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NATIONAL MARINE FISHERIES SERVICE

NORTHWEST FISHERIES CENTER

PROCESSED REPORT

THE EFFECTS OF CHANGING JURISDICTIONAL AND MANAGEMENT CONCEPTS
ON THE OCEAN'S LIVING RESOURCES AND ENVIRONMENT--
THE POTENTIAL IMPACT ON FISHERIES SCIENCE

by

Dayton L. Alverson

August 1975



Prepared for the
8th Session of ACMRR

W.P. 10

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Working Paper 10

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TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
FISHERIES SCIENCE IN THE POST WORLD WAR II ERA	2
MANDATE FOR CHANGE	7
THE CONSEQUENCES OF JURISDICTIONAL AND PHILOSOPHICAL CHANGES	24
SUMMARY AND CONCLUSIONS	29
LITERATURE CITED	31

INTRODUCTION

Several years ago, a former scientific advisor to the British Government, Sir Solly Zuckerman, stated:

We live in a period of uncontrolled and accelerated change, an age in which technology has raced ahead and in which hallowed social values have tumbled... We live in an age of paradox: an age in which the politician has been straining after the scientist and technologist, and in which the latter have been trying to understand the social consequences of the innovations to which their work has led. The world is clearly living through a period in which the aims of politics and the outcome of scientific endeavor appear to clash.

This quotation is particularly germane to the current turmoil and confusion regarding freedom of seas, ownership of ocean resources, rights of national and international entities to control and prevent oil pollution, and the right of coastal states to limit scientific research. These contentious issues are all currently being debated by the Third Law of the Sea Conference, as well as in many regional and national forums.

Although the character of a new legal regime which may emerge from the Conference or which may evolve as a result of unilateral actions is difficult to forecast, it is becoming increasingly evident that many of the historical freedoms associated with the high seas will be sharply modified, particularly as they relate to geographic areas that may come under the jurisdiction of coastal states.

To some extent, the changing views on jurisdiction vested in national entities versus the international community may have been inspired by questionable goals associated with managing ocean resources. The objective of managing to achieve the maximum sustainable yield of resources exclusive of other economic or sociological objectives has been challenged by a number of economists and sociologists. More recently, the utility of MSY has been questioned in terms of its viability as a theory in a technical sense; and a growing number of management failures has stimulated scientists to consider alternative goals and techniques for managing natural resources. At the same time, conservationists and scientists have considered new functional definitions for "conservation" and their application to resource management.

It is the purpose of this paper to examine the character of jurisdictional changes and policies which may alter management goals and to evaluate their impact on the conduct and execution of fisheries science.

FISHERIES SCIENCE IN THE POST-WORLD WAR II ERA

Fisheries science grew rapidly in the post-World War II era, particularly during the period of expanding high seas fishing activities. The concept of large-scale, multi-nation cooperative studies apparently was initiated in the North

Atlantic and North Pacific, and multi-national fisheries investigations in waters seaward of the territorial sea were common, particularly during the decades of the 1950's and 1960's. During this period, scientists had rather free access to ocean areas, particularly in the Northern Hemisphere, seaward of coastal states territorial limits. Multi-national fisheries science was facilitated through international fisheries commissions such as the International Commission for North Atlantic Fisheries (ICNAF), the International North Pacific Fisheries Commission (INPFC), and the Inter-American Tropical Tuna Commission (IATTC); and through international scientific groups, e.g., IOC and ICES; as well as by efforts of the Department of Fisheries of FAO.

Traditional freedoms associated with scientific activity in the world's ocean began to erode, first as a result of unilateral extension of territorial seas by South American countries, and subsequently by international treaty arrangements which were a product of the 1958 Law of the Sea Conference. Several nations which extended their territorial jurisdiction to 200 miles at the same time required fisheries science and fisheries activities in general to be conducted only on a "consent" basis.

Another major step in limiting scientific freedom was taken during the 1958 LOS Conference, which in the Convention on the Continental Shelf (Article 5, Paragraph 8) stated:

"The consent of the coastal state shall be obtained in respect to any research concerning the continental shelf and undertaken there..." Although this language was intended to deal largely with the scientific activity related to the geological aspects of the shelf and to inanimate resources, studies related to certain sedimentary resources also required consent of the coastal state.

Although I have not examined in any detail the consequence of extended jurisdiction in the Southern Hemisphere and impact of the consent requirement of the Continental Shelf Act, it does not appear that these actions have substantially altered or interfered with the conduct of high-seas fisheries studies. Both acts were perhaps more legalistic in character in influencing the nature of rights rather than interferring directly with high-seas fisheries investigations. The fact that they did not impede the execution of fisheries science may in part reflect the fact that large-scale high-seas fisheries studies during the 1950's and 1960's largely occurred in the Northern Hemisphere or other areas of the world's ocean which were still considered (seaward of territorial sea) open access in terms of conducting fisheries science or were conducted in the water column and, hence, not subject to consent requirements.

During the period between 1958 and the present time, however, a number of additional countries extended their territorial or fisheries zones, and at the same time required consent for fisheries science conducted in areas coming under their jurisdiction. These actions did impact on fisheries science,

although not on a large scale. Regardless, they delayed or prevented initiation of fisheries studies.

We must accept the fact that in the three decades following World War II there have been rather substantial jurisdictional changes which have increased the complexity of conducting fisheries science in the world's ocean. At this point, it is perhaps fair to state that the changes to date have not resulted in major impediments inasmuch as a variety of well-established international fisheries institutions have assisted in the planning and execution of such activities. At any rate, they must be considered insignificant in terms of the impacts which may result from jurisdictional changes formulated at the Third Law of the Sea Conference.

The post-World War II era must also be identified as a period during which the concept of exploiting ocean resources consistent with their maximum sustainable yield (MSY) became accepted as a universal standard. It can be characterized as an era of feverish investigation to assess the distribution, abundance, and behavioral characteristics of fisheries resources in order to establish the surplus yields which could be extracted from them at various population levels. The concept of MSY, which was originally established as a parameter of mathematical model, was gradually introduced as a basic management objective. On the assumption that a particular model appropriately reflected the behavior of a stock or stocks to

exploitation, the concept of MSY permitted investigators to theoretically evaluate the impact of exploitive activities and to establish an acceptable rationale for national and international management.

The problems, however, of defining the MSY in a statistical and philosophical sense, began to emerge during the 1960's--a period when a number of fisheries scientists began to question the wisdom of using MSY as a management goal and to question its philosophical basis for managing species complexes. A rather substantial review of the issue was recently published in the Proceedings of a symposium held during the 104th Annual Meeting of the American Fisheries Society (Roedel, 1975). The preface of this report states that, "The traditional view of maximum sustainable yield as the philosophical basis for fisheries management programs has come under increasing attack over the last decade or so."

Disillusionment with MSY as a management goal (Alverson, 1975) has led to several alternative goals being proposed: e.g., optimum yield, optimum sustainable yield, optimum ecological management, etc. In addition, there have been attempts to redefine conservation, consistent with operational goals. Hence, parallel with changing jurisdictional views, there has been in the last few years attempts by scientists, politicians, and the general public to redefine management goals for the ocean living resources and to reevaluate the scientific basis for decision making in this area.

MANDATE FOR CHANGE

Despite a number of pleas to the world community by leading scientists, philosophers, etc., that compartmentalization of the oceans in terms of extended economic zones and/or territorial seas will greatly inhibit the conduct of ocean sciences, other forces are mandating change in the behavior of man's actions on the ocean. The proposed Law of the Sea changes in jurisdictional concepts reflect a major philosophical change and may have profound effects on the conduct and performance of fisheries science. Language which specifically deals with this issue in the LOS documents can be found in the Informal Single Negotiating Text, Part 3 (Document A/CONF.62/WP.8/Part III). In order to provide an unabridged version of the LOS document, I have quoted in its entirety Chapters 1-6 which deal with marine scientific research:

MARINE SCIENTIFIC RESEARCH

CHAPTER ONE

GENERAL PROVISIONSArticle 1

Marine scientific research means any study or related experimental work designed to increase man's knowledge of the marine environment.*

*/ A provision containing a definition of marine scientific research could be embodied in a special introductory chapter of this Convention together with all other definitions.

Article 2

All States, whether coastal or land-locked, as well as appropriate international organizations have the right to conduct marine scientific research subject to the provisions of this Convention.

Article 3

States shall endeavour to promote and facilitate in accordance with the provisions of this Convention the development and conduct of marine scientific research not only for their own benefit but also for the benefit of the international community.

Article 4

States and international organizations shall apply in the conduct of marine scientific research the following principles:

- (a) marine scientific research activities shall be conducted exclusively for peaceful purposes;
- (b) such activities shall not unduly interfere with other legitimate uses of the sea compatible with the provisions of this Convention and shall be duly respected in the course of such uses;
- (c) such activities shall comply with regulations established in conformity with the provisions of this Convention, for the preservation of the marine environment.

Article 5

Marine scientific research shall be conducted subject to the rights of coastal States as provided for in this Convention.

Article 6

In conducting marine scientific research in accordance with the provisions of this Convention States and competent international organizations shall use appropriate scientific methods and may utilize vessels, aircraft, devices, equipment or installations.

Article 7

Marine scientific research activities shall not form the legal basis for any claim whatsoever to any part of the marine environment or its resources.

CHAPTER TWO

INTERNATIONAL AND REGIONAL CO-OPERATIONArticle 8

States shall, in accordance with the principle of respect for sovereignty and on the basis of mutual benefit, promote international co-operation in marine scientific research for peaceful purposes.

Article 9

States shall co-operate with one another, through the conclusion of bilateral and multilateral agreements, to create favourable conditions for the conduct of scientific research in the marine environment and to integrate the efforts by scientists in studying the essence of and the interrelations between phenomena and processes occurring in the marine environment.

Article 10

States shall, both individually, and in co-operation with other States and with competent international organizations, actively promote the flow of scientific data and information and the transfer of knowledge resulting from marine scientific research in particular to developing countries, as well as the strengthening of the autonomous marine research capabilities of developing countries through, inter alia, programmes to provide adequate education and training of their technical and scientific personnel.

Article 11

The availability to every State of information and knowledge resulting from marine scientific research shall be facilitated by effective international communication of proposed major programmes and their objectives, and by publication and dissemination of the results through international channels.

Article 12

States and international organizations shall endeavour to facilitate marine scientific research through bilateral or regional and other multilateral agreements.

CHAPTER THREE

CONDUCT AND PROMOTION OF MARINE SCIENTIFIC RESEARCHArticle 13

Coastal States have the exclusive right to conduct and regulate marine scientific research in their territorial sea. Scientific research activities therein shall be conducted only with the explicit consent of, and under the conditions set forth by the coastal State. Requests for such consent shall be submitted to the coastal State well in advance and shall be answered without undue delay.

Article 14

Marine scientific research beyond the territorial sea, in the economic zone and the continental shelf, shall be conducted by States as well as by appropriate international organizations in such a manner that the rights of the coastal State, as provided for in this Convention, are respected.

Article 15

States and international organizations which intend to undertake scientific research in the economic zone or on the continental shelf of a coastal State shall provide that State with a full description of:

- (a) the nature and objectives of the research project;
- (b) the means to be used, including name, tonnage, type and class of vessels;
- (c) the precise geographical areas in which the activities are to be conducted;
- (d) the expected date of first appearance and final departure of the research vessels or equipment as the case may be; and
- (e) the name of the sponsoring institution, its director and the scientist(s) in charge of the expedition.

Article 16

States and international organizations when undertaking scientific research shall comply with the following conditions:

- (a) ensure the rights of the coastal State, if it so desired, to participate or to be represented in the research project;
- (b) provide the coastal State an opportunity to participate directly or be represented, if it so desires, in the research on board vessels at the expense of the State conducting the research but without payment of any remuneration to the scientist of the coastal State;
- (c) provide the coastal State with the final results and conclusions of the research project;
- (d) undertake to provide to the coastal State on agreed basis raw and processed data and samples of materials;
- (e) if requested, assist the coastal State in assessing the said data and samples and the results thereof;

- (f) ensure that the research results are made internationally available through International Data Centres or through other appropriate international channels as soon as feasible;
- (g) inform the coastal State immediately of any major change in the research programme; and
- (h) comply with all relevant provisions of this Convention.

Article 17

The communication concerning the research project shall be made through appropriate official channels and the coastal State shall acknowledge its receipt immediately.

Article 18

1. States and international organizations, which intend to undertake scientific research shall indicate in their communication to the coastal State whether they consider the research project to be of a fundamental nature or related to the resources of the economic zone or continental shelf.

2. States shall seek to promote through competent international organizations the establishment of criteria and guidelines concerning the differentiation between research directly related to the exploration and exploitation of the living and non-living resources and fundamental research which is not directly related to exploration and exploitation of such resources.

Article 19

If the coastal State considers that the research project defined by the researching State as fundamental is not of such nature, it may object only on the ground that the said project would infringe on its rights as defined in this Convention over the natural resources of the economic zone, or continental shelf.

Article 20

Any dispute with respect to the determination of the nature of the research project, if not settled by negotiation between the parties concerned shall, at the request of any of the parties of the dispute, be submitted for settlement in accordance with the procedures set out in the relevant articles of this Convention.

Article 21

Any research project related to the living and non-living resources of the economic zone and the continental shelf shall be conducted only with the explicit consent of the coastal State. In this case the following conditions shall apply:

- (a) the conditions specified in Articles 15 and 16 with the exception of condition (f) of Article 16;
- (b) if requested, submit to the coastal State as soon as practicable after the completion of the research, a report including a preliminary interpretation;
- (c) ensure that the research results are not published or made internationally available without the express consent of the coastal State; and
- (d) fulfill any other request for information relating directly to the research project.

Article 22

When the research is of fundamental nature the coastal State may indicate within ____ days of the communication concerning the research project its intent to participate in the different phases of the research on mutually agreed terms. In case the coastal State does not reply, the researching State or the international organization shall proceed with the realization of research project in accordance with the conditions referred to in Article 16.

Article 23

1. States and international organizations conducting marine scientific research in the economic zone of a coastal State shall take into account the interest, and rights of the land-locked and other geographically disadvantaged States of the region, neighbouring to the research area, as provided for in this Convention, and shall notify these States of the proposed research project as well as provide, at their request, relevant information and assistance as specified in Article 15 and Article 16 subparagraphs (e) and (g).

2. Such neighbouring land-locked and other geographically disadvantaged States shall, at their request, be given the opportunity to participate, whenever feasible in the proposed research project through qualified experts to be appointed by them.

Article 24

Coastal states shall on the basis of bilateral or regional and other multilateral agreements and in a spirit of international co-operation with a view to promoting marine scientific research activities conducted in accordance with this Convention, adopt measures, including domestic legislation, to facilitate access to their harbours and to provide assistance for marine scientific research vessels carrying on such activities.

Article 25

1. All States, whether coastal or land-locked, as well as appropriate international organizations shall have the right in conformity with the provisions of this Convention to conduct marine scientific research in the international sea-bed area.

2. Information concerning the research project in accordance with Article 15 shall be submitted not less than _____ days beforehand to the International Sea-Bed Authority, established in accordance with the provisions of this Convention.

3. When a resource oriented marine scientific research programme is planned in an area immediately adjacent to the economic zone or continental shelf of a coastal State, and research incidental to the research programme, involving entries into the economic zone of the coastal State may be required, the coastal State may request that the provisions of Article 21 be fulfilled.

4. The research results should be published in a readily available scientific publication, and in any event made internationally available through appropriate international channels, as soon as possible.

Article 26

All States whether coastal or land-locked as well as appropriate international organizations shall have the right in conformity with the provisions of this Convention to conduct marine scientific research in the waters of the high seas beyond the limits of the economic zone.

CHAPTER FOUR

STATUS OF SCIENTIFIC EQUIPMENT IN THE MARINE ENVIRONMENT

Article 27

The development and use of any type of scientific research installations or equipment in the marine environment shall be subject to the same conditions as those for the conduct of marine scientific research, as provided for in this Convention.

Article 28

All the rights necessary to operate and manage and the responsibility for such installations or equipment shall remain with the States or the international organizations which have deployed them or on whose behalf they have been deployed, in accordance with the provisions of this Convention, unless otherwise agreed between the parties concerned.

Article 29

In areas where the consent of the coastal State is needed for the conduct of marine scientific research in accordance with this Convention the coastal State has the power to inspect and ensure that the installations or equipment are used in conformity with the purposes and conditions set out for the conduct of the research project, including the right, in the case of contravention by the deploying States or international organizations, to take all appropriate judicial and administrative measures.

Article 30

The installations or equipment referred to in this Chapter shall not have the status of islands or possess their own territorial sea, continental shelf or economic zone of the coastal State.

Article 31

Safety zones of a width not exceeding ____ metres measured from the outermost points of the installations referred to in this Chapter may be created around the installations. All States shall ensure that such safety zones are respected by their ships.

Article 32

The deployment and use of any type of scientific research installations or equipment must not constitute an obstacle to the established international shipping routes.

Article 33

Installations or equipment referred to in this Chapter shall bear identification markings indicating the State or international organization to which they belong and will have adequate warning signals to ensure the safety of sea and air navigation.

CHAPTER FIVE

RESPONSIBILITY AND LIABILITYArticle 34

States and competent international organizations shall be responsible for ensuring that marine scientific research, whether undertaken by them or on their behalf, is conducted in accordance with the provisions of this Convention.

They shall be liable in conformity with international law for damage arising out of marine scientific research undertaken by them or on their behalf.

Article 35

1. States shall also take the necessary legislative or regulatory measures to prohibit any conduct of marine scientific research by their nationals, natural or juridical, or by other persons under their jurisdiction, which is in contravention of the provisions of this Convention and to establish sanctions therefor.
2. States shall ensure that recourse is available in accordance with their legal systems for compensation or other relief in respect of damages arising out of marine scientific research.
3. The liability in respect of damage caused within the area under jurisdiction and/or sovereignty of a coastal State arising from marine scientific research activities shall be governed by the law of the coastal State, taking into account the relevant principles of international law.

Article 36

States undertake to co-operate in the development of international law relating to procedures for the assessment of damage, the determination of liability, the payment of compensation and the settlement of related disputes.

CHAPTER SIX

SETTLEMENT OF DISPUTESArticle 37

Any dispute with respect to the interpretation or application of the provisions of this Convention with respect to marine scientific research shall be resolved by the dispute settlement procedures contained in Chapter ____ of this Convention.

The above material reflects the subcommittee chairman's view of an informal negotiating text. The President of the Conference notes that these documents must "...not in any way be regarded as affecting either the status or proposals already made by delegations or the right of the delegations to submit amendments or new proposals."

As regards scientific activities in the ocean, there is some confusion in the Conference deliberations inasmuch as the subject is alluded to in almost all the subcommittee reports. For example, in the Informal Single Negotiating Text, Part 2, of the Second Subcommittee, one can also find articles dealing with scientific activities under the title, "The Exclusive Economic Zone." Article 49 of this document states:

The consent of the coastal State shall be obtained in respect of any research concerning the exclusive economic zone and undertaken there. Nevertheless, the coastal State shall not normally withhold its consent if the request is submitted by a qualified institution with a view to purely scientific research, subject to the proviso that the coastal State shall have the right, if it so desires, to participate or to be represented in the research, and that the results shall be published after consultation with the Coastal State concerned.

The language in the LOS documents speaks for itself, and it is apparent that regardless of which version (Part 2 or Part 3) of the Informal Single Negotiating Text is ultimately adopted, both imply major departures from historical legal patterns.

The LOS Conference may provide a legal environment somewhat less restrictive than that implied in the above material; but it is unlikely. At this point in time, I have chosen to evaluate the future impacts of jurisdictional change, based on the assumption that either a consent regime or a consent/obligation regime similar to that defined in Part 3 of the Single Negotiating Text will prevail and hence structure the environment under which we must operate in the future--that is, when conducting science in the economic zone of another state. Some general language may also find its way into the LOS text which may require certain procedures to be followed, even when conducting science seaward of an established economic zone.

In addition to jurisdictional changes, the LOS documents appear to modify traditional goals of fisheries management. In Part 2 of the Informal Single Negotiating Text, Article 50 states:

1. The coastal State shall determine the allowable catch of the living resources in its exclusive economic zone.
2. The coastal State, taking into account the best evidence available to it, shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation. As appropriate, the coastal State and relevant subregional, regional and global organizations shall cooperate to this end.
3. Such measures shall also be designed to maintain or restore populations of harvested species at levels which can produce the maximum sustainable yield, as qualified by relevant environmental and economic factors, including the economic needs of coastal fishing communities and the special requirements of developing countries, and taking into account fishing patterns, the interdependence of stocks and any generally recommended subregional, regional, or global minimum standards.
4. In establishing such measures the coastal State shall take into consideration the effects of species associated with or dependent upon harvested species with a view to maintaining or restoring populations of such associated or dependent species above levels at which their reproduction may become seriously threatened.
5. Available scientific information, catch and fishing efforts statistics and other data relevant to the conservation of fish stocks shall be contributed and exchanged on a regular basis through subregional, regional and global organizations where appropriate and with participation by all States concerned, including States whose nationals are allowed to fish in the exclusive economic zone.

In the third paragraph of this Article, the conservation and management measures have the goal of being designed to maintain or restore populations of harvested species at levels which can produce the "maximum sustainable yield" but modified on the basis of relevant sociological or economic factors, including the economic needs of the coastal fishing community and species requirements of developing countries.

Under Article 51 (Part 2 of the Informal Single Negotiating Text) the goal of fisheries management is stated in terms of "optimum utilization" of living resources in the economic zone. The term "optimum utilization" is, however, left undefined. Several recent publications elaborate on the concept of optimum sustainable yield and provide new definitional approaches to the concept of conservation. I have alluded earlier to the publication of the American Fisheries Society concerning optimum sustainable yield as a concept for fisheries management. Within this opus, the authors discuss "optimization" in terms of various goals and objectives of fisheries management vis-a-vis the concept of maximizing sustainable physical yield.

Recent debates on this subject are having a major impact on legislators and policy makers, and there are attempts to incorporate language into national legislation in the U.S. to alter the principles and policies of national and international fisheries management. A document published by the American Society of International Law (1974) proposed that the goal of international fisheries management should be to "maximize opportunities of individual states acting individually or collectively, depending on the characteristics of the particular fishery under consideration."

In addition to the symposium proceedings published on optimum sustainable yield by the American Fisheries Society, the World Wildlife Fund has recently distributed a report

generated by a workshop on the conservation of wild living resources. The workshop undertook a critical review of the scientific basis for existing goals of conservation and prepared an interpretation of their new proposal with respect to the U.N. Law of the Sea Conference. The group proposed several principles and definitions which are worthy of the Committee's (ACMRR) inspection. The report of the workshop states that:

The privilege of utilizing a resource carries with it the obligation to adhere to the following four general principles:

1. The ecosystem should be maintained in a desirable state such that
 - (a) consumptive and non-consumptive values can be maximized on a continuing basis
 - (b) present and future options are ensured
 - (c) risk of irreversible change of long-term adverse effects as a result of use is minimized
2. Management decisions should include a safety factor to allow for the facts that knowledge is limited and institutions are imperfect.
3. Measures to conserve a wild living resource should be formulated and applied so as to avoid wasteful use of other resources.
4. Survey or monitoring, analysis and assessment should precede planned use and accompany actual use of wild living resources. The results should be made available promptly for critical public review.

In the appendices of the workshop report, the following definition of conservation was given:

Conservation of the living resources of the sea is that aggregate of measures required to maintain those resources and their environment in a state such that

- 1) a maximum and stable supply of food and other marine products may be taken from them on a continuing basis;
- 2) there is minimal likelihood of irreversible or long-term adverse effects of exploitation on particular resources or on the marine ecosystem as a whole;
- 3) a wide diversity of options for future use is ensured.

This is followed by a statement concerning the manner in which conservation measures should be formulated. That is:

- 1) avoiding wasteful use of other natural resources expended to secure the supply of food and other marine products;
- 2) providing a margin of safety to allow for unpredicted variations and characteristics of marine resources and their environment, and for the fact that the application of measures may be subject to delay or be otherwise imperfect;
- 3) securing in the first place a supply of food for human consumption.

Although the objectives as stated in current LOS documents may not directly influence the character of fisheries science, the intent and manner of defining management goals in these documents and the others referred to could significantly modify the scope and direction of marine science and influence the performance and capacity of science to contribute knowledge important to rational management of the ocean's living resources.

THE CONSEQUENCES OF JURISDICTIONAL AND PHILOSOPHICAL CHANGES

It is not my intent to question the desirability of jurisdictional changes which have been proposed at the Law of the Sea Conference or to challenge the need for altering traditional fisheries management goals. Certain changes are inevitable and we must expect that the working environment for fisheries scientists will be sharply altered during the next decade. Our purpose here should be, then, to briefly examine the legal and functional implications of possible changes and, in light of these, determine whether or not ACMRR can in the future play a role in facilitating the conduct of fisheries science on the high seas and in clarifying the role of the fisheries scientist in light of changing resource management goals and philosophies.

The establishment of an international 200 mile economic zone will create a legal regime which perhaps encompasses 95%-98% of the world's fisheries resources now being exploited. The zone will cover the major areas where high seas fisheries are conducted and the area where much fisheries science has been carried out. It seems to make little difference whether or not the language finally adopted by the Conference is that proposed in the Informal Single Negotiating Text of Subcommittees 2 or 3. The legal implications of both either explicitly or implicitly require that scientific investigations of living resources within the proposed economic zone be conducted only with the consent of the coastal state. Hence, the historical legal freedoms

associated with science will have departed, particularly as they relate to the fisheries arena. The language of Subcommittee 3 would seem to exempt science directed towards more basic objectives; however, semantics and definitional aspects of the Articles are indeed difficult to interpret and perhaps all of ocean science will operate on a de facto level within a consent regime.

If one examines the functional requirements for clearance, it is quite clear that science will no longer be unbridled. The question which remains is whether or not fisheries science can be conducted in a reasonable fashion and still meet the obligations that relate to a consent regime. The requirements of the proposed consent regime impose certain bureaucratic procedures which in themselves will increase the complexities of planning and program execution. The lead time to carry out large-scale, high-seas fisheries studies of a unilateral or even cooperative basis may be substantially extended in order to insure all the appropriate clearances have been achieved. In addition, the planning of fisheries science takes on a different character inasmuch as it must take into consideration the thoughts, wishes, etc., of the coastal state in whose economic zone such research will be conducted. Planning also must consider the inclusion of scientists from host countries into the activities and insure that they have more than observer status in developing the research plans. Right to publish the results of research activities may also be evaluated by the coastal state or states in whose waters the research is to be conducted. Hence, one must assume that the new environment

will require a high degree of formalization and structuring of the science activity.

In many areas of the world, consent may be rather routine without the coastal state requiring that all options placed at its disposal in terms of obligations are met. In other areas, the processes of planning and executing fisheries science may be complex and time consuming. In the design of any large-scale high-seas fisheries activity, planning will have to be geared to the most complex nationally established procedures. This will have to be considered in conceptualizing multi-area or national cooperative studies from the standpoints of the likelihood of obtaining consent to carry them out, the time required for permission, and the complexity of the operational procedures.

Scientific performance may or may not be influenced by the more complicated bureaucratic process. Once clearance has been obtained to operate in a particular area, one might assume that the capacity to perform particularly scientific missions would not be changed. This, of course, would depend on the benefits or costs of multiple group planning and whether or not experimental designs evolved by scientists were modified as a price to achieve consent. Performance might also be altered by the fact that governments could not respond quickly enough to insure certain priority multi-national studies were undertaken within the appropriate timeframe. Finally, one must consider that the

level of bureaucracy itself in the ocean scientists' arena could have a negative affect in terms of stifling the recruitment of competent individuals to the fishery field.

The impact of changing philosophical bases for fisheries management may be less drastic. Regardless, it still may have an influence on the direction of fisheries science and the perception of the technical basis required for decision making.

There has been some rhetoric that the fisheries biologist has been unable to budge from his support of the hallowed values associated with the maximum sustainable yield concept. In general, however, I do not find this to be the case. There is as much, or more, debate within the biological community concerning the shortcomings of MSY as a management goal as there is concerning goals within other scientific and technical disciplines. The problem does not seem to be as much one of clinging tightly to tradition as it is of questioning the goals proposed to replace MSY, such as optimum yield, optimum sustainable yield, ecological management, etc. The concept of a management goal which allows decision makers to take into account economic and sociological factors is acceptable to most marine biologists and is probably a desirable modification from past goals. Language which would require management decisions to be based on the maximum sustainable yield, taking into account sociological and ecological factors, would not seem to impact directly on the nature of biological studies required of the fisheries scientist.

What appears as a more imposing hurdle is adopting new goals which cannot be quantified and which may have different meanings among nations. In this sense, society as a whole must decide the overall objectives of management of the oceans living resources. The scientist, however, must have some scale to determine what technical inputs are desirable in terms of formulating decisions. These inputs to the decision making process may be reports on the status of stocks, the anticipated surplus production, the population level, the consequences on an entire community of animals of exploiting only one or a few species within it, etc. Hence, unless clarified, the objectives of optimum yield or optimum sustainable yield do not really provide any desirable guidelines; and if they are to be functional, they must be defined in more specific sociological, ecological, and biological terms.

The concept of managing to maintain the "ecological health" of a community is appealing to a large segment of the general public as well as to some scientists. Managing to achieve ecological objectives must ultimately be defined in terms of the dynamic ranges of population complexes and ecological norm. Such objectives become important only when we have the capacity to verify ecological relationships in a meaningful way. Until such time as this management goal is quantifiable, it will not provide any real guidance or direction to the fisheries scientists. Quite the opposite, it may result in a diffusion of effort without any real focus in terms of desirable outputs for managers.

If the cost of generating such information is exorbitant in terms of society's willingness to pay, fisheries science will have to retrench into more simplistic approaches and assume that the interactions of animal assemblages culminate in certain surpluses being produced on an average for individual species or species groups.

The fisheries scientist can best serve society by establishing a clearer understanding of the types of biological information which can realistically be acquired and which is important to the decision processes, regardless of the scope and character of goals which are associated with human values. For better or worse, the fishery biologist must assume there will be a broadening of inputs into decision making and a demand for biological data which has not traditionally been available to decision makers.

SUMMARY AND CONCLUSIONS

It seems clear that jurisdictional changes are likely to have a substantial impact on the conduct of fisheries science over the next several decades. Because a new philosophy of fisheries management is now emerging based upon both old and new concepts and goals, it seems appropriate that ACMRR in its discussions evaluate two basic questions: (1) Can ACMRR as an organization or through its interrelations with other organizations propose procedures which will minimize the

impediments to the conduct of fisheries science? and (2) Should ACMRR as a group or through one of its working parties evaluate the concepts of new definitions and objectives that are being proposed for the management of ocean living resources? From the author's point of view, ACMRR should be responsive in an affirmative manner to both questions.

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