particular attention will need to be given to the appropriate geographical scale of the projects. To a degree this will be determined by the scale of the phenomena being investigated, which may be large - even ocean-wide. However, a more important criterion, at the present time, may be a political one. The extension of national jurisdiction by coastal states have created an imperative for co-operation among neighbouring states, and between them and other states, that did not previously exist, or at least was not so evident. The possibilities of vessels from more than one country conducting research, exploitation or exploration in a particular zone are now matters for negotiation and formal agreement between the coastal states for the area under their jurisdiction; decision regarding study or use of internationally shared resources - which is the category into which fall many living resources and physical, resource-like properties of the sea itself - must also be matters of formal agreement between neighbours if the resources are to be exploited in a sustainable manner and the uses of them developed harmoniously and peacefully. The regional and sub-regional programmes of the IOC are themselves changing character as a taking into account the consequences of the changes in limits of national jurisdiction and seem, therefore, to be ripe candidates for international support.

The earlier regional investigations co-ordinated by IOC covered very large areas (e.g. IIOE, CICAR, CIM, CSK, etc.) but there has been a progressive focussing of effort on more specific problems in smaller areas. This is so even within the large regional activity most recently adopted - WESTPAC. Same applies to IOCARIBE, which lay greater emphasis on environmental geology, coral reefs, etc. Multi-lateral co-operation on sub-regional scales will undoubtedly continue, but to them might be added international co-operation on an even more limited scale. Many problems arising from extensions of national jurisdiction concern only two, or very few, adjacent or opposite coastal states. Regardless of disputes over the delimitation of common boundaries, agreements regarding continuing activities in the areas close to those boundaries will now be needed. Often the boundaries are a developing and a developed country. Already many bilateral negotiations are in progress to establish common policies on movement and scientific research in such areas. More will follow. They may concern entire EEZs or shelves of the states involved or, more usually, parts of their EEZs or shelves. Negotiations are leading in some cases to the establishment of joint commissions or other continuing mechanisms with various functions, including the co-ordination of research. Scientific advice is needed by states during the negotiations. It is likely that neighbouring developing states will in this situation together seek assistance

from an existing international organization which could be useful in arranging for continuing studies or special research projects prepared for this eventuality and make known its willingness to help Member States if the countries concerned so wish. In any case, whether or not the international organization becomes involved in such ways, the development of bilateral and small multi-lateral research programmes, strictly limited in scale, should be expected and generally provided for in planning the assistance programme.

#### 9.4 Special Arrangements for Groups of Small States, Particularly Islands

The new law of the sea has led to a situation in which some small states including least developed countries exercise jurisdiction over vast sea areas and considerable marine resources. Groups of such states are situated on the South Pacific, the Western Indian Ocean and the Caribbean. If they are to derive substantial benefit from the ocean space and resources to which they now have privileged access, they will need, as do other states, marine scientific and technical competence, yet it can hardly be expected that many of them can become self-reliant in this respect. Thus, although regional programmes and projects in the context of the comprehensive plan should be the channel of assistance to the participating states in strengthening their particular organizational infra-structures, in certain cases it will be necessary to create or strengthen multilateral mechanisms to the extent of their possessing or operating joint research and related facilities.

The exact form of such arrangements will vary from area to area. In certain cases, there are in existence multinational joint academic facilities, for example the University of the South Pacific and of the West Indies. (There is under discussion a possible university or college for the Western Indian Ocean). In other cases, an island or other small state may prefer to establish and depend on a bilateral arrangement with a larger neighbour, which may or may not itself be a developing country. It is suggested that an appropriate form of assistance would be through sub-projects of the proposed regional/sub-regional assistance projects which would be specifically concerned with funding joint facilities and mechanisms. Thus a research vessel might be shared among a number of small states and operated by a suitable structure joint mechanism.

The joint mechanisms could be responsible also for a shared documentation and data centre, shore laboratory, computer facility, as well as for a training programme. It would also be available to interface with regional economic and policy bodies of which the states concerned may be members. Such arrangements could greatly assist the participation of the countries concerned with Unesco marine science programmes including the study and management of the coastal zone programme and the global programmes of the IOC, and even in large regional scientific programmes, such as those undertaken in the framework of the regional subsidiary bodies of the Commission. It is not always feasible, because of limitation of funds and manpower, for small

states to participate in all the technical activities (including conferences) of broad interest. Through joint mechanisms, it would be possible for their common interest to be represented without, of course, prejudice to their individual powers of decision in bodies such as the IOC Assembly.

In some areas it will be necessary for IOC membership to be expanded and the scientific community to be directly involved if it is to perform such regional functions effectively. For example, the south-eastern sub-region of WESTPAC is particularly weak with respect to membership by the developing island states of the area, yet development, assisted by organs of the South Pacific Forum, of fisheries and sea-bed resources in that area, as well as other maritime uses, are highly dependent on oceanographic research on a rather large scale.

#### 9.5 The Role of Unesco and IOC in Marine Sciences and Ocean Services

Unesco through IOC and the Division of Marine Sciences is concerned in principle with all relevant scientific disciplines, and neither is limited to particular applications of marine science. The IOC is the central co-ordinating body in the field of marine sciences and related ocean services within the United Nations system. Within its statutory provisions it is responsible for promotion of scientific investigations for developing, recommending and co-ordinating programmes which call for concerted action of its Member States and interested international organizations. In carrying out its functions, the IOC seeks to provide small amounts of assistance and to apply this selectively for catalytic action to foster the development or strengthening of infrastructures in marine science and marine technology, and, when requested to do so, assist local efforts for the formulation of a comprehensive ocean policy. Within its terms of reference, the Commission provides technical assistance through its programme known as Training, Education and Mutual Assistance in the Marine Sciences (TEMA). Furthermore, IOC is a joint specialized mechanism for organizations of the United Nations system (UN(OETB), Unesco, FAO, WMO, IMO) having major activities in the field of marine affairs and which are members of the Inter-Secretariat Committee on Scientific Programmes Relating to Oceanography (ICSPRO) agreement.

The Division of Marine Sciences in Unesco, in respect to marine sciences, is mainly concerned with infrastructural development at national level as well as co-operative programmes in the coastal area. It also implements the major projects receiving multilateral assistance from funding agencies within the UN system. Unesco therefore, is in a unique position to ensure implementation of the Comprehensive Plan for major assistance programmes aimed at strengthening national capabilities in the field of marine science and ocean services.

The development strategy of the Unesco Division of Marine Sciences is to couple the formulation of marine research programmes to the national development of manpower and facilities. Special emphasis



is placed on:

- (i) the establishment of research programmes of special relevance to developing countries in order to provide the scientific foundation for the utilization and management of their marine resources and coastal environment; and
- (ii) the strengthening of training for specialists and technicians and of marine science infrastructures in these countries.

The scientific programme is drawn up in co-operation with scientific non-governmental organizations and provides a firm scientific basis for the type of activity, which establishes a framework for larger extra-budgetary projects for the development of marine sciences.

The scientific analysis of coastal ecosystems has made it possible for Unesco to establish a major inter-regional project on research and training leading to the integrated management of coastal identification of human resources and scientific projects of local projects which themselves can be expanded through extra-budgetary funding, as has been done for the mangrove project in Asia and Oceania and the research and training project in Africa.

The Commission's major regional programmes, especially those relating to the Caribbean and adjacent regions, the Western Pacific, investigations of "El Niño" (West coast of South America) and the Tsunami Warning Systems in the Pacific, are similar in concept to the major regional project for coastal systems. The countries participating in these studies are grouped according to the natural limits of the oceans or seas in the region. These activities are characterized by close co-operation between the Unesco Regional Offices for Sciences and Technology and the IOC, including its regional subsidiary bodies established in certain regions to co-ordinate its programme.

## 10. GUIDELINES FOR A STRATEGY FOR IMPLEMENTATION OF THE PLAN

The implementation of the Comprehensive Plan for a major assistance involves five categories of actions.

### 10.1 Development of the Outline into a Full but Evolving Plan

The IOC, having launched the idea of the Comprehensive Plan for a major assistance programme, with total support of Unesco provides the essential intergovernmental input required to develop the specific projects under the plan in consultation with the states and regional bodies concerned and the strategy and means for its implementation. The question arises as to the specific mechanism for doing this, and particularly whether an existing mechanism is adequate or a new one should be created. The Working Committee for TEMA should be requested for its implementation or funding and to review its progress. This would, for example involve careful identification of

assistance projects to be prepared and selection of those for priority consideration, where the regional subsidiary bodies of the Commission have a strong role to play. It also involves further consideration of the details of the projects, beyond the skeleton scheme presented in Annex IV. Further elaboration of the strategy is more appropriately a task for the Executive Council and could benefit from consultation as appropriate with other UN organizations under ICSPRO.

#### 10.2 Compilation of Information from Developing Member States

The Secretariats of IOC and of the Unesco Division of Marine Sciences, and corresponding specialized units of other ICSPRO bodies, should have available to them a set of marine science national profiles of IOC Member States, with relevant information about facilities, personnel and arrangements. This information needs to cover the whole spectrum of institutional arrangements at national level. The compilation serves as the basis for diagnosis of the state of marine affairs in the country and identification of requirements. A system of compiling and continuously updating such profiles should be maintained by the IOC. The best procedure would be for the IOC Secretariat, in consultation with the Unesco Division of Marine Sciences, to arrange preparation of country profiles<sup>++</sup> (as indicated in para. 103 of the Summary Report of the Thirteenth Session of the Executive Council). This would involve close co-operation of local experts with missions by staff or consultants to the countries concerned and the full involvement of the appropriate local institutions and experts. These drafts would then be submitted for verification to appropriate bodies in those countries. A framework for such profiles should be developed by the Secretariat, taking account of experience by other ICSPRO agencies (especially FAO for fisheries country profiles) in systematic compilation of such information. A particular region should be selected for a pilot study based on the voluntary participation of countries in the area. It will be necessary to seek information from a number of other units in Unesco, as well as from other agencies, for example with respect to general sciences policy and support arrangements in each country, and the promotion of technology transfer.

#### 10.3 Identification of States' Activities and Needs

This is the direct responsibility of the developing Member States, through their delegations to Unesco and IOC. In order to develop an appropriate co-operative programme of assistance, it is necessary for Unesco and the Commission to be aware of the bilateral and multilateral ocean activities in which Members are, or expect to become, engaged, and of what they consider to be the specific research needs, manpower and facilities required to provide the requisite scientific base for those activities.

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<sup>++</sup> The concept of Marine Science Country Profiles

#### 10.4 Formulation of Regional/Sub-regional Assistance Projects

As indicated earlier in this document this is primarily the responsibility of representatives of groups of Member States concerned with selected regional programmes, assisted by Unesco and IOC. The usual steps involved in formulating and acceptance of projects for external assistance are as follows:

- identification of significant scientific problems having bearing upon national and regional needs;
- assessment of the state of knowledge on the given scientific problem and the actual research requirements for its solution;
- a survey of the scientists, facilities and equipment available in the region;
- a census of the scientists as to their interest in tackling the problem;
- consultation with the governments as to the national priorities given to solving that problem;
- identification of manpower and equipment facilities needed to carry out the necessary research;
- formulation of the research and development projects;
- agreement of governments and institutions to carry out the project;
- finding national, bilateral and international financial backing for the project;
- organizing the project;
- co-operative execution of the project

Clearly such a project requires much preparation and typically takes several years to bring to fruition. Examples of such extra-budgetary projects now in implementation (and which could be expanded further) are Unesco's training and research programmes on the mangrove ecosystems in Asia and the ECA/Unesco project on development of marine science and technology in Africa.

Other projects being considered for funding and subsequent implementation include IOC's project on "El Niño" and on the "International Tsunami Warning System", and Unesco's regional project for research and training on coastal ecosystems of Latin America and the Caribbean and their relations with continental shelf. IOCARIBE has also prepared useful components of projects dealing with turtles, spiny lobsters and environmental geology. Other areas where the foundation for projects has been largely established include estuaries and river inputs to the oceans, coastal lagoons and coral reefs. Under active preparation are components dealing with the integration of near-shore and offshore systems.

When the groups of nations concerned, with the help of the Unesco and IOC Secretariats have defined the assistance needs, it is suggested that Unesco should be requested to prepare and negotiate the assistance project. IOC is able to draw upon the competences of the Divisions of Marine Sciences and Operational Programmes of the Science Sector of Unesco, as well as the Unesco Regional Office for Science and Technology. Account must also be taken of such marine science components as exist in regional marine development projects being conducted by other UN organizations.

#### 10.5 Funding

The Comprehensive Plan implies the expansion and full use of traditional approaches to provide assistance to Member States, through promotion and implementation of regional/sub-regional assistance projects. Each such project would ensure national participation and would be associated with relevant international co-operative regional activities. Some of these activities would be co-operative investigations under IOC.

The magnitude of the assistance programme is such that it goes far beyond financial support available from the limited regular budget of Unesco/IOC. Adequate funding may eventually only be possible through a consortium of international funding agencies and other donor institutions. As an example of such external funding reference may be made to the assistance provided by the United Nations Development Programme (UNDP) to several projects in the field of marine sciences implemented by Unesco. Active negotiations on some other projects submitted by Unesco and IOC to UNDP in the field of marine sciences and ocean services (e.g. Tsunami) are already in progress. Assistance for future programmes could be explored from UNDP and other multilateral sources such as UNFSSTD, etc. In addition, several aid-giving agencies are involved in bilateral and multilateral assistance activities in a number of developing countries. Negotiations with such agencies would be initiated in order to mobilize their co-operation support. Assistance through these sources could be provided in the form of research grants, training and education of scientists and technicians, expert services, institutions development including assistance to universities, equipment and other assistance, including operation of research vessels for regional/sub-regional proposals or any other assistance for the execution of projects.

MARINE SCIENCE AND OCEAN SERVICES FOR DEVELOPMENT: UNESCO/IOC  
COMPREHENSIVE PLAN FOR A MAJOR ASSISTANCE  
PROGRAMME TO ENHANCE THE MARINE SCIENCE  
CAPABILITIES OF DEVELOPING COUNTRIES

PART II

MODALITIES FOR IMPLEMENTATION

## INTRODUCTION

The Comprehensive Plan provides a framework for meeting the needs and aspirations of developing countries to acquire the marine science and technology capability required to achieve their national goals in ocean affairs. It is designed to play a catalytic role in mobilizing international support required to meet the needs arising from increased use of the oceans and their resources and challenges resulting from the expansion of areas under national jurisdiction. It will also provide a framework to (i) optimize the use of available national resources and external assistance for enhancing the capacity of developing coastal states in the fields of marine scientific research and ocean services, (ii) and to eventually integrate the results of such studies into strategies and actions for economic development, management of marine resources and protection of the marine environment. However, the major purpose of the Plan is to strengthen the national capability of participating coastal States to build up the necessary marine scientific knowledge, experience, services and other infrastructures, in order for them to exercise effectively their rights to fulfill obligations under the new ocean regime, and to achieve their national goals in marine affairs. The Plan, through the proposed regional/sub-regional projects will also reflect the will of coastal states to work collectively on matters of mutual interest and benefit.

The creation of favourable conditions for the systematic development of marine science infrastructures, including universities as well as an adequate number of trained manpower, is expected to set the stage for effective transfer of needed marine science and technology. The ensuing growth of marine scientific research during the various stages of implementation of the Plan at national and regional levels will contribute to the well being of the developing coastal states through a better understanding of the ocean and a rational use and management of its resources. Any progress achieved in reducing the gap between the industrialized and developing States will thus provide the necessary basis for a more constructive cooperation at the international level. Thereby conditions are created for participation of all States in peaceful uses of the ocean space as the major goal of the Convention on the Law of the Sea, and the aim of the Resolution of "Development of National Marine Science, Technology and Ocean Service Infrastructures", adopted by the UNCLOS (Ref. Resolution IV; Annex VI, in April, 1982).

### 1. OBJECTIVES OF THE COMPREHENSIVE PLAN

The general objective of the Comprehensive Plan is to bring about appropriate actions at national, regional and global levels with a view to ensure that by the end of the century, the majority of coastal states will have attained sufficient capability for undertaking marine scientific research and ocean services activities, as well as for absorbing the benefits of scientific and technological transfer, so as to be able to

resolve such issues as rational management of marine resources, protection of the marine environment and balancing multiple uses of ocean space. Thus the specific objective of the Plan is to assist States to achieve their national goals in marine affairs, as well as to contribute to overall national management and protection of the oceans through concerted actions in regional and global scientific programmes.

## 2. MAJOR ELEMENTS OF THE COMPREHENSIVE PLAN

The basic philosophy behind the Comprehensive Plan is based on the assumption that advancements of marine science and technology and their applications to economic development activities, as well as for the management of marine resources and in the protection of the marine environment is considerably hampered by the inability of many coastal states to mobilize their own facilities and talents towards these ends. It is therefore of mutual interest to all coastal states, regardless of present level of development of marine science and technology, to participate in an effort to create a critical mass of marine science infrastructures and trained manpower. This will form the required basis for discharging their rights and assuming their new obligations within the areas of national jurisdiction and meaningful participation in international programmes related to ocean affairs.

It should be noted that Unesco, through IOC and the Division of Marine Sciences already have an extensive number of projects in marine science and technology development. However, the Comprehensive Plan will bring more coherence and a new dimension to those activities and will serve as the basis for expanding them, filling gaps and making them more effective to meet the imperative new needs of the Member States and of the world community.

The development of marine science and technology depends primarily on the perception in States of the benefits of such development and on the political determination to engage in marine science activities. However, the concrete action depends on the political will of the States on one hand and on the existence of an appropriate marine science organization infrastructure on the other. A major element in the Comprehensive Plan is therefore the recommendation that all coastal states establish a high level national oceanographic coordinating body (e.g. a National Oceanographic Commission or equivalent body) with sufficient status and power to play an effective role in the formulation and implementation of a national marine science policy. The composition and mandate of such bodies will vary according to the tradition and socio-economic structure of individual states. It is therefore important that an equitable representation be ensured of all governmental departments, research and educational institutions and other organizations with interests and/or competence over the wide range of ocean affairs.

A major thrust in the Comprehensive Plan is the strengthening and development of national marine science and ocean services capability through participation in regional activities. The approach is based on the advantages of pooling scarce resources for the benefit of all participating states, and of intellectual stimulation resulting from an individual's cooperation with a larger, but more diversified group of scientists than any single country would have, and access to sophisticated and costly research means and facilities (e.g. research vessels, et.).

For groups of small states, such as the island states of the South Pacific, the Western Indian Ocean and the Caribbean, the regional cooperation envisaged through regional/sub-regional projects under the Comprehensive Plan acquires a special relevance. Because of their small sizes, these states will probably not be able to develop a sufficiently diversified marine science infrastructure to achieve adequate use and national management of the resources in their areas of jurisdiction. However, the relative cultural homogeneity of groups of such states and the similarity in their needs for marine scientific advice and provision of appropriate ocean services, may facilitate the creation of multilateral mechanisms aimed at the joint operation of research and service facilities.

IOC, because of its mandate and experience in stimulation and coordination of marine scientific research activities and related aspects, including TEMA, which required concerted action of its Member States, provides a proper forum and is particularly qualified for developing the Plan. As a joint specialized mechanism for the UN organizations cooperating under the ICSPRO agreement, the IOC can also play a central role in facilitating their concerted action required to meet the objectives of the Comprehensive Plan. Thus the Plan contributes to the creation of national manpower required to meet sectoral needs falling within the agencies' areas of competence. The Comprehensive Plan points to the special role of Unesco among the ICSPRO agencies, as the leading agency in the field of science and education, including marine science infrastructure development and with strong connections to scientific non-governmental organizations. The success of the development and implementation of the Comprehensive Plan is therefore highly dependent upon the full mobilization of Unesco as a whole, and particularly of its IOC and the Division of Marine Sciences.

### 3. MODALITIES FOR THE IMPLEMENTATION OF THE COMPREHENSIVE PLAN

The Comprehensive Plan is an ambitious undertaking with a time-frame of ten to fifteen years to be implemented through a series of regional/sub-regional projects and their national components. At the present stage, it is premature to discuss the detailed modalities for the implementation of the specific national, regional and sub-regional projects. However, it is opportune to examine the modalities for the further development of the Comprehensive Plan itself, and particularly the actions required and the budgetary consequences for IOC in its development.



There is a wide range of development in marine science capability of States. This is reflected in the varying degree of participation of the states in international cooperative programmes, including those of the Commission. In implementing the Comprehensive Plan, due consideration must be given to the degree of marine science development and research capabilities that exist in each country and in various ocean regions. Therefore, the modalities for implementation will have to be tailored to the existing needs and level of marine science development of the countries; the following elements of the modalities will apply to all States.

### 3.1 Marine Science Country Profiles

A Marine Science Country Profile (MSCP) for each state will be prepared with the active involvement of the authorities and local institutions concerned, by the Secretariats of IOC and the Division of Marine Sciences with the help of consultants. Each country profile will be a compilation of information on the situation in the field of marine sciences, ocean services and related education. It will also include other aspects, the general scientific, administrative, industrial, institutional frame within which marine scientific activities are conducted and the economic, social and other circumstances concerning the prosecution of marine sciences and the application of their results. At a subsequent stage, further information will be collected and analyzed at the request of, and in close association with the countries concerned in order to assist them in the assessment of the situation in respect of ongoing activities, and of requirements to achieve stated national goals in marine science development.

### 3.2 Assistance for Developing or Strengthening National Marine Science Infrastructures

Upon the request of state governments, small advisory missions will be organized to countries to review, advise and to assist in respect of the activities needed for development or strengthening of national marine science infrastructures. The mission will be conducted by staff members of the Secretariats of IOC, the Divisions of Marine Sciences and Operations, the Regional Offices of Science and Technology, the staff or experts designated by donor assistance will depend on the level of marine science development of the country concerned. Thus, in countries with little or no existing marine science infrastructure, it is foreseen that the initial emphasis will be on matters related to the formulation of a marine science policy and the establishment of a national oceanographic coordinating body (e.g. National Oceanographic Commission or equivalent body), to assist in the formulation, development and implementation of the national policy. In countries at a higher level of marine science development, the advice and assistance may be more directed towards upgrading of infrastructures, personnel and of specific scientific research capability to a higher international standard, and towards the promotion of the application of marine science and technology for rational use and management of resources and protection of the marine environment.

Regardless of the level of marine science development in the countries it is foreseen that the missions will result in proposals for assistance projects in the context of the Comprehensive Plan to be submitted for funding by national, bilateral and/or multilateral international sources. Considering that there is a highly competitive demand for

funds, it is important that each proposal meets certain agreed criteria: the project must respond to national priorities and commitment to development of marine sciences, satisfy the aims of the government to integrate the result of research activities into strategies for national development plans (especially within the context of expanded areas of national jurisdiction), and ensure the involvement and counterpart funding at the national level. Where possible, each project should also be aimed at contributing to the solution of an identified major scientific problem or the better understanding of oceanic phenomena having bearing upon development of socio economic activities in a given region. The projects will be strengthened by also being built upon the problem-oriented marine science programmes and ocean services programmes of Unesco and its IOC. The projects will further be directed to strengthening capabilities of States to allow their full participation in those programmes.

Although, as stated above, it is premature to go into much detail concerning the actual content of project proposals to be developed in future, it is foreseen that the common elements of such projects will include short-term, medium-term and long-term fellowships; training courses; provision of international experts; university to university exchange programmes of students and visiting professors; on-the-job training in foreign laboratories in the region or abroad; the use of research vessels; and the provision of literature, equipment and supplies needed for the planned teaching and research programmes.

### 3.3 Strengthening Regional Cooperation and Establishment of Regional Centres and Cooperative Networks

In the Comprehensive Plan, it is envisaged that participation in cooperative regional programmes of marine scientific research and education will be of considerable benefit to countries engaged in the development of their marine sciences. This is partly because such cooperation will not only serve as an effective means for further development of national capabilities, but also afford an opportunity for participating states to benefit from international programmes in ocean science and services, such as those coordinated by the Commission.

Regional programmes will require actions at an intergovernmental level. The IOC will therefore be in a particularly favourable position to facilitate the formulation by the governments concerned and through its regional subsidiary bodies (e.g. IOCARIBE, WESTPAC, CINCWIO, etc.) of the feasibility and drafting of concrete regional/sub-regional project proposals to be submitted to international sources of funding.

In the formulation and implementation of the regional activities, it is important to draw upon the existing regional subsidiary bodies of IOC, as appropriate, and the support of the Unesco regional offices for science and technology. IOC should also be, where it is deemed necessary, prepared to establish subsidiary bodies in areas where such structures do not exist.

The Comprehensive Plan provides a framework for a coherent and expanded Programme based on extrabudgetary regional projects presently under-way or already carried out.

### 3.4 Responsibilities and Functions for the Implementation of the Plan

#### 3.4.1 Role of Unesco

Unesco through the IOC Secretariat, jointly with the Unesco Division of Marine Sciences and with the assistance of the Division of Operations in the Science sector and the Regional Offices of Science and Technology of Unesco, will be responsible for the organizations of missions jointly with donor agencies, for the preparation of the project proposals. The IOC Secretariat and the Division of Marine Sciences should be responsible for the technical execution of the projects with the assistance of the Operations Division.

#### 3.4.2 Role of IOC

IOC will be responsible for the overall development of the Comprehensive Plan. In this regard, it would draw upon its subsidiary bodies:

The Working Committee for TEMA, as an intergovernmental body within the framework of IOC, will be responsible for reviewing progress and for providing general guidance and overall coordination to the development and implementation of the Comprehensive Plan. In the discharge of this function it will actively interact with other subsidiary bodies of the Commission.

Regional subsidiary bodies of the Commission, such as CINCWIO, IOCARIBE, WESTPAC, etc. and other regional bodies with which IOC is cooperating such as the CPPS, will provide inputs to the identification of regional requirements to be taken into account when formulating regional/sub-regional project proposals. They will also provide a mechanism through which the Member States directly concerned, can provide general guidance on the projects' implementation and evaluation of progress.

Unesco and IOC meanwhile will approach funding agencies to secure their agreement to the principle of the Plan before projects are submitted for funding. In this regard, close contact with aid-giving agencies will be maintained for mobilization and support to projects envisaged under the Plan.

#### 3.4.3 Role of National Bodies

The national governments through their relevant machineries including high level oceanographic coordinating bodies will

define national objectives in Marine Sciences and related aspects, identify requirements to fill gaps, contribute to the formulation and be responsible for the national components of the regional/sub-regional projects and the objectives and contents thereof with the assistance of Unesco and IOC. The governments will ensure provision of national matching contributions and support for securing international funding for the projects.

3.5 Funding of the Future Development of the Comprehensive Plan and of the Concrete Assistance Projects

The Comprehensive Plan, though primarily devoted to enhancing the marine science capabilities of the majority of coastal states within a time frame of ten to fifteen years, is dependent upon a favourable consideration by the local authorities concerned and by major multilateral and bilateral funding agencies. Clearly, as the project proposals for national and regional activities foreseen in the Plan have yet to be developed, it is premature to solicit a firm commitment from the funding agencies towards a specified level of funding. It must be the prerogative of the funding agencies to evaluate the virtues of individual projects when proposals have been submitted. However, it would be important for the further development of the Plan by Unesco/IOC to have the concurrence, in principle of the major funding agencies that the Comprehensive Plan is an avenue worth pursuing. It is proposed that Unesco organize a meeting of the major international and national funding agencies in 1983 in order to inform them of the objectives of the Plan, to ascertain their reactions and to consider possibilities for funding of the various phases of the Plan inter alia through the establishment of a consortium of multilateral and bilateral funding agencies as recommended by the Third Session of the Working Committee for TEMA.

IOC has already allocated funds from its Regular Programme for development of the Comprehensive Plan, in the 1981-83 triennium and 1984-85 biennium, but a full-scale implementation of the next phase of the Plan requires funding at a level which greatly exceeds the capabilities of IOC's own budget. IOC should, therefore, as early as possible, seek funding at the level of about US \$ 1,5 million to be used for preparation of the Marine Science Country Profiles (Phase I), advisory missions for identification of national projects components proposals, and for workshops and seminars for formulation and approval of regional/sub-regional proposals.

The implementation of the Comprehensive Plan will constitute a significantly increased work load on the staff of the Secretariats of the IOC and the Division of Marine Sciences of Unesco. Measures should therefore be taken at an early stage to ensure the necessary increase in the staff and budget assigned to the two Secretariats in the context of the Medium Term Plan and budget of 1984-85.

4. EXPECTED RESULTS

The Unesco/IOC Comprehensive Plan, when it would be fully implemented, is expected to yield the following results. It would contribute to or leave behind:

- solid marine science infrastructure at national levels and would yield substantive marine scientific information and data on the resources, the environment and other uses of the ocean space to be utilized in the formulation of national goals for socio-economic development; and their achievements;
- knowledge and capacity to allow international exchange of information and data to be used in effective development and management of national and/or regionally shared resources and the environment;
- adequate facilities to gain access to documents and information through regional centers and other international bodies such as ASFIS and IODE;
- adequate information for mapping the ocean floor, other geological, physical, chemical, biological and fisheries parameters, particularly for the areas of national jurisdiction;
- solid bases for ocean monitoring including various parameters of physical condition and pollution;
- cooperative networks on areas of special interests at regional and global levels;
- regional centers for marine scientific and technological research and training as envisaged in the Convention on the Law of the Sea, and in response to the Resolution adopted by the Third UN Conference on the Law of the Sea (See Annex III).
- sufficient number of trained manpower in multidisciplinary fields of marine sciences which could considerably strengthen the role of various international organizations such as FAO, WMO, IMO, UN(OETB), Unesco, in their respective areas of competence, namely fisheries, ocean/climate, maritime activities, coastal zone management and for furtherance of marine sciences and education. This trained manpower will also permit the establishment of links to the global scientific community which is essential for scientific progress.

ANNEX I

Resolution EC-XIII.15

A COMPREHENSIVE PLAN TO ENHANCE THE MARINE SCIENCE  
CAPABILITIES OF DEVELOPING MEMBER STATES

The Executive Council,

Being aware of the progress made by the Third United Nations Conference on the Law of the Sea (UNCLOS),

Considering that the objectives and recommendations of the UN Conference on Science and Technology for Development and the UN Conference on Technical Co-operation amongst Developing Countries apply also to ocean affairs,

Believing that marine science and technology constitute an essential basis for the rational use of the oceans and of their resources, and for the protection of the marine environment,

Being aware of the fact that adequate national capacities are a prerequisite for the effective transfer of knowledge and technology, as well as for effective international co-operation in marine affairs on global, regional and sub-regional levels,

Being convinced that appropriate steps on national and international levels are urgently needed to bridge the scientific and technological gaps between developed and developing Member States of IOC,

Decides that a comprehensive plan for a major assistance programme aimed at strengthening the marine science infrastructures in developing Member States be developed to enable them to achieve their national goals in the field of ocean affairs, and to participate fully in global, regional and sub-regional oceanographic research programmes of the Commission,

Requests

- (i) bilateral and multilateral funding agencies, particularly the United Nations Development Programme and the Interim Fund for Science and Technology for Development, to give favourable consideration to joining their efforts to finance the major assistance programmes in marine science and technology for development, as recommended by the Third Session of the Working Committee for TEMA,

- (ii) Unesco to provide full assistance in the promotion and implementation of this programme,

Reminds Member States that they must take the initiative in applying for UNDP and IFSTD funding for this programme,

Calls on the Chairman with the assistance of the Secretary, to draw this Resolution to the attention of the relevant organizations, requesting them to fund the programme,

Instructs the Secretary to prepare, in co-operation with the TEMA ad hoc Group for Co-ordination and Implementation, or with consultants, an outline for such a plan, and guidelines for a strategy for its implementation, to be submitted to the Twelfth Session of the Assembly for approval.

ANNEX II

Resolution EC-XIII.12

IOC'S ROLE IN THE EDUCATION AND TRAINING  
OF PERSONNEL, AND IN MUTUAL ASSISTANCE

The Executive Council,

Being firmly convinced that training, education and mutual assistance in the marine sciences (TEMA) form one of the most important aspects of the Commission's activities,

Considering that the active participation of the developing countries in the IOC's programmes is of mutual interest to the developing and the industrialized countries,

Recalling Resolution IX-18, which recognized the need to develop further, with the other units in Unesco, a meaningful programme in TEMA that will ensure more effective participation by the developing Member States in the Commission's marine science programmes, and which will take full advantage of the resources of IOC and of all additional resources of Unesco, as well as those of other ICSPRO agencies, devoted to activities in the field of marine sciences,

Noting that nearly 30% of the IOC's budget and 70% of the resources of the Division of Marine Sciences of Unesco (not including the Trust Fund, UNDP and other sources of financing) are expended on activities in the field of training, education and mutual assistance,

Expressing its hope for an ever-increasing coherence in the joint action of ICSPRO members concerning TEMA and for the effective use of the resources available for that purpose,

Recalling further Resolution XI-24, which invited the Working Committee for TEMA to scrutinize and prepare proposals on the structure of TEMA,

Approves the Summary Report and Recommendations of the Third Session of the Working Committee for TEMA, especially the decisions:

- (i) to retain the Working Committee for TEMA as a forum for the representatives of countries and specialists in TEMA matters, and
- (ii) to create a TEMA ad hoc Group for Co-ordination and Implementation (referred to as Steering Committee in Recommendation TEMA-III.1) composed of the IOC Vice-Chairman in charge of TEMA, the Chairman and Vice-Chairman of the Working Committee for TEMA and, as required, the TEMA co-ordinators of IOC Subsidiary Bodies and the TEMA officers of ICSPRO organizations, which will, between meetings of the Working Committee for TEMA, assist and advise



the Secretary IOC and other Unesco staff on the implementation of the TEMA programmes, including the IOC Voluntary Assistance Programme,

Requests the IOC Chairman, the IOC Vice-Chairman in charge of TEMA, and the Secretary, in consultation with representatives of the Director-General of Unesco, to prepare, on the basis of the Comprehensive Plan (Resolution EC-XIII.15), proposals for submission to the Twelfth Session of the IOC Assembly for a complete definition of the functions of the IOC Secretariat and its working relationship with other units of Unesco, especially the Division of Marine Sciences, with a view to ensuring the most effective use of available resources and staff, bearing in mind that

- the IOC should pay special attention to studying and identifying the needs of the developing countries for technical assistance required to enable them to participate in the IOC's programmes,
- Unesco (together with other ICSPRO agencies) should implement specific projects linked with assistance to the developing countries, and use for this purpose Unesco's Regular Programme, UNDP, IOC-VAP and other sources of funding.

ANNEX III

RESOLUTION ON DEVELOPMENT OF NATIONAL MARINE SCIENCE,  
TECHNOLOGY AND OCEAN SERVICE INFRASTRUCTURES<sup>±±</sup>

The Third United Nations Conference on the Law of the Sea,

Recognizing that the Convention on the Law of the Sea is intended to establish a new régime for the seas and oceans which will contribute to the realization of a just and equitable economic order through making provision for the peaceful use of ocean space, the equitable and efficient management and utilization of its resources, and the study, protection and preservation of the marine environment,

Bearing in mind that the new régime must take into account, in particular, the special needs and interests of the developing countries, whether coastal, land-locked, or geographically disadvantaged,

Aware of the rapid advances being made in the field of marine science and technology, and the need for the developing countries, whether coastal, land-locked or geographically disadvantaged, to share in these achievements if the aforementioned goals are to be met,

Convinced that, unless urgent measures are taken, the marine scientific and technological gap between the developed and the developing countries will widen further and thus endanger the very foundations of the new régime,

Believing that optimum utilization of the new opportunities for social and economic development offered by the new régime will be facilitated through action at the national and international level aimed at strengthening national capabilities in marine science, technology and ocean services, particularly in the developing countries, with a view to ensuring the rapid absorption and efficient application of technology and scientific knowledge available to them,

Considering that national and regional marine scientific and technological centres would be the principal institutions through which States and, in particular, the developing countries, foster and conduct marine scientific research, and receive and disseminate marine technology,

Recognizing the special role of the competent international organizations envisaged by the Convention on the Law of the Sea, especially in relation to the establishment and development of national and regional marine scientific and technological centres,

Noting that present efforts undertaken within the United Nations system in training, education and assistance in the field of marine science and technology and ocean services are far below current requirements and would be particularly inadequate to meet the demands generated through operation of the Convention on the Law of the Sea,

<sup>±±</sup> This resolution (ref.: Resolution IV; Annex VI) was adopted by the Final Session of the United Nations Conference on the Law of the Sea, dated 30 April, 1984.

Welcoming recent initiatives within international organizations to promote and co-ordinate their major international assistance programmes aimed at strengthening marine science infrastructures in developing countries.

Calls upon all Member States to determine appropriate priorities in their development plans for the strengthening of their marine science, technology and ocean services;

Calls upon the developing countries to establish programmes for the promotion of technical co-operation among themselves in the field of marine science, technology and ocean service development;

Urges the industrialized countries to assist the developing countries in the preparation and implementation of their marine science, technology and ocean service development programmes;

Recommends that the World Bank, the regional banks, the United Nations Development Programme, the United Nations Financing System for Science and Technology and other multilateral funding agencies augment and co-ordinate their operations for the provision of funds to developing countries for the preparation and implementation of major programmes of assistance in strengthening their marine science, technology and ocean services;

Recommends that all competent international organizations within the United Nations system expand programmes within their respective fields of competence for assistance to developing countries in the field of marine science technology and ocean services and co-ordinate their efforts on a system-wide basis in the implementation of such programmes, paying particular attention to the special needs of the developing countries, whether coastal, land-locked or geographically disadvantaged;

Requests the Secretary-General of the United Nations to transmit this resolution to the General Assembly at its thirty-seventh session.

ANNEX IV

Resolution XII-8 <sup>±±</sup>

**A COMPREHENSIVE PLAN FOR A MAJOR ASSISTANCE PROGRAMME TO ENHANCE  
THE MARINE SCIENCE CAPABILITIES OF DEVELOPING COUNTRIES**

**The Intergovernmental Oceanographic Commission,**

**Recognizing that marine science and technology constitute an essential basis for the peaceful and rational use of the oceans and their resources, and the protection and the preservation of the marine environment,**

**Recognizing further that adequate national capacities in the marine sciences will facilitate effective transfer and use of knowledge and technology, as well as effective international co-operation on global, regional and subregional levels, and full participation in the programmes of the Commission,**

**Considering that an urgent need exists to bridge the scientific and technological gaps between the industrialized and developing countries,**

**Recalling resolution 2/06 of the twenty-first session of the General Conference of Unesco which recommended that the Director-General of Unesco give special attention to the need to strengthen Unesco's 'intergovernmental programme in the marine sciences and ocean services, in order to assist Member States, in particular, developing countries, to cope with the demands placed on them in connection with the new ocean regime emerging from the Third United Nations Conference on the Law of the Sea',**

**Recalling further the resolution adopted by the Third United Nations Conference on the Law of the Sea (contained in United Nations document No. A/CONF. 62/L. 127) on 'Development of National Science, Technology and Ocean Service Infrastructures' which, *inter alia*, recommends that all competent international organizations expand programmes within their respective fields of competence in marine science, technology and ocean services, and recommends that bilateral and multilateral funding agencies augment and co-ordinate their operations for the provision of funds to developing countries for the preparation and implementation of the aforementioned programmes,**

**Having reviewed the 'Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of Developing Countries' (document IOC/EC-XV/8 Annex 5 rev.) which was prepared in response to Resolution EC-XIII. 15,**

**Recalling Resolution EC-XV. 5, which: recommended to the Assembly that it consider the adoption of the Comprehensive Plan; further recommended the developing Member States to make every possible effort to develop further, or, as appropriate, establish national oceanographic co-ordinating bodies or their equivalent, to facilitate the transfer of knowledge and technology they require; and urged the member organizations of ICSPRO to provide all possible support to the implementation of the Comprehensive Plan,**

**A**

**Adopts the Comprehensive Plan, as well as the guidelines provided in the document on modalities for its implementation (document IOC-XII/8 Annex 10);**

**Invites the Director-General of Unesco to take any actions that he deems appropriate to enhance the promotion and implementation of the Comprehensive Plan and in particular to:**

- (i) place it before the Executive Board and the twenty-second session of the General Conference of Unesco;**

<sup>±±</sup> This Resolution was adopted by the Twelfth Session of the IOC Assembly held in Paris, 13 - 19 November, 1982

- (ii) mobilize needed extra-budgetary financial and other resources required for its preparatory phase;
- (iii) bring to the notice of the bilateral and multilateral international funding agencies, and subsequently to host a high-level consultation to provide them with information on the concept and content of the Plan and to identify, so far as possible, ways and means by which they can assist in its implementation.

**B**

Requests the TEMA ad hoc Group for Implementation and Co-ordination, supplemented as necessary by advisers from donor Member States and with the collaboration of appropriate units of Unesco, in particular the Division of Marine Sciences (OCE), to assist as required with preparations for the proposed consultation referred to in section A (iii) above;

Decides to proceed with the implementation of those elements of the Comprehensive Plan, as part of the TEMA activities of the Commission, for which budgetary and administrative resources can be made available, and to prepare, on a trial basis, a limited number of Marine Science Country Profiles, in consultation with appropriate United Nations and other international organizations.

**C**

Urges the Member States of the Commission:

- (i) to establish and maintain appropriate mechanisms for the formulation of national marine science policies;
- (ii) to improve or establish, as required, National Oceanographic Commissions or equivalent bodies, composed, as appropriate, of representatives of interested government departments, universities and research institutions actively involved in marine science and technology and other related aspects of ocean affairs; to maintain liaison with national users of the results of marine scientific research; to work closely with other national institutions and international organizations concerned with this multidisciplinary field; and to develop and support marine science activities, using the mechanisms proposed in the Comprehensive Plan, ensuring the close involvement of their national scientific community;
- (iii) to give priority to the marine sciences as an essential element in the development of socio-economic activities and to take the initiative of applying to UNDP, the United Nations Financing System for Science and Technology for Development (UNFSST) and other sources of funding in support of projects to be developed under the Comprehensive Plan.

ANNEX V

Decision 7.1.5 - Third United Nations Conference on  
the Law of the Sea

The Executive Board,

1. Noting with satisfaction the adoption of the United Nations Convention on the Law of the Sea and its signature in Jamaica in December 1982 by a great number of states,
2. Believing that the United Nations Conference on the Law of the Sea demonstrated the capacity of the United Nations system to provide a forum for co-operation among nations,
3. Recognizing the fact that the Convention establishes a framework for international co-operation to promote the peaceful use and the equitable and efficient utilization of the resources of the seas and the oceans, the study, protection and preservation of the marine environment and the conservation of its living resources,
4. Believing that the signing of the Convention will help to establish a just and equitable international economic order that takes into account the interests and needs of mankind as a whole and, in particular, the special interests and needs of developing countries, whether coastal or land-locked,
5. Recalling the need to facilitate international co-operation for a better understanding of the ocean and better knowledge about its resources through scientific research,
6. Recalling the resolution adopted by the Conference on the 'Development of National Marine Science, Technology and Ocean Service Infrastructures',

±± These decisions were adopted by the Executive Board at its 116th Session, Paris, 25 May - 29 June 1983

7. Recalling the responsibilities of Unesco in the fields of science and education, and of its Intergovernmental Oceanographic Commission (IOC) for the Long-Term and Expanded Programme of Oceanic Exploration and Research (LEPOR) and for the development of international co-operative marine science programmes, ocean services and the related training, education and mutual assistance (TEMA),
8. Recalling resolutions 2/06 and 2/10, adopted by the General Conference at its fourth extraordinary session, on the strengthening of the programme for the marine sciences,
9. Recommends that the strengthening of the programme for the marine sciences, and of IOC, be pursued during the coming biennium to contribute to the development of the marine science and technology capacity in Member States required by the New Ocean Regime and to enable Unesco and its Intergovernmental Oceanographic Commission to fulfil their roles in the development of ocean sciences, services and related training, education and mutual assistance within the United Nations system;
10. Commends the 'Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of Developing Countries' adopted by the Assembly of the Intergovernmental Oceanographic Commission at its twelfth session;
11. Notes the proposals made by the Director-General, in response to resolution 2/10 on Major Programme X, as well as to IOC resolutions XII-10 and XII-11, to strengthen Unesco and IOC programmes relating to the ocean and to increase the resources available to them;
12. Invites the Director-General to endeavour to mobilize extra-budgetary resources for the regional and subregional projects called for by the Unesco/IOC Major Assistance Programme referred to in paragraph 10 above;
13. Further invites the Director-General to promote co-operation among the organizations of the United Nations system concerned with marine science with a view to their contributing to the implementation of the Unesco/IOC Major Assistance Programme;
14. Invites donor countries and agencies to support international efforts to reduce the gap between industrialized and developing countries in the field of marine science, particularly as envisaged in the Unesco/IOC Major Assistance Programme;
15. Urges Member States to develop their co-operation and to continue their efforts in the field of marine science so as to mobilize the necessary means and manpower and to contribute more effectively to international co-operation.

ANNEX VI

## LIST OF ACRONYMS AND ABBREVIATIONS

ACMRR (of FAO)	Advisory Committee on Marine Resources Research
ASFIS (FAO/IOC)	Aquatic Sciences and Fisheries Information System
CCOP (of ESCAP)	Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas
CCOP-SOPAC (of ESCAP)	Committee for Co-ordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas
CICAR (of IOC)	Co-operative Investigations of the Caribbean and Adjacent Regions
CIM	Co-operative Investigations of the Mediterranean
CPPS	Comisión Permanente del Pacifico Sur
CSR (IOC)	Cooperative Study of the Krushio and Adjacent Regions
ECA (of UN)	Economic Commission for Africa
ECOR	Engineering Committee on Oceanic Resources
ECOSOC (of UN)	Economic and Social Council
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
GIPME (of IOC)	Global Investigation of Pollution in the Marine Environment; Working Committee for GIPME
ICSEM	International Commission for the Scientific Exploration of the Mediterranean Sea
ICSPRO (of FAO/IMO/Unesco/WMO/UN)	Inter-secretariat Committee on Scientific Programmes Relating to Oceanography
ICSU	International Council of Scientific Unions
IIOE (of IOC)	International Indian Ocean Expedition
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission



IOCARIBE (of IOC)	IOC Sub-commission for the Caribbean and Adjacent Regions
IOCEA	Cooperative Investigations in the Eastern Atlantic
IOCINCWIO (of IOC)	Cooperative Investigations in the North and Central Western Indian Ocean
IOCINDIO (of IOC)	Cooperative Investigations in the Central Indian Ocean
IODE (of IOC)	International Oceanographic Data Exchange
ITIC (of ITSU)	International Tsunami Information Center
ITSU (of IOC)	IOC Tsunami Warning System in the Pacific; International Co-ordination Group for the Tsunami Warning System in the Pacific
LEPOR (of IOC)	Long-term and Expanded Programme of Oceanic Exploration and Research
LOS	Law of the Sea Convention
MARPOLMON (of IOC)	Marine Pollution Monitoring
MSCP	Marine Science Country Profile
OCE (of Unesco)	Division of Marine Sciences
OSLR (of IOC)	Ocean Science in relation to Living Resources
OSNLR (of IOC)	Ocean Science in relation to Non-living Resources
OTEC	Ocean Thermal Gradient Energy Convention
ROSTA (of Unesco)	Regional Office of Science and Technology for Africa
SCOR (of ICSU)	Scientific Committee on Oceanic Research
SOC (of IOC)	Southern Oceans; Programme Group for the Southern Oceans
TEMA (of IOC)	Training, Education and Mutual Assistance in the Marine Sciences IOC Working Committee for TEMA
UN	United Nations
UN(OETB)	UN Ocean Economics and Technology Branch

UNCLOS (of UN)	United Nations Conference on the Law of the Sea
UNCSTD	United Nations Conference on Science and Technology for Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFSSTD	United Nations Financing System for Science and Technology for Development
WESTPAC (of IOC)	Western Pacific; Programme Group for the Western Pacific
WMO	World Meteorological Organization