

Group I

THE NEW OCEAN REGIME AND ITS IMPLICATIONS FOR CO-OPERATION IN MARINE SCIENCE AND TECHNOLOGY

1. The need for a new legal regime for the ocean which became pressing in the last decade, was triggered by a number of interrelated developments:

- (i) New scientific discoveries in the geophysics of the oceans;
- (ii) the penetration of the industrial revolution into the oceans;
- (iii) the growing importance of the oceans in the economy of the world community and of each individual state;
- (iv) the transformation of international relations due to the emergence of many newly independent States;
- (v) the ongoing transition from a system of laissez-faire in the oceans to a system of management comprised of two components:
 - (a) extended areas under national jurisdiction adding a new dimension to national development strategies;
 - (b) ^a sea-bed area beyond national jurisdiction to be governed ₁ by an international authority

2. The Convention on the Law of the Sea, adopted by the Third United Nations Conference on the Law of the Sea, provides, for the first time a comprehensive set of rules covering all major uses of ocean space and its resources including marine scientific activities and the development and transfer of marine technology, *particular in Part XI, XII, XIII and XIV*

Review
3. The regime of scientific research is an integral part of the comprehensive framework of the Law of the Sea. The general rules governing the legal status of maritime areas and the uses of the oceans and their resources provided also the legal foundations of the regime of scientific research. There are,

however, some principles which are specifically related to scientific research embodied in Article 240 and other provisions of the Convention, while others are reflected in various provisions of the Convention.

4. Article 240 stipulates in subparagraph (a) that "marine scientific research shall be conducted exclusively for peaceful purposes" (emphasis added).

Article 143 on marine scientific research in the international seabed area contains a similar provision. These articles reiterate one of the Principles of the Declaration on the Seabed adopted by the General Assembly in 1970.

5. The conduct of marine scientific research for peaceful purposes is only one important aspect of the more general principles of the peaceful uses of the seas and their resources.*

6. Another important general principle underlying the ^{new} regime of scientific research and the development and transfer of technology is the principle of cooperation. The duty of States to cooperate with each other was enunciated as a fundamental rule of conduct in international relations by the Declaration of Principles of International Law Concerning Friendly Relations and Co-operation among States in accordance with the Charter of the United Nations. Parts XIII (Marine

Question of the Law of the Sea

* The Antarctic Treaty of 1959, the Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water, of 1963, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, of 1966, the Treaty on the Prohibition of Emplacing Nuclear Weapons and other Weapons of Mass Destruction on the Seabed and Ocean Floor and in the Subsoil thereof, of 1972, and other international treaties in the field of arms limitation and disarmament.

Scientific Research) and XIV (Development and Transfer of Technology) of the Convention contain several provisions on the promotion of international co-operation in oceanic science and its application for the understanding of the characteristics and phenomena of the oceans, the exploration, exploitation, management and conservation of their resources and for the protection and preservation of the marine environment. Section 3 of Part XIII (Articles 242-244) and Section 2 of Part XIV (Article 270-274) are entitled, "International Co-operation". Thus the whole regime of scientific research is designed to promote international cooperation.

7. The jurisdiction which is conferred in coastal states with regard to marine scientific research enables those States to exercise increased control over the ^{activities for} acquisition ^{application} [and utilization] of knowledge about the characteristics of marine resources and ecosystems in areas under their jurisdiction - such knowledge being essential for the rational management and utilization of these resources, and the protection and preservation of the marine environment. International cooperation in assisting developing States to acquire the necessary skills and technologies has acquired legally binding meaning under the Convention. Article 269 for example explicitly establishes that "States directly or through competent international organizations shall endeavour inter alia" to establish programmes of technical cooperation for the effective transfer of all kinds of technology"; and to "promote favourable conditions for the conclusion of agreements, contracts and other similar arrangements under equitable and reasonable conditions.

8. The Convention also establishes the right of States Parties to carry out marine scientific research in the international Area (Article 143, para. 3). At the same time, the special nature of the regime for the Area entails broad scope of powers and responsibilities to be assigned to the International Seabed Authority in the field of marine scientific research. Such powers should be viewed in connection with competences of that organization regarding the activities in the Area, as well as with operational functions it shall carry through the

Enterprise (Art. 158, Para. 2, Art. 160 and Annex IV, Statute of the Enterprise). Accordingly the Authority may take measures to acquire technology and scientific knowledge relating to activities in the Area, and therefore, is entitled to undertake marine scientific research concerning the Area and its resources. It shall promote and encourage the conduct of marine scientific research in the Area, coordinate and disseminate the results of such research and analysis (Art. 143, Para. 2); and encourage the conduct of prospecting in the Area (Annex III, Art. 2, Para. 1 (e)).

9. The Convention ^{emphasized and codified some of the principle of Cooperation & scientific research and some new ones} thus introduced new principles of international cooperation in scientific research. At the same time it vastly expands the rights and responsibilities of coastal States in matters pertaining to scientific research. It is often assumed that these two trends, the nationalization and the internationalization of scientific research, are contradictory. In reality, they are the two faces of the same coin. International cooperation in scientific research can grow and flourish only on the basis of strong national scientific infrastructure. But, given the vastness and ecological unity of ocean space as well as the very nature of modern research technology, including its high cost, national oceanographic ^{scientific programmes} sciences can grow and flourish only through international cooperation. The interrelation between national and international scientific research is not one where one loses where the other gains: It is an organic process where the whole and the parts grow together, or wither together.

10. The Convention on the Law of the Sea, for the first time in the history of International Law, sets forth as a general principle, the rights of all States and competent international organizations to conduct marine scientific research (Art. 238). The significance of this is reinforced by the fact that most of the provisions in

Parts XIII and XIV place on equal footing States and competent international organizations in the field of international cooperation. Furthermore, there is a special provision (article 247) on marine scientific research projects undertaken by or under the auspices of international organizations. This is an important aspect of the regime of scientific research. It emphasizes the advantages of coordinated research efforts through projects undertaken or sponsored by international organizations. Article 278 of the Convention provides for closer cooperation among the competent international organizations themselves for "the effective discharge of their functions and responsibilities" in the field of marine scientific research and the development and transfer of technology.

11. The Convention offers a new platform from which to launch concerted efforts towards the building of a New International Economic Order. The rational management of ^{the} ocean space and marine resources, ^{can} make a crucially important contribution to these efforts. The Convention recognizes throughout that ^{such} management must be based on sound scientific knowledge. To benefit from the new ocean regime, both in areas under national jurisdiction and through active and full participation through the Authority in the management of the common heritage of mankind, vast improvements are required in the national and international scientific infrastructure, with particular consideration for the needs of developing states. The new ocean regime offers the possibility, and imposes the obligation, for such improvements.

12. The Convention makes it mandatory that "States, directly or through competent international organizations, shall cooperate in accordance with their capabilities to promote actively the development and transfer of marine science and marine technology on fair and reasonable terms and conditions". They "shall promote the development of the marine scientific and technological capacity of States which may need and request technical assistance in this field, particularly developing States, including landlocked and geographically disadvantaged States, with regard to the exploration, exploitation, conservation and management of marine resources, the protection and preservation of the marine environment, marine scientific research and other activities in the marine environment compatible with the Convention, with a view to accelerating the social and economic development of the developing

States" (Article 266, para. 1 and 2). Consideration is given in this connection to cooperation for the development of human resources through training and education of nationals of developing States (Article 268 (d)). Particular reference is also made to the development of programmes by the Authority and other competent international organizations for strengthening the research capabilities of developing and technologically less developed States; and the training of their personnel and the personnel of the Authority in the techniques and applications of research (Article 143, para. 3 (d)).

II - RECENT TRENDS IN MARINE SCIENCE AND TECHNOLOGY

13. While there are very broad aspects of requirements for international cooperation in the development and transfer of technology regarding the ocean and its resources, In this report are examined primarily the implications of the new regime for the development of marine science, particularly in developing countries. In doing so attention has been given to the requirement for science to contribute to the further development of marine technology, and also to the general impact of technological change on the investigation of ocean processes.

14. In the ^{decade} fifteen years, since the process of negotiating a comprehensive new law of the sea began there have been radical changes in the conduct of marine science as well as in the scope and nature of some types of activities in or affecting the marine environment. These changes, and continuing trends, must be analyzed and fully taken into account in appraising the needs for and modes of international cooperation in promoting marine science and the development and transfer of marine technology.

15. The legal process was itself initiated in anticipation of developments in the technology of exploration and exploitation of the deep-sea bed, which have now happened. In the same period, there have been important developments in ship design and operation, in the means of extracting energy from the ocean, in fishing methods, in the ability to operate under the sea surface and in the use of the ocean - deliberately or otherwise - as a recipient of wastes from human activities on land. All these, and other continuing developments in multiple use of ocean space have generated the present need for a much greater intensity, diversity and quality of investigation of the marine environment by all nations.

16. Marine science has changed dramatically with respect to the technologies employed by its practitioners, to the nature of the problems addressed by them and to the diversity of nationalities engaged. Technological developments include :

- exploitation of space technology for remote sensing of the sea surface and the near sub-surface, for accurate position fixing at sea, and for ship-to-ship and ship-to-land communication;
- sensing with acoustic devices;
- sensing and 'sampling' with electronic devices which have multiplied the rate of some kinds of data gathering by several orders of magnitude;
- provisions of platforms other than surface vessels, such as moored and drifting instruments and equipment placed on the sea bed;
- research submersibles to carry humans or robots to any depth, and new diving apparatus;
- data processing equipment which makes possible both real-time analysis of numerical data and the immensely complex calculations.

17. New types of scientific problem that have been addressed vigorously in that ^{decade} ~~fifteen year period~~ range from the examination of recently discovered life-forms and processes in the deep ocean to the effects on more familiar forms of marine life of heavy metals, radionuclides and synthetic biologically active chemicals ; from examination of the role of the ocean and of energy exchange at the sea-atmosphere interface in processes of climatic change to the structure and dynamics of the earth's mantle ; from the biological modelling of entire ecosystems such as that of the Southern Ocean to the understanding of physical processes of the scale of the deep sea eddies.

18. The new instruments and methods have made studies of such problems possible; new forms of activity in the marine environment have made it necessary. And some of these problems have created the need for new methods; other methods have emerged from the more general development of science-based technology.

19. At the same time far more countries have become aware of a need for competence in marine science and have in fact developed a certain capacity in that field, regarding both qualified and experienced people and the physical means of conducting marine research. With that has come awareness of the scale of the need for international cooperation and experience of the possible modes of such cooperation. An indication of that evolution is given by the fact that in 1967 there were _____ member states of the IOC of which _____ were developing states, and now there are _____ of which _____ are developing states.

20. Notwithstanding the fact that more countries now have a capacity to engage in marine research and that their number continues to grow, it must be recognised that precisely because of the technological changes here identified, the gap between the countries most advanced in this field and those that are new to it remains wide and is possibly even widening. This may have unfortunate consequences with respect to the implementation of the 'consent regime', which calls for understanding of the modes of research at the present time and as they are evolving. Such understanding comes best from engagement in the research activities from planning through conduct of them to the processing of data and the evaluation of results.

21. Other studies prepared by IOC, SCOR and other bodies give indications of likely future priorities for marine research*.

* See specially IOC/INF - 505, 22 July 1982. Ocean Science for the year 2,000.

The revolution in the techniques of marine research which we have outlined is not completed - it may only have begun. Thus, in considering the consequences for such research of the new legal regime we must realise that continued rapid technological change is to be expected, with unforeseeable consequences for the pattern of research activities. Thus if marine science is to thrive and if its potential value to humanity is to be fully realised within the new political framework considerable flexibility in the interpretation and application of the associated legal provisions will be necessary.

Group III.

Implementation of requirements for international co-operation.

Mandates for international co-operation at all levels for ~~the~~ promoting international co-operation in the development of marine science and technology are given in numerous Articles scattered through several Parts of the Convention. The Workshop did not attempt ^{an exhaustive} ~~an comprehensive~~ analysis of these, ~~instead~~ although that exercise might have been a reasonable approach to the set task. Instead, Article 243 Creation of favorable conditions (for marine scientific research) in Part XIII was taken as a starting point for consideration of ~~the~~ experience to date and proposals for ~~future actions~~ new initiatives ^{regarding} ~~as to~~ the possible modes of co-operation and the means of promoting them. According to this Article "States and competent international organizations shall co-operate, through the conclusion of bilateral and multilateral agreements, to create favorable conditions, ^{for} and to integrate the efforts of scientists.. in, studying... processes and phenomena... in the marine environment.. "

Favorable conditions include an appropriate intellectual climate for creative work, ^{and some assurance of continuity in} ~~continuity~~ such work; ~~physical~~ material means appropriate to the problems to be investigated and the techniques necessarily to be used; ~~and~~ adequate opportunities for scientists to exchange ideas (directly and through publications), to learn about new techniques and related research activities by others, and to have their work ^{Evidently, such} ~~criticized~~ by their peers. ~~Such~~ conditions cannot be assured through bilateral and multinational agreements. In the context of the new law of the sea what such agreements ^{possibly} can/do is ~~to~~ contribute to the creation of national capabilities in marine science and help engender mutual confidence among national groups of scientists and among governments. These two processes reinforce each other.

There is a vast array of possible types of agreements under the general formula of Article 243. There probably already exist examples of all or most of them. Major categories are agreements between States, between one or more States and an inter-governmental organization, and between international organizations. The negotiators of the convention probably had in mind, when writing here and ~~elsewhere~~ in other Articles, the term "international organizations", primarily intergovernmental bodies. However, the Workshop emphasised the importance, with respect to the ~~objectives of~~

For example,

Article 244, in mandating that States "in co-operation with other States and with competent international organizations shall actively promote the....strengthening of the autonomous marine scientific research capabilities of developing States", establishes that this process includes ..."programmes to provide adequate education and training of their technical and scientific personnel".

intent of Article 243, of the non-governmental international bodies in this field. While recognising that some of those bodies will need to change in response to the changes in the nature of marine research noted in paragraphs 16 to 20 (and particularly para.19) of this report, especially by an increased participation of scientists from developing countries in them, agreements between them and intergovernmental organizations and, in certain cases, States ~~can~~ contribute substantially to national capabilities and international confidence. The non-governmental bodies concerned range from those concerned with/science ~~xxxxxxx~~ itself, such as the Committees, Unions and Associations assembled in ICSU, to ~~those~~ inter-disciplinary bodies such as the International Ocean Institute concerned with ~~the xxvxx~~ marine policy/- including science policy - and training. *The 101 Training Programme concluded with the cooperation of all 4 countries intended to expand all world system, and organize a system to inspect needs of various regions*

Matters ~~that~~ to be covered by international agreements of various kinds *develop, create, we consider a pioneer experience & the no field*

include:

- education and training of scientists and technicians;
- the flow of scientific information and transfer of knowledge;
- the planning and conduct of research activities;
- the provision of scientific equipment;
- the creation and ~~is~~ further development of institutions ~~of various kinds~~ and networks.

Many/agreements would ~~cover~~ be concerned with only one or two of these matters, others ~~others~~ would cover aspects of all of them. Agreements concluded under one or more Articles of Part XIII Section 3 of the Convention (Conduct and Promotion of Marine Scientific Research) might be expected ~~to~~ often to be of the latter kind. Most agreements between developing and other States would be expected to contain ~~reference~~ provisions regarding education and training, whatever else they covered. ← p 2 bis

International co-operation in marine

~~Marine~~/science education and training has been the subject of many studies under the auspices of IOC/TEMA, and these have given rise to numerous specific proposals for action. [Quote documentation]. Stimulus for the implementation of these proposals may be derived from specific provisions in the Convention, such as that of Article 275(2) which says that States, through competent international organizations and the Authority, shall give adequate support to facilitate the establishment and

strengthening of (national research centres, particularly in developing coastal States) so as to provide for advanced training facilities and necessary equipment, skills and know-how....". In addition, it is clear that among the conditions that may be established by a coastal state regarding consent for other States and competent international organizations to undertake marine research in its exclusive economic zone or on its continental shelf could be included provisions for the provision of training opportunities to ~~the~~ nationals of the consenting State.

Provisions for training are concerned not only with the formation of specialists. At the present time there is an urgent need also ~~for~~ to convey a very wide range of information to administrators who are or will be responsible for national activities affected or required by various provisions of the convention. Agreements to provide for special broad training of this kind will be necessary if consciousness of the implications of the marine revolution, of which the convention is both a mirror and a motor, is to be more widespread. Such consciousness is another ~~essential~~ ^{social} favorable/condition for the necessary growth and health of marine science.

A special provision regarding training, which will call for new forms of agreement, is that in Article 143 wherein "States Parties shall promote international co-operation in marine scientific research by (inter alia) training...the personnel of the Authority in the techniques and applications of research".

Article 244 says that "States...in co-operation with other States and with competent international organizations, shall actively promote the flow of scientific data and information and the transfer of ~~scientific~~ knowledge resulting from ~~a~~ marine scientific research, especially to developing States..." Paragraph 1. of the same Article makes it clear that this flow includes publication and dissemination of information about research programmes and plans as well as of the results of research. There already exist a number of multi-national agreements regarding such exchanges, ranging from those concerned with the operation of oceanographic data centres and referral centres to the agreements involving several organs of the United Nations system and States as well as non-governmental bodies for the Aquatic Sciences and Fisheries Information Service (ASFIS). The convention by implication greatly enhances the

"States shall seek to promote through competent international organizations the establishment of general criteria and guidelines to assist States in ascertaining the nature and implications of marine scientific research". This activity might be expected to lead to international organizations sponsoring global or regional agreements regarding such criteria. Then, according to Article 25~~5~~, States "shall endeavour to adopt reasonable rules, regulations and procedures to promote and facilitate marine scientific research conducted...beyond the territorial sea...and, as appropriate,...to promote assistance for ...research vessels", (including/^{facilitating} their access to harbours)~~4~~. Not only does the adoption of "reasonable" rules, etc., call for co-operation between coastal States and the flag States of research vessels, but also ~~there is likely to be~~ it is likely to prove desirable that such rules be as far as ~~harmonised~~ is practicable harmonised internationally. This latter process could be actively promoted by/^{experienced} international bodies such as the IOC. → p 5 bjs

~~The provisions of~~

International agreements regarding the provision of research equipment, like such agreements for exchanges of scientific personnel, can be regarded as special facets ^{essential} ~~aspects~~ of arrangements for planning and conducting research, and equally as/elements in the creation and development of research institutions and networks.

Much attention has been given to co-operation in the creation and strengthening of national institutions in the "Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of Developing Countries" drawn up by the IOC. The Workshop did not see the need, nor/^{in any case} have the time, to give further consideration to the ~~RD~~ matters.

By 'institutions' was understood the entire range of internal arrangements and facilities for planning, co-ordinating, conducting and appraising the results of research as well those for ensuring the application of the results of research to the end of "achieving national goals in the field of ocean affairs" and for enabling full participation in "global, regional and sub-regional oceanographic research programmes".

New problems are arising with the deployment of drifting instruments in a world in which much of the ocean area is under national jurisdictions. Such instruments, whether put out in the area over which the researching State has jurisdiction or in the high seas will frequently move into areas under the jurisdictions of other States. ~~It is becoming increasingly~~ There is now an increasingly urgent need to reach agreement on the status and protection of such instruments, including the possibility of experiments using them being conducted under the ~~sponsorship of~~ auspices of competent international organizations.

International institutions, and especially regional institutions, were a subject of special attention by the Workshop. Multilateral agreements among a number of countries in a certain geographical area are a common feature of the global pattern of marine ~~research~~ affairs, and scientific research is a subject - often the only subject - of most of ~~these~~ them. Many of these ~~agreements~~ relate to a co-operation regarding a defined ocean area, but often linguistic, historical, cultural, political considerations determine the participation/ⁱⁿ and scope of the agreements. Where many, usually small, island States exist in a region there is a strong impetus to arrange for common facilities of the kinds which none of them could support alone. At the level of fundamental scientific education and research there are already, for example, regional universities in the South Pacific and the Caribbean, and similar arrangements have been discussed for the Western Tropical Indian Ocean. It would seem natural to encourage the development of faculties of marine science at such institutions. Corresponding arrangements for the promotion and co-ordination of marine activities are proposed in the "Comprehensive Plan" in the form of Joint Oceanographic Commissions.

As far as they are concerned with marine science most of the regional agreements hitherto have been limited in their functions to planning and co-ordination of national ~~participation~~ ~~activities~~ in regional programmes. In some cases the bodies established under the agreements also serve to facilitate relations between States, and they may serve as channels of multi-lateral assistance to their weaker members. Some bodies have a stronger operational role in providing common services to their Members~~z~~ or participating countries. The most common such service is compilation and exchange of data and information, but there are a variety of other needs and arrangements to meet them.

Some of the types of service already provided under existing agreements in certain regions are

- ~~data~~ processing of numerical data;
- analysis of samples and identification of materials and specimens;
- libraries, archives, information holding and retrieval of all forms;
- calibration of instruments, standardisation of methods;
- maintenance and repair of equipment.

A steady increase in such provisions, and growing variety of them, are expected. There

are already cases where simple services, such as exchange of numerical data, are being upgraded to more complex operations, such as data analysis and testing and development of models for such analysis. Such upgrading has the effect of tending to transform regional 'information' centres into regional ~~research~~ centres for research. In fact there seems to be a general trend for ~~bodies~~ existing bodies established under international agreements to become more directly ^{engaged} ~~involved~~ both in research and in provision of services for research. There are cases where an organization which ~~was~~ previously facilitated the placement of scientists from ^{some} ~~one~~ of its Members on the research vessels of others, has later become engaged in the planning and conduct of international ~~programmes~~ investigations using chartered vessels and paid for from specially contributed funds.

In ^{some} fields of ~~scientific~~ research other than marine science international research institutions - often regional in scope - have been established and have been highly successful. There have also been failures. ~~Nevertheless~~ Notwithstanding those failures, and many practical and political difficulties, there are more international research institutes being ~~established~~ created, planned or proposed now than at any time in the past. Some of these, if they come to fruition, may be of direct assistance in the promotion of marine science although not explicitly directed to it. There is already much experience in the creation and management of such institutions which could be valuable to the marine scientists and administrators in considering new forms of international action to meet demands arising from the new law of the sea and the new scope of marine activities by States and enterprises.

The convention calls for the creation of regional centres, to be promoted by States, in co-ordination with competent international organizations, the Authority and national marine scientific research institutions. The special purpose of these is to "stimulate and advance the conduct of research by developing states. In the fields of marine science the ^{functions of the} regional centres are to include training and education, ~~programmes~~ study relating to the protection and preservation of the marine environment, organising the collection, exchange, ^{dissemination} and evaluation of information of all relevant kinds, and - most importantly - the acquisition and processing of scientific data. (Articles 276 and 277).

There are many institutional forms for centres to perform such functions. One possibility is for arrangements to be made for an existing national institution to serve a regional function. Such arrangements are not uncommon. However, in an increasing number of situations no one country in a region (or even, for that matter, in the world) has the funds, trained manpower or technical ability to support a certain type of research facility. In the field of marine science there are now a number of developing countries which have acquired a considerable capacity for the conduct of research but which nevertheless do not have the ability to engage in all the kinds of research from the results of which they could benefit. It is among these countries that one might expect arrangements for the establishment of new specialised regional/^{research} institutions to emerge. Existing global bodies such as the IOC could be in a position to assist in this process, particularly if they make it their business to be well-informed about similar developments in other fields of science.

Any regional institutions will naturally be foci for the provision of common services for national research institutions. As such they will be nodes in communication networks linking those national groups. When, as is likely eventually to happen, several regional institutions having similar functions come into existence in a number of regions, they will form a network among themselves. Within any general region a number of regional institutions having different, complementary functions in the field of marine science will form a network of another ~~type~~ type. And ~~quite important~~ regardless of the state of evolution of regional institutions, there will be increasing opportunities for national bodies, both governmental and ~~inter~~ non-governmental, to improve their capacities by participation in networks involving an enormous variety of types of co-operation and ~~of~~ kinds of information flow. Global organisations such as, in particular, the IOC could ~~assist~~ seek ways of helping the growth of such networks without ~~ix~~ tending to impose rigid structures or pre-conceived patterns on them. A ~~certain~~ degree of creative disorder is essential for the development of science.

The Workshop gave some consideration to the specific forms of agreements for co-operation ~~at~~ in scientific activities at a more 'operational' level than has hitherto been common practice. In particular the method of establishing consortia and joint ventures was commended for further exploration. It was noted that there were an

increasing number of such arrangements coming into being for joint exploration and exploitation of marine resources, particularly by developing coastal states and other States interested in being active within zones of national jurisdiction. There seem to be opportunities for promoting marine science by including provisions for research in the agreements which ~~govern~~ govern such ventures. However, there ~~have~~ are examples of ^{bilateral} joint ventures and consortia being established for the specific purpose of conducting expensive or difficult types of marine research. The ~~JOIDES~~ ^{JOIDES} programme is ~~an~~ a case in point. Such arrangements have so far been confined to groups of technically advanced States or national institutions. ~~Therefore~~ This form could usefully be explored as a means of making available research vessels and other facilities to groups of developing States, and for establishing regional research institutions of various kinds. An important part of such an exploration should be consideration of the requirements for support ~~for~~ from host countries, ~~and~~ flag States ~~and~~ port States. ↗

It was suggested that ^a joint ventures might be an appropriate form for co-operative remote sensing of the marine environment. Similarly, the further development of ICOS, especially at the regional level might be facilitated by the formation of consortia for the provision of science-based ocean services of that kind.

Lastly, the Workshop offered some general suggestions regarding the ~~role~~ of overall role of "competent international organizations" with special regard for that of the IOC.

GROUP III

In concentrating ~~the~~ effort to develop an efficient strategy for the promotion of marine science and technology in developing countries, ~~the competent international organizations should follow two main avenues:~~ ^{lines should} ~~be followed:~~ ^{awareness}

- i) ~~To help establishing~~ ^{in these countries} the ~~political understanding~~ ^{essential} that a sound scientific basis is ~~indispensable~~ ^{essential} if the opportunities ~~and~~ ^{and offered} responsibilities ^{laid down by} of the new ocean regime are to be ~~taken care of properly~~ ^{fully accepted,} and that ^{for this} sufficient and stable support for marine science is needed.

← This could be promoted by, inter alia,

- Missions of marine science experts from IOC/Unesco;
- Information about technical assistance opportunities;
- General information on ocean affairs and relevant international co-operation, directed to governments, universities, schools and ~~to~~ the public.

GROUP III

- ii) ~~To help activating~~ ^{to help activating} the endogenous capabilities and intellectual creativities regarding marine science and technology in these countries, ^{which, while} ~~what - is~~ maintaining and protecting their cultural identity, ^{is} will lead to real partnership in oceanography between developing and ~~other~~ ^{other} ~~industrial~~ countries on equal footing. To this end ^{it is necessary to}

- Replacing ^{the} one-way export ^{of} technology by the exchange of culture and knowledge;
- ~~Substituting~~ ^{Substituting} "imitation" by "innovation" in the educational field;
- ~~Making~~ ^{help allow and help} the developing countries decide ^{for} themselves which kind of technology would harmonize best with their identity and traditional structure;
- ~~Reducing~~ ^{reducing} discrepancies in scientific standing, and ~~building up~~ ^{building up} mutual trust between developing and ~~industrial~~ ^{other} countries.

D The priority given to the role of the ocean and its resources has in many cases been inadequately identified within the context of national development. Therefore no overall marine policy in many countries has yet been established.

C There is a general lack of recognition of the complexity and the value of the ocean and its resources and of the need to consider them with an integral approach,

d In many cases the value of marine sciences and technologies have even been ignored or have not been given proper emphasis;

Due to the multidisciplinary and intersectorial nature of marine matters, these are taken on a fragmentary basis, without the necessary planning and coordination,

Insufficient cooperation between the sectors tends to lead to duplication and under-use of the scattered available human resources, infrastructure and funding,

g In many countries the national legislation does not correspond to the present national and international requirements;

l International cooperation, both bilateral and multilateral, is largely under-utilized;

l In many countries, there is an insufficient understanding regarding the opportunities offered by the UN organization for increasing marine science capabilities, *is very weak.*

A The development of a solid scientific and technological sector is of paramount importance for the proper use and exploitation of the sea and its resources by developing countries

2 Despite the efforts so far made by developing countries in the promotion of marine science and technology, weaknesses and limitations still exist, in:

- a. the number of marine scientists and technologists,
- b. the quality of academic programmes, and of the ongoing research projects,
- c. the organization of sound and continuous training programmes for marine technicians capable of meeting the demands posed by governmental and private institutions,
- d. the availability of appropriate infrastructure laboratories, equipment, libraries, vessels, maintenance of equipment.

3.5 ^{Many} Most developing countries lack the political will or the commitment to assign priority ^{to} and allocated resources to promote and maintain their oceanographic programmes on a long-term basis. ^{for these purposes} Quite often isolated efforts are made ^{but} resulting in duplication and waste of available facilities.

4.12 The above-mentioned limitation and the limited, or often non-existent, integral knowledge ^{of a} regarding ~~each~~ country's Exclusive Economic Zone makes ^{the taking of} management decision extremely difficult and reduces their capacity to adequately participate in ~~force~~ ^{of} responsible ⁱⁿ for promoting research and ^{formulation of} ~~advancing~~ recommendations for ~~appropriate~~ management.

7.7 As a result of the ^{the} above mentioned difficulties, efforts ^{of} made by developing countries ^{formulate} towards national plans are usually incomplete and fragmented ^{and} failing to ^{provide a basis for} reflect authentic development. ^{These} Such difficulties are serious obstacles ~~for~~ the countries to ^{achievement} become self-sufficient and ^{the} capable to select ^{and} or adopt appropriate technologies.

The scientific and technological development of a nation is a ~~long~~ ^{and generally protracted} complex, ~~and a~~ continuous process. ^{But, while the demand are} ~~urgent~~ ^{urgent} responses by coastal states, ^{is} ~~is~~ becoming ^{more} difficult for developing countries to cope with the priorities and needs of the new ocean regime,

to reach required level. conference. This not only grandly conference by each of these countries, conference also individual

~~The~~ marine scientist ^{and scientist} has to contend with ~~many~~ ^{such} problems/as:

- a. Inadequate recognition of his status, which is reflected in indifference towards his work, etc.
- b. Poor incentives in remuneration and/or means to carry on his job
- c. Improper working environment
- d. Not being consulted in decision making even in his line of expertise
- e. Difficulties to get funds to attend international meetings with colleagues for greater professional growth.
- f. Absence or inadequate appropriate journals in which his studies may be published.

The Acquisition of Competence

29. The development of marine sciences over the next few decades will certainly be marked by the effects of the advances in instrumentation that have vastly increased the capacity for observation and measurement. A much expanded array of variables can now be monitored, in situ or remotely by powerful sensing units, ^{and} ~~in many cases~~ ^{now} variables can be monitored continuously over long periods. ~~but it must be emphasized that~~ These advances have become effective, for research, because of the parallel, and quite dramatic, development of equipment for recording observations, for storing and processing data, and for transmission and reception of data and information.

30. These advances in scientific instrumentation have important effects on the planning and conduct of research, but more significantly they give a freedom to think more largely and make it possible to develop more powerful models of the structure and dynamics of natural systems. Success in realization of those possibilities will depend greatly, however, on the effectiveness of arrangements for international cooperation in the conduct of observational programmes and in the analysis and interpretation of data. Both developing and developed countries must have their part in this enterprise, but, as shown in the preceding section, most developing countries have far to go in developing or even in creating programmes through which they could make their contributions to, and draw benefit from, global programmes, as it is necessary they should do, and of course they need to accomplish this development in order to deal with their own expressly local problems, especially those arising out of the responsibilities they have accepted with regard to their EEZ.

31. Thus while promotion of the development of marine sciences must have a general component, involving developing and developed countries, it requires also a major component directed towards raising the competence of developing countries to a level of participation as equals with developed countries.

This second component must have several sub-components running in parallel: to reinforce the basic educational background to specialized research, to develop institutional arrangements for planning and conduct of research, and to acquire the entire repertoire of modern research instrumentation and the skills in its use.

Analysis of the problem

22. There is a wide range in the level of marine science and technology development among the coastal states. The most advanced industrial states have developed specialized institutions for all aspects of marine affairs,

~~there are~~ university programmes in marine sciences and technology (both at undergraduate and graduate levels), and ~~there is~~ continual development

~~of~~ scientific concepts and methodology, ^{and} as well as in application ^{of the results} of science ~~and constantly being found.~~ ~~to economy.~~ On the other extreme, ~~there are~~ some countries ^{have} with practically

~~no~~ marine science and technology ~~infrastructures at all,~~ and ~~the majority~~

of Coastal States ~~are~~ at present ^{standing} at varying degrees of development between

~~the extremes.~~ ^{the majority have only meagre facilities and modest programmes} The general trend is that the level of development in marine

sciences and technology ^{in general, marine} parallels ^{have developed in with progress in other} that of scientific, economic and techno-

logical ~~development generally,~~ but there are some distinct exceptions. Some

states which ordinarily are considered ^{to be} Developing Countries are more advanced

in marine science and technology than some industrial states. ~~The obvious~~

~~reasons for this is the difference among States in their dependence on the~~

~~oceans for transportation or exploitation of its resources, and the conse-~~

~~quent differences in maritime limitation.~~

~~The~~ rational management of the resources of the ocean requires scien-

tific knowledge and information, ^{for the acquisition of which} appropriate facilities, equipment and tech-

nology as well as highly qualified human resources. ^{must be provided} It also requires national

financial and legal commitments by ~~the~~ responsible governmental authorities.

Although ~~there is a wide range in~~ the specific needs ^{of} and ~~limitations in~~ indivi-

dual states, there are some general trends that should be mentioned.

1. Governments should ^{to} give more recognition ^{of} to science and technology

as factors for development ^{as well as to a wide range of other}