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# Conflict in use of Ocean Resources

a collection of papers edited by:

Susan Hanna  
Kwang H. Im  
Larry O. Rogers



# Exploring Conflicts in the Use of the Oceans Resources

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Kwang H. Im  
Larry O. Rogers

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a collection of  
lectures by:

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Donald McKernan  
Marvin L. Durham  
Ed Condon  
James A. Crutchfield  
Howard F. Horton  
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# **INTRODUCTION**



## Exploring Conflicts in the Use of the Ocean's Resources

by Bruce A. Weber,  
Department of Agriculture and Resource  
Economics, Oregon State University.

As world population growth increases the competition for the world's resources, and as technology increases our ability to exploit ocean resources, conflicts over the use of the ocean and the seabed have taken on a new intensity. During the past several decades, depletion of fishing stocks due to overfishing, increasing economic access to ocean floor minerals and petrochemicals that are outside the traditional territorial seas of any nation, unilateral extensions of sovereignty over the continental margin, ocean pollution and other developments have caused increasing international stress. These developments and individual disputes take place within the context of a broad debate about who owns the oceans: how far seaward does a coastal nation's jurisdiction extend? Is this jurisdiction the same for all purposes (for fishing, navigation, etc.)? And perhaps most importantly, how should the property rights in the oceans' resources (particularly the "unowned" oil and mineral resources of the ocean floor) be distributed among nations? Should they be appropriated by those first able to exploit them or should they be viewed, as Arvid Pardo suggested in 1967, as the "common heritage of mankind," with the economic returns from these exploitations distributed among all (landlocked as well as coastal) nations?

Since 1958, a number of international conferences attempted to define the complex issues surrounding ocean use and to reach agreement on the major issues. The First United Nations Conference on the Laws of the Sea (UNCLOS) was convened in 1958 in Geneva with 40 participating nations. This conference reached agreement on four conventions covering fisheries, and the territorial sea, the high seas, the the conti-

mental shelf. Ambiguities within the conventions and the existence of many unresolved issues (including most importantly the control of the seabeds) led to subsequent United Nations Conferences on the Law of the Sea. The Third UNCLOS was convened in 1973 in New York with 150 participating nations. The agenda for this conference includes 93 major issues. While some progress has been made during the first seven sessions of this conference, resolution has not yet been achieved on any of the issues.

The present collection of papers is designed to give a background and a perspective to those who wish to understand the current debates over the use of the oceans' resources. It is being issued as the eighth session of the Third UNCLOS begins its work.

This collection is edited from lectures delivered as part of a Liberal Studies course taught at Oregon State University in the spring of 1977. Marvin Durham, Richard Johnston and I designated and coordinated the course, with the intent that it become part of the core in a proposed Conflict and Peace Studies curriculum, which never materialized. The course was an attempt to provide students interested in international conflict with a laboratory for increasing their understanding of the causes and possible resolutions mechanisms for international conflict. The "world's oceans" topic was selected as the laboratory for a number of reasons:

1. the oceans and the seabed were felt to be critical areas of international conflict -- the future of our planet depends in a very real sense on our ability to resolve these conflicts;
2. "ocean conflict" was timely -- the seventh session of the Third UNCLOS had been scheduled to convene during spring quarter; and
3. "ocean resources" and "ocean conflicts" have received a considerable amount of study at Oregon State University, one of the first Sea Grant colleges in the nation.

In the course, we were able to draw on the very considerable talent of Oregon State University faculty and the faculty of two other universities in the Pacific Northwest (the University of Oregon and University of Washington) to provide the information and perspective the students needed as a background for doing their individual projects on conflict resolution.

The collection reflects a belief that intelligent participation in the debates and the process of resolving the conflicts requires an understanding of the physical and biological characteristics of the various marine resources and the economic, legal and socio-political framework within which resource use decisions are being made. Information about the characteristics and use of the resources (sections 4, 5, 6, 7, 8, 9) is juxtaposed with discussion of the institutional framework (sections 2, 3, 10, 11, 12, 13). Many of the papers, of course, integrate both these aspects into their discussions.

DONALD MCKERNAN leads off the volume by identifying the major uses of the ocean: fishing, shipping, minerals (including oil), waste disposal, research and national security. After a brief discussion of the history of ocean conflict, he provides an overview of the current status of the Law of the Sea Conference and recent national actions which have changed world ocean policy.

MARVIN DURHAM expands on one important element of the institutional arrangements for resolving ocean conflicts: international law. After identifying some of the sources and principles of international law, he discusses how these relate to international conflicts in trade, commerce, pollution, and other subjects, both in peace time and in war.

The resources and major uses of the ocean are discussed in the next section of the volume. Emphasis in this section is on the three major uses/resources: fishing, commerce and minerals.

EDWARD CONDON provides an overview of how the ocean is used as a "highway" for commerce and military maneuvers. He identifies the major trading nations and some economic factors explaining their dominance. His paper concludes with a discussion of the naval military strength of various nations.

JAMES CRUTCHFIELD'S paper is a comprehensive introduction to the living and non-living resources of the sea, and to the economic factors in the exploitation of these resources. After a brief mention of the minor resources (energy and fresh water), the major resources are discussed under two headings: mineral (hard rock, dissolved, unconsolidated, and oil and gas) and fishery resources. His paper concludes with a discussion of the demand and supply

outlook for fish and the prospects for a more rational fishery management regime.

The next three papers in this section focus on the living resources of the sea: fish and whales. HOWARD HORTON reviews statistics which show the volume and value of the world fish catch and the geographic distribution of this catch and the fishing fleets, as well as the extent to which various fisheries are being fully exploited. These statistics provide a background for his examples of specific fishery conflicts. BRUCE MATE reviews the history of whaling and of international attempts to regulate whaling, emphasizing the whale management efforts of the International Whaling Commission. The paper concludes with a discussion of the economics of whaling and the effect of extended jurisdiction on whaling. HERBERT FROLANDER completes the discussion of the living resources of the sea by focusing on the estuaries and their role in the food chain. His paper discusses the characteristics of estuaries and how man's activities in estuaries can affect marine life.

The final paper of this section provides an overview of the mineral resources of the sea. JOHN BYRNE explains *what kinds* of minerals and petrochemicals are found *where* in the ocean floor, and *why*. The paper concludes with a discussion of the conflicts which involve ocean mining (ownership, pollution, and conflicts between mining and other uses).

The third section deals with the economics of the use of resources that are not "owned" by anyone. These resources, known as "common property" or "open access" resources, require a different management regime than those which can be "owned." RICHARD JOHNSTON argues that the market has a mechanism (prices) for resolving conflicts and that institutional change which yield stronger property rights in what are now "open access" resources would have the effect of reducing certain conflicts. His paper concludes with a discussion of the factors affecting the benefits and costs associated with defining and protecting property rights. R. BRUCE RETTIG uses the concept of "open access" resources to develop an economic explanation of why "overfishing" occurs, and why fishery management schemes are difficult to implement. His paper outlines a framework for determining "optimum yield" and discusses the difficulties involved in reaching consensus on, and implementing international fishery management agreements.

The final section of this collection focuses on the unresolved issues in the use of ocean resources and the prospects for the resolution of the conflicts about their use. COURTLAND SMITH and LARRY ROGERS introduce the section by focusing on two conflicts: the conflict between the developed and less developed nations on the distribution of the ocean's wealth, and the conflict among neighboring states over the harvest of migratory fish species. Their paper discusses the potential for increased conflict among nations caused by extended jurisdiction.

JON JACOBSON concludes with an assessment of the progress of the Law of the Sea Conference. After a review of the history of the three United Nations Law of the Sea Conferences, his paper discusses the political realities of the current Law of the Sea Conference and the areas of agreement. He concludes by identifying the deadlock issues and assessing the degree of consensus on the unresolved issues.

We feel that this collection may have potential use as supplementary reading in both courses on conflict management (to provide examples of important and complex conflicts) and courses in oceanography and marine resource management (to provide a background on institutional arrangements designed to manage conflict over marine resources). It may also be of interest to the lay person who wishes to better understand current debates over the Law of the Sea Conference.



# **PART I:**

## **The Institutional Framework for Ocean Conflict Management**





## **I-A Institutional Arrangements in the Use of the World's Oceans**

by Donald McKernan,  
Director of the Institute for Marine  
Studies, University of Washington.  
Professor McKernan passed away suddenly  
on May 9, 1979. A respected diplomat,  
statesman, and academician, he will be  
remembered for his tremendous knowledge  
of fisheries issues and his willingness  
to help others. We are fortunate to  
have had his insights to assist us in  
addressing an important conflict issue.  
The paper, a modified version of an  
earlier draft, was edited by Susan Hanna  
of Oregon State University and reviewed  
by William Burke of the University of  
Washington.

I want to talk tonight about developing  
ocean policy and some of the conflicts and  
confusion that arise because of the rapidly  
changing ocean regimes.

The world population is about 4 billion at  
the present time and is expected to be about  
7 billion by the turn of the century.  
Weather conditions in many areas of the  
world combined with soaring energy and  
fertilizer costs have severely reduced  
grain and meat supplies. Resources from  
the land are limited and in recent decades  
man has turned to the sea for food, miner-  
als, and energy. The production of living  
resources from the sea has increased about  
5 percent annually; the question of how  
much increase in world fish catch can be  
expected in the future depends to a con-  
siderable degree upon the developing world  
and on national ocean policy.

Because of newly expanded national juris-  
diction over marine resources, the extent  
to which we will be able to expand our  
world fish production beyond its present  
level depends both on the view of nations  
towards sharing these resources, and on the

wisdom of future management regimes in various parts of the ocean.

There are other important uses of the ocean as well. Compared to the estimated \$10 billion generated annually by the fishing industry, it has been estimated that commercial ocean shipping and the off-shore oil industry each generate \$40 billion in revenue annually. World sea-borne trade has increased at a phenomenal rate in recent years. Off-shore oil production is also a rapidly developing use of the ocean; it represents about 20% of the world petroleum production and about 10 percent of the total gas production. Mining may be another important ocean use. Many people believe that there are great economic benefits to be gained from mining the deep sea bed for manganese nodules. Another important use of the ocean, particularly from the standpoint of the United States, is ocean research. An enormous amount of background knowledge of the ocean's resources and characteristics is essential to the development of a rational ocean policy.

We also use the ocean as a dumping ground for our waste materials. The ocean appears capable of absorbing vast quantities of waste, but there are problems with certain highly toxic and nondegradable chemicals and with high levels of pollution in the productive coastal zone areas. The developing world ocean policy is essential to the well-being of this environment.

Since World War II the United States has used the sea as the most vital aspect of its national security. It is in the interest of the United States to keep an open ocean with as much freedom of action for our security forces as possible; some people believe that the major issue to the United States in the current Law of the Sea Conference is the national security issue.

The increased use of the ocean for multiple purposes in recent decades has resulted in conflicts between users of ocean space and the ocean's resources which promise to continue with increasing intensity. We have off our own coast several thousand foreign fishing vessels from about 25 nations fishing in the Atlantic, Pacific, and sub-Arctic Oceans, the Gulf of Mexico, and the Bering Sea. Here in Oregon, Soviet ships fishing for Pacific hake conflict with bottom fish dragners and salmon trollers. This type of conflict has been severe both in the Atlantic and in the

North Pacific, where American owned fixed gear, such as deep water lobster and crab traps, has been trolled through by large foreign vessels. As the extensions of national jurisdiction strengthen the sovereignty of the coastal states over the resources, the conflict will ease. The United States has been in the vanguard of those nations who have sought new laws for purposes of security, economics, and law and order on the seas.

Conflicts in the use of the ocean are not new. Between the 13th and the 17th centuries, maritime nations (particularly Spain and Portugal) tried to divide the sea among themselves. The developing powers of Britain, France, and Holland, in their search for both fish and trade, collided with some of these dictates; one early conflict was between Holland and Great Britain when Dutch herring fishermen along the Dover coast cut into the British herring grounds.

As a result of those early conflicts, Hugo Grotius in 1609 published his treatise on the freedom of the seas and expounded the virtues of a narrow (three mile) territorial sea. For about 350 years after this, nations tended to accept the relatively narrow territorial sea along with great freedom of the seas and great common property areas. But now these concepts have begun to be questioned. Over the past 50 years the accelerating development of technology and use of the ocean space has radically altered our relationship with the sea. Since the last world war attempts have been made to redefine acceptable uses of the ocean from the world point of view.

The first Law of the Sea Conference was called in 1958. It reached agreement on four conventions, one of which was the Territorial Seas Convention, but this convention was notable in its failure to agree on the breadth of the territorial sea. The United States, influenced at that time substantially by its defense interests and its distant water fishing interests, strongly advocated a very narrow territorial sea, whereas a number of coastal nations advocated a more extensive territorial sea. In 1958, there were only about 84 nations at the conference, and the terms of the treaties were essentially dictated by the developed maritime nations -- the United States, Japan, The United Kingdom, and the European nations.

A Continental Shelf Convention was also

approved in 1958, which gave to the coastal states substantial authority and jurisdiction over sea bed resources. This convention was considered to be a "customary law" of the sea, but it didn't accurately define the outer edge of coastal state jurisdiction. It didn't foresee that technology was going to extend man's capability of exploiting the resources beyond very shallow depths as quickly as it did, and so it called for coastal state authority out to 200 meters or to the point of exploitability. Now, of course, exploration occurs very deep in the ocean. So, both in the Territorial Seas Convention and in the Continental Shelf Convention very important issues were left unsettled.

There was also a High Seas Convention that reiterated the concepts of "freedom of the seas" and the "right of nations" to operate freely beyond areas of national jurisdiction. This convention essentially ratified the "rights" of maritime nations which had already been in practice.

The Fisheries Convention could not reach an agreement on the extent of coastal state jurisdiction over the fisheries, but there was no clear definition of coastal state authority and it left the coastal nations very unhappy.

None of these conventions were ever widely ratified. Some of the major nations -- in fact the two largest fishing nations in the world -- did not ratify the 1958 Fisheries Convention. The same is true of the other conventions, and so in terms of their purpose they were ineffective. It was not surprising, then, to see the maritime nations look to the time when they could define the breadth of the territorial sea or to see the coastal states look to the time when they could protect themselves from shipboard pollution. The coastal states were seeking increasing numbers of foreign fleets off their coasts and felt that the time had come for them to have more control over the activities of fishermen.

This led to the development of talks in the mid 1960's by the United States, Canada, and the Soviet Union about the desirability of a Law of the Sea Conference and about other major issues of common concern. I participated in those talks; they centered on fishing rights, the extent of national jurisdiction over the sea bed, and navigation rights.

It was Ambassador Arvid Pardo who spoke

before the General Assembly of the United Nations in 1967 about the potentially great wealth of the ocean, particularly the sea bed. Pardo spoke eloquently about the ocean and its resources being the common heritage of all mankind. After this a resolution was passed by the General Assembly setting up a Sea Bed Committee in 1968. The Sea Bed Committee operated until 1973 and attempted to develop a draft and to discuss the 60 or 70 major items on its agenda. This period from 1968-1973 was mainly a period of discussion; not much else really happened. One of the outcomes of these discussions was the formation by the less developed countries of an informal group of 77. (Today it has 110 members out of the 150 nations represented at the conference.) The developing countries had developed in other United Nations forums the idea of a new international economic order and were eager to apply this to a new regime in the ocean.

The period from 1973 to 1975 I would call a period of negotiation. The tendency was for nations to negotiate among their ideological and geographical groups but there was some intergroup negotiation as well. Tentative agreement was reached on a number of issues: the right to navigate through international straits, fishing rights, and the 200-mile boundary of economic zones. Pollution had never been a major issue of the conference primarily because the developing nations were not concerned about pollution problems.

The conference so far has failed in some very important areas. For example, there is agreement on the 200-mile extended jurisdiction, but the question of the type of jurisdiction (territorial seas or high seas) and its administration has still not been settled.

Another issue of great importance is the rights of the landlocked and geographically disadvantaged states. Some states in the Mediterranean and the North Sea don't have a full economic zone, others have very little continental shelf, and some of the African and European states are landlocked. These nations want some rights to the sea; not only to the living resources but also to the oil resources. These states will have to be accommodated in reaching a final agreement because together they have veto power over the convention.

The issue that is most critical is the sea bed issue; the rights of access to the deep

sea bed. Here is the question of the heritage of mankind: are the revenues from the resources of the deep sea bed beyond these areas of national jurisdiction going to come largely to the developing nations who will not get revenues from the continental shelf? For the most part, the rich nations are also the nations with the continental shelves. Giving the resources of the shelf and the water column out to 200 miles to the coastal states is tantamount to giving them the known resources of the ocean. What this does is give more to the "haves" and take from the "have nots," further widening the gap between them.

One can understand the consternation in the developing world over ownership of the last remaining resource which someone thinks may have value, the manganese nodules. The issue of rights to the manganese nodules and the regime of the deep sea bed has become an ideological issue. The Group of 77 wants to establish an International Sea Bed Resources Authority which would control the exploitation of the deep sea bed by contracting for mining technology and carrying out the mining itself. The mining companies of the developed countries insist on their right under a free enterprise system to benefit from the mining technology they have developed. This sea bed issue is likely to be a difficult one for some time. In the meantime, customary law will prevail, but a great many conflicts will develop between nations over use of the ocean's space and resources.

In the absence of agreement at the Law of the Sea Conference, several nations took action themselves for both political and economic reasons. The United States responded by passing the Fisheries Conservation and Management Act in April of 1976, which established a 200-mile economic resources zone. By far the most important part of this act, from my point of view, was the establishment of a national scheme for conservation and management of the ocean resources for the first time in our history. I consider this law to be the most important fishery law that has ever been passed in the United States, and it will have a greater impact on American fisherman and resource management than any other conservation law dealing with fisheries. Other nations have generally accepted our concept of control.

There are problems arising with the new fisheries law. One is the composition of

the regional councils which tend to have too much special interest group representation and not enough public interest representation. Nevertheless, this law has created the opportunity for the United States to develop a national fishery management plan, with standards that apply in the Gulf of Mexico as well as in the Bering Sea, and to reap great benefits from these resources off our coast.

#### DISCUSSION

Q: You have indicated that you feel strongly about the need for a world ocean facility. Could you comment on what seems likely to happen in the future?

A: I feel that it's necessary to try to continue to reach a broad agreement because the alternatives are disadvantageous to U.S. interests. Things are pretty well set in fisheries, but the security issue is another matter. To the extent that regions of the world, such as the Mediterranean or the Indian Ocean begin to be considered closed regions -- national lakes -- one can see instability developing because of the problems that the U.S. might have with its security policies. Another perspective on this is the transportation of goods and energy resources. The control of efficient transportation routes by coastal countries could greatly increase costs and eventually affect the world economy.

There is also the matter of the polarization of the "haves" and "have nots," and the problems the developing world faces in trying to keep the gap between itself and the developed world from widening. In view of the developed world's rapidly expanding technology and use of the oceans, it is easy to empathize with the developing countries' attempts to modify the rate of development so that they can at least stay even, if not catch up. It looks to me as if for a period in world history there will continue to be an increase in this disparity which will only lead to greater conflict. One sees the time coming when the maintenance of world peace will necessitate a reallocation of resources.

With respect to the Law of the Sea Conference, I see the same stalemate continuing, easing here and there, and an inching ahead by both customary and conventional law.

Q: Isn't it true that customary law has

usually been made by the maritime states?

A: Yes, but now when one says maritime states one isn't necessarily talking about developed nations. A number of the developing nations are maritime states and more are becoming so all the time. So I think that the Law of the Sea will be developing law less favorable to the developed maritime nations as time goes on.

Q: In light of Canadian and United States extended jurisdiction, what institutional arrangements do you see emerging to cover the management of Pacific salmon in the North Pacific?

A: Pacific salmon is what the law calls a trans-boundary stock: that is, a stock that migrates across national boundaries. It can't be managed by the Pacific Council alone nor by the Canadians alone, so I see a new kind of convention arising -- an umbrella convention. A North Pacific convention of Canada and the United States would deal with three kinds of problems: the problems of northern trans-boundary stocks, southern trans-boundary stocks, and the panhandle streams (rivers that originate in Canada and come down through the archipelago into U.S. waters). These fish stocks are all mixed. This type of umbrella convention would have somewhat limited authority at the top and a rather substantial authority in the panels, and would be a mechanism for involving the councils as well as the national governments to deal with these problems in a rational way.

Q: Is anything being done to reduce or control pollution?

A: There are some efforts, but I don't think they are adequate. There is an International Dumping Convention by which parties to that convention agree not to dump harmful wastes deliberately into the water. The difficulty is that the controls are coming too slowly in terms of both shipboard pollution and coastal zone pollution. Most of the pollution comes from land. Some of it is airborne from land, and some of it runs into the ocean from the waterways. At present we don't have any international way of controlling it and few nations -- including our own -- have and are enforcing adequate national regulations to control pollution. The United Nations has set up an environmental program (UNEP) and is talking about

a worldwide monitoring program as well, so it has got a start. But I think we are moving backwards faster than we are moving ahead.

Q: What about the attitude of many developing nations that pollution is a sign of industrialization and they don't really want to do anything to slow that down?

A: I suppose if their economy developed to the point where the cost of pollution was affecting their benefits they would probably be willing to spend some money to overcome pollution. Their attitude now is: "If you want to control pollution in our waters then you pay for it. Don't expect us to reduce our income by using our revenues to pay for the costly processes of pollution abatement unless there is enough pollution for us to see that there is an adverse affect." My experience in talking to developing countries is that they are not very interested in reducing pollution. They would much rather have the development.

Q: Wasn't one of the purposes of the Fisheries Conservation and Management Act to reduce the amount of fish caught off our coasts by foreign fishermen?

A: Yes, there is a reduction in foreign catch off our coast. There has been about a 50 percent reduction in the number of foreign vessels, which tells me that to some extent the nations are reducing the number of inefficient vessels because there is now a cost in terms of license fees and other costs. We have gradually been getting control. Before the passage of the Fisheries Conservation and Management Act, foreign catches were probably not reported accurately. But now we can board these vessels for inspection and they are subject to fines and imprisonment for violations. This is an incentive for them to keep accurate records, probably for the first time, so actually the real reduction in catch is probably greater than the records would show.

The bulk of the foreign catch are fish that we do not harvest. For instance the largest foreign fishery in the world is the Alaskan pollack fishery in the Bering Sea. Americans don't harvest any pollack. The hake fishery is another big foreign fishery. Hake is a low quality fish that doesn't keep well under our

methods of keeping them in the hold for a day or two before they're brought into shore for processing. Foreign vessels bring them aboard, machine fillet them, and freeze them within an hour after the fish are caught.

If we are wise enough to transfer capital in the right direction with appropriate use of human resources, perhaps the reallocation of resources can be accomplished effectively without the riots and conflict that appear inevitable otherwise.

Q: Would you comment on the type of jurisdiction over mining in the deep sea bed that is likely to be implemented?

□

A: There are two kinds of legislation being considered. One type would specifically "give" the site to the entrepreneur, so that if he invested in it and developed the site he could depend on receiving the returns from it. The other type of legislation would not be site-specific and would not give ultimate rights to the entrepreneur. Obviously, the entrepreneurs are in favor of the former and opposed to the latter. Both types of legislation would provide some insurance against losses caused by international action. If a Law of the Sea Conference Agreement were signed and ratified and the mining sites put under control of a sea bed authority controlled by the developing nations, a company would be indemnified for any loss caused by new restrictions on its mining permit. If the company lost money because it wasn't a good investment, that would be another matter. The point of this type of legislation is that is something the United States does costs the company money after they have invested in good faith, then guaranteed insurance by the U.S. government would indemnify the loss. Developing a mining site requires substantial investment. The nodules are harvested by suction dredging; the material is then transferred to carrier vessels, brought to shore, crushed, and then the minerals are recovered by electrolytic and chemical processing.

The problem with this legislation when it was first introduced was that it didn't distinguish U.S. capital in multinational mining corporations from the total investment. That has apparently been straightened out satisfactorily. Many people -- myself included -- see the multinational corporation as a joint venture which is still in its infancy in terms of ocean industries. I see this type of venture as an important way to transfer technology and to resolve in part some of the problems between the "haves" and "have nots." I believe that private industry and private capital can do a great deal toward bringing the developing countries into their share of the wealth.

## **I-B International Law and Conflict Over the Use of the World's Oceans**

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### INTRODUCTION

I won't try to give you an international law course in one hour, but I will try to go over some basic tenets of international law as they relate to the ocean. One of the initial questions is whether there is such a thing as international law. You could spend many sessions if you wanted to argue the legalistic points of view on that question.

### ORIGINS OF INTERNATIONAL LAW OF THE SEA

I would say historically that what occurred is that men have been trading, sailing fleets, and protecting their commerce. They have tried to resolve the conflicts which inevitably arose concerning this commerce on the oceans by arriving at some mutually acceptable agreements. There are various methods of resolving conflicts. One of these is war, and that has occurred; indeed, if you study history you can see all sorts of examples.

With respect to the development of international law and the sea, a number of things have occurred. First, certain customs or procedures have evolved. These are general practices that came into being and that were agreed to or observed and carried out by most trading "countries." Initially it may have been among the city-states. Since their inception, it has been carried out by most of the nation-states. These actions by nation-states came to be accepted and considered customary international law.

A famous case illustrating this source of international law is the Scotia case. Here was a situation where two vessels had collided at sea and the court was trying to establish responsibility. One was a British vessel and one was an American vessel. The problem was that the American vessel had been sailing with only a white light. It did not carry the green and red lights customarily shone by such vessels. This was contrary not only to national law, since the Congress of the United States had legislated on this matter, but the court held that it was "... contrary to customary international law." By that time, during the 19th century, most nations had accepted the concept that you had specific lights to identify ships in a certain way -- it was customary international law.

Another source of international law came about when nation-states concluded agreements with each other. Usually this took the form of what we call bilateral treaties (between two countries) and was most often between major shipping or trading nations. Most of these began as trading agreements, though for this class I am not going to even discuss such questions as transference of monies, bills of lading, tariffs, quotas, countervailing duties, dumping and things of that sort. These are matters that make up treaties and are part of international law, but for the most part they do not concern us immediately except to mention that such treaties or conventions are another source of international law. Many of these did become multinational in that many nation-states became parties to them.

One illustration of a case involving treaty or "conventional" law was the famous Lotus case, in which the court referred to the Convention of Lausanne of July 24, 1923. The Turkish ship, Boz Kourt, and the French ship, Lotus, had collided at sea with some loss of life. Since there had been a previous agreement between France and Turkey at Lausanne as to which country would have jurisdiction in certain cases, the court settled the case, avoiding violent action by either nation. In its decision it referred to the Lausanne convention. Thus, convention is another source of international law.

Then you have what is referred to as "judicial decisions of international tribunals" as another source of international law. This began to develop towards the end of the 19th century when there was an impetus to set up some international courts or tribunals and to get learned

judges that would hear cases or problems between countries. The Hague in the Netherlands was one of the places that this was centered, although there were and are some regional courts set up in other places. One of the most prominent was the Permanent Court of International Justice. Your last week's speaker, Prof. Donald McKernan, mentioned various regional organizations. In some instances these may have or may develop a regular court system where judges hear cases between members, thus creating another forum for international disputes.

I might mention that nations tend to think in terms of sovereignty. As Prof. Condon says, nations look on their ships as being extensions of their own lands or shores and the concept of control over them is so vital that they tend to guard it jealously. Thus when nations agree that they will go to some third body to judicially resolve some issues, they give up some of their rights or control. This seems always an issue in international law: what are you going to give up and what do you get in return?

Q: When a nation-state passes a law they have a means of enforcing that law. What is the force behind international law?

A: That's a good question. Short of war, how do they decide how to do such things? Certainly it is a question that has never been resolved in the sense that nations may or may not agree to a judicial decision. In most cases it is voluntary. So in order to bring a case to the Hague, for instance, the parties would have to agree to abide by the decision on certain types of issues. Previously they might have agreed to allow the courts to decide certain kinds of things. For instance in the matter of collisions at sea, or conflicts over fishing rights, or neutrality during war and so forth. One that they all seemed to agree on was the outlawing of piracy. That doesn't mean that all nations abided by the agreement, but they all agreed that it was to be outlawed. Then they would turn around and commission privateers to go out and prey on the enemy's commerce. As you may recall in the Revolutionary War and in the War of 1812, we did not have enough war vessels so we commissioned privateers. That is an interesting commentary on international law.

It is one of those concepts in international law that is difficult to grasp. We are used to a law where we have enforcement. You incarcerate someone, or fine them, or do whatever it is to penalize them; but in



international law we just don't have an enforcement agency. There is no police force, so to speak. Even under the United Nations you have got only a theoretical police force. It is usually only a moral force or maybe world public opinion that is brought to bear.

Q: Wouldn't the power or force be the economic advantage for cooperating?

A: Well, in many instances you have to go right back and raise the basic question, "Is it in the interests of the nation-states to set up some peaceful methods of settling their disputes?" If it is in their interest, they will agree to it. If it is not in their interest, they will find some justification for not doing so. This is reality, whether you think it is legal or not. When I used to teach international law one of the persistent questions raised by the students was, "What is the *stare decisis*, or previous decision?" In this country we are used to the English concept of law which often refers to previous decisions on which to base a court decision. I would often respond by asking them to look at decisions. It may refer to previous decisions or it may just not consider them important in a certain case because of social or economic or moral issues. So you see that even at the national level we don't always look to *stare decisis*, though we think our court system embodies this concept.

In a sense these international judicial bodies, these judges, are looking to the previous intentions or decisions, looking to accepted customs, and looking to generally accepted principles of international law as they decide cases. Prof. Herbert Briggs has this to say about the subject: "International law, as well as domestic law, may not contain and generally does not contain express rules decisive of particular cases, but the function of jurisprudence is to resolve the conflict of opposing rights and interests by applying in default of any specific provision of law, the corollaries of general principles and so to find exactly as in mathematical sciences the solution of the problem. This is the method of jurisprudence. It is the method by which law has been gradually evolved in every country resulting in the definition of the settlement of

legal relations as well as between states as between private individuals."<sup>1/</sup>

This process takes a long period of time. A decision of a judge may set a precedent or it may not depending on the situation or principles involved in the case. So you can see that this is an area that is somewhat nebulous, when we speak of the "general principles" of law as a source of international law. It is sometimes difficult to get agreement on these principles among nations. Closely related to this source is that of the doctrine of recognized authorities. When we look back at some of the recognized authorities of the past, i.e. the great writers such as Hugo Grotius or Herschel Lauterpacht, we probably don't have too much trouble. When we get to more recent authorities then we get into problems since they differ in their opinions, so we tend to go back in order to be relatively safe. But, whether the doctrines that authorities all agreed upon 100 to 200 years ago or even 50 years ago may apply to present day problems is a serious question, so this source becomes less viable. Some authorities refer to another source of international law or you may look on it as a variation; this is the concept of "equity" or what is "fair" or "just" under the circumstances of a case. Sometimes you will find a tribunal making decisions on such a basis.

#### AREAS OF CONTINUING CONFLICT

*Issues of Trade and Economics:* Let us look broadly at some of the treaties or conventions between nations. Most of them were related to trade and in that respect usually had articles concerning financial aspects. Even today trade questions and tariff questions and tariff questions are some of the key factors in our treaties and agreements and cause some of the most bitter disputes in the negotiations. Economic factors are often a cause of disagreement among nations. How high or what kind of taxes will be levied on goods is a serious question. You know what a tariff is, I presume. It is a

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<sup>1/</sup> Briggs, Herbert W., Law of Nations: Cases, Documents and Notes, 2nd ed. (Appleton, 1972).

a custom duty or tax levied on goods. Another factor is a quota or limit on the goods, i.e. whether you will allow some other country's goods to come in. These are key factors in trade and thus in treaties. There may also be such matters as docking privileges, privileges to purchase supplies and other matters pertaining to the vessels or crews themselves. In early days they were much concerned about the treatment of sailors who were shipwrecked. A related subject is the vessel in distress, which has come to be allowed into territorial waters under international law even though the vessel may be a warship.

*Freedom of the Seas:* Another basic concept that is accepted at the present, but which was not in early times is the one mentioned by Prof. Condon, which is "freedom of the seas." It was espoused by many nations historically, but there were those who preferred to think in terms of control for themselves. For instance, Spain and Portugal were quite content with the Papal Bulls of 1493 and 1506, which essentially divided the world's oceans between the two countries. Interestingly, it was strongly espoused by Hugo Grotius in 1609, so you can see that it took some time to be accepted. Yet in reality it is a concept that has some limitations even today and may be changing with respect to these limitations in the future. In general, freedom of the seas means the right to navigate the seas and to ply trade between countries. It also means the right to fish in these seas. Over the years nations have agreed that any country can lay submarine cable under the high seas. In more recent times we have now extended this concept to the matter of flying over the high seas. With the technological development of the airplane the seas have in effect been extended upwards. We now think of this area of free navigation as extending 30 miles upward over the seas in those parts that are considered the "high seas." When nations talk about extending their territorial seas this may raise an interesting question whether that extension of jurisdiction and restriction of freedom of the seas includes the air above those seas or not.

*Right of Innocent Passage:* Some other basic concepts that are held under international law that effect the use of the oceans is the "right of innocent passage," meaning that vessels can travel peacefully through territorial waters, i.e. waters adjacent to and claimed under the control

of some nation. This means that a ship may traverse the high seas and then come into and pass through the territorial water of some country, but it is subject to certain laws and regulations governing those waters that may be related to navigation or even security. This is one concept that has been developed and held for some time.

*Extraterritoriality:* A concept mentioned by Dr. Condon is "extraterritoriality" by the flag and the vessel. The vessel is considered as an extension of a country's territory. This brings up a number of matters under international law and I will mention a few. One aspect of extraterritoriality is that the authorities in charge of a vessel have certain civil and criminal jurisdiction over persons aboard -- the captain has control, even in the territorial waters of other countries. Sometimes you may get questions of conflicting jurisdiction, but unless there is a violent crime, usually the flag of the vessel will indicate the authority; you might say control follows the flag.

Then there are questions of legal jurisdiction involving collision of ships at sea. These matters are primarily decided nowadays by conventions among nations. Sometimes in the past it was under the jurisdiction of the closest port. Another question involving the "flag" is the matter of political asylum. Ordinarily this is prohibited for merchant vessels; they can't effect political asylum by taking someone aboard from another country. War vessels may do so. An interesting case that showed the problems of concurrent jurisdiction was The Crown vs. Anderson. In this case, a citizen from country A was aboard a vessel flying the flag of country B and plying the territorial waters of country C: Anderson, an American seaman, was aboard a British ship sailing in French waters. Anderson had murdered a fellow seaman and the question was which country had jurisdiction. The French authorities made a claim of jurisdiction based on territorial waters, but the British captain sailed his vessel into a British port and France did not then press the claim. In the British court, Anderson made the assertion that since he was an American he must be tried in an American court. The court rejected that plea, and tried him, and subsequently sentenced him to jail for his crime using the concept that jurisdiction follows the flag.

Q: You mentioned the concept of freedom of the seas. I ran across an article pointing out the new competition of the seas and I wonder if in your opinion these extended 200-mile jurisdictions are turning away from the traditional concept of freedom of the sea?

A: Well, that is one of the questions that have to be resolved and I really don't have any simple answer now. We have been talking primarily about trade and trade routes and the problems involved in international law related to such things, but I think that the 200-mile limit issue is related to the economic issues of the resources within and under the seas. What is under the sea and what sea life is within the sea within those arbitrary limits? If national utilization of those resources becomes extensive enough and important enough, then it might well interfere with the concept of freedom of the seas. Historically, you remember, there were nations that tried to control the seas: Spain, Portugal and Britain. Basically the United States Congress does not seem concerned with the concept of freedom of the seas within the 200-mile limit because it wishes to control the oceans within that limit. I believe that the major powers of Russia, Britain and the United States want freedom of the seas, but with some restrictions. So how we resolve these issues -- our strategic and economic concerns -- is very important.

*Piracy:* On another subject, I mentioned previously that all nations agreed under international law that when caught, pirates should be tried in appropriate courts. Whereas in the past piracy was primarily for economic gain, in recent times acts considered piracy are increasingly motivated by extreme hatred, or revenge and retaliation for some action by a state or faction within a state. This is an interesting new twist to the concept of piracy. A similar area of agreement among nations is found on the question of "slavery." After the British took the lead in prohibiting the slave trade, they were soon successful in getting all nations to prohibit the transportation of slaves and in nearly all of the conventions there is a clause allowing the stoppage and search of suspected "slavers."

*Servitude:* "Servitude," is the rights of using or passing through some seaway or

canal that belongs to another country. Countries may grant these things under some pressure or they may be voluntary, but they are usually part of a treaty or convention. For instance, under the U.S. Panama Treaty the United States included the concept of servitude in granting to all ships the right to use the Panama Canal. The U.S. actually controls the canal but allows all ships to pass through it. The Suez Canal operates under the same concept. Another interesting example is close to home: if the British and later Canadians had not allowed American ships to use the St. Lawrence Seaway our ocean-going ships would not have access to the Great Lakes. When the Brazilians opened the Amazon River they granted servitude to ships of other countries. An interesting variation was the convention governing the Black Sea passage wherein the British primarily forced the restriction of passage of war vessels on the Russians. This points up something that you should be aware of in international law: such law relates directly to the power relationships among nations. To ignore this is to not be realistic about international relations or international law. You might have an agreement among a number of small nations concerning some matter of international law, but unless you got agreement from the major maritime powers such as the U.S., Britain, Japan, France, Germany, etc., the agreement would not be "effective international law." That is a concept to keep in mind.

*Public Vessels or Warships:* A rather new area of international law concerns state-owned vessels which are engaged in trade. Intentionally, state-owned vessels were warships. Not being engaged in trade they were not subject to the applicable rules of international law. Since WWI there emerged countries whose form of government provides for only state-owned vessels. After a series of court cases and disputes it has fairly well been accepted that if a vessel is used exclusively for trade, even though state-owned it is subject to the rules of international law.

Basically, public vessels have immunity from many things on the high seas, as you can well imagine, although they are still subject to certain restrictions as well. However, on the high seas they may stop merchant vessels to search for pirates or slaves, and in one other instance they have special authority: they can stop a merchant vessel of their own flag or any other if

they suspect that a vessel is trying to use another flag disguised as their own. This is accepted international law.

*Territorial Waters:* We have been talking about the high seas and basic concepts of control and freedom. I should mention that a recent development is the concept of a zone contiguous to a nation's land mass. This is a very recent development, and I would say it is not yet accepted international law. It involves a territory beyond the fairly well accepted distance of three miles (or the distance that a cannon ball could strike and thus control that area). In recent times there has been a move on the part of some nations to extend that limit to twelve miles. This raises some interesting questions if we look to technological development and defense. Should we now extend our territorial waters 3000 or 5000 miles, since we now can fire ballistic missiles that distance and thus control that area? This question of the concept of territorial waters and contiguous waters is one that is fraught with much potential conflict between nations. Internal waters such as bays and inlets are pretty well clarified under international law, but these other zones are still not clarified because of recent moves by various nations.

As long as we are talking about military matters, I should mention another concept that is accepted in international law. That is the matter of the rights of a nation's public vessels to engage in "hot pursuit." Such an instance arises when a nation, trying to enforce its laws within its territorial waters pursues a violator with war vessels on the high seas to make the arrest. There are specific rules: the war vessel must have made voice contact on sight of the violation and then must be in the act of continuous pursuit before making the arrest. Where would you think this might have been particularly useful? Answer: *During prohibition.* Right! During the days of prohibition there were so-called rum-runners that would wait three miles off shore for the opportunity to come in and unload their wares. If they could not be pursued beyond the three mile limit, chances of capturing them were restricted.

Q: What are the penalties for piracy?

A: The usual penalty is death. Yes, it

is an extreme penalty. Even today it can often be that. You have to go through a trial now, but then it doesn't have to be too long.

Q: What is piracy?

A: I knew you might ask that so let me read you a definition given by Jacobini: "Piracy in more modern comprehensive terms is the act of doing or attempting to do an unauthorized act of violence by persons aboard one private ship or aircraft to persons or property aboard another ship or aircraft or to the ship or to the aircraft itself on the high seas or in the air with the intent of depredation. Piracy also includes successful mutiny."<sup>1/</sup> As you may recall from the story of *Mutiny on the Bounty*, those people were considered pirates.

Q: Can a ship captain revolt against his government? Is that piracy?

A: No, that is usually defined as insurrection and that would be in a whole other area of international law, concerning the questions of recognition of insurrection, rights and responsibilities towards insurrectionists and so forth.

*Issues of Warfare:* I hope you have some feel for how these things develop in international law. We ought to touch on the matters related to war because nation-states did get into conflict situations and go to war. This brought up the question of neutrality and neutral rights for nations not involved. What rights and obligations did they have? Again it goes back to commerce on the high seas.

*Historical Agreements:* One of the first modern declarations was that of the 1856 Paris Declaration which came out of the Crimean War. This declaration abolished privateering. A neutral flag was to cover the enemy's goods, with the exception of "contraband." For instance, if you had Russian goods on an American ship you could pass through the British blockade

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<sup>1/</sup> Jacobini, H.B., International Law (Dorsey, 1962).

without confiscation, provided the goods were not of a type considered contraband. Also, neutral goods, with the exception of contraband, were not liable to capture under the enemy's flag. Thus if there were American goods on a Russian ship captured by the British, they could not confiscate them unless they were contraband. Another part of the Declaration of Paris dealt with blockades. They must be sufficiently maintained and effective in order to be binding by international law. The United States took exception to the question of blockades, but shortly we were involved in a civil war of our own and were happy that we had not protested too much. The U.S. government decided these were sound principles and basically supported them from there on. We had essentially reversed ourselves in a matter of less than six years.

The Hague Conference of 1907 tried to set up international prize court. This was followed by the Declaration of London in 1909, which tried to set up rules basically for "non-belligerents or neutrals." It spelled out definitions of blockades in time of war, what was to be defined as contraband, the destination of neutral prizes, the transfer of neutral flags, the character of "enemy," a convoy, etc. By this convention there were three kinds of contraband. The first was "absolute contraband." Theoretically this is anything that could be used immediately for war purposes. Next was "conditional contraband," made up of items that might or might not be considered directly useful in warfare. Then there was "occasional contraband" made up of items that might rarely be useful in war. There were lists of items that fit into these various categories. In modern day warfare, where we have the concept of total war, the whole question of contraband has literally been thrown out the window. It doesn't fit anymore.

Q: I'm still confused. You say that for instance an American ship was carrying contraband to England: then would the Germans have a right to sink it?

A: Technically, no. They could capture it because it was carrying contraband. That was one of the key questions involving submarine warfare in WWI. The Germans took that position in the sinking of the Lusitania; even though it was a passenger vessel they said it carried munitions of war. The British said the items were not

direct war items. If it were proven that there was contraband aboard then the Germans might have been within the legal definitions of the London Convention on that score. They really did not know at the time. In times of war international law does not seem to matter too much. This is one of the things that you must recognize.

*Submarines:* This discussion naturally leads to the question of the submarine and its use in warfare. It is a technological development and technology has made and will continue to make changes in international law, not only in times of war but in other ways. For instance, the modern fishing fleet's cruising ability, the huge oil tanker's docking problems and potential pollution problems, and vessels that can mine the ocean bottoms. All raise issues that international law could settle. We have been talking mainly about trading routes, but technology, particularly the submarine, has changed that, too. In the past, it was acceptable to attack enemy warships but enemy merchant vessels were subject only to capture - or if you sank them you had to warn them and allow the crew to get off, and so forth. When a vessel was put into use that itself was subject to sinking, ramming or even shelling from an armed merchant vessel, it created a new situation. The rules of international law were just not technically in line, or should we say that technology was not in line with international law? Anyway, the Germans in particular began to sink enemy merchant ships. Von Glahn has this to say of the matter: "The submarine could abide by the traditional rules governing the encounters with enemy merchant men, including visit and search, as long as those vessels were not armed and had not been instructed to ram submarines on sight and as long as extended flights from shore or from carriers were not practicable. As soon as any of these three factors made its appearance, the submarine had to abandon adherence to customary procedures. Lauterpacht was legally correct when he asserted that the novelty of the weapons does not by itself carry within it the legitimate claim to change in the existing rules of war. But he became naive from the practical point of view when, after admitting that international law must adapt itself to the changes required by the appearance of new weapons, he outlined how the rules might be changed to accommodate the peculiar problems connected with submarines. To propose seriously then that in exchange for the abandonment of the arming

of merchant vessels, submarines should be prohibited by treaty either from striking merchant vessels altogether or from sinking them anywhere except in certain areas close to shore was totally unrealistic. History has shown that almost every new weapon -- the battle elephant, Greek fire, longbow, crossbow, siege gun, rifle, balloon, airplane, dirigible, submarine, and now nuclear weapons and ballistic missiles -- has been initially greeted with outraged denunciation. If, however, the weapon proved effective and its users were able to defend themselves successfully against retaliatory use of the weapon in question, the use of the weapon would be regarded sooner or later as lawful.<sup>1/</sup> This is an international law that it adjusts itself to the new circumstances created by technology.

*Other Issues:* Mines are another technical problem for international law. I don't have any figures from WWII on the losses from mines, but it was considerable. The development of contact mines and then the electrically detonating and other types of mines increased the problems for commerce, and in effect for any formulation of international law on the subject.

Another area related to technology and international law which is of real concern to our own institution, Oregon State University, is the question of freedom to undertake and carry out scientific research under international agreement. This is an area that has traditionally been immune from interference by any nation under international law. Now it is being subjected to pressure from some nations who wish to control all scientific research within their territorial waters.

Hospital ships were supposedly immune from any attack by the enemy under international law and there was also a customary international law which allowed fishing vessels and small boats to be immune from capture or attack. There may have been a few problems in WWI, but what you had in WWII was the use of such small vessels by the Japanese in their commerce to an extent that the allied nations began "violating

international law' because they felt it was in their war interests to do so.

*Neutrality and Nonbelligerency:* Neutrality may be a difficult concept to understand, but it has long been recognized under international law that any state has the right to remain aloof from the conflict and thus be neutral. There is a difference between neutrality and nonbelligerency, although it is rather technical. If you are neutral you take no sides in a conflict. In nonbelligerency, although you may not openly take a position nor enter actively into the conflict, you do in fact support one side. Just so you won't think that I am picking these things out of my head let me mention that in 1939, the United States government passed certain neutrality legislation and it repealed certain laws embargoing the sale of weapons. It was not particularly interested in supplying these weapons to Germany, but rather supplying them through Canada, or directly, to Great Britain and France. In 1940, the President by proclamation exchanged some 50 aged destroyers in return for 99-year leases on some British bases in the Caribbean. We were still somewhat neutral in a technical sense, but more realistically we were a non-belligerent because we were supporting the Allied side. The subsequent lend-lease legislation of 1941, in which we agreed to lend or lease certain items to the Allies, is an additional piece of evidence of our non-belligerency rather than strict neutrality.

To some degree during the 1970's, nation-states have been bound under international law to honor neutrality and neutral rights. Under neutral rights you have the inviolability of territorial waters; that is, belligerents cannot invade those waters. A neutral country cannot discriminate between them; it has the right to bar all belligerent ships from its ports, or it may let all belligerents enter. This is interesting, for to discriminate would in effect violate the concept of neutrality. If it should decide to let all belligerents into its ports, that includes warships. There are some interesting technicalities involved in the question of allowing warships into a neutral port. There is traditionally a 24-hour time lag between the time one belligerent warship may depart the port and the time that an opposing warship may depart. The theory is to allow them time to get outside the territorial waters before they could fight each other. Neutral countries

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<sup>1/</sup> Von Glahn, Oerhard, Law Among Nations (Macmillan, 1965).

may limit the number of warships in port, for instance, some countries have said they don't want more than two at any one time. Another right of neutrals is to control the extent of repairs to warships entering their ports. They traditionally allow this, but the extent is limited and they must make the limit clear. Again, they cannot discriminate between belligerents. One of the most celebrated cases occurred during WWII with respect to the battleship *Graf Spee* which was severely damaged in battle with some British heavy cruisers and put into Montevideo Harbor while the British ships cruised outside the territorial waters. The captain was given 72 hours to make it seaworthy -- that was the standard rule. You are not allowed to make major war repairs in a neutral port. If Uruguay had allowed that it would have violated its neutrality and the British would have been justified in entering the territorial waters instead of waiting outside the boundary for the 72 hours. So the German captain transferred all but a skeleton crew to another German vessel in port, the *Tacoma*, I believe, and then took his ship out into the territorial waters with the skeleton crew, scuttled it, and committed suicide. He knew that it was not in good enough repair to fight and survive.

Also, it should be noted that anyone has the right to reprovision and refuel in a neutral port. But, here again it is a matter of how much reprovisioning and refueling: totally, or what used to be called "bunker full," or just enough for a ship to make one of its own national ports.

There is a related question -- can a country still be neutral and yet supply belligerent warships through use of another country's ships. It is difficult sometimes to determine the destination of goods, as well as the true nationality of the ship. As you have learned earlier tonight, many ships may fly the Liberian flag, but may be owned by, say, Japanese. So if such a ship had a contraband cargo bound for China, who might be at war with Russia, it might be difficult to detect and prove that the country supplying the goods was not neutral. Most of the courts have shied away from dealing with this kind of question. Theoretically, a neutral should not be shipping contraband goods to either side, but that is difficult to enforce in fact. Another principle involving neutrality is that under international law ships are not allowed to change registry in order to avoid being part of a belligerent nation's shipping fleet. To put it another way, a ship which

really belongs to a belligerent may not change its registry to gain neutrality. With so many vessels flying the Swiss and Liberian flags this may raise some questions in the future.

*Continuous Voyage:* The question that we have just been speaking of leads quite naturally into another concept in international law known as the doctrine of "continuous voyage." This concerns the right of belligerents to stop and search vessels for contraband. It really grew as a reaction to a procedure that was used by weaker naval powers to get needed war supplies even though they were blockaded. For instance, the French commissioned American or Dutch or other neutral ships to carry goods through the British blockade. The British then championed the concept of "continuous voyage." They said that they could prove that a neutral vessel was picking up contraband goods from a belligerent territory and transporting it eventually to a belligerent country, they could confiscate those goods. Even though the origin of the vessel might be a neutral port and it might be a neutral vessel, it was indeed bringing contraband goods to the enemy, they said.

#### *International Courts:*

Q: Where would the kind of issue that you are speaking about now be resolved?

A: Usually they would be heard either at the International Court of Justice or an arbitration court of a regional nature, or a special arbitration court set up to deal with such issues and agreed to by the nations involved. The U.S. would probably send most issues to the International Court of Justice. Also, we have had standing arbitration courts with the Canadians for a long time. Over a long period of time nations develop the pattern of going to court with certain types of disputes in order to avoid conflict. This is what we are talking about today -- trying to develop agreements or treaties among nations to settle differences peaceably concerning the use of the world's oceans. These concepts of international law and the various treaties have developed historically out of trade and commerce, fishing rights, problems of neutrality and war, etc. You know that in the past there has been conflict among nations for power and control of these things and this has often led to war. More recently we have been talking about rights to resources in the ocean -- and maybe even the matter of survival itself.

These are questions that haven't been raised before, or at least not to this degree. Technology now has capabilities that give a whole new dimension to the situation, and this is disturbing to people. We don't know quite how to cope with it.

Q: What aspect does the United Nations play in all of this?

A: The International Court of Justice is part of the United Nations. The countries that are members of the United Nations, and there are over 140, would ordinarily agree to have certain kinds of issues settled in the International Court of Justice. The question really goes back to the matter of national sovereignty. If a nation does not want a matter to be decided by the court it will say that it is not a juridical dispute, i.e., it is not a legal question, rather it is a political matter. It will say, we are not going to allow this matter to go to the courts for a decision. Then you are into the game of power politics.

*Issues of the Use of Ocean Resources:* What we are talking about in questions relating to the use of the world's oceans is very, very important. I have only touched on aspects of international law that relate to trade, commerce, war and some other things. There are many more aspects of international law. When you deal with the use of the world's oceans you are dealing with the use of 70 percent of the world's surface, trade among nations, food sources, mineral sources and relations among people. These are very important issues in today's world. In fact, I do not know of any area that is more important. We recognize that our resources are limited and here is another potential source of the minerals and food which are basic to mankind. The United States is one of the great trading nations of the world and we make great use of the oceans. Others do as well. What we are trying to do is come to some agreements among nations concerning these new and continued uses of oceans.

Dr. Johnson and I were discussing the multinational corporation in the use of the oceans and trade, a matter I haven't even touched on this evening. Does the multinational corporation go beyond the nation-state? Is its very existence supernational as some people allege, and therefore do we have to devise new techniques for grappling with this entity? A corporation which can shift capital easily from one country to

another or shift the utilization of labor from one country to another, is something quite powerful. On the other hand, the exploration of the ocean floor for mineral resources will take large amounts of capital, probably somewhere between 250 million and 250 billion dollars; we don't know exactly. Anyway, it is going to take a pretty good size organization -- quite probably a multinational corporation. So there you are!

Q: One topic that you have not talked about is off-shore petroleum.

A: We have been talking about the oceans and international law primarily in terms of trade. Now that you mention it, this brings up the issue of who owns the oceans. It has been held that the high seas were not owned by anyone, as I mentioned earlier. As far as petroleum deposits there, those areas have been considered too deep for use, although we must recognize that technology may catch up with us. Then you have the continental shelves; how far they extend is still a question. I am not an oceanographer but I understand that different countries have set certain depths as determining the extent of their continental shelf. The Truman doctrine of 1945 set 200 meters, I believe, as the depth of our continental shelf. That happens to fit our geological pattern. If it were universally accepted it might not benefit some countries, as the "ledges" of some countries drop right off -- they would not have much of a shelf at 200 meters.

Petroleum is a mineral resource that is out there under that continental shelf and new technology is raising the issue of who owns it and who can have access to it. This is another force at play, one that is calling for the restriction of the high seas and an extension of the so-called contiguous zone.

This also brings up fishing rights as well. The importance of sea life is one of the issues that caused the United States to unilaterally extend its jurisdiction to 200 miles. It's interesting how we have reversed ourselves. In 1945, President Truman stated that the oceans belonged to humanity, and in thirty years we have gone 180 degrees the other way. We now say that we own 200 miles for fishing rights or sea life, and we want to extend it for mineral rights as well. From the point of view of international law, technically we have not established a principle since it was a unilateral declar-



ation. However, you cannot ignore the power relationship and again I go back to this point: when the major maritime nations make unilateral declaration these become potential areas of conflict, tremendously dangerous areas. Some people would stress that we must resolve these issues by coming to agreements among nations. As I interpret the reading of the records from the various Law of the Sea Conferences from 1958 to 1974, and the agenda of this coming session, that's what we have been trying to hammer out. That is what these conferences are all about.

There are two other areas of concern related to the question of freedom of the seas. The first is the question of ocean pollution either through river systems or by vessels. In 1954, a convention was held in London concerning these matters. One of the things the convention attempted to do was set up some rules governing pollution by ships and prohibiting it within 50 miles of shore. Unfortunately these rules have not been very effective up to this point - this is a problem we have yet to solve. The other area of concern is related to the testing of nuclear weapons in ocean areas. Theoretically, the testing of these weapons was banned by treaty in 1963. Whether this treaty is going to be upheld I don't know. There are a number of countries not signatory to the treaty who are interested in testing and developing nuclear weapons. Some of them have island possessions in the oceans and since they are not signatories to the treaty they would not be prohibited by international law from conducting tests at those sites. We have learned that when you do that kind of testing there is an effect on fishing and on the whole ecology, and depending on the location commerce may be disrupted, and so forth. These are all matters of importance in our world today.

#### *Conflict Resolution:*

Q: There seems to be a trend for unilateral action by nations in regard to the ocean. How do you see this affecting the development of international law?

A: As I have mentioned, in the development of international law it usually takes leadership. In many instances it takes a unilateral act -- perhaps taking an extreme position, getting others to come along, and then modifying your position if necessary to get agreement. This has been the pattern quite often with one or more powerful nations taking the leadership role. I

would say that probably this is what the United States has done, basically. It has taken a leadership role trying to keep the momentum going for resolving problems of the use of the world's oceans through the Law of the Sea negotiations -- trying to get the other powerful maritime nations to participate and to come to agreements. This is quite difficult to do in a democratic society for various reasons. First, the great masses of people probably do not understand the issues since they are partially or totally ignorant of the facts. Then the vested interests see themselves losing something or gaining something, and do not see that in the total picture one party might have to give up something in order to gain overall benefits. That is the pattern of international politics or international treaty negotiation. The democratic country has these problems to contend with while carrying on the negotiations, while a dictatorship can pretty well control its public -- not absolutely, but enough so that it often has an advantage during the negotiations and ratifications of treaties.

All of these negotiations are going to be a matter of give and take, or concessions, if you like. We are going to have to give up some things or make certain concessions; this is going to take leadership. I don't know what these concessions are and I am not advocating anything specific. However, I think we must be guided by certain considerations, and in that regard the questions raised last week are very important. How can we relate the influence and wealth of the developed nations to the interests of the underdeveloped nations? This is crucial. The underdeveloped nations see ocean use as being very important to their futures, as well they might. They are probably looking at the matter quite egocentrically, something most difficult for nations to avoid, especially emerging nations. If you look back in our own history we were fairly belligerent when we emerged. You have to reach a certain level of maturity before you can even look at yourself and reflect that something you did was probably wrong. When you think of it, many of these nations are not even 20 years old yet. Besides that, the leadership in most of these countries has little or no opposition. There is no differing point of view. Practically all of Africa is governed by one-party leadership. There isn't a storehouse of leaders. This causes a real problem in dealing with these nations, and yet they are determined to have a voice in many of these matters. I see it as a hopeful sign that we are tak-

ing certain leadership steps, that the United States, Russia, Japan, Germany and other maritime and military powers of the world are involved. We are going to have to make some concessions to the less developed nations, and some of our people don't like this. But I see no other alternative if we are going to avoid conflict, and after all that is one of the basic, underlying principles of all relations among nations.

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# **PART II:**

## **The Ocean's Resources and Their Uses**



## II-A The Ocean as a Highway

by Ed Condon,  
Extension Oceanographer, School of  
Oceanography, Oregon State University.  
Professor Condon died on November 29,  
1979. Well known by a wide circle of  
marine colleagues, Condon will be sorely  
missed for his many innovations in marine  
advisory education. Ed was tall physi-  
cally and a giant as a human being.  
Among students, faculty and friends he  
cast a long shadow.

If you've been reading the papers recently,  
you have seen the tremendous increase in  
the amount of oil spills caused by ships at  
sea. This is either a result of a lot more  
oil being transported or seamen who are not  
able.

My topic is ocean transportation. What is  
it? What is ocean commerce? One answer  
might be the trade of goods or services  
between nations by means of water. Why do  
it by water? The coefficient of friction  
for moving an object on water is far less  
than the friction coefficient for cargo  
movement on land or air. Ocean transpor-  
tation is the most energy-efficient way to  
move heavy and bulky cargos.

### SOME HISTORY OF OCEAN COMMERCE

Here are some stories of the beginning of  
ocean commerce.

The Phoenicians wore out a thousand camels  
and ten thousand mules before they discover-  
ed they could build rafts and move heavy  
objects from place to place. A single man  
could move 1000 tons if the cargo is afloat.  
Phoenicians started in this area a long,  
long time ago. At the same time, history  
now tells us, the Norwegians were island  
hopping between Iceland and Greenland, and  
Polynesians were starting to make ocean

voyages between islands. Ocean transportation is energy efficient.

At the time the Phoenicians started moving their trade by water, other people observed the trading ships and decided they contained wealth, so they built ships of like size to capture the Phoenician cargo vessels. This was the beginning of piracy.

As a response to piracy, the Phoenicians started putting escort boats in the water to protect the cargo ship at sea. This was an infant navy. The navy's basic purpose was to protect.

The Polynesians were the first to navigate out of sight of land. The Phoenicians and the Vikings stayed in sight of land. In 1976, a Polynesian ship made a trip from Hawaii to Tahiti in about a month's time, using the navigation systems that were used by the ancients -- they followed the stars in the sky.

Moving ahead in history, in 1492, Columbus, an Italian, was supported by Spain in his effort to find the Spice Islands. The wealth of the world at that time was counted not only in gold and silver, but also in spices. Europe obtained spices by way of the Mediterranean from the Arabs, who transported spices from the Spice Islands by a combined sea-land route. Columbus said, "Let's go west to the Spice Islands." So in 1492, he landed in America.

A few years later in 1520, Magellan decided to start out on the same adventure under the flag of Spain. Spain was the largest, most powerful nation in the world at that time, and the most feared. Magellan sailed with a fleet of five ships, each 65 tons and a little smaller than a harbor tugboat. They started from Spain, reached the Straits of Magellan, the Philippines (Magellan was killed by Filipinos, but the rest of the crew went on), and finally to the Spice Islands. They returned to Spain sailing around the Asian-Indian continent and Africa. The expedition lost four ships and 190 men, but the survivors returned wealthier than when they left.

From 1500 on, Spain ruled the sea, later to be challenged by England. Sir Francis Drake, England's hero, started out as a pirate. He raided Spanish galleons, so the Spaniards began taking a navy along to protect their cargo. Part of a fleet of 10 galleons, each about 120 feet in length, loaded with silver and gold from Central America, started home for Spain.

A hurricane overtook them and drove them aground in the Florida Keys. The ships broke up and disappeared. There is still 250 million dollars in gold that hasn't been found on the Florida Keys ocean floor.

After the galleons sank, Spain began losing her empire to English aggressiveness. Spain ruled the waves until 1620, then England ruled the waves until 1945 using large merchant ships with an auxiliary fleet behind them.

In 1869, the French opened up the Suez Canal which shortened the voyage around the continent of Africa by thousands of miles -- months of voyage time. As an aside, India was a colony of England. When the British went to India for their 2- or 3-year tours in the army and navy they sailed through the Mediterranean, the Suez Canal and the Red Sea. About this time the word "posh" came into being. Do you know what it means? "Luxurious." The voyage through the Mediterranean and Red Sea was very hot. The word "posh" stands for "port outbound, starboard home" -- the place to be out of the sun, on the cool side of the ship.

In addition to developing trade, nations also had to have a naval force and a strong merchant marine to protect the goods. A ship became an extension of a nation's soil. That has been proven over the years. Look back in American history -- remember the *Maine*, the *Mayaguez* in Cambodia four or five years ago? Going back to World War I, I recall that the *Lusitania*, an English passenger ship sunk by Germans, was considered an extension of England. The world became incensed and war ensued from the attack. Ships are still thought to be extensions of the owner-nation's soil.

#### SOME POLITICS OF OCEAN COMMERCE - THE BLOCKADE

During World War I, the United Kingdom and its allies were at war with other nations, primarily Germany. As part of the war effort, the Germans were blockaded. No nation can live apart from others for more than a short time; no nation is totally self-sufficient. Recently we have discovered that we need Arab oil, we need rubber, iron, manganese, and lots of other things. If we were blockaded like the English blockaded the Germans, our industrial machine would grind to a halt. Back in WWI, Germany retaliated by putting out ocean raiders -- pirates. They raided English commerce and also our commerce.

In World War II, once again England and Germany were at war. This time the English were blockaded by the Germans, only now submarines were used. German raiders and submarines sunk thousands of English ships. They almost broke England's back with the blockade. The British retaliated by blockading Germany and countries that traded with her. Japan ran afoul of these blockades. She was without oil, and all her west bound ships were being stopped by German and English ships. The blockade moved Japan more rapidly toward war.

In more recent times the U.S. blockaded Cuba, whose trade was mostly in sugar.

### SOME ECONOMICS OF OCEAN COMMERCE

Total world imports and exports were worth \$2.1 trillion in 1974. Of that, the value of U.S. exports was \$98 billion and the value of imports \$107 billion. That is more than our national budget. Trade is very important to the U.S. The United States is far and away the world leader in trade, followed closely by West Germany, Japan, Britain, France and Canada. Saudi Arabia has a tremendous export rating, but imports almost nothing.

With whom do we trade? What is the dollar value of our trade? How do we accomplish all this trade? The U.S. owns a total of 843 ships, eighteen of which are bulk carriers. A bulk carrier is a large ship; it looks like a tanker but carries iron ore, bauxite, or grain. We are one of the world's leading exporters of grain, but we have only eighteen bulk carriers. Greece has a merchant fleet larger than ours by a factor of two, and as far as carrying grains and ore, has a fleet twenty times larger than ours. Norway is now carrying twice as much commerce as does the U.S. Who can name a seaport in Austria or a seaport in Switzerland? Why do some of these countries own large merchant fleets? Of what value is a merchant fleet to these countries? Some of the ships never see home port. Most of the Russian fleet never see Russia. They fly the Russian flag, but they spend all their time on the sea. They leave the west coast of the U.S. to go to Japan, Singapore, Australia, back through the Canal Zone, and never go home.

To carry Alaskan fertilizer, the U.S. had only one barge and it was sunk three years ago so we had to get a waiver of the Jones Act (which says that if cargo is going from

a U.S. port to a U.S. port it has to be on U.S. ships), which disturbed our union people. These are American jobs for American people. The unions feel we shouldn't use foreign ships when we have our own seamen who can do the job at approximately the same price. In the case of liquid natural gas (LNG), we don't have any U.S. carriers at this time so we have to get a waiver of the Jones Act to import LNG. In the case of Alaskan oil, the U.S. does not have any ships that can haul it now.

The lumber men in the Northwest see a tremendous lumber market in the Northeast for their lumber, but no means of hauling it because of the Jones Act. The Canadians are presently moving the lumber from Vancouver, B.C. and unloading it in Portland, Maine.

We haul about 4 percent of our own goods on our own ships. Other countries like Norway, Greece, and Liberia haul all the rest of our goods. This is not really bad until our nation has a disagreement with another nation; then suppose we want to import a load of iron ore from Asia and the nation which has been hauling our ore refuses to cross the blockade line. There is no easy solution.

The Japanese and Swedish can build a ship for about 70-80 percent of our costs. We can't compete with them, or perhaps we don't want to compete. But how long can you keep a shop inactive? It is like putting your car in the driveway and leaving it there for three years without using it. You go out and expect it to start, and the tires are flat, the engine sick. It takes a lot to get ships back in shape.

Most ships are owned by public stock companies except in countries like Greece. Examples of our big shipping lines are Gulf Oil co., American President Lines, or State Marine Lines. Our fleet of 3,000 Navy ships was built about 1940-46. Add thirty years to that and you have floating Brillo pads, but Congress doesn't see fit to enlarge our fleet. The plan now is to keep it at about the same number.

Looking a little bit to the future and different types of ships: one thing to reflect on is an occurrence which revolutionized shipping, the closure of the Suez Canal in 1967. The Canal was open from 1869 to 1967, and has just now opened again. In the 100 years since the Canal was opened, a tremendous volume of trade was establish-

ed due to its existence. Western Europe became dependent on Middle Eastern oil. Japan has also depended on Mid-Eastern oil since as far back as 1940. When the Suez Canal was shut down, the world tanker fleet could no longer get from the Mid-East to Western Europe without going around the continent of Africa. What had been a 2000 mile voyage had suddenly become 14,000 miles or so.

World industry answered by building larger and larger ships. In 1965, before the Suez Canal closed, the average tanker might have been 35 thousand tons; after the Suez Canal crisis, the new ones weighed 477 thousand tons. It is now cheaper for them to make the run from the oil fields all the way around Africa into Western Europe or into Bermuda or Japan than it is to go through the Suez Canal. The larger vessels can't make use of the canal. Their very size staggers the imagination. The *Globetrotter Tokyo* is 18 stories high from the engine room to the bridge. It would hold all of Magellan's five ships. A single coat of paint for this vessel (400 tons) weighs more than the loaded weight of Magellan's fleet. No harbor in this country can hold vessels of this size, with the possible exception of Puget Sound.

#### OCEAN RESOURCES INFLUENCE BOUNDARIES

One of the things that happened recently in the world ocean is that the U.S. unilaterally declared the 200-mile limit on fisheries (extended jurisdiction). The U.S. said, "We are going to have a 200-mile zone outside all our shores in which we have exclusive right to all the fish." The family of world nations has been fighting about the 200-mile zone for a long time. A few years ago Peru had declared a 200-mile zone; about 5 years ago Iceland had a 50-mile zone. Iceland and England started a shouting war. The Icelanders objected to the British fishing on their fishing grounds. After lengthy negotiations England backed down, and Iceland permitted them a quota.

In more recent times, U.S. and Japanese mining companies formed a consortium and declared through the state of Louisiana that they were going to mine the ocean floor about 1800 miles southwest of San Diego. So the world's nations started extending their territorial ambitions to the ocean as they saw it best for themselves. In the tradition of Magellan and Columbus, these firms are laying claim and essential-

ly extending U.S. borders into the ocean. At the same time Japan and some other nations formed a very large consortium, and laid claim to manganese nodules 1700 miles south of Hawaii. Knowing the speed of technology, it won't be long before Western Europeans, who are very developed, will lay claim to other manganese nodules in the deep ocean. What does this do to the 200-mile zone? What does it do to any ship passing through the zone? What is there to prohibit a transient ship from mining in these deep ocean "claims"; could that be called piracy?

Jon Jacobson at the University of Oregon Law School drew a map showing what the ocean might look like if countries continue to extend their jurisdiction. He drew a line down the middle of the ocean and said, "That's yours and this is mine. The problem is that our heritage leads us to believe the sea to be a 'commons' for mankind, but yet by laying claim we are acting as the conquistadors and Sir Francis Drake carving out new territories for our nation. The results of this claim laying must end in world chaos." For instance, all commerce coming out of the Persian Gulf and crossing the Indian Ocean towards Japan has to pass through the Straits of Malacca. There are about twenty nations in this area. What if they all had a 200-mile limit, and all forbid any pollution! Then Japan would have to make the run around the continent of Australia, which would slow down the flow of fuel, making it more expensive and more hazardous.

Why transport goods by sea? Because it is still easier to move merchandise by ship than by any other way. Barges and ships are far cheaper haulers of heavy cargo than any other means.

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## II-B Marine Resources

by James A. Crutchfield,  
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Washington.

### INTRODUCTION

This discussion is primarily concerned with fisheries (fisheries is used here as shorthand for all living resources of the sea), various types of minerals (minerals dissolved in sea water, sea bed minerals, and oil and gas), power and water. It will not be concerned with the sea as a resource *in situ*; that is, a resource for recreation, transportation, and other services.

Marine resources are not unique. To the extent that the sea is capable of producing minerals, it will produce them to man's benefit when, and only when, demand and cost factors make them cheaper than land-based minerals. There appears to be a tendency to ascribe something romantic to minerals or anything else that comes out of the ocean, especially by those who do not have to do the work. The proper way in which to evaluate the present and prospective potential of the sea is to set it within the framework of the market for its resources.

### MINOR RESOURCES OF THE SEA

*Energy from the Sea:* Energy from the sea is a dream that men have lived by for many years, but it is very far from reality and does not warrant the time and effort for much consideration here.

*Tidal Power:* Man has learned to produce useful power from tidal sources at a cost about four or five times greater than the next best alternative. This combines with overwhelming problems of conflict between competing users.

*Power from Temperature Gradients:* There is a possibility, increasingly interesting, that under some conditions man may be able to produce useful amounts of power from temperature gradients within the sea. With ocean thermal energy conversion units, coupled with a wind generating system to eliminate, as much as possible, the storage problem inherent in any intermittent system, it might be possible to produce electric power at rates cost-competitive with other power sources in some parts of the world. Research directed toward pilot operation within the next decade is now under way. What makes the idea intriguing is that while the prospect of really massive production of energy from the sea does not appear on the horizon at the moment, the technology to produce relatively small but usable amounts of electric power may well be. While the technology very likely will come from the sophisticated science and engineering of the developed countries, it may be that the underdeveloped countries will be the first to use that technology in a practical way. Production of small quantities of power from some combination of wind and thermal gradient, or even wave action generators in isolated areas would be highly attractive.

*Fresh Water from the Sea:* The sea is not going to produce desalinated water in our time at prices approaching the incremental cost of getting water from the more conventional surface sources as far as the United States is concerned. There are many parts of the world, however, in which desalination is an accomplished fact, and an economically viable source of water. Even in some parts of the U.S., some of the newly developing technologies offer the promise of additional water supplies at fairly high cost but in fairly small increments: an investment that might be useful to small coastal communities for whom the only other option would be a fifty year commitment to a major river basin transfer system which would be underutilized for the first 30 or 40 years. Reverse osmosis processes in particular, can produce increments of fresh water at virtually constant cost and with low capital investment. With respect to water at costs required for major irrigation systems, we are still a very long way indeed from desalination processes that can compete with surface and groundwater alternatives. Incidentally, it is possible to produce pure water from brackish water at much lower cost than from sea water. Brackish groundwater below the Imperial Valley of California, for example,

could deliver processed water to an existing distribution system with present techniques.

## MINERALS

*Hard Rock Minerals (Compacted Minerals):* Extracting compacted minerals from the sea would be a true mining operation. At present we have neither the means to locate nor the technology to recover and process any compacted, hard rock mineral. No known authority feels that it is even a remote prospect.

*Dissolved Minerals:* The concentration of most dissolved minerals in sea water is so low that there is no interest at all in recovering any of them except the long established industries producing salt, magnesium, and bromine. Of the three, salt is by far the most important. About 30 percent of the world's salt is produced from the sea, and, if nothing else, this sets a ceiling price on salt.

Until recently, we had been producing nearly a million tons of magnesium per year from sea water. Currently, however, such operations are not competitive with high grade magnesium deposits on land. The same is true for bromine; virtually all bromine is now produced from land-based sources.

### *Unconsolidated Minerals:*

*Going Concerns:* The biggest going concern by a considerable margin is sand and gravel. The U.K., U.S., Japan, and a number of other countries continue to recover substantial amounts of sand and gravel from the sea. The best estimate of a dollar value of annual production is about \$80 million.

We are also getting very small amounts of alluvial minerals by dredging. These include tin (the most important in value), iron, aluminum, and zircon.

### *Prospective Enterprises:*

(a) Phosphates from phosphorite nodules. Land-based supplies of phosphates for fertilizer will continue to be of more uniform and better quality and lower price than any possible phosphate production from the ocean for at least the next three or four decades. Over the very long run, the ocean sources provide a comfortable future reserve.

(b) Ferro-manganese nodules. This is the only sea bed mineral that offers an identified commercial prospect within this century, and even beyond. Thus, they are worth examining in some detail. These nodules are consolidated bonded minerals ranging from the size of rice to three- or four-pound chunks. In general, however, they run from walnut to potato size. They are found in enormous profusion scattered over the ocean floor in most parts of the world, with heaviest concentrations in the central Pacific Ocean at depths ranging from about 12,000 to 20,000 feet. Apparently both chemical and biological processes are involved in ferro-manganese nodule formation. They are composed of a large number of chemical elements; the actual metallic content varies widely. On the average, manganese comprises 25-35 percent, nickel 1-1.5 percent, copper about .5 percent, and cobalt .25 percent. These four metals are highly important to any industrialeconomy. They also happen to be metals which the United States imports. In spite of the term "manganese nodules," it is the copper nickel (and to a lesser extent, cobalt) in which mining companies are really interested. The quantities of these minerals available in the sea are measured in trillions of tons. In a sense, these are a renewable resource; but since the annual increment to nodules is probably on the order of ten million tons, they are, in economic terms, more closely akin to exhaustible mineral reserves.

Capital requirements are large (in the range of \$1.5 billion if we include the essential investment in expensive processing plants). All of the companies that appear to be zeroing in on commercial production within the next five years or so are international consortia of firms representing between three and twelve major industrial nations. These arrangements are partly to spread the risk, partly to develop international support for deep sea mining ventures where legal title is still very uncertain, and partly to get adequate financing for the ventures.

The problem of an adequate legal framework, about which American companies are deeply concerned at the present time, is still unresolved despite long, rancorous arguments in a series of Law of the Sea Conferences. In general, there are two conflicting positions: The U.S., Germany, and Japan, among other industrial nations, are pushing for an interim arrangement under which secure title to seabed mining tracts could be obtained, while paying lip service to the

idea that the Law of the Sea Conference should ultimately produce a multilateral international framework. The companies argue that this framework may be years in coming and that we should be getting the job done since time is of the essence, with unit investments of \$100 million already being made. The conflicting point of view, being pushed largely by the developing nations, is that the deep sea bed is the heritage of all mankind, not just a few technically proficient nations. They see no reason why the developed nations now technically capable of operating in the open sea should stake out all the promising areas before anyone else is in a position to claim part of the benefits.

The legal framework must be one in which the technically proficient nations can mine under license with payment of an appropriate tax or fee, or where the technically proficient will sell their expertise to an international agency which will actually do the mining and whose rents earned from that mining will then be dedicated to programs for the underdeveloped countries. American industry has been pushing very hard for an interim domestic policy which would say, in effect, the American firms are free to go to the open ocean despite the absence of any international agreement to secure tenure for the tracts that they are licensed by our government to exploit. If any subsequent regime is created by the Law of the Sea Conference, and if the U.S. becomes a party to that agreement, then the U.S. government will insure the company against any losses that it might suffer as a result of being restricted by, or forced to pay taxes or fees to a new international entity.

This is, of course, very nearly a no-risk proposition. It amounts to saying that the company is free to go into operation, gain a two or three year lead on our more advanced competitors and a much larger lead than that on anybody else, and nail down the most promising sites. Then if an international organization gets really tough about taxing away some of the economic benefits that would accrue if the operation is really successful, the U.S. government will pick up the tab and the taxpayer will shoulder the burden.

However, there is real doubt about the wisdom of pushing ahead on a forced-draft basis of that kind, even from the standpoint of our own national interest. There is a good deal of basic logic in the position of the developing countries, and an even larger amount of emotional support for that

position. If the U.S. and a few other developed countries unilaterally create a situation of *de facto* property rights, in the face of international disapproval, they are going to polarize international opinion in the U.N. and elsewhere, which might really pose a threat to our access to the minerals. What the U.S. might have at stake -- getting some copper, cobalt, and nickel from the sea on a preferred basis -- is so small compared to our stake in maintaining an orderly international trading community of nations. We need to consider very carefully the short-term benefits versus the longer-term implications of any unilateral action. On the other hand, the fact remains that until and unless a firm prepared to make a capital investment of between \$.5 billion and \$1 billion to chase a unicorn around the bottom of the ocean has some assurance that success will secure its tenure in the area, and it will be able to recover its investment, no one will go out and do anything.

*Sea and Oil:* Petroleum and natural gas are critically important to the energy situation worldwide. Both are being produced offshore along the coasts of some 50 nations at the present time, and exploratory drilling is going on off the coast of 30 or 40 more. It is reasonably certain that we are not limited to continental shelf supplies. The continental margins, the slope and rise, may well contain significant deposits of oil and even the abyssal depths may contain commercial amounts.

1. The U.S. seems to have taken a firm position that it is in the national interest to recover our own offshore oil just as fast as we can. This implies that we should undertake, on a forced-draft basis, to lease out, prove out, and start producing from off-shore sources at top speed. However, the U.S. still has substantial off-shore reserves. We know that the real price of oil will be increasing steadily over the intermediate and long term. Is there any reason to believe that we would not be better off in the long run to use other people's oil as long as they will sell it to us? It is essential to define as accurately as possible the resources that will still be under our own physical and political control, in order to assess the benefits of having gas and oil when the external sources begin to become very costly, as they must in time.

There is clearly a conflict of interest -- real, not imagined -- between the well-

being of a private oil industry and the public interest of the American people. From the standpoint of the oil industry, the way we have chosen to lease oil-bearing land offshore (bonus bidding plus royalties), guarantees that once oil is discovered in an outer continental shelf area, and bidding has been opened for the right to explore and exploit, a financial commitment of really major proportions has already been made.

For example, some companies have laid out, in the Gulf of Mexico and off Santa Barbara, as much as \$.25 billion for a single lease, and this is only a "hunting license," no more. These companies feel that they must begin to recover this investment immediately. At a minimal opportunity cost of 10 percent, they are paying out hundreds of thousands of dollars a day for lease rights only. Thus, the pressure to produce is tremendous, while it is not clear that it is in the interest of the United States (or the larger global interest of the world community) that we rush to produce off-shore petroleum as quickly as we can.

Prudhoe Bay provides an excellent example of "haste makes social waste." After the headlong rush to develop North Slope oil resources it seems that we have been moderately successful in restricting demand for petroleum products through price increases and other measures. Now we have North Slope oil coming out of the end of the pipe in very large quantities and there is no place to put it except through the Panama Canal at prohibitive cost. But where else can the tankers go? The law says that oil must go to an American refinery. But there is nowhere on the West Coast to sell it. There are no pipelines to carry it. Further, it takes four years to get a terminal and pipeline on line by the time all the environmental impact statements and physical construction are completed. We will probably end up selling the oil to Japan, which probably would have been the most economic thing to do in the first place, though it makes a mockery of all the arguments for frantic haste in development.

2. Environmental aspects of petroleum are crucial. Every stage of the producing, transporting, transferring to shore-based establishments, processing, and using oil, creates environmental hazards. There is no way that man can produce and transport oil from a marine life environment that is not many, many times as hazardous to marine life and to other elements of man's well-being as it is produced on land. Yet

we have made only the most slipshod kinds of preparations for dealing with such dangers. The Bureau of Land Management is now busily doing impact studies of off-shore drilling along the Pacific coast states and Alaska, while engaged simultaneously in leasing these territories.

#### LIVING RESOURCES OF THE SEA

In 1946, world production of fish was about 20 million metric tons. By the late 1960's, that figure had risen to about 70 million metric tons, an annual rate of increase of around 6 percent a year, and a spectacular increase in the supply of protein food available to the world. However, from 1970 to 1975 there has been no further increase in output of the world's fisheries. Yet this has been a period in which the increase in fishing effort, measured in tonnage alone, has been tremendous. The whole Eastern European community, the Taiwanese, the Israelis, the Belgians and others have been putting deep water, highly productive fishing equipment in every major ocean fishing area.

Even more alarming is that the output of food fish production and the relative stability in the last few years has been almost entirely the result of an enormous increase in industrial fish production. Most has come from a handful of major fish meal operations; Peru is the principal one, and South Africa and Norway have also been important. In fact, then the production of fish for direct human consumption has not been increasing over about the last 20 years. The industry has been moving to lower valued species in order to maintain aggregate total production. Coupled with slowly rising demand, this has led to sharp increases in the real price of fish. This has tended to stave off what otherwise would have imposed a tremendous economic bind on the fishing industry world-wide.

The Soviet Union has moved up to become one of the major producing nations. Japan has continued its very rapid increase. Chinese figures are unknown. Peru emerged as a major producer of fish with its massive fish meal operations, but it dropped almost out of the picture the last few years due to the failure of the anchovy fishery. Norway has moved up fairly steadily. The U.S. in 1970, despite a major increase in public investment, is producing about what it did twenty years ago, much of that in lower valued species. While the U.S. is

the world's largest consumer of fish, it is increasingly an importer of fish. The total catch of fish taken off our own continental shelf by foreign fleets was substantially greater than the entire American catch until the Fishery Conservation and Management Act began to reverse the situation in 1977. For most of the Eastern European nations, as well as Russia, there has been a spectacular increase in both the level and sophistication of fishing effort.

The actual distribution of world catch geographically is roughly along the following lines: about 90 percent by weight and probably 95 percent by value of the world's catch is taken very close to shore and well within 200 miles, in effect, over the continental shelf. Except for the tuna and tuna-like species and billfish, there is very little in the deep ocean areas that is of interest for commercial fishing. The fish are either too deep, too scattered, or unmarketable at the moment.

The dominance of the Northern Hemisphere in fish production reflects two factors:

1. continental shelves are wider,
  2. upwelling areas are greater in number,
- thus productivity is higher in the whole marine ecosystem.

Unfortunately, a large part of the world's poor lives in tropical areas, and in parts of the Southern Hemisphere, so an overwhelming majority of the world's total fish catch is taken in areas where it is not accessible to those whose physical needs for protein from the sea are probably greatest. In fact, most of the world's fish catch is consumed by a small handful of "have" nations. This is due in part to the fact that the "have not" nations are poor and therefore can't buy the fish, and in part to the physical proximity of the developed world to the most productive fisheries.

Demersal fish catches are heavily concentrated along the shores in relatively shallow waters. The same is true of a majority of all the pelagics we harvest and of all the crustacea.

#### FUTURE PROSPECTS

*Demand:* In the developed nations, the income elasticity of demand for fish is relatively low. *Per capita* consumption has hardly changed over the last forty or fifty years. However, the demand for services associated with fish is highly income-

elastic, which is true of most foodstuffs. Hence, demand for fish *per se* is increasing only at a rate roughly approximating population increases. Japan is an exception.

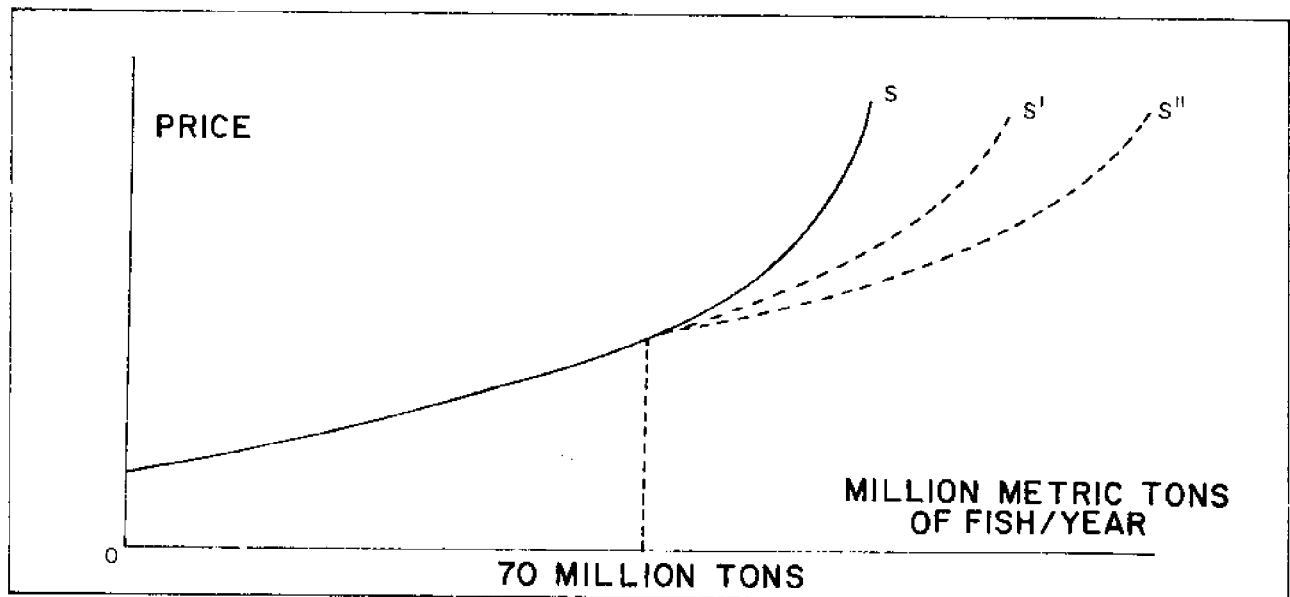
In the developing areas, many of which are regionally dependent on fish as a major source of protein food, demand is highly elastic to income, and in addition population growth rates are very high.

On a world basis, then, the aggregate demand for fish is expected to grow, and grow fairly steadily, at a rate which is substantially greater than our short-run capacity to expand production.

*Supply:* We have been more optimistic than we probably should have been about total production from the sea because so much of the discussion seems to have been couched in terms of biological productivity alone. Expressed in terms more familiar to an economist the proper question is: "What does a long-run supply function for usable protein from the sea look like?" If we plot the cost of producing fish, and therefore the price necessary to elicit increases in production, as we move to larger levels of annual production we get a function looking something like Figure 1 (the curve labeled S). The question is: "Where are we at 70 million metric tons per year?" I'd suggest that we are fairly close to the level beyond which any further

increase in output will be forthcoming only at very high cost. In effect, we are approaching an economic limitation on further expansion of output, with today's fish, today's processing methods, today's markets, and today's harvesting techniques. This would also suggest that over time the function could be expected to shift outward to S' or S'' as attractive prices induce people to find better ways of searching for and locating fish, new ways to utilize species that presently are not commercially attractive but over time can be converted to useful products. An example of this latter case is the present use of fish sticks made out of minced pollock. Ten years ago it would have been very difficult to market that product. Another example is ocean perch. Many of us now think of ocean perch as a first-class fish. But red fish (ocean perch) on the east coast was formerly untouched until it was found that it could be filleted and sold in package frozen form. We are learning all kinds of things about transforming fish flesh into a variety of products that either can be converted directly into human food, or indirectly via animal feed.

Therefore, it is still possible to generate a good deal more useful protein out of the sea than our present markets, technology, and tastes would indicate. But I still would argue that the limit, beyond which further expansion gets really unattractive economically, is creeping up a lot faster



11-B 1. Long-run supply of ocean fish.

than we thought it would. One good example illustrates this point. At one time everybody was terribly excited about the prospects of food fish production in the Arabian Gulf. (more precisely, the area running north from Somalia past the Gulf of Aden and around the Arabian peninsula). The initial Indian Ocean study conducted some time ago suggested a very heavy concentration of fish in the area on the evidence of high basis biological productivity. When the Norwegians, in their hard-headed way, ran a test cruise through the area they found that there was indeed a tremendous quantity of fish, but most of it consisted of meso-pelagic species that nobody knows how to catch or process into marketable form. Instead of getting two or three million marketable metric tons from the area, the liklihood is something like three-quarters of a million metric tons if we are lucky. Since the countries concerned have already built enough meal processing plants to process three times that much, they are in some difficulty. The same is likely to be true in the South China Sea. All of the six neighboring nations along that sea have fishery expansion plans which in the aggregate add up to several times the productivity that they can economically get out of South China Sea waters.

#### CONFLICT

Thus, the world may be facing more severe conflicts in fisheries than has been anticipated. The prospect of constantly rising demand for protein food and a much tougher physical and therefore economic limitation of productivity than had been assumed in the past adds up to an increasing basis for serious conflict as time goes on.

How well have we utilized the ocean? To answer that question we must answer four related questions:

1. Have we actually exploited fishery resources at the proper rate to maintain productivity of the stocks?
2. Have we harvested them efficiently, so that any given rate of harvest can be conducted as cheaply as possible?
3. Have we provided inducements for fishermen to develop still better ways of harvesting?
4. Have we provided for any kind of orderly allocation of the fish catch of the world, in terms of both food and the incomes generated from the

activity among the countries and the people who participate?

I would argue that the record ranges from very poor to awful in man's utilization of the living resources of the sea. We have failed signally to deal with the fact that the common property status of ocean resources -- our inability to establish exclusive property rights over living marine resources -- has left us vulnerable to constant pressure toward over-harvesting. In some cases depletion or even destruction of whole marine life populations has occurred, and in virtually every case the industry is using far more gear and labor than is actually required to harvest any given level of catch. Examples are legion. Ten or twelve years ago a working group estimated that the catch taken from the Northeast and Northwest Atlantic -- one of the great fishing areas of the world -- could be taken with about 33 percent less effort than was actually being exerted, and that after a short period of lower catches, as a natural result of reduced effort, the subsequent increase in the average size of the fish would have produced catches 3-5 percent higher. The vessels were catching such small cod in the North Atlantic that the fish had to be reduced for meal in many cases. If allowed to grow two more years, the gurry alone would make more meal than could be realized from the "codlings," not to mention the fillets and other products that could be produced. The degree of overcapacity was estimated at that time to impose a dead weight burden of needless costs of \$100 million a year. At today's prices it would be more like \$4 or \$5 billion a year. The same general tendency has developed on a worldwide basis throughout the fishing community. It's a very poor record indeed.

Had the resources available to us been managed on a more rational basis, even within the limits of scientific knowledge that we are bound to struggle with, the total figure today might well be 90-100 million metric tons rather than 70 million; the 70 million represents the lower output from a number of severely overstressed fisheries, offset by expansion into new operations and new areas. These resources are not being utilized fully or wisely, and nothing in the international arrangements that had been tried in the 40 or 50 years prior to this last one had really made any significant difference in the tendency to utilize inefficiently the living resources of the sea.

Hence, the pressure for the 200-mile limit: a second-best solution, clearly, but obviously better than the management regime -- or lack of it -- that it has supplanted.

#### QUESTIONS

Q: Concerning our efficiency in the use of the world's living resources: it ranges from very poor to awful. You spoke in terms of weakness in property rights. What is meant by property rights and how optimistic are you with respect to strengthening those property rights?

A: The issue involved is a fairly familiar one which is usually termed common property status. A better term, I think, would be open-access status, since common property is almost a contradiction in terms: a bad term that's gotten well established. With very few exceptions, neither within a nation's waters or among nations in international waters has there been any effective way to restrict new entrants from coming into the fisheries. As a result, the essential link in planning exploitation of the resource -- between activities in harvesting fish this year and the availability and size of the fish that are available for harvest in subsequent periods -- is broken. It might benefit you to hold back, to harvest at a slower rate using gear that captures only larger fish; because the investment in further growth exceeds the losses in natural mortality you would tend to restrict your effort. But under common property conditions, all you do is guarantee that somebody else catches the fish. From the standpoint of technical economics, then, each individual operator regards the cost of the resource to him as zero and proceeds accordingly. In the international sphere, the open access situation answers an otherwise difficult question: Why would the East Germans and the Poles suddenly appear in the North Pacific when it is already apparent to all that the Bering Sea and the Gulf of Alaska are overfished -- heavily with respect to some species, moderately with respect to others? There is no area within which new entrants will not drive actual total catch down. But from the standpoint of a new entrant, he starts at zero, and it is of no concern to him that he will reduce the aggregate catch, if what he can take is more than enough to cover the costs of operation. He does not count as a cost what he inflicts on those already engaged in the fishery. As a result, we find the persistent tendency toward overinvestment

in fishing equipment and gear, at the very least severe economic waste, and in more serious cases, actual depletion of physical production capacities. This is a universal problem in the world's fisheries, and despite some cogent arguments to the contrary by Professors Bromley and Bishop I remain convinced that it is an institutional problem that simply must be resolved if we're to make any sense or rationally exploit these living resources.

Q: What channels would you think are the most promising for resolving this problem? The U.N.?

A: The ones that I thought were the most promising have been closed out, unfortunately. I would have thought or hoped that the most effective way of dealing with these problems internationally would have been through regional multilateral conventions, in which a division of the available catch-benefits among participants and a method of closing off potential new entrants would be agreed upon. Within those constraints it would be possible for individual participating nations to reduce the level of effort to one that would at least approximate the largest economic benefit, modified perhaps by employment considerations or other objectives that they might have. That approach is totally out the window at the present time. The pressure toward the extension of an economic conservation zone to 200 miles has now become irresistible. The 200-mile extension changes the number of players. It changes the identity of the participants in many cases. It reduces the number of people that you have to deal with. It does not resolve, of itself, the common property problem, either nationally or, in most cases, internationally.

We've had a few good examples of how it can be done. Alaska has a rather good limited entry program in salmon. Canada's experience with its salmon fishery has been moderately successful. In the state of Washington we have at least managed to get a moratorium on any new salmon licenses, after the number had tripled in about a six year period: a little late, but still better than no control at all.

Q: If the regional solution is out, given the dynamics of how fish move around and don't pay any attention to international boundaries, isn't that going to force regions to solve serious problems?



A: I would hope that might be so. As a case in point, North Africa has some extremely rich fisheries off the north-western bulge. There is the usual tropical bare area around the Gulf of Guinea, with a return to rich waters as we move from Angola to the southern part of Africa. There are some 27 nations that participate in that West African coastal fishery, including such fishing powers as France, Spain, the Soviet Union, and Japan. About 70 percent of the total catch goes to the developed nations of Europe and Japan. About 30 percent is taken by people of the coast of Africa, who really need it badly; but of the 30 percent they catch, about 15 percent is sold to European markets. Very little of it actually goes to African consumers. In addition, it has become abundantly clear that if you run the boundaries of Gambia out 200 miles, (Gambia is about 40 to 60 miles wide along its seacoast), you don't encompass very many populations of the sea.

The West African nations simply have to manage jointly the resources that are now under their joint control, and they will have to develop some kind of international management mechanism. Beyond that, they will have to deal as a unit with the distant water operators, otherwise the distant water operators will "pick them off" one by one, offering more favorable considerations to one over the other if they don't face a common price for the right to fish. In fact, the West African nations principally involved -- Senegal, Mauritania, Ivory Coast and several others -- are now engaged in an effort to form a regional management unit of just that type.

The situation in the Northeast Atlantic is so chaotic it just defies description. The European Economic Community nations are finding it very difficult to allocate the fisheries within the 200-mile zone declared by the community. Moreover, there are historic fishery rights, for example off the coast of the U.K. and Ireland, enjoyed by Dutch and French fishermen that go back to the 15th or 16th century. By the time you sort out the fact that the EEC nations do not include Norway (and Norway is one of the biggest fishing nations of the group), you've really got a few hassles to iron out. Clearly, there must be a regional approach to utilization of the fisheries of the Northeast Atlantic that is wider than EEC. It is totally impossible that the key controversies could be resolved simply by extending territorial jurisdiction to make a series

of national lakes out of the area in question; that wouldn't solve anything at all. What it does do, in a good many cases, is to reduce the number of participants who have actual access to the resource to a much smaller number and it puts the distant-water operator in a position where he must deal with the coastal state as an actual property right owner in the fishery. That is a big change that the 200-mile extended jurisdiction will accomplish.

Q: You mentioned that on a world-wide basis we do have severe overcapitalization, particularly with regard to harvesting equipment. Keeping in mind that in the extended jurisdiction legislation in this country it was stated that the intent of that law was to increase U.S. catch and to increase capitalization in the U.S. fishery, in particular the Alaskan fishery, how do you as an economist view that in terms of efficiency?

A: Since I am a member of one of the councils I am particularly uneasy about it. You have asked a couple of questions; let me see if I can separate and answer them. There is a great deal of confusion (and there was a great deal of confusion in the minds of its Congressional sponsors) as to what the Fishery Conservation and Management Act was actually set up to achieve. One of its objectives was to increase the share of fish caught off our continental shelves by American fishermen. Another less clearly defined but in my opinion much more fundamental purpose was to insure that whoever harvested fish within that 200-mile control zone did so in accordance with some sensible understanding of the biological underpinnings of the resource, its yield capability, and a reasonably efficient harvesting regime. These two are not as separate as they might appear. It is, I think, quite possible that American fishermen would be able to exploit pollock successfully with fairly severe reductions in current catch levels by Japanese, Korean, and Russian operators, simply because the resource is so heavily exploited at the present time. If that fishery is now to be managed in such a way that populations can be rebuilt to some level that will provide optimal yield, you provide some assurance to the American investor that he is going to be able to harvest at fairly high levels for the indefinite future. The fish are being marketed in America at the present time. There is nothing particularly magical about the techniques that the Korean or Japanese fishermen are using. American fishermen

are perfectly capable of harvesting there and are a lot closer to both the resource and the market taken. I think it's quite plausible that this mush that we eat in the form of minced pollack might be produced by American rather than foreign fishermen.

This raises, however, a more subtle and much more difficult question. If we really undertake to maximize the benefit to the United States as a whole from our control over the 200-mile zone, would we always be better off by harvesting with an American-flag fishery as long as it simply covered its total cost -- if the opportunity cost of inputs were covered? Or might we do better under some circumstances by simply renting the resource to somebody who produces at lower costs than we can? That is indeed an open question.

It has another twist to it as well. There's a great deal of interest among American fishermen in harvesting and marketing hake, which is abundant off the Pacific coast all the way up from northern California. They've been there for years and no one has been able to market them successfully yet. But these fish bring 36¢ to 50¢ per pound in European markets. Obviously, somebody eats them and finds them attractive. Why not undertake to market American-caught and Russian- or Polish- or Japanese-processed hake? We would have a product already at hand. They know how to handle it. They've got the facilities to do what it really essential: gut it, clean it, get it frozen and in storage within an hour of the time it's on the deck. We could find out if there is a good American market for the product. This would be a much shorter way of doing the job than to try to learn how to catch hake, process it, and market it all at the same time. I see nothing wrong at all with a good vigorous American fishery for hake and pollock exporting its product to Japan or Korea; if our markets do not want it, theirs certainly do. The big obstacle, of course, is the Japanese themselves, who are very reluctant to permit access to their markets, particularly in foodstuffs. They are very tough. But these would seem to be options that the councils and the American fishing industry ought to be considering. It's not just a question of throwing foreigners out and immediately creating a bonanza for American fishermen. It's far from that simple.

Q: The processing of hake has lasted for quite some time, since over 80 percent of the canneries in the Alaskan peninsula in

the bottom fish areas are Japanese-owned right now. Why would they allow Americans to harvest in the Bering Sea?

A: Let me make the way it works clear, if I can. An estimate is made of the maximum sustainable yield for each of the major fisheries involved. (Don't ask me where that number comes from -- or what it means for that matter). An estimate is also made of what the American fleet is capable of harvesting. That number is even tougher to define. But somehow, it gets defined. What is left over is available for allocation among applicants from foreign nations, and those allocations are made by the State Department. But there is no quota on American fishermen. They can catch any amount they want, and if it turns out that they actually catch 10 or 15 thousand tons rather than the 6 thousand tons the council had estimated, the next year's allocation to foreign fishermen will be reduced accordingly and the American fisherman's capacity to harvest recognized in a larger reserved amount.

The situation, incidentally, is rather different in some of the other areas. In New England, it's probably correct to say that for most of the major species the American fleet is perfectly capable of harvesting and marketing profitably the fish that are now being taken there by Russian, Polish, and other druggers off the coast. In New England waters the degree of overfishing is so severe that adequate control over fish in the area could be expected to produce substantially better economic returns within a fairly short period of time.

Q: We have given quotas to a number of foreign nations, including the Soviet Union. Will they be observed in view of the immediate violations by Russian vessels in New England waters after the Act went into effect?

A: This is a reasonably informed guess. I'm not surprised that the Russians did what they did. That's exactly the kind of action that would have been expected after what they did to the International Commission for the North West Atlantic Fisheries (ICNAF) agreement. Some of you who are fishery people may recall that in the North West Atlantic some years ago a two-tier quota system was set up for the major species in this fishery. The 14 participating nations were given percentage quotas, basically on past experience in the fishery (some other factors entered as well). An

overall quota would be determined each year and each country's percentage applied to that, to give an actual tonnage quota to each participating nation. In addition, an overall catch quota for each nation was set to prevent them from shifting from the quota-protected species to other unprotected species. It was not a perfect system but it gave promise of getting a rather chaotic situation under some kind of control pending a more refined management program. It worked for just a short period of time, and then it became apparent that the Russians were flagrantly violating the agreement and making no particular effort to conceal it. ICNAF was pretty well on its way out even before the U.S. and Canada extended their 200-mile limits.

Why would they do that? I honestly don't know. I would hazard a guess that it may represent the same kind of bureaucratic, single-track operation that characterizes our own government and our own large corporations from time to time. Once you get a five year plan to expand fish production and fish catching capacity on the road, it's much easier to go through than to stop it and revise the whole thing. And I suspect that in part, the Russians may have been caught with a very expensive and very extensive investment program on their hands and no place to deploy those boats. They're running right out of ocean at this point, because they face the same restrictions in the alternative areas. The west coast of South America has been effectively closed for some period of time by very restrictive access policies. If they were willing to run the risk of international disapproval as they have in the past, it's not surprising that they ran the risks of testing our quotas to see if we really meant business.

As a member of one of the councils, and therefore with a strong interest in making the system work as honestly and efficiently as it can, I hope that the enforcement action is vigorous, tough, and prompt. There's no way that even the fiction of fairness can be maintained if we punish the little guys and let the Soviet Union go free because we're negotiating with them on an arms agreement.

I have, I'm afraid, a strong bias against letting the State Department handle all these fisheries negotiations. There's some truth in the fishermen's strongly felt attitude that the State Department has tended to trade them out of their socks whenever there were non-fishery issues for

which fishery issues could be traded. And the test of whether the United States really means business in managing these resources wisely -- not just squeezing foreigners out so that American-flag fishermen could expand, but managing them in the interest of everybody concerned -- will be in part the vigor with which the regulations are enforced against the big boys. If the Soviet Union gets away with this regularly, then the whole system obviously is out the window. If we can't or won't enforce our regulations within 200 miles, it's hard to see how a Mauritanian gunboat is going to chase the Soviet Union off their coast, which is a very important consideration.

Q: How are the foreign quotas allocated among different countries?

A: When the first memorandum appeared outlining the proposal for fees to be levied on foreign users of our resources, I just hit the ceiling because the first statement said that we would not use the fees as a means of allocating fish. Why not? What possible reason could we have for not utilizing it? Capacity to pay is one of the tests of efficient utilization of that resource. Why shouldn't we allocate, at least in part, on the basis of who can make the best use of the resource? (And in the process profit handsomely ourselves, something which is not too shabby to look at.) It also would get the State Department out of an impossible position of choosing among good guys and bad guys.

The allocations are made now in the most weasel-worded language I think I've ever seen: partly on the basis of historic fishing position; partly on the basis of how well the nations observed regulations in the past; partly on the basis of how much they contributed to scientific research in the area; and, "other factors that may be taken in consideration." What this says, in effect, is that if you've been really nasty and uncooperative we may cut you down from your historic position, unless you happen to be important to our defense posture, in which case we'll raise you up a notch. It gets down to something about as crude as that.

It seems perfectly plausible that we might divide -- let's just pick a number -- 50 percent of the catch available for foreign quotas and allocate that on the basis of historic fishing position within our own

waters and put the other 50 percent up for competitive bid, thus dodging the questions of setting fees and of picking good guys and bad guys. It is not a particularly difficult system to administer, certainly no more cumbersome than the one we have at the present time. I can see no particular arguments against it.

Q: Would anyone in the State Department buy that?

A: Well, I couldn't find very many people in my own council who would buy it. There was a roar of dismay when this was proposed.

Q: All of them?

A: No, not all of them. A number of people said, "Well, that certainly is an interesting idea that deserves further consideration." To answer your question seriously, the State Department regards this as an overwhelmingly important matter of turf protection. And it does not propose to let a group of ignoramuses who know only about managing fish or managing the fishery to interfere. The State Department guards its prerogative of negotiating with other nations very, very jealously. It was an open meeting. There was nothing hidden about it. The State Department representative there got madder than a wet hen when the proposal was made and indicated that under no circumstances would State consider this.

I find it very difficult to argue against it as a means of realizing a larger benefit from that share of our fishery resources, unilaterally declared, which other people are allowed to harvest, and from providing some real pressure to harvest efficiently -- which would be to our advantage as well as theirs. There are twice as many vessels out there in the ocean than are required at present to take their quotas.

The other thing that I found most intriguing was that the fee that was actually set (\$1 per gross registered ton plus 3.5 percent of the market value of the fish) was apparently determined on the basis that this wouldn't chase anybody out. But why not? If we've got twice as many foreign vessels in our waters as we really want and if we set it at 7 percent, one might logically assume that the Soviet Union would take a look at the deployment of its

fleet and take its quota with perhaps half as many vessels, well adapted to the particular target species that they are going after. That's the only way they could pay the 7 percent and still come out ahead. What's wrong with that?

Q: Did you make that proposal also?

A: Well, we suggested that, but it didn't get very far.

Q: Do you get the feeling that you guys are paper tigers?

A: Well, I don't think we're going to have the authority to change the world. But at this stage, nobody quite knows within the federal or state government establishments what these councils really are or what they might become.

There is a very strong feeling on the part of the states of Oregon and Washington to give the councils a real try as something far better than full federal control, which clearly is the only other option. We're not going back to state control. That does not seem to be true of either Alaska or California. They may, over time, see the handwriting on the wall. I think the councils may end up having a considerable amount of influence on the way fish are allocated among our competing foreign users. But it's going to take some time to shake the State Department loose from their position. They're simply not used to negotiating in terms of fish alone.

Q: Let's say the State Department reacted negatively to your proposal for rationing the catch by higher fees. How would they go about rationalizing that action in terms of historic U.S. control?

A: I don't know. Nobody would say it in these terms. The statement has been made that you cannot negotiate any single international issue among nations solely on the basis of that issue alone, and State is reluctant to tie its hands on fishery negotiations when there might be a possibility of getting other things unblocked: the Canadians with regard to energy, the Japanese with regard to television exports, and so on. I have a certain amount of sympathy with that view. But I cannot see why we couldn't continue to negotiate in that broader way while making efficient use of this particular resource. My argument is

essentially an efficiency argument: not for perfection but for a more efficient harvesting regime than the sort of sloppy way that we're doing it now. That still does not rule out the possibility of negotiation with the Japanese, the Soviets, and others with respect to these resources.

I can't see at the moment any tendency on the part of the State Department to give up its authority, or any indication that the Department of Commerce is very eager to assume it. In fact, they seem to be running from that responsibility as hard as they can.

Q: Are the councils dominated by the special interests of the fishing industry and the state representatives?

A: In the first place your statement is a little too broad. The councils vary quite a lot, depending in part on the personalities involved and in part on the actual structure of the council. To use names: in this particular council I'd say that Jack Donaldson votes his conscience and his knowledge as a very able fishery man as much as he does his position as Director of Fish and Game for the State of Oregon. And the same was true of Don Moos and now Frank How of Washington. In a sense, they're functioning as public members of the type you'd want. I've tried to function in that way. I have no strings attached to me and am in fact a public member. The man who represents the sport fishing interest, Vern Smith of California, has voted rather independently in the same way. On the other hand, there are problems. I'd like to see the councils include more truly public representatives who are not there because they are members of the fishing industry, or state or federal government with turf to protect, but to learn and to exercise informed judgement in the public interest. Pushing against that is the fact that you just don't learn all that is involved in the complex biological, economic, sociological and legal complications of fish catching, harvesting, and management overnight. To function effectively on these councils most of the members have to come from a group that has been intimately connected with the operation for some period of time. And that can get you into a jam, because almost anybody who's worked in the fishery long enough to be effective in the first year or two on the council, whatever be his position, has some built-in biases. God knows I have. But I think it's better to do the job with people who know the fisheries, at

least in the initial stages.

The representation of industry interests, I think, is much better achieved through strong advisory groups. Our technique seems to have been reasonably effective. We have an industry advisory group for each of the fisheries for which we undertake to develop management plans and regulations. Obviously, the industry advisory committees will always be angry at us because we cannot accept all their advice -- particularly since we usually get six conflicting sets of advice. But that's all right. We want to get from the trollers, purse seiners, gillnetters, sport fishermen and Indians their own recommendations for salmon management. They are bound to present conflicting points of view. And that's what the council should hear. We'll never get a perfect solution to the problem of industry inputs, but I think we get better industry input that way than by having every pusher and user in town represented on the council itself.

Q: I'm wondering how you feel about the potentials and the interactions of favorable and nonfavorable activities of man in propagating those fish over which he has some control to harvest?

A: Well, the promise of aquaculture has been upon us for years. The people closest to aquaculture feel that we do not know enough as yet on the purely scientific level to push ahead with big action programs or even to evaluate the long-term potential. Fish farmers don't even know which animals will be the best to produce. We've been working with a very small number thus far: carp, milkfish, tilapia, catfish, trout, salmon. That's about the size of it. I don't know how many millions of dollars have been lost in unsuccessful efforts to propagate prawns because of their high price and market acceptability. But look at the problems: we don't know how to breed marine fish in captivity as yet, so we have to get wild stock to raise. We don't know how to feed them properly at every stage of their life cycle. We don't know how to raise them in crowded conditions which make them economically attractive without bringing in uncontrollable disease problems, which have given all kinds of trouble in the past. We are, in effect, hundreds of years behind animal husbandry and we need somehow to pursue the same set of steps, hopefully more rapidly, with the fast growing and researchable marine animals that are available. This is a long rambling way of say-

ing that until we know the answers to the seed problem, the breed problem, the feed problem, the disease control problem for each of a battery of potentially good manageable species (and until we know the potential for genetic improvement of these animals to make them more amenable to culture) we won't really know the full potential of aquaculture.

The other thing that dictates caution is that raising fish under controlled conditions is very demanding in terms of water quality. And because it is demanding in terms of water quality, it requires control over land usage within the drainage area of the water supply required. That begins to get into some pretty expensive alternative uses for the land and water in question. It may well be that the most successful aquaculture will be carried on in relatively remote areas like the mangrove swamps of Southeast Asia, which aren't good for much of anything else, and we will have to accept the higher marketing costs that go with these remote locations. The idea that you can turn fish loose in an enclosure close to where you want to eat them and that nature will feed them and rear them for you, is not quite the way it works. There is a battery of tough scientific problems to be solved. I hope we can make some progress on it because it's tantalizingly clear that the Chinese, the Thais, the Filipinos, the Indonesians, the Germans, the Hungarians, the Israelis, to mention a few of the obvious ones, have reared fish successfully under controlled conditions. But no one has systematically assessed why these have been successful, and the extent to which these production functions are capable of being translated into larger scale operations, and what that implies in terms of control. Those questions will be the object of a very intensive research program that will be mounted by at least one of the research agencies in the Southwest Pacific fairly soon. Some wag once put it: "Aquaculture is the Twiggy of the biological world -- oversold and underdeveloped." It still has to prove its potential.

Q: I assume that you are in favor of optimum economic production and one of the things you mentioned -- increased efficiency -- and I'm not opposed to that either. I think you assume that reducing the number of entrants into the fishery is essential. I've heard some arguments that if that takes place, you will eventually reduce the initiative of those individuals

to produce. What is your rebuttal toward that argument, or solution to it?

A: I would turn it completely upside down and say that the present situation is one in which there is virtually no incentive for efficiency because the minute any kind of more efficient technology is developed it's promptly legislated out of existence because it's a threat to the continued productivity of the stocks. If you can't control numbers of fishermen, you can't allow the existing numbers to become more efficient or you are in trouble. As you know, this has been the history of fishery regulation in this country.

Q: But you know, about 10 percent of the fishermen catch about 90 percent of the fish, so in terms of efficiency I'm speaking of the individual, not the method that he's using.

A: There is a wide variety of methods of reducing excess capacity in the fishery that would stimulate rather than retard efficiency. Let's just put it this way. If by magic we could cut the number of salmon licenses in California, Washington, and Oregon in half, the remaining half could harvest all of the salmon we would want to take with no difficulty at all. The licenses would acquire a significant value, its exact amount depending upon how heavily that restricted property right which you've conferred is taxed. The minute you make that license cost something you generate a good deal of pressure for those licenses to migrate into the hands of more efficient, more professional fishermen. One of the abiding mysteries has been that the most vigorous opposition to limited entry into the fisheries always seems to come from the really professional, long-time high liners who actually stand to gain the most from it.

Q: What would you do to limit the possibilities of monopolies owning all this?

A: We don't have any monopolies in agriculture because we allow people to own land. Agriculture still retains a very substantial amount of market autonomy for most crops. The fact that one must own, lease, or otherwise control, the use of a piece of agriculture land makes you a monopolist of that little piece of agricultural land but does not make you an effective monopolist in the market. If we had, let's say, 2500 individual salmon fishermen instead of 7500,

I doubt that you'd have any condition of monopoly that would be significant, nor have you denied anyone entry to the fishery. Anybody is perfectly free to enter the fishery simply by buying or leasing land.

Q: What if a cannery subsidizes an individual to buy a license such as they've already done in Alaska?

A: Well, the Alaskans have taken care of that fairly well, if you're really concerned about it. The fisherman who owns a license in the Alaskan scheme must fish the license, and there's no particular reason for the cannery to subsidize him unless it controls the vessel itself. They can't under the Alaskan scheme. I'm not completely convinced in my own mind that it's necessary even to worry about it. Vertical integration has been a very effective tool for efficient production and quality control in many agricultural areas.

Let me give you an operational definition of optimal use of a fishery that might be useful. First, get some estimates of physical yield of which the resource is capable. Second, let's ask the question how far would we back off from maximum *physical* yield in order to achieve something approximating the most efficient harvest (which means that we don't take the full maximum yield since it will cost far more to catch the last few fish than the fish are worth). Third, we must take account of the fact that the fish may support a recreational as well as a commercial fishery and recognize that we have no really good techniques for valuing recreational fisheries in commensurable terms. Fourth, let's take into consideration the fact that fishermen are not always mobile into other occupations and that any program that might cause serious dislocation of these fishermen should be avoided where possible. In effect, I would argue that optimum yield means an estimate of physical yield capabilities, modified to achieve as efficient an operation as we can, to achieve some workable allocation between recreational and commercial, if that is at issue, with minimum adverse impact on the socio-economic status of the people now participating in the fishery. That's still pretty vague, but it's something which, for a given fishery, is capable of being reduced to a set of finite choices that the council can make.

That procedure would stand the test of a court. If I read the legislation properly,

the court does not demand that the council do everything *right* to determine optimum yield; it simply asks that it interpret optimal yield in a reasonable way and use the best data available to achieve its interpretation. And that would be one heck of a lot better than the objectives we've had for fishery management to date.

□

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James A. Crutchfield, "Marine Resources" The Economics of U.S. Ocean Policy," American Economic Review, May, 1979, vol. 69, pp 266-271.





## **II-C Ocean Fishery Resources: National and International Conflicts**

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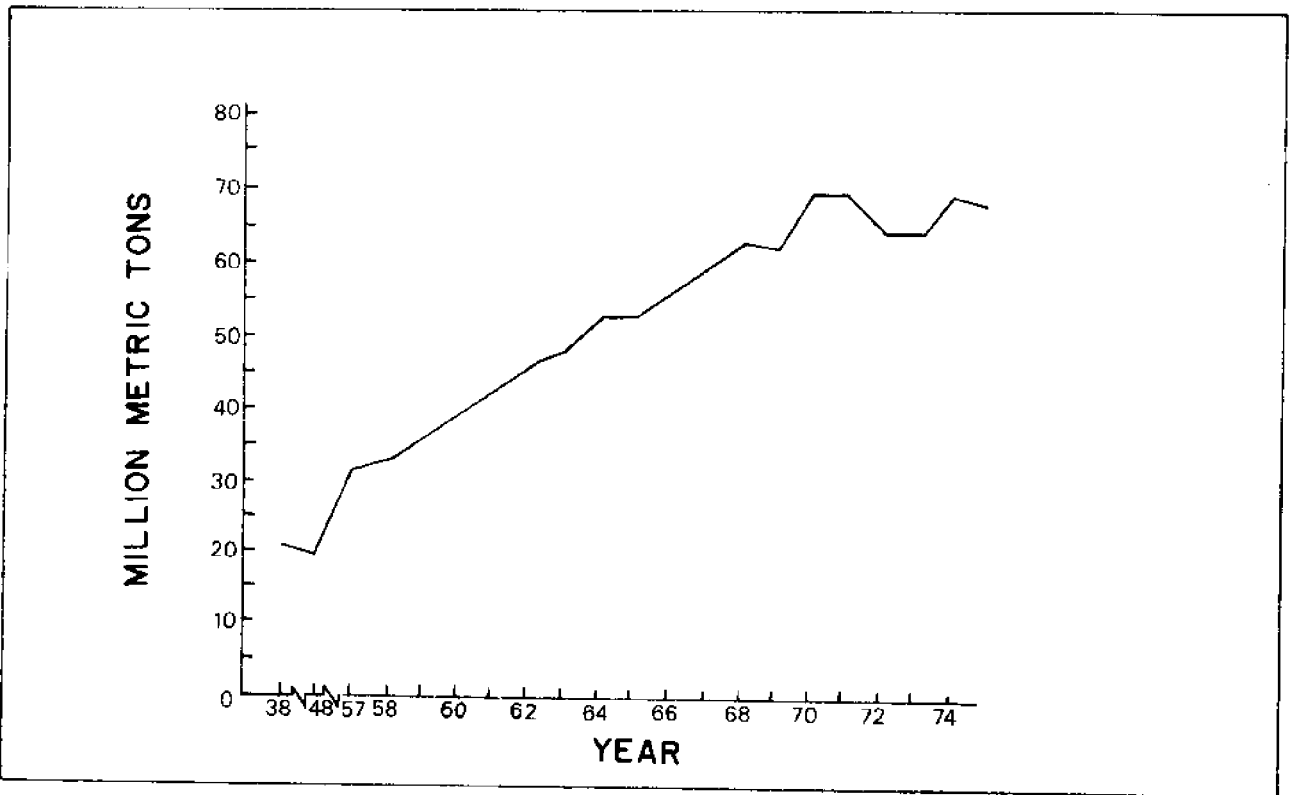
### INTRODUCTION

This presentation is primarily concerned with both national and international conflicts in ocean fisheries. These conflicts will be illustrated with examples from the herring, cod, tuna, and Pacific and Atlantic salmon fisheries. Before examining these conflicts, let us look at the potential and actual world catch of fishes in order to gain some perspective regarding these conflicts.

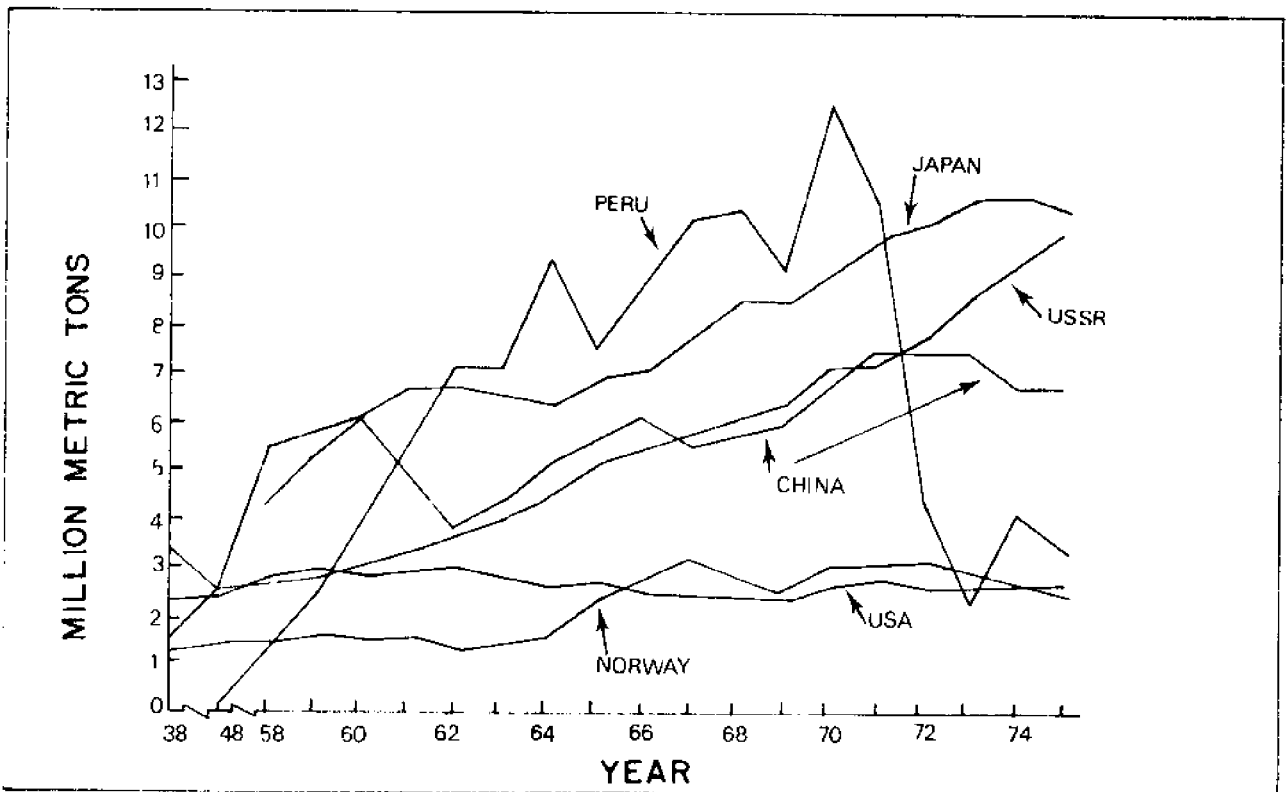
### WORLD CATCH

Figure 1 shows that the world catch of fishes has been increasing steadily since 1938. In 1975, the catch was approximately 70 million metric tons (MT). The drop in the world catch around 1972-1973 is attributed to the decline in the Peruvian anchovetta (anchovy) which normally constitutes a relatively large proportion of the world fish harvest. The decline in the anchovetta catch was due to the reduction of the anchovy population, which declined when the usual surface winds (El Nino) ceased. The El Nino blows from the west raising deep water nutrients to the surface. These nutrients, coupled with the tropic sun, enable the growth of vast amounts of tiny organisms upon which the anchovy feed.

In terms of individual countries (Figure 2), Japan is now the foremost fishing nation, having caught nearly 11 million metric tons of fish in 1975. The Soviet Union holds second place with a catch of 10 million metric tons in 1975. The catch listed for



11-C 1. Total world catch, 1938-1975. From Yearbook of Fishery Statistics: Catches and Landings 1938-1975. Rome; FAO, United Nations.



11-C 2. World catch by leading nations, 1938-1975. From Atlas of the Living Resources of the Seas. FAO Department of Fisheries, Rome. 1972.

China is based upon estimates; however, her fishery is generally listed as the third largest in the world. At times the United States and Norway exchange positions, each having been in the fourth and fifth place. However, the U.S. catch has remained fairly static from 1938-1975 at approximately 2 million metric tons. (The earlier years are only shown sketchily in Figure 2.) Finally, Peru climbed from virtual oblivion in 1955 to the leading position from 1962-1970, until the decline in anchovy.

#### ACTUAL AND POTENTIAL WORLD CATCH BY REGION

Figure 3 shows both the estimated potential world oceanic fishery resource and the degree to which that potential is being utilized. The potential is shown by the size of the circle, while the dotted area within the circle indicates the level of utilization. The large circle in the Southeast Pacific represents primarily the anchovetta resource. This is about the largest circle on the chart, and since the dotted area nearly fills the circle, that anchovetta stock is basically fully utilized.

#### VALUE OF LANDINGS

While Figure 3 represented landings by weight, Figure 4 shows landings by value. The circle off the coast of Peru and Chile is small in Figure 4 because the price per pound of anchovetta is relatively low, even though as Figure 3 shows, the total landings are large. On the other hand, the nearly totally utilized fish stocks in the North Atlantic and Western Pacific bring a relatively high price per pound.

Figure 5 gives the distribution of demersal (bottom dwelling) fishes throughout the world's oceans. There is a very substantial bottom fish resource in both the North Atlantic and off the United States coast. The blue symbol indicates demersal fish caught by ships bearing foreign flags. The red symbol indicates fish caught by ships bearing the flag of the adjacent state.

Figure 6 shows the coastal pelagic catches. The large fish off the Peruvian coast represents 10 million metric tons of anchovettas caught there in 1968. There are also large pelagic resources in the northeast Atlantic; these are primarily herrings. Off California, there is a large pelagic resource composed primarily of

anchovies.

Figure 7 illustrates crustacean resources (crabs, shrimps, and lobsters). There are large crab resources in the Gulf of Alaska and the eastern Bering Sea.

The distribution of catches of tuna is shown in Figure 8. As can be seen, tunas are pretty much distributed in or near the equatorial zone.

The degree of exploitation of ocean stocks is given in Figure 9. Black indicates that the species is almost completely exploited, red, moderately harvested, and blue relatively unexploited. Thus, we can see that most of the under-exploited fish are in the Southern Hemisphere. These areas are more distant from the countries which have the buying power to consume and harvest those resources.

#### INTERNATIONAL FISHERY COMPETITION AND NATIONAL CONFLICTS

##### Herring

One of the themes of this seminar is the conflict over use of oceanic resources. One area of conflict is the abundant herring resource that spawns adjacent to Norway and feeds to maturity in the central North Atlantic. In mid-ocean the species is fished upon by many nations using a variety of fishing gear, yet when they move adjacent to the coast of Norway, they are considered to belong to the Norwegians.

##### Cod

Figure 11 shows the location of 12 stocks of cod, some of which were the source of disputes between England and Iceland over these resources adjacent to Iceland. The cod resources in the Northwest Atlantic were one of the reasons why we have the 200-mile extended jurisdiction law. Many nations including Spain, Portugal, Poland, Japan, Russia, and others were fishing on these resources to the detriment of the adjacent states.

##### Tuna Migration

Figure 12 illustrates the distribution of albacore tuna in the North Pacific. Albacore tuna are fished upon by U.S., Canadian, and some Mexican vessels, when they're

adjacent to the west coast of North America. When they migrate to the Western Pacific they are fished upon by the nations of Asia, primarily Japan. When they move into the Central Pacific they are fished by Korean and Japanese fishermen.

#### *Coho Salmon*

Figure 13 illustrates the migration of coho salmon along the west coast of North America. Notice that a large percentage of the coho migrate south off Eureka and Crescent City, California, and then back to their rivers of origin. Some migrate north, off Vancouver Island and then move back to their stream of origin. In recent years there has been a heated controversy between California and Oregon salmon fishermen over who should harvest this resource, where and when. Oregonians believe they should have a preferential right to the resource because the cohos are bred and born here, whereas Californians believe they have a right to fishes utilizing their marine pastures.

#### *Chinook Salmon*

Another controversy involving salmon occurs between Canadians and Americans over the harvest of chinook salmon. Many of these fish are reared to migrant size in Oregon and Washington rivers and streams. When they migrate north (Figure 14), large numbers of them are caught by Canadian fishermen. Again, fishermen of the country or state of origin believe they should have a preferential right to the resource. The Canadians, however, believe they should be free to harvest those fishes occurring in their coastal waters.

#### *Sockeye Salmon*

Figure 15 symbolizes the stocks of sockeye salmon in Fraser River, British Columbia. The Fraser River is probably the second most important sockeye-producing river in North America, being second only to perhaps the Iliamna system draining to Bristol Bay in western Alaska. For conservation purposes, Canada and the United States entered into a treaty whereby each nation shared jointly in the cost of rehabilitating and managing these stocks. In return, it was agreed that U.S. fishermen would have license to catch half the sockeye salmon in the treaty waters. Now that the U.S.

is objecting to the number of U.S.-produced chinook salmon that are caught by Canadians, the Canadians are likewise concerned about the U.S. catch of sockeye salmon of British Columbia origin.

#### *Salmon in the North Pacific*

Figure 16 shows the area of the North Pacific in which the jurisdictional dispute between Japan and the U.S. over salmon occurs. The Japanese have, for years, sent fleets into this Central North Pacific area to catch salmon with high seas gill nets. We now have a treaty that says the Japanese can't fish further east than 175 degrees west longitude. The U.S. believes it should have exclusive rights to salmon produced in its coastal streams, particularly when these fish are adjacent to the U.S. side of the Pacific Ocean.

#### *Atlantic Salmon*

Figure 17 illustrates the migratory route of the Atlantic salmon. At one time Danish fishermen successfully caught Atlantic salmon off Iceland using high seas gill nets. World pressure caused Denmark to agree to phase out their high seas fishery on Atlantic salmon because the species was becoming endangered. The high seas fishery is almost completely phased out now, and Atlantic salmon stocks are on the increase.

#### *Pacific Ocean Perch*

Figure 18 graphically shows what happened to the U.S. catch of Pacific ocean perch when the foreign fleets appeared off the coast of Oregon and Washington in 1965 and 1966. Notice that the catch started dropping around 1964-1965. The Oregon catch plummeted because the foreign fleets concentrated on the Pacific ocean perch resource and reduced the stock to a low level of abundance. With extended jurisdiction, we hope that this trend will be reversed.

#### *Atlantic Haddock*

On the Atlantic coast, the haddocks and cods were subjected to similar heavy fishing. The United States catch and the catch by foreign vessels are illustrated in Figure 19. From this figure it is clearly apparent that the catch by foreign fishermen

was at the expense of U.S. landings. Management under extended jurisdiction has begun to reverse this trend.

#### DOMESTIC CONSUMPTION VS. FOREIGN AND DOMESTIC CATCH

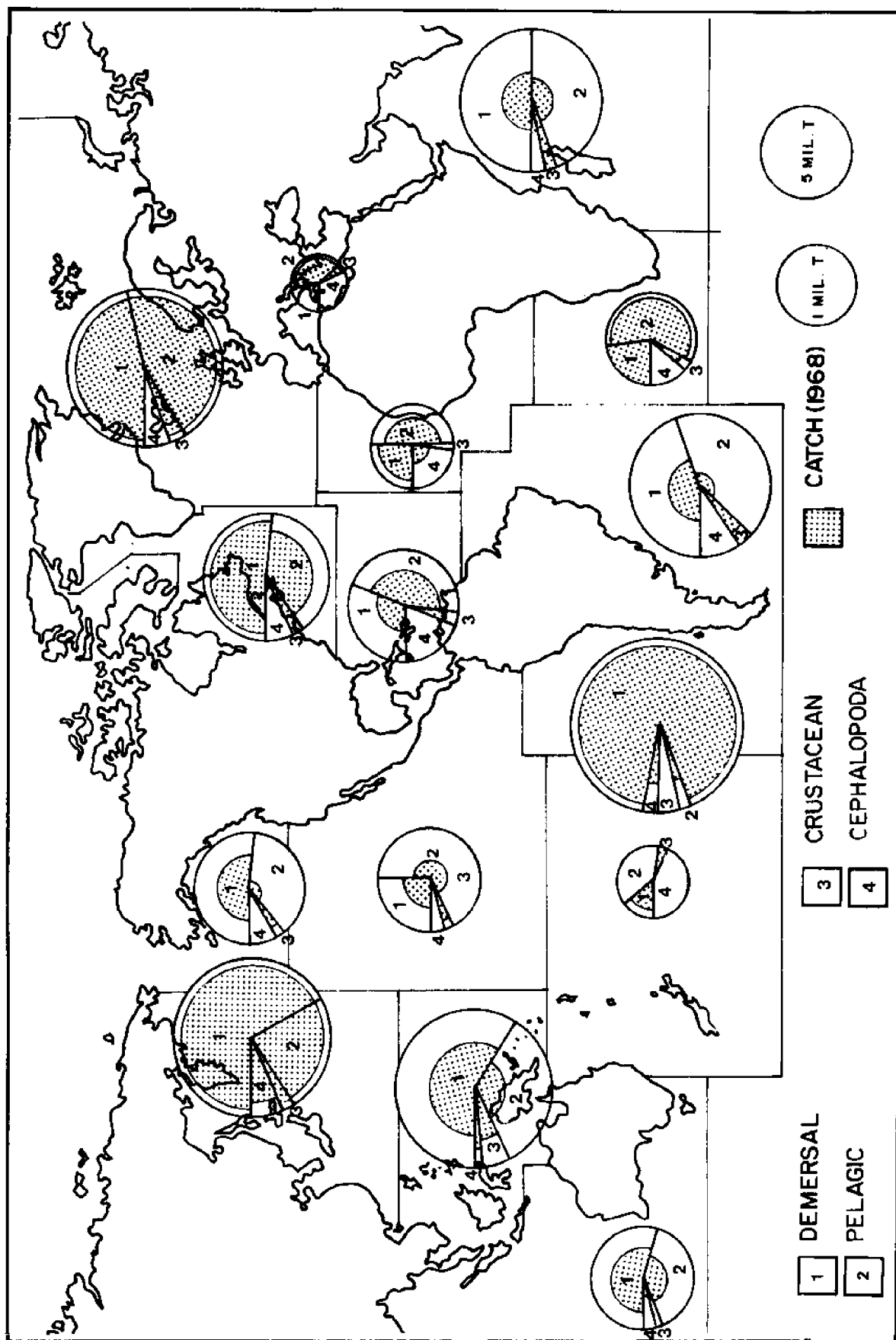
The *per capita* consumption of commercial fish and shellfish in the United States since about 1965 has ranged from 11 to about 12 pounds (see Figure 20). As population has increased, total U.S. fish consumption has increased (see Figure 21). However, since U.S. fish production has remained static, increased consumption has meant increased U.S. imports of fish.

In Figure 22, the total supply of edible fishery products in the United States in 1975 was between 6.5 and 7 billion pounds. But the greatest percentage of the total supply is made up of imports. We would like to see more of the supply coming from our domestic fishermen.

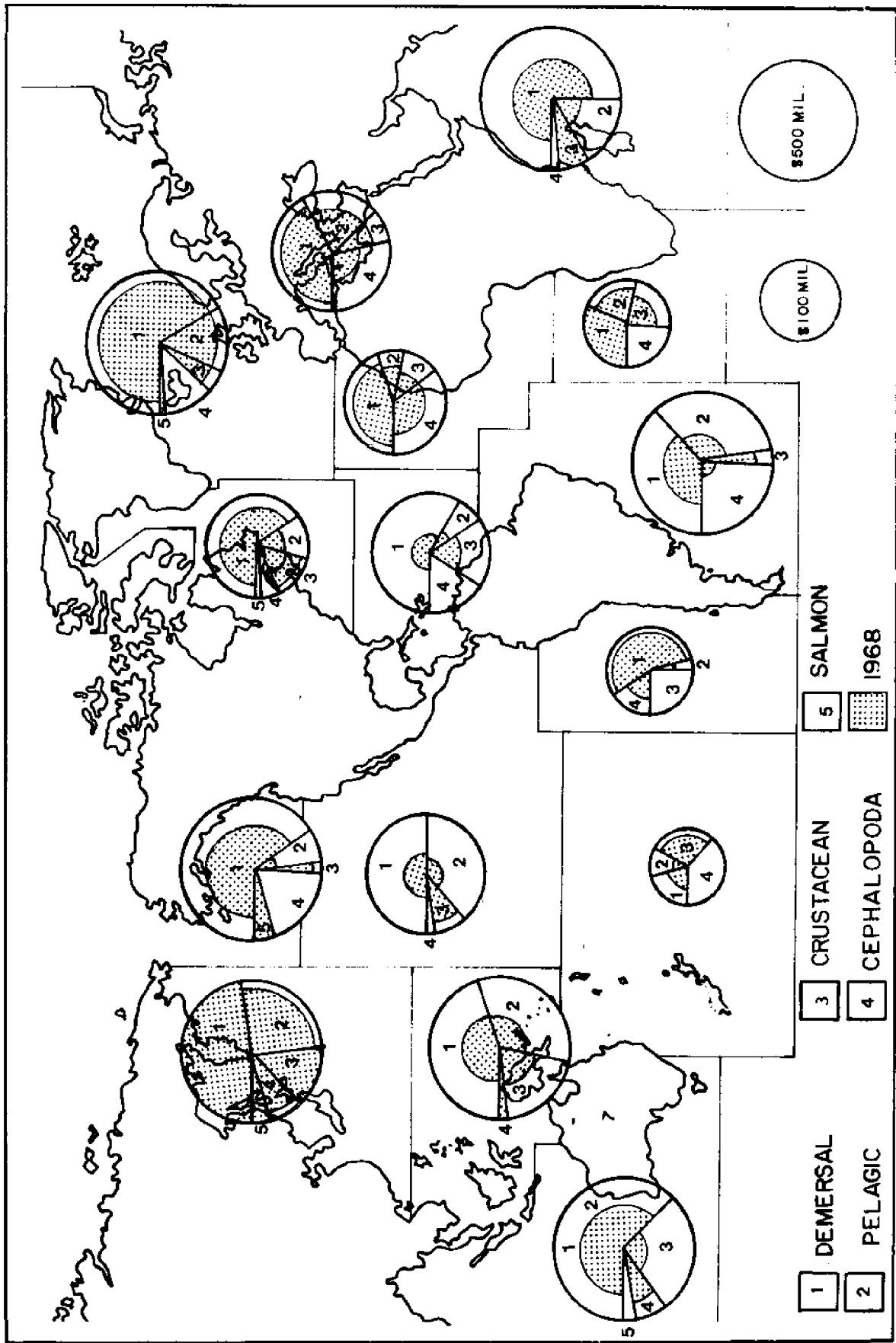
The U.S. does export some fish but the value of imports exceeds the value of exports by nearly five times (see Figures 23 and 24).

With the advent of extended jurisdiction over the fishery resources within 200 miles of our coastline, and with the regional council system of fishery management, we in the fishery profession and business are optimistic that many of the conflicts over marine resources will be resolved. We are also optimistic that the assurance of fishery management toward goals of optimum yield, coupled with preferential fishing rights to U.S. fishermen within the 200-mile belt, will encourage greater investment and ultimately greater yields from our domestic fisheries. In 10 to 15 years, it is reasonable to expect that the U.S. will once again be considered one of the strong fishing nations of the world.

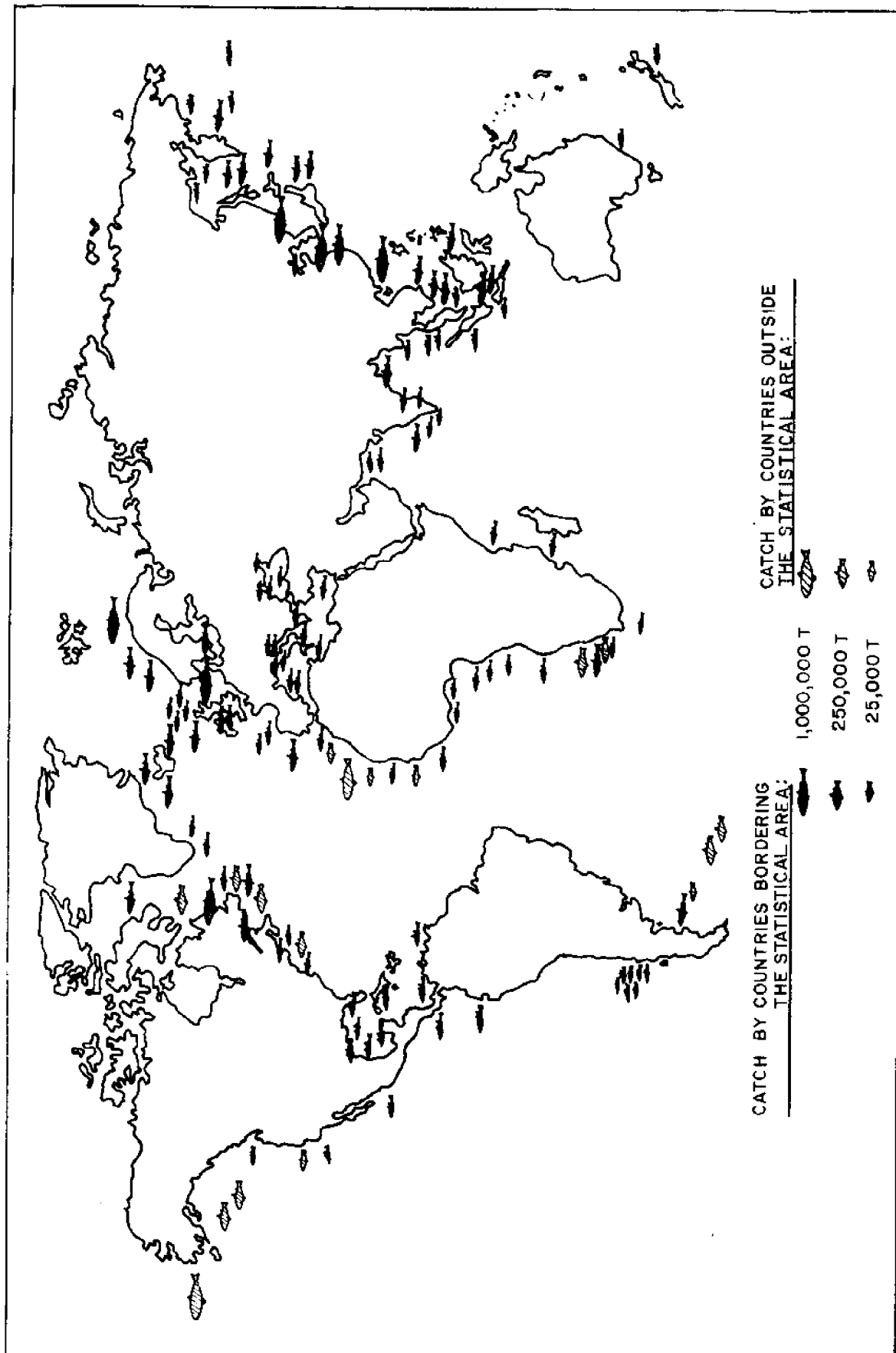
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11-C 3. World catch and estimated world potential (1968).

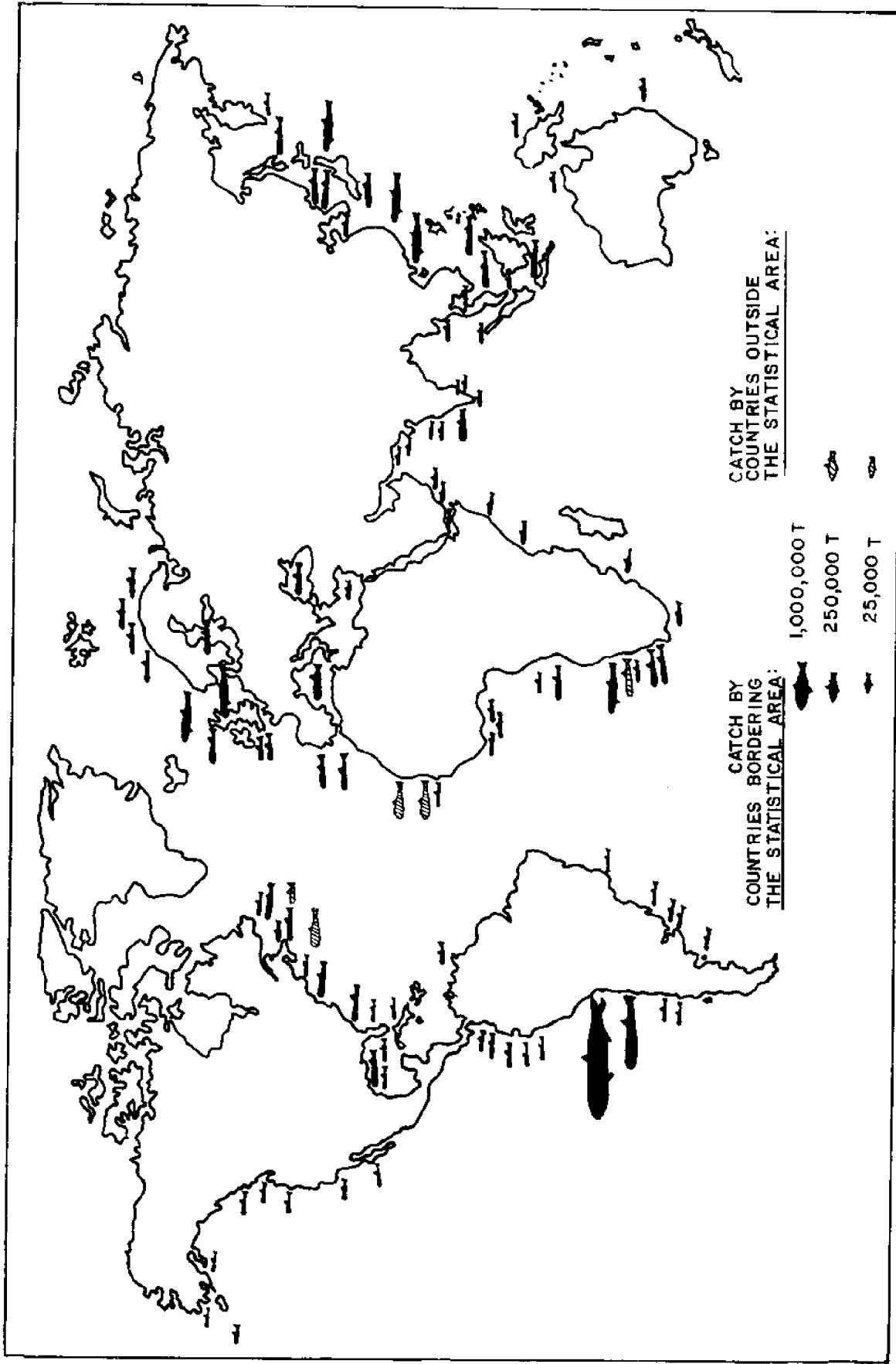


11-c 4. Value of world catch and estimated potential (1968).

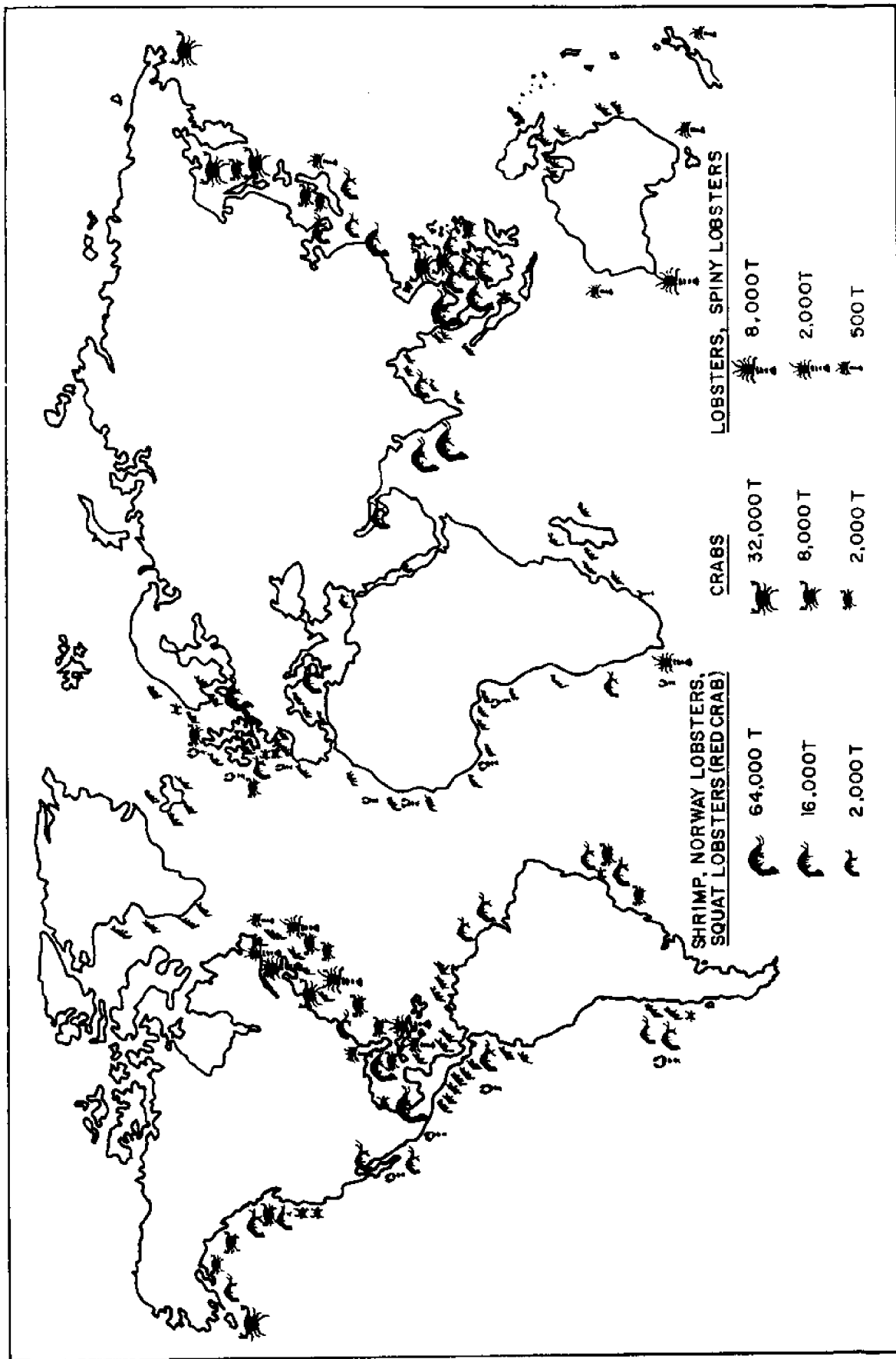


11-C 5. Distribution of Demersal fish catches (1968).

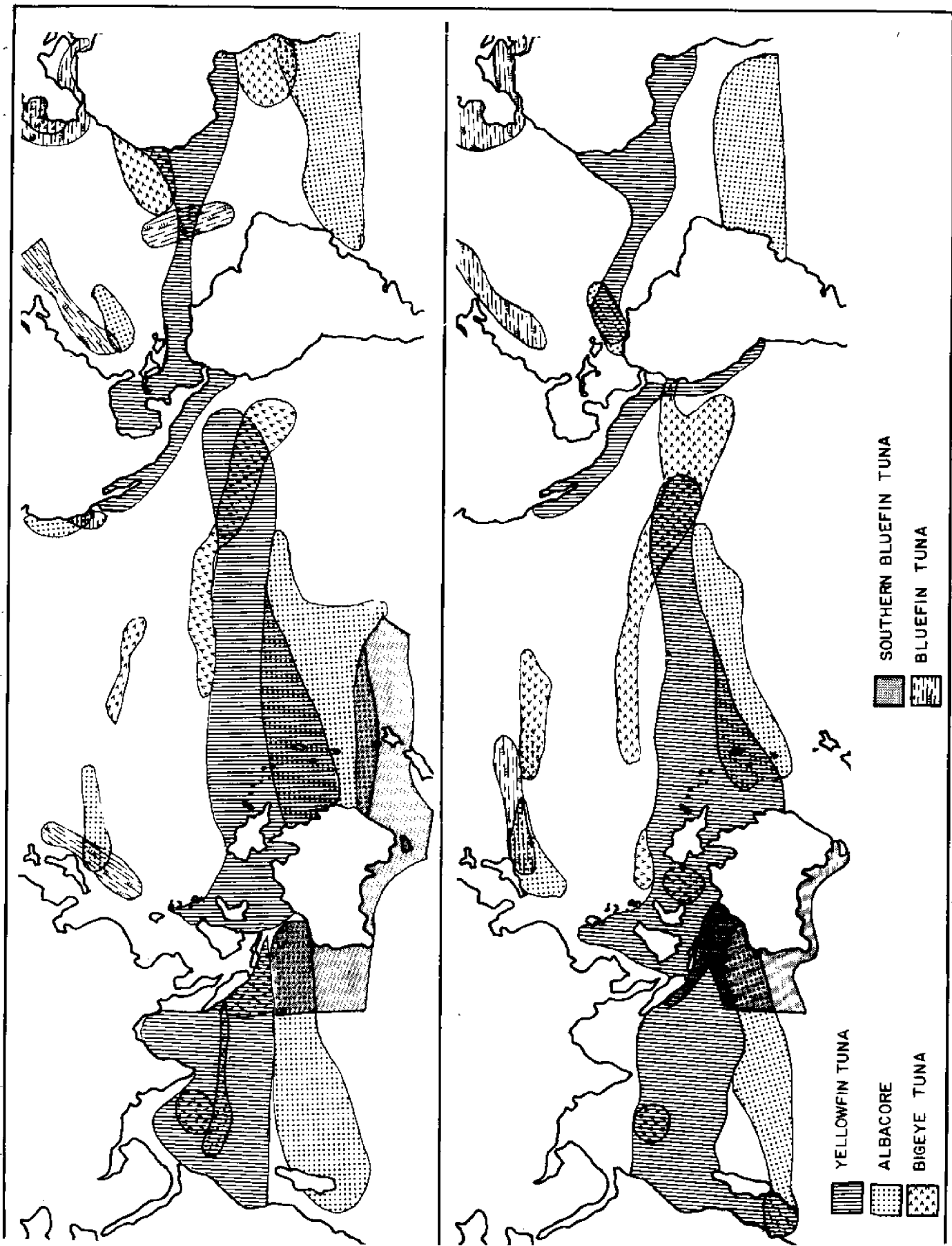




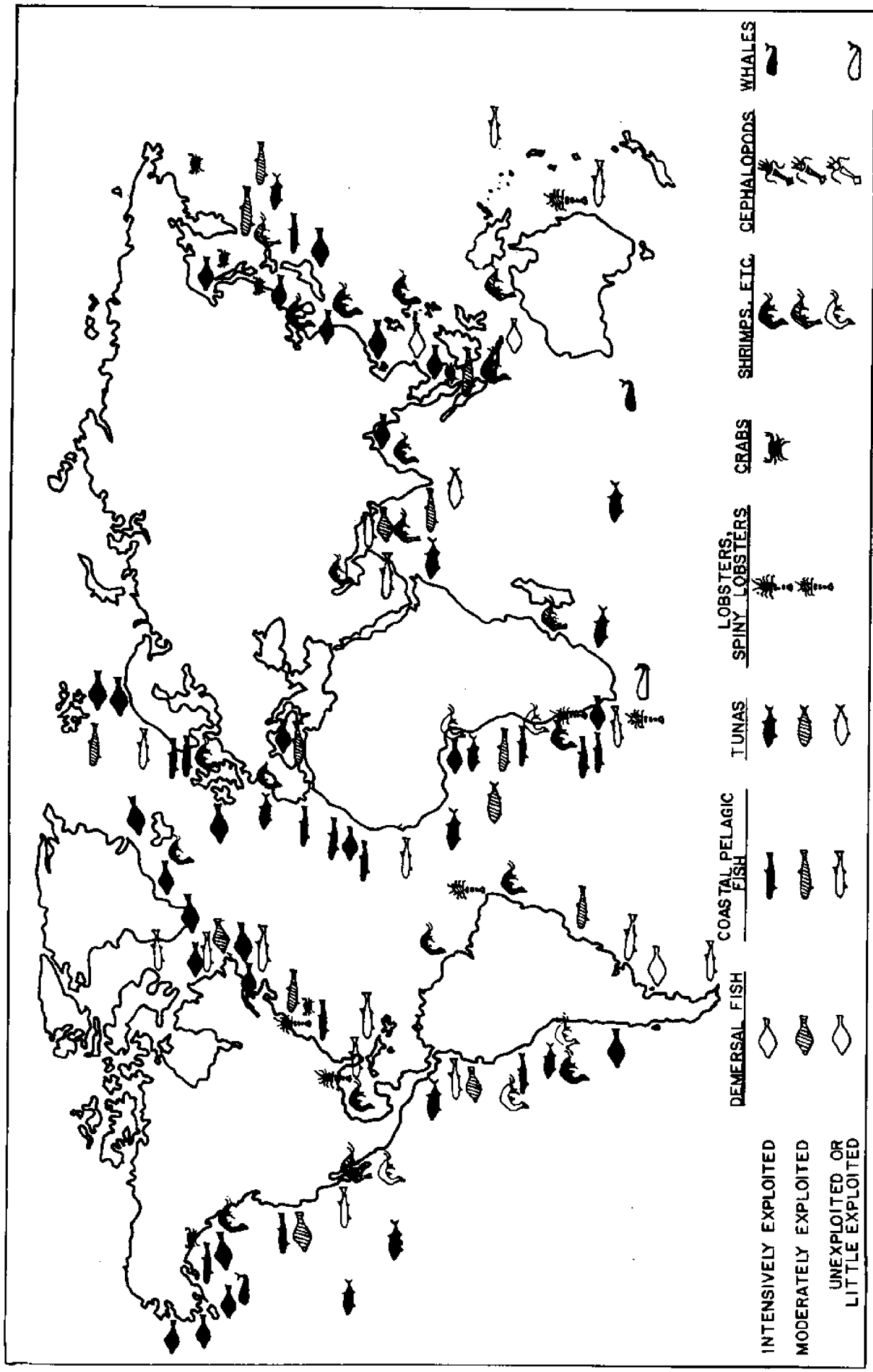
83 11-C 6. Distribution of coastal Pelagic catches (1968) (excluding tuna and tuna-like fish).



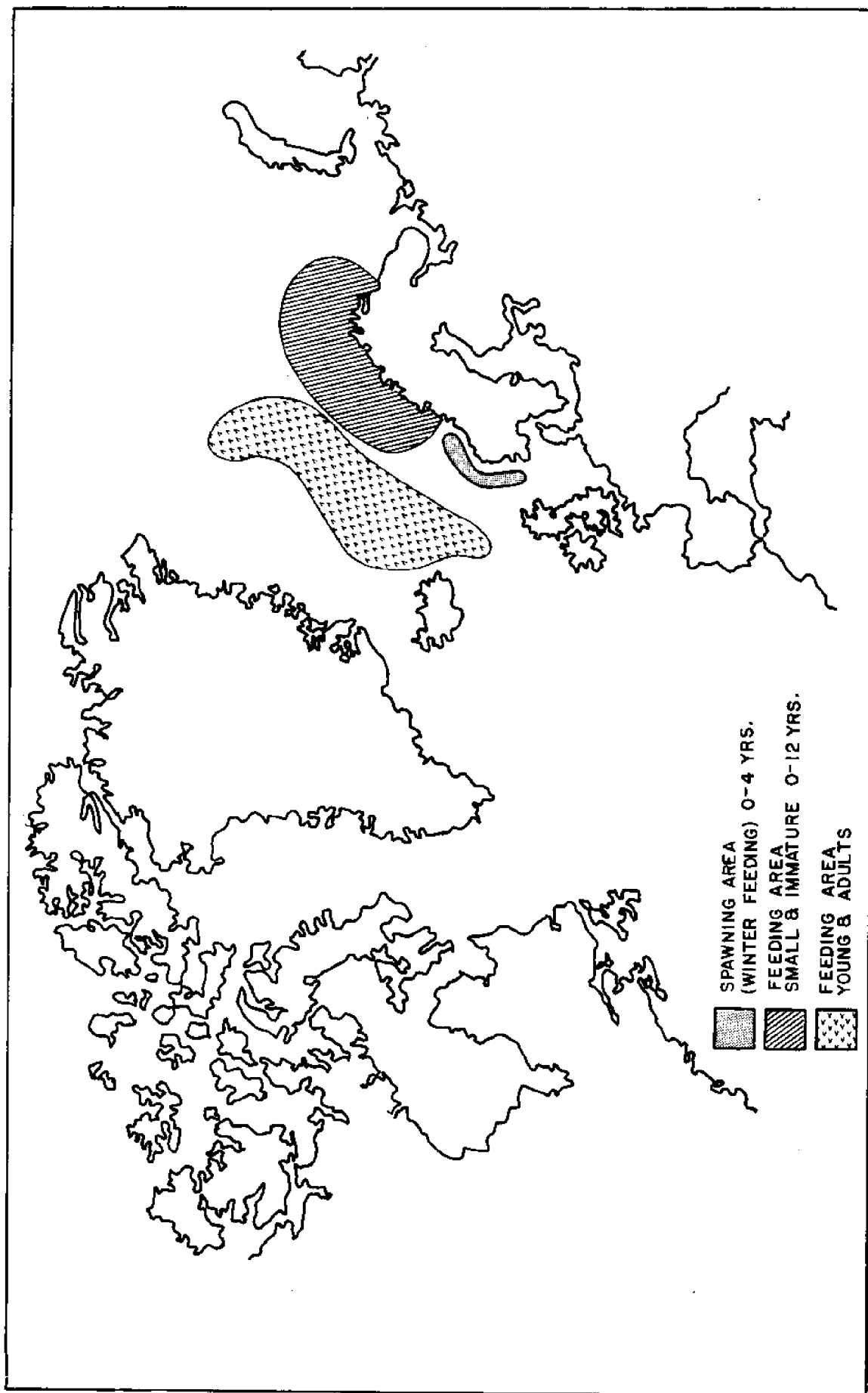
11-C 7. Distribution of Crustacean catches (1970).



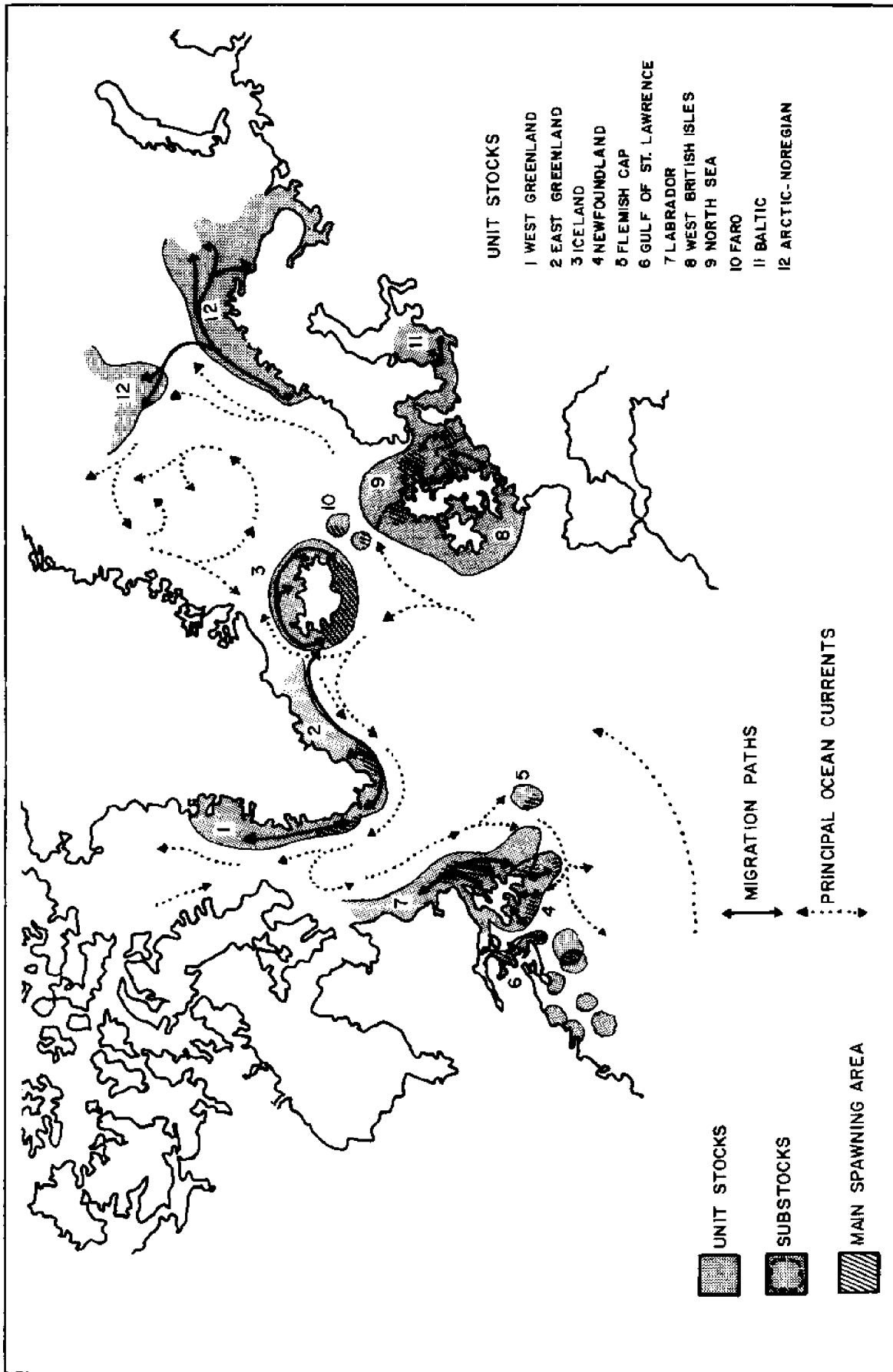
11-C 8. Distribution of Tuna catch.



11-c 9. State of exploitation of the major stocks.

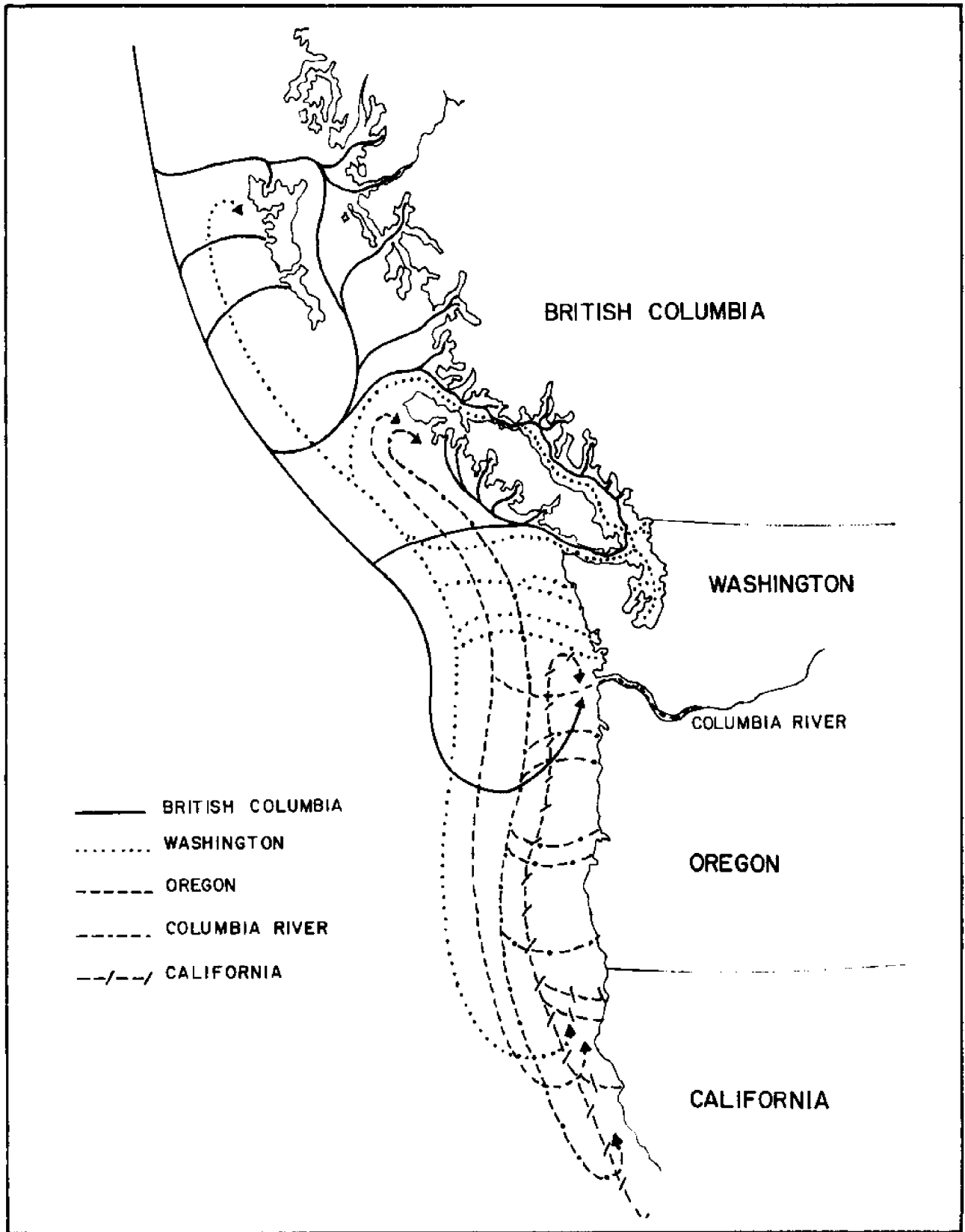


11-C 10. Migration of Atlanto-Scandian Herring (Norwegian spring spawners only) Normal yield about 1,000,000 tons/year (at present unproductive).



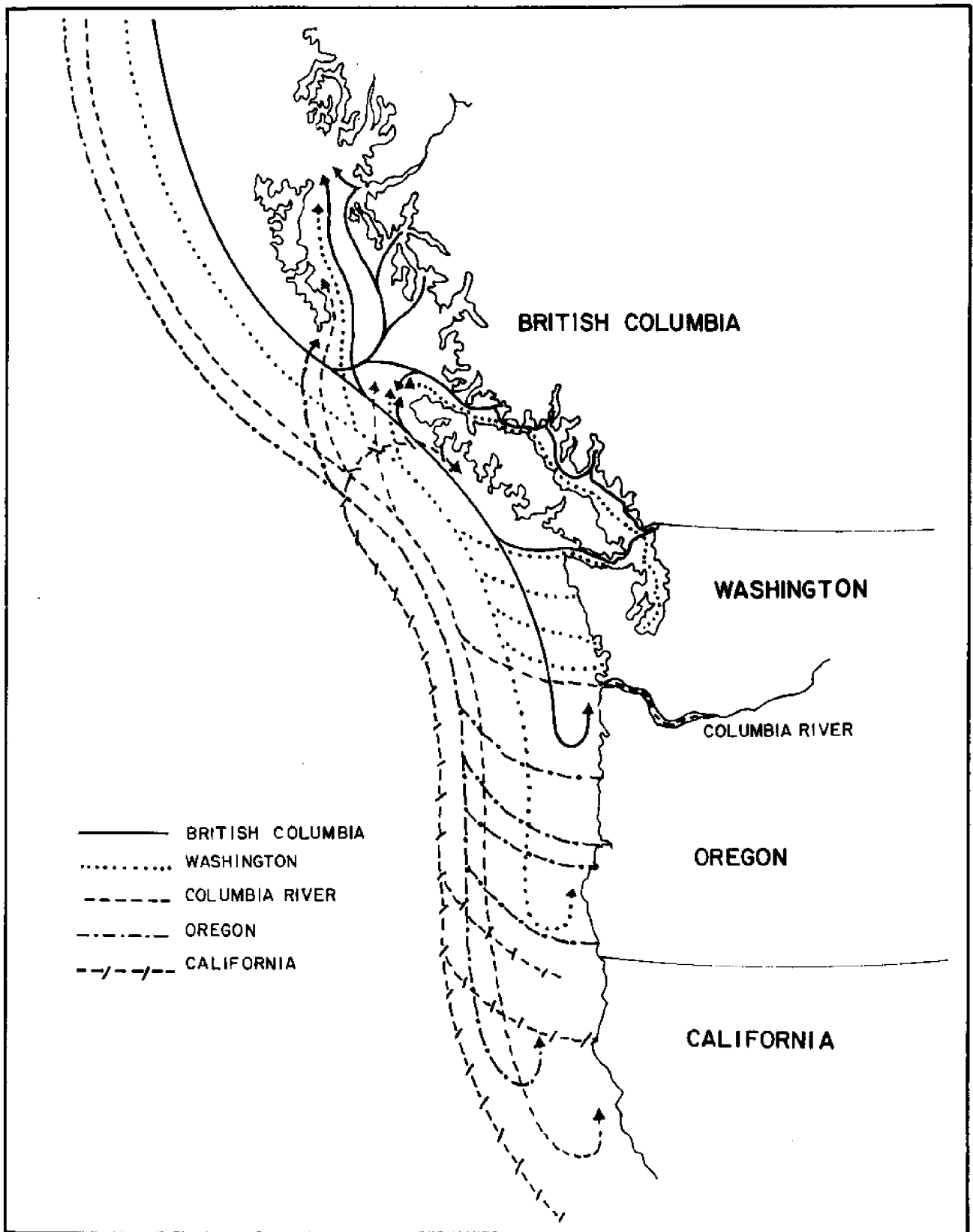
11-C 11. Migration of North Atlantic Cod stocks.



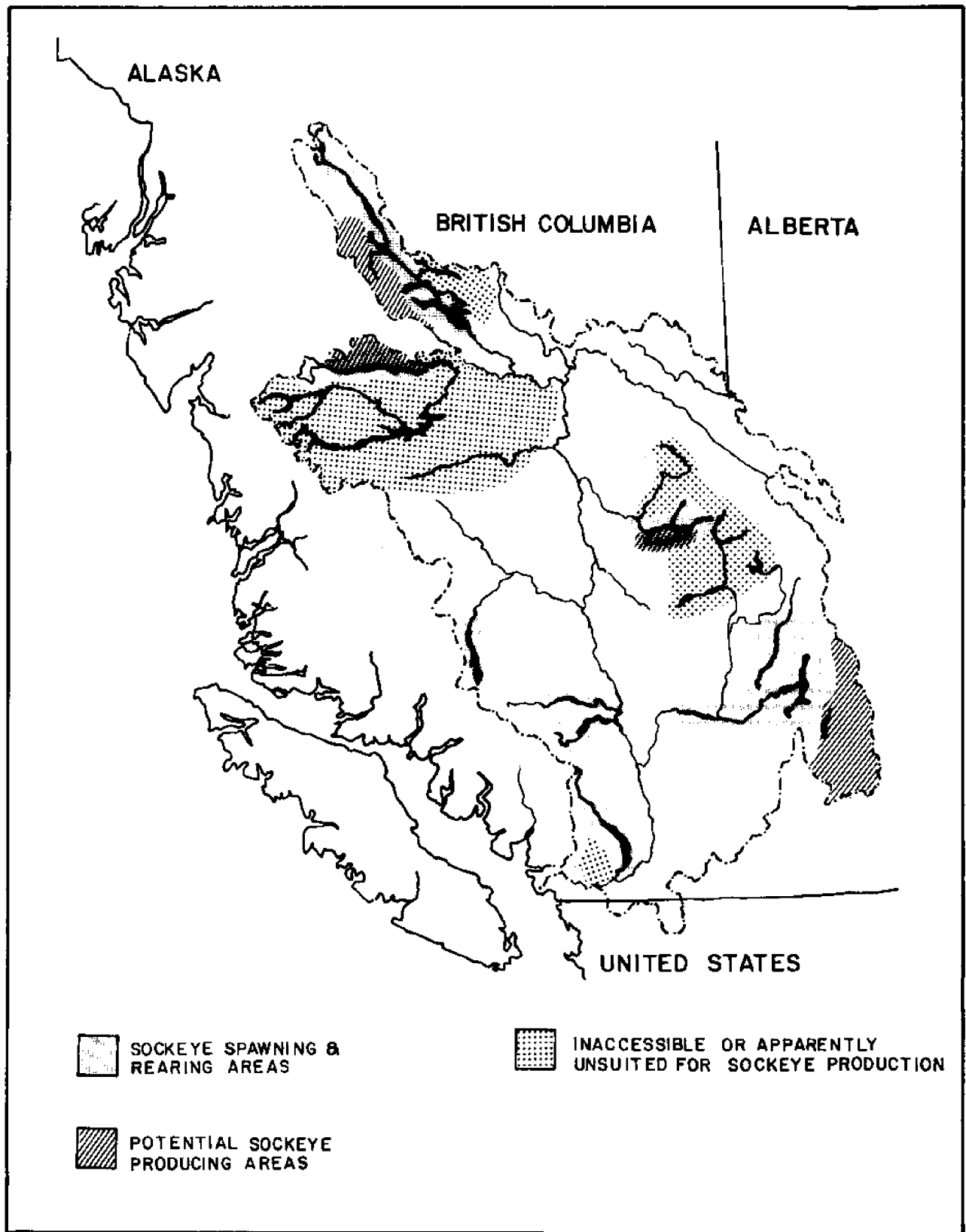


11-C 13. Migration Patterns of Silver Salmon (as shown by tagging and marked hatchery releases).

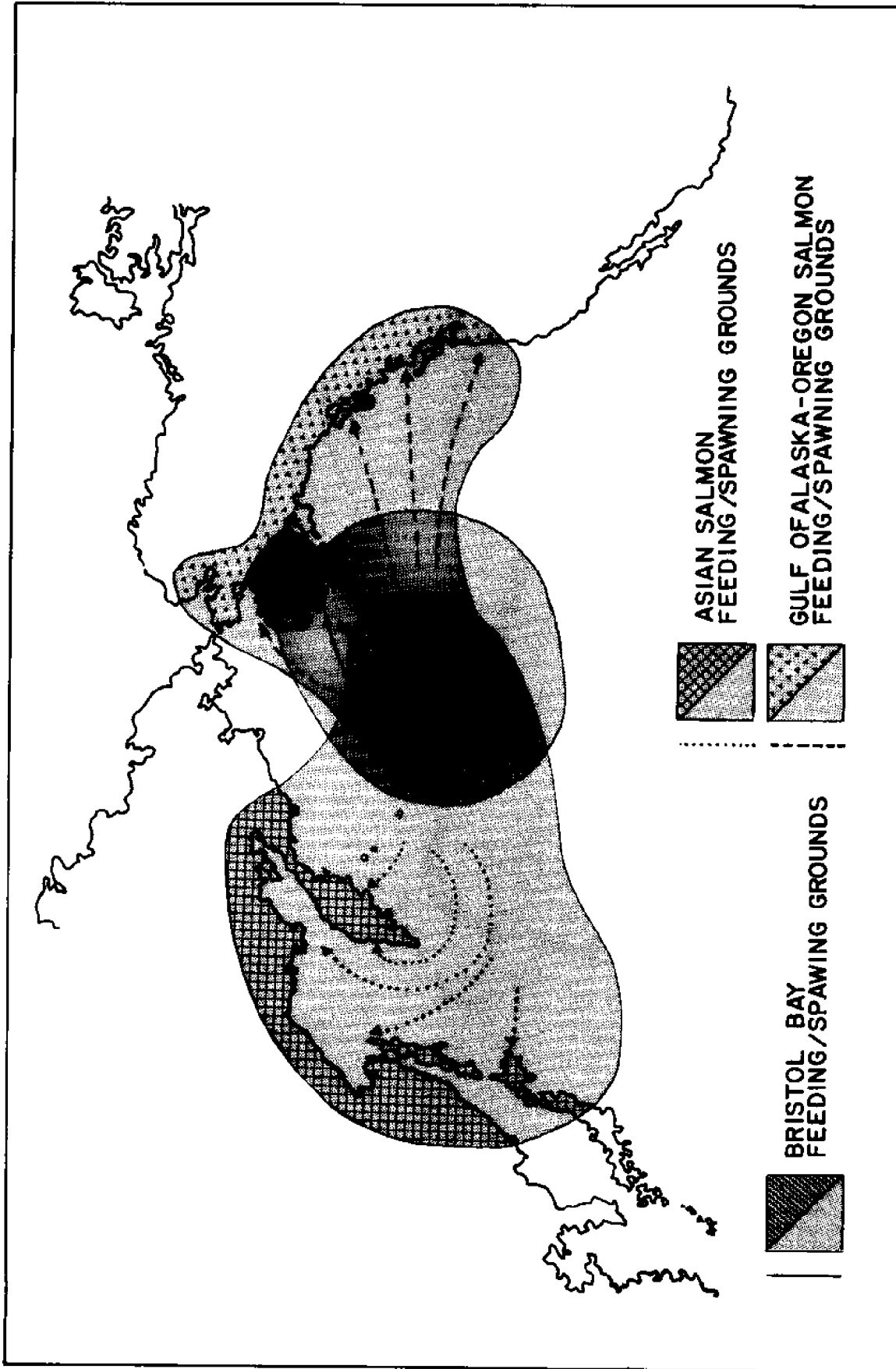




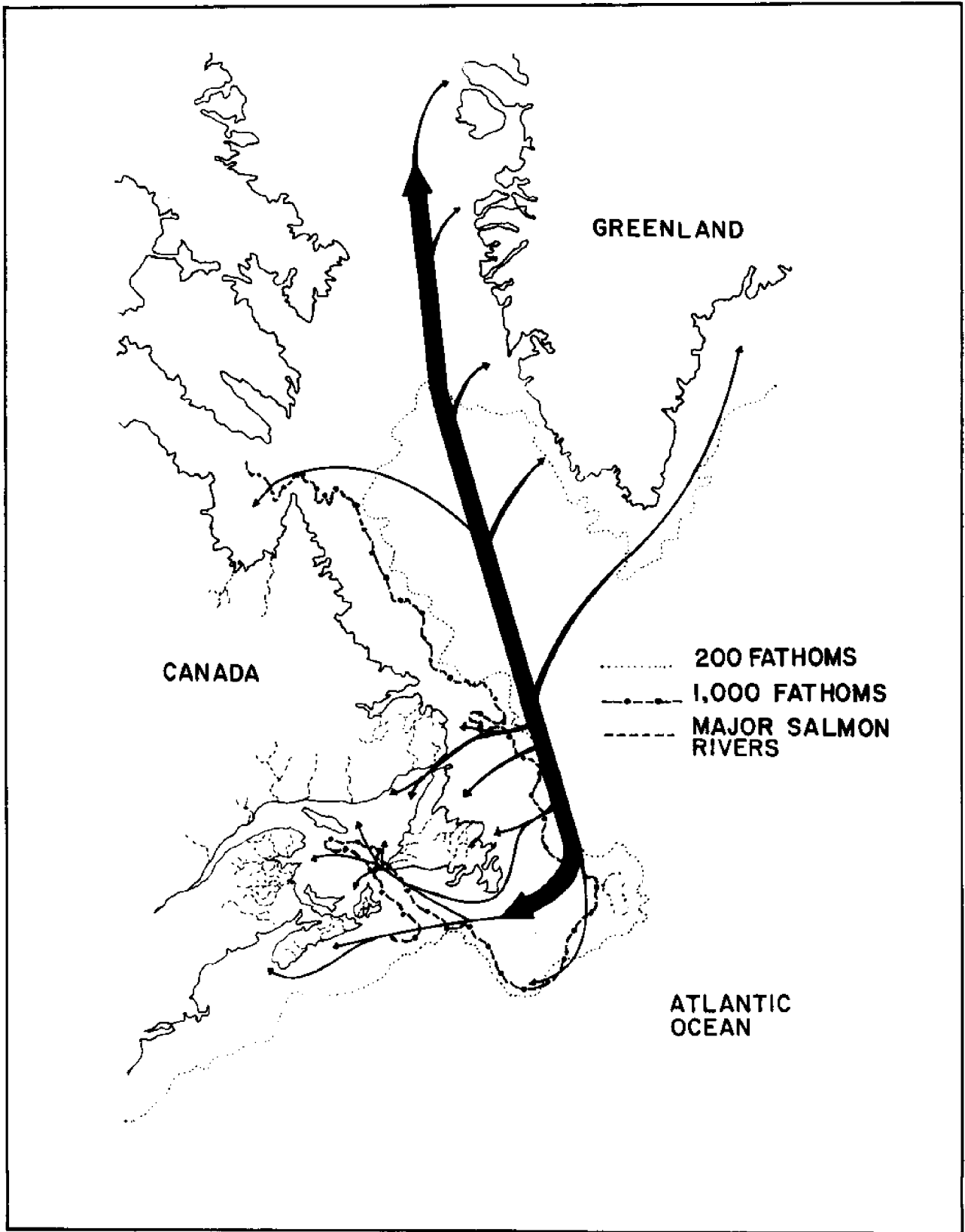
11-C 14. Migration Patterns of Chinook Salmon (as shown by tagging and marked hatchery releases).



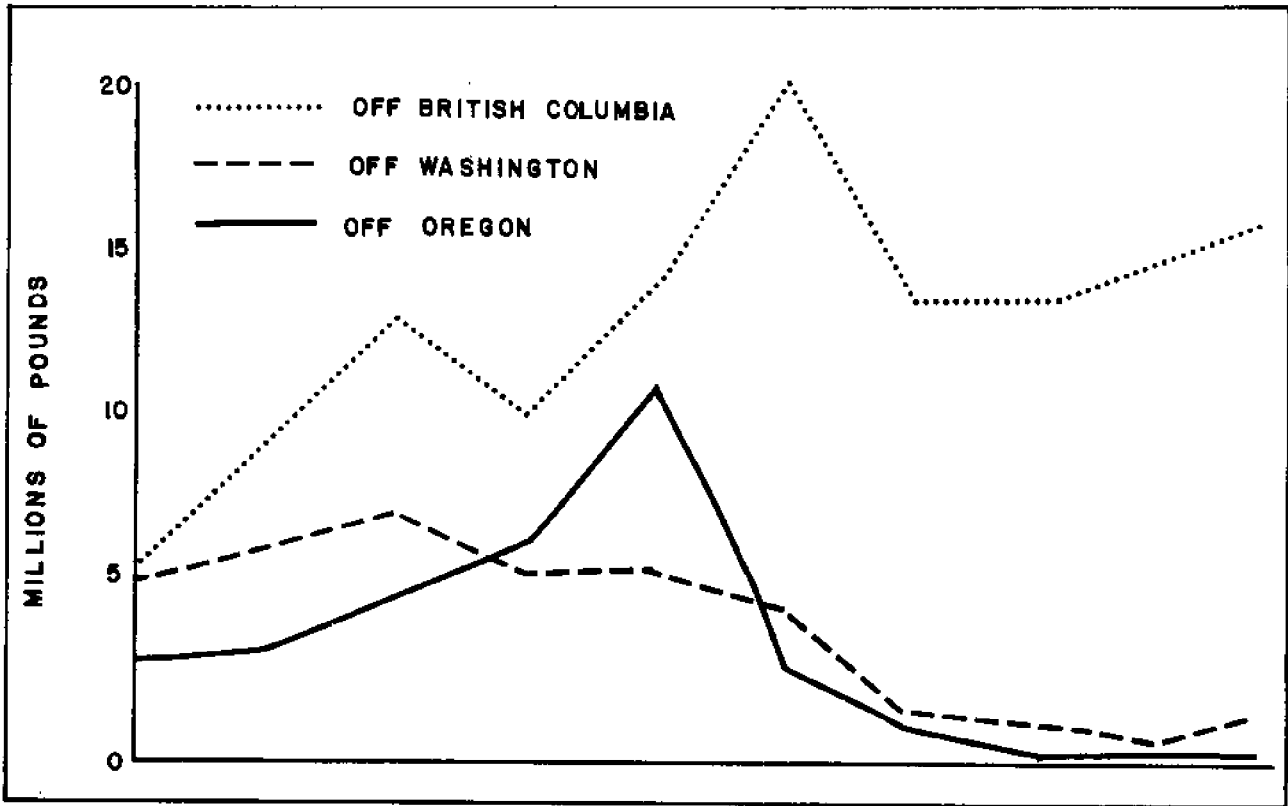
11-C 15. Distribution of Sockeye spawning grounds in the Fraser River Watershed (International Pacific Salmon Fisheries Commission-1953).



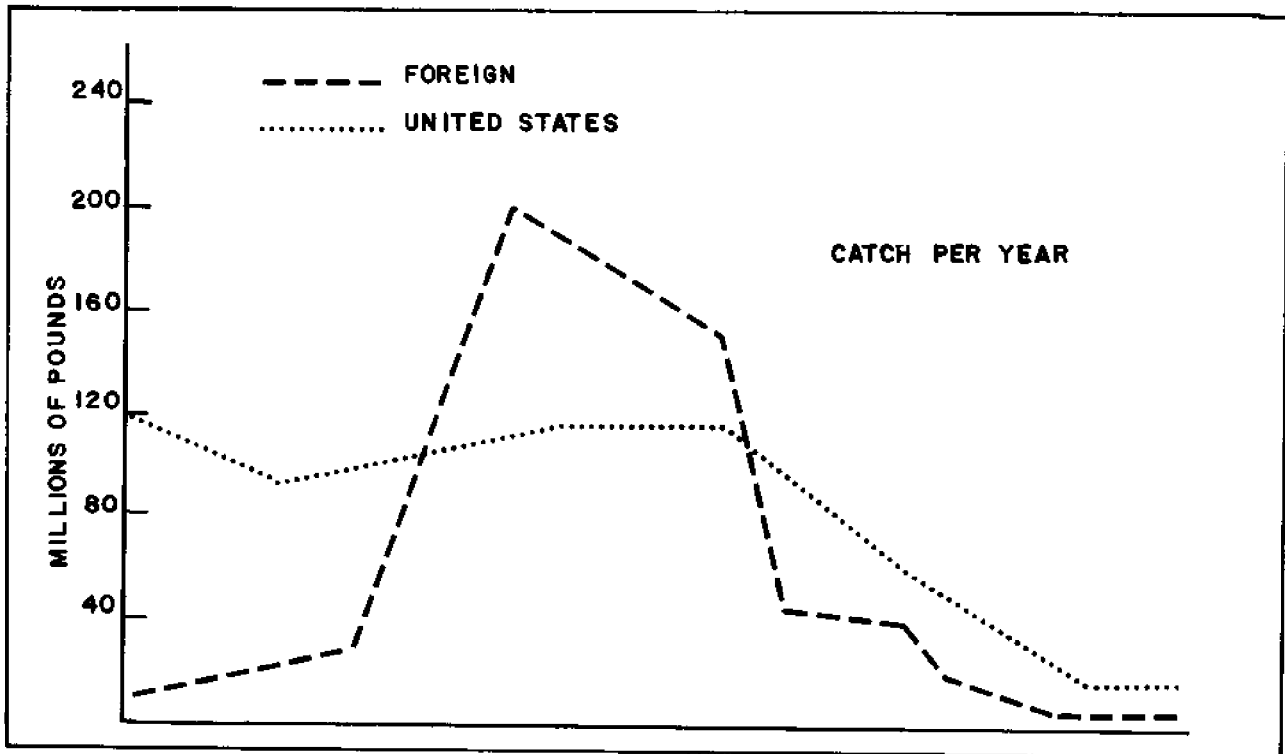
11-C 16. Migration of North Pacific Salmon.



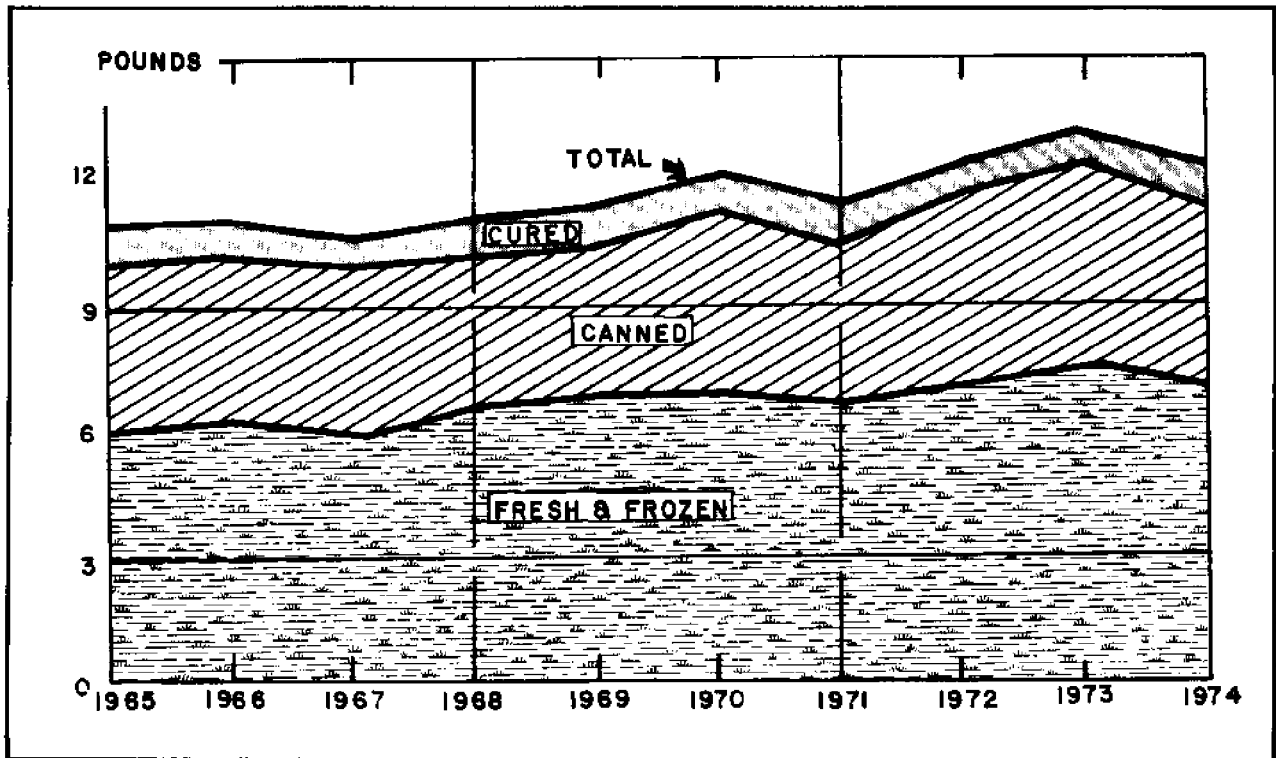
II-C 17. Atlantic Salmon migration.



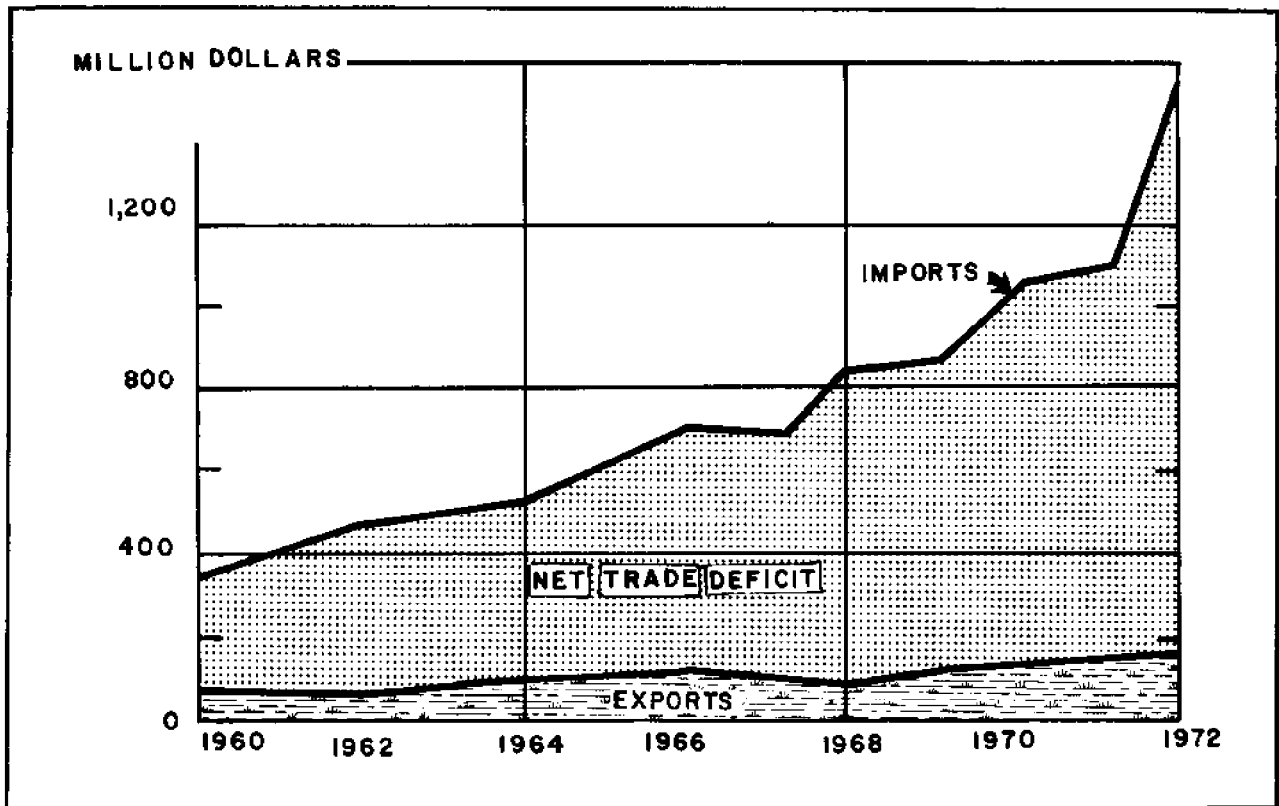
11-C 18. Pacific Ocean Perch Graph.



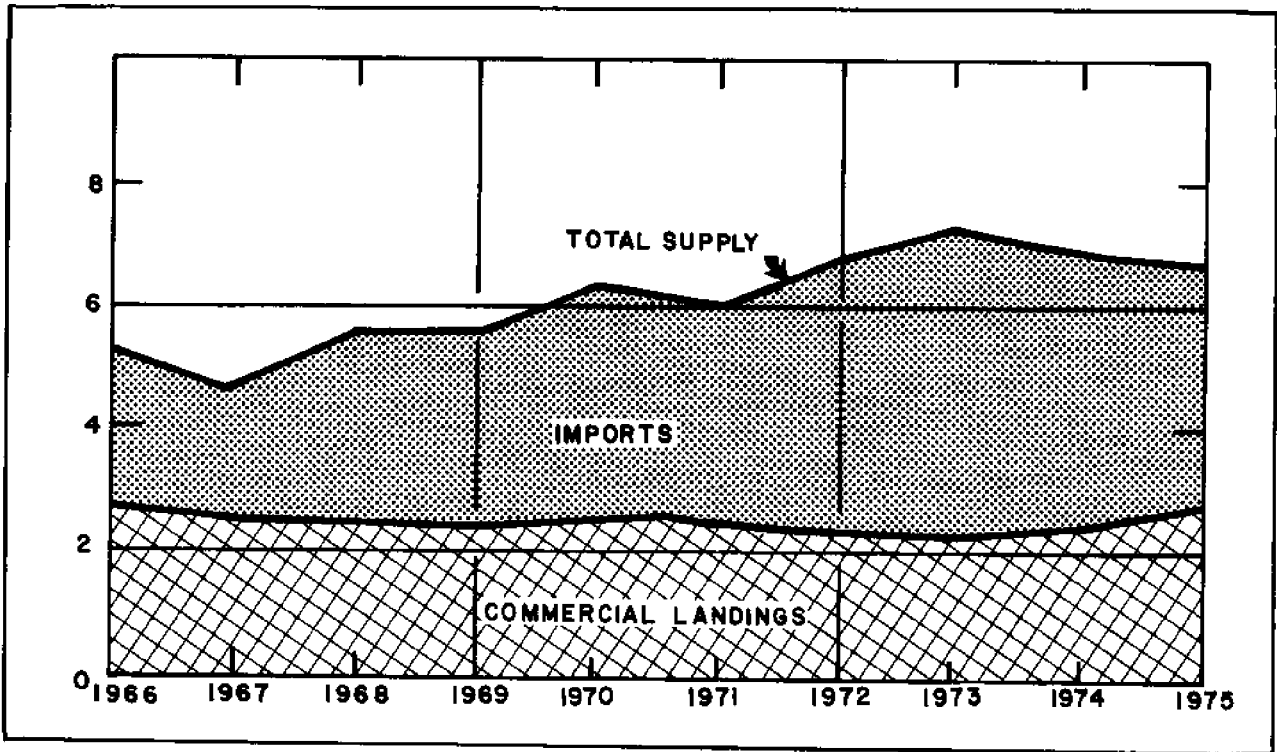
11-C 19. East coast Haddock graph.



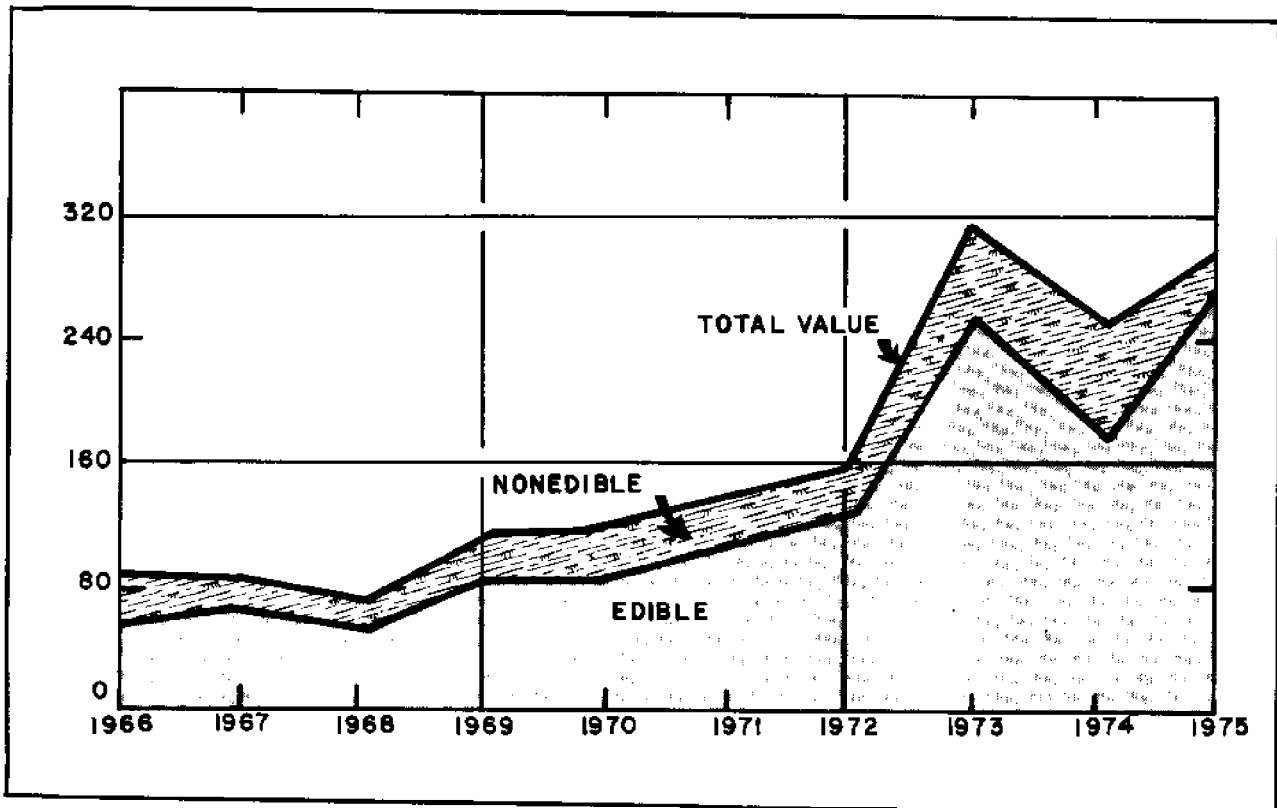
11-C 20. Per capita consumption of commercial fish and shellfish, 1965-74 (Edible Meat)



11-C 21. Value of U.S. Imports and exports of fishery products, 1960-72.



11-C 22. Supply of edible fishery products, 1966-75 (billion pounds, round weight).



11-C 23. Value of exports of domestic fishery products, 1966-75 (Million dollars).

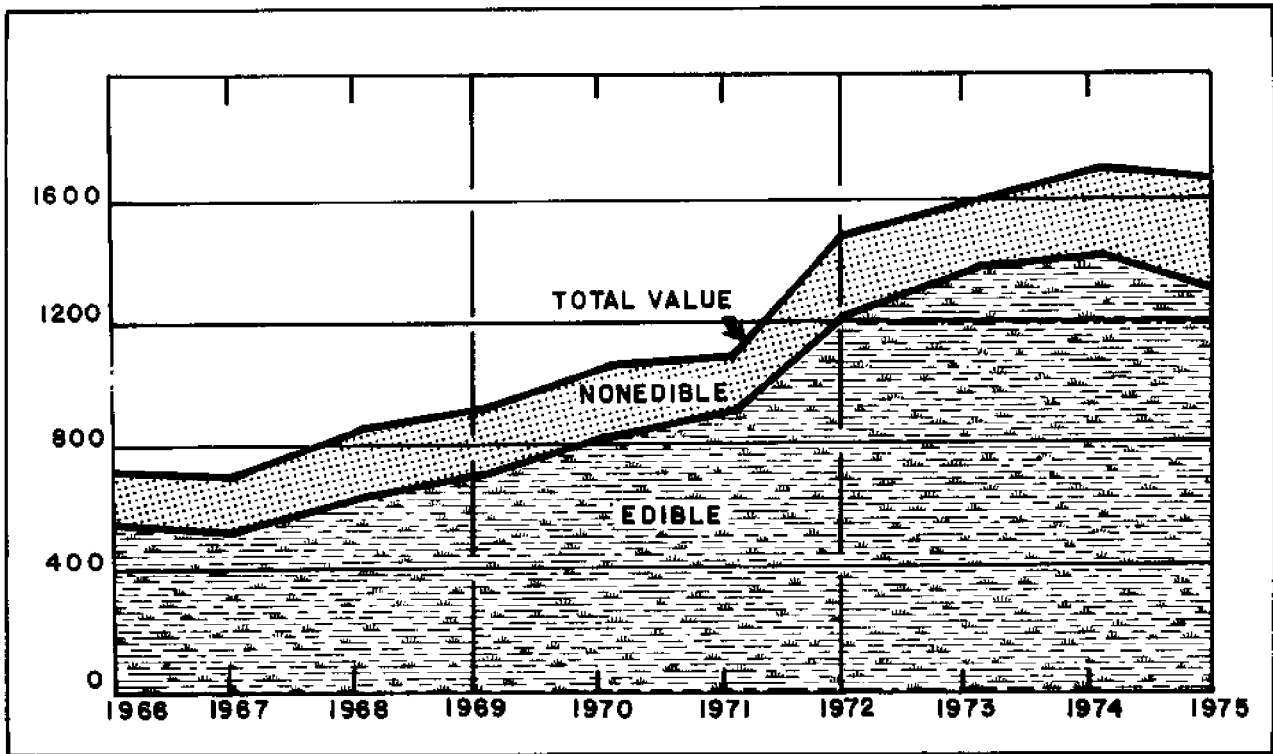


Figure II-C 24. Value of imports of fishery products, 1966-1975.



## II-D Whaling: Past, Present and Future

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### INTRODUCTION

Although humanity's use of whales goes back in time farther than written history, concern for the preservation of whales is a 20th century phenomenon. The history of whaling is described here right up to the difficult present day problems. Even though regions and nations recognize problems in whale management, controlling worldwide whaling poses great difficulties.

### WHALES

Whales are mammals. As such, they are warm-blooded animals, breathe air, have some hair and give birth to live young which are nourished from their mother's milk. Scientists categorize whales into two distinguishable groups: those with true teeth (e.g., sperm whales, killer whales and all of the porpoises and dolphins) and those with baleen. Baleen is similar in consistency to human finger nails. In some species of whales baleen hangs in tapered sheets from both sides of the roof of the mouth and acts as a filter to collect food (small animals) from water or bottom sediments.

Most of the large whale species are baleen whales (e.g., blue, fin, humpback, sei). These whales are usually found in polar regions during summers when the small animals they eat are extremely abundant. The polar areas were not exploited as whaling grounds until relatively recent times because of the treacherous ice and storms.

## EARLY WHALING

People in prehistoric times probably used any whale that washed ashore. The early efforts of hunting whales were directed at a few species of baleen whales jointly termed right whales. Slow moving, frequently near-shore, easily killed, and floating after death made these the "right" whales to hunt. The main product of whaling was oil, used for lamps, fuel and secondarily for food. The first organized "fisheries" for whales were conducted from small open boats operating during the day and pulling their catch to shore for processing (such as the 12th century Basques taking black right whales in the Bay of Biscay).

By the 17th century, whaling had become much more sophisticated and was no longer shore based. The British and Dutch dominated whaling, using ships that remained at sea for months. They took primarily black right whales and Greenland right whales in the area of Greenland, Davis Straits and the Arctic. The dead whales were secured to the side of the ship, where crewmen with long handled "flensing" knives removed the blubber "blanket" (the fat layer between the skin and the muscle). The blubber was stored in casks until the end of the cruise, when a shore station would render (melt) the oil from the blubber. The blubber often became rancid before rendering and produced an inferior quality oil. Although the species hunted during these times did not become extinct, they have not recovered from that exploitation (despite several recent decades of protection).

This was the first example of an all too frequent pattern of unregulated take of species or localized stocks (reproductively distinct populations of a single species). Even when the number of a target species dropped below that necessary for an economic fishery to be sustained (commercial extinction), they were taken as opportunity allowed, whenever they were found while hunting for other species. Shortsighted economics, without regard for the biological considerations, created the incentive to harvest every possible whale. Although certain whalers noticed declines in specific areas and types of whales, the oceans were still considered vast and there was little thought given to the concept of limited resources or long-term renewable resource management.

As whales close to shore became depleted, the ships had to go farther out to sea, forcing the development of shipboard rendering equipment. This produced a superior product and made longer cruises possible. During the 18th and 19th centuries, the United States became a principal whaling nation, hunting mostly Arctic bowheads, humpback and sperm whales which had broad distribution. During this period, humpbacks were reduced to low numbers and still have not recovered.

## TECHNICAL EVOLUTION OPENS THE ANTARCTIC

In the 1860's, the explosive harpoon gun was invented. At the same time, the development of air floatation and fast steam-powered catcher boats opened new horizons to the whaling industry. No longer was it necessary to hunt only the "right" whales; now fin, sei, blue and humpback whales could be chased, killed and recovered. The time was right to exploit the untapped polar populations of these species, which led to the rapid depletion of some small localized stocks. In 1903, the development of the first factory ship replaced the need for shore stations in the Antarctic. Whales were caught by other ships and brought to the factory ship for processing. They were killed by the tens of thousands each year without regulation. During this time, Great Britain instituted taxes and quotas on oil from whales taken in the Antarctic. Some of this money was used to finance the early *Discovery* expeditions which were the first attempts at studying the natural history of whales in the Antarctic. In 1925, the *Lansing* was launched. This ship incorporated a stern ramp which allowed a whole whale to be taken aboard for processing in virtually any weather. An increased number of these vessels ultimately led to the closure of almost all shore stations. During the 1930's, the decline in whale oil prices due to the depression, loss of the whale bone market and competition from petroleum products led to voluntary quotas from the whaling industry until World War II.

## EARLY ATTEMPTS AT INTERNATIONAL REGULATION AND THE IWC

The first attempt at international regulation came from the League of Nations in 1935 when they extended protection to right whales, forbade the killing of females with

calves, provided for the licensing of vessels and required the collection of catch statistics. In 1937-38, the International Whaling Conference met and called for the protection of gray and right whales, temporary protection for the Antarctic humpback, minimum length requirements for individual species, an Antarctic whaling season and limited numbers of factory ships. In 1944-45, the blue whale unit (BWU) was established as a management unit. A BWU could be one blue whale or two fin whales, or 2.5 humpback whales, or 6 sei whales. This was the formula established for roughly equal yields of oil. An initial quota of 16,000 blue whale units per year was established. By comparison, the 1937-38 whaling season produced approximately 25,000 blue whale units. In 1946, the International Whaling Commission (IWC) was established to regulate pelagic whaling. The commission was designed to allow each country to present the best available scientific evidence for the management of whale stocks and to agree on quotas that would prevent the future deterioration of whale stocks.

While the IWC goals were admirable, its first 20 years of operation failed to prevent the deterioration of several stocks of whales. Procedurally, the IWC continues to operate today as it has in the past. Delegates from a number of countries meet once a year, preceded by a two week meeting of the scientific and technical committees (which may also meet during the year to consider special problems). The recommendations (including quotas) of the scientific committee are supposed to be based on the best available data. These are forwarded to the commissioners for a three-quarters majority vote. Commissioners then return to their own countries and have 90 days to file objections or amendments to a regulation. If an objection is made and is not withdrawn in a further period of 90 days (during which other countries may also object), the regulation is not binding to the objecting countries. This has amounted to a one vote veto in the past, as no nation was willing to continue whaling under a quota or condition which placed it at a competitive disadvantage with other whaling nations not so restricted. This tactic was frequently used in the early years of the IWC. Also, the commissioners frequently ignored the advice of the scientific committee in the formulation of regulations (usually for socio-economic or political reasons). Catch statistics from 1946 to the present appear in Appendix 1.

## RECENT ADVANCES IN WHALE MANAGEMENT

A scathing review of the IWC and its failures in the mid 1960s resulted in a much improved operation. It is only since 1972 that the IWC has stopped managing by the indiscriminate BWU system and begun single-species management. Where possible, in fact, species management is even broken down into regional stocks. In 1974, the IWC adopted the concept of maximum sustainable yield (MSY). Whale populations have a natural capacity for increase and a natural rate of mortality. Unharvested, these two factors balance one another so that the population remains more or less in equilibrium. As the numbers of whales are reduced, the pregnancy rate increases and whales start to reproduce at an earlier age resulting in a higher birth rate and better survival possibly due to less competition. Animals surviving to any specific age class are termed "recruits" (e.g., recruitment to the age 1-year class). At some particular population level, the "surplus" of recruits over natural deaths reaches a maximum -- the MSY -- which can be harvested without reducing the stock size. At stock sizes above or below this level, the surplus of recruits over natural mortalities declines. IWC quotas are supposed to be set conservatively to avoid overharvest. Theoretically, these stocks, therefore, will remain at their present size and provide a harvest for an indefinite time.

All whale stocks are now classified by the IWC into one of three categories according to the advice of the scientific committee:

1. "Initial Management Stocks," which may be reduced in a controlled manner to achieve MSY levels or optimum levels, as these are determined.
2. "Sustained Management Stocks," which will be maintained at or near MSY levels and then at optimum levels, as these are determined.
3. "Protection Stocks," which are below the levels of sustained management stocks and will be fully protected (zero quota).

This new management policy of the IWC represents a major step forward in the protection and conservation of the world's whale stocks. It is designed to bring all these stocks to the levels providing the greatest long-term harvests. The stocks presently being utilized should not be de-

pleted below the levels providing this continuing harvest, and those which are already below this level are supposed to rebuild under complete protection before any further catching is permitted.

Many of the problems of the IWC in the past have involved socio-economic factors which are weighed more heavily than the biological aspects. This possibility still exists with the inclusion of "optimal" levels of harvest rather than MSY. Even at MSY, problems in world whaling still exist.

#### QUOTAS, QUOTAS, QUOTAS.....

Within the IWC, there are of course differences of opinion and interpretation about certain kinds of data or population models which may affect the ultimate determination of an MSY population level and hence a quota. Of the present 17 member nations (Argentina, Australia, Brazil, Canada, Denmark, France, Iceland, Japan, Mexico, Netherlands, New Zealand, Norway, Panama, South Africa, U.K., USA and the USSR), only Australia, Brazil, Iceland, Japan, Norway and the USSR carry on commercial whaling. Many of the non-whaling nations, including the USA, have been strong advocates of conservative quotas and have also officially voiced support of a 10-year whaling moratorium. The value of the latter has been debated, especially since the IWC now has adopted the complete protection (zero quota) of whales designated as depleted below MSY levels.

Despite the "enlightened" quota system now used by the IWC, some conservation groups and scientists still have concern over the quality of the information used to make quota decisions (e.g., bias in collecting data and assumptions used to interpret data). There may be abuses of quotas even in the name of science. IWC nations may issue themselves permits to take whales outside the quota system. This year, new procedures have been initiated for international scientific review of applications for special scientific permits.

If quotas were conservatively estimated and were obeyed worldwide, most people concerned about preventing the extinction of whales would feel some security and satisfaction. While there may be some infractions of regulations (size, sex or even species judgments) among the whaling IWC nations, there are probably minor concerns relative to the effect on whaling by non-IWC nations.

#### WHALING OUTSIDE THE IWC

The 1976 IWC quota for sei and Bryde's whales for the western coast of South America was set at 198 animals, which were taken by IWC nations. However, between January and May of 1976, Peru (a non-IWC nation) took 213 whales of these species, more than doubling the scientific "best estimate" of allowable take. Another non-IWC nation, Korea, took 43 fin whales in the North Pacific during 1976, after the IWC had classified the fin whale in that area as a "protected stock." Obviously, these actions reduce the effectiveness of IWC quotas in conserving whales and may lead to the depletion of whale stocks. An estimated 4000 whales are taken by non-IWC nations annually. The IWC quota for 1977 was 17,839.

Numerous attempts have been made to enlist the non-IWC nations into the IWC; however, there is very little incentive for them to join. The allocation of the IWC-established quotas takes place outside of the IWC and a nation such as Peru could not expect to command the entire quota for the eastern South Pacific Ocean (which would reflect its present level of activity) and would probably find it difficult to wrestle a "living share" from the IWC nations which have a tradition of whaling in that area.

The international politics resulting from non-IWC nations' whaling are incredible. Because whaling by these nations diminishes the effectiveness of the IWC's conservation efforts, the U.S. has considered invoking the Pelly Amendment (Section 8 of the Fisherman's Protective Act of 1967) to embargo their other fisheries exports in an effort to force compliance.

Japan is the world's largest market for whale products and imports from both IWC and non-IWC nations. From January to May of 1977, Japan imported 23,325 metric tons of whale meat valued at \$33.4 million from the USSR (19,946 tons), Iceland (493 tons), Brazil (75 tons), Norway (3 tons), Peru (972 tons), South Korea (949 tons), Somalia (586 tons), Spain (292 tons) and North Korea (10 tons). The last five countries were not IWC members and accounted for 2,809 tons (12 percent) and \$4 million of Japan's whale imports during the five month period. Other non-IWC nations whaling today include Chile and Portugal. A resolution at the June, 1977 IWC meeting was adopted, urging members to ban the importation of whale products from non-member nations. Japan abstained on the vote

and there is no way to force such a restriction. Several of the whaling operations in Africa and South America (including Peru) are partially owned by Japanese interests, generating accusations that in this manner Japan is circumventing IWC quotas. However, the companies involved are not part of the official Japanese delegation to the IWC and only special legislation in Japan could stop their free-lance activities. In a further attempt to restrict whaling efforts, the 1977 IWC meeting adopted a resolution urging members not to transfer whaling vessels, equipment and technology to non-member nations. The IWC is a voluntary participation organization and, as such, has no enforcement authority. Resolutions are not binding to members, while regulations are.

### ECONOMICS

Economics of operations and markets are crucial to the survival of any "fishery" and so it is with whaling. A certain "critical mass" of catch must be landed in order to make any whaling venture viable. Many nations have dropped out of whaling in recent years because of economics (the U.S. closed its industrial whaling history in 1968, before the Marine Mammal Protection Act of 1972 forbade such enterprises), and their allocation of the IWC quota has been redistributed among the nations still whaling. Japan and the USSR now account for approximately 80 percent of the IWC quota. Even the Japanese have felt the effects of reduced quotas and during 1976, the six firms sharing the Japanese quota merged into a single company (Nippon Kyodo Hoge Kaisha of Tokyo). There even has been a discussion of a joint venture between the Soviets and the Japanese to further reduce operating costs. Each nation has more than enough equipment to take the total of all IWC quotas.

Typically, reduced supply with constant or increased demand creates higher prices. In the case of whale products, the price per pound covers quite a broad range determined by quality and type. Recently, whale meat has sold from \$730 to \$1,907 per metric ton. The worldwide whaling industry produces \$150 million per year of product. With inflation and energy costs driving prices of everything upward, it is hard to determine whether whaling will be profitable in the future or if suitable substitutes for whale products might not become more attractive. Edible protein has a

world market, but some specialty products such as sperm whale oil (used as a high-temperature lubricant) have only recently found substitutes in the form of two plants: jojoba which is grown in arid regions and meadowfoam which requires a more moderate climate with more moisture. The production economics of both are current research topics. Whaling will likely remain a viable economic venture until product substitutes become more available and less expensive.

### THE UNITED STATES

Economics closed the U.S. whaling industry in the 1960's. In 1972, the U.S. Congress passed the Marine Mammal Protection Act (MMPA) prohibiting all importation of marine mammal products and the harassment or killing of marine mammals with just five exceptions: scientific research, public display, approved management programs (including international treaties), native subsistence or creation of cultural artifacts, and incidental take by commercial fishermen. All but the native take provision are regulated by permits and must go through a review process. After passage of the Act, several problems relating to whales were immediately recognizable and others have materialized.

The largest U.S. problem encountered was in the yellowfin tuna fishery. Tuna boats working in the eastern tropical Pacific surround porpoise schools with large nets (purse seines). The tuna are commonly associated with the porpoise and thus both animals are caught together. Efforts are made to free the porpoise, yet keep the tuna in the net. In 1972, an estimated 387,000 porpoise were killed incidental to this fishery. Government agencies and the fishing industry have worked hard to develop modified nets and new procedures to lower this kill. In addition, U.S. courts have argued over the language and interpretation of the MMPA, which requires that all marine mammal species be at "optimal" population levels but not exceed the "carrying capacity" of their environment or endanger the "health and stability" of the ecosystem. Application of these rather vague guidelines resulted in biological and legal research. Fortunately, the results of these various efforts have produced a drastic reduction in the incidental kill of porpoise. Unfortunately, the problem has not been eliminated and the U.S. has the distinction of killing more cetaceans (all

whales including porpoises) than any country in the world. Recently, quotas have been established for each porpoise species caught in the tuna fishery (in a manner similar to the IWC quotas), thereby assuring that these populations will not be reduced below an MSY level. While the MMPA affects only our domestic fishermen, international regulatory bodies responsible for tuna fishing in conservation areas are considering following the U.S. lead and requiring that porpoise-saving procedures be used by all nations.

A source of some international dispute involves the sperm whale. Although currently on the U.S. endangered species list, the sperm whale is the most intensively hunted whale under IWC jurisdiction. Designation of the sperm whale as an endangered species in 1973 was probably premature biologically, but was more of a tactical move by conservationists for protection of a soon to be exploited (perhaps overexploited) resource at a time when the IWC was just starting to become functionally effective. This has caused problems for the U.S. delegation to the IWC, which participates in international quota determinations of sperm whales while they have a domestic designation of "endangered." There are, in fact, stocks of sperm whales (in certain areas) where concern is warranted.

Currently, the most serious domestic and international whale problems for the U.S. concerns the bowhead whale. Bowhead whales have been a part of Eskimo culture for hundreds of years. The species has been under full protection (zero quota) by the IWC for 30 years with an exemption for native subsistence take. A similar exemption in the MMPA has made bowhead hunting a legal activity for U.S. Eskimos in Alaska. Prior to 1970, the yearly take of bowheads averaged 10 and never exceeded 23. During this period very few whales were struck by harpoon and lost, but recently this has changed. During the spring (the annual season for bowhead hunting) of 1977, 26 whales were taken, one whale was killed and lost, and an alarming 77 whales were struck and lost (one out of every four whales struck was recovered). It is not possible to say how many struck whales were seriously injured or subsequently died. Some (if not most) of this problem is related to the increased number of new and inexperienced crews hunting bowheads. Thirty-three crews hunted in 1974, 47 in 1975 and 58 in 1976. The population estimates of bowheads vary, but the most quoted guess is around 2000. Concern in the IWC over the increased take

and the poor struck and lost record by U.S. natives has resulted in a special quota.

#### EXTENDED JURISDICTION

The U.S. has declared that there will be no whaling within the 200-mile zone created by the Fishery Conservation and Management Act of 1977. Both the USSR and Japan traditionally have whaled in some of these areas (especially for sperm whales). Technically, a permit to allow whaling within 200 miles could be issued under the MMPA, but not for sperm whales because they are on the endangered species list. Japan has reacted by noting that: whales should be managed as an international resource (by the IWC) because most species are highly migratory; the U.S. action may adversely affect the IWC and U.N. Law of the Sea Conferences as other nations may take similar unilateral action to manage whales in their 200-mile zones, but may emphasize utilization rather than preservation; and if the U.S. action is favoring domestic law over international agreements, it may be in violation of the Constitution. The U.S. position is "that coastal states should have the right to take action more restrictive than that agreed upon in the international body, but not to take less restrictive action and thereby weaken internationally accepted conservation measures." While this issue appears to be at an impasse, the Japanese salmon fishing industry has applied for an incidental take permit under the MMPA for 2050 Dall porpoise they expect to take during their 1978 high seas gillnet fishing inside the U.S. 200-mile limit. In total, that fishery may be responsible for the accidental death of as many as 20,000-40,000 Dall porpoise annually in operations in the North Pacific and Bering Sea.

Basically, most of the world whaling problems (either direct or indirect) boil down to man's overpopulation of the land. The need for food, industrial oils and animal feed protein supplements has made the whales of the world cheap sources of supply. Indeed, whalers today completely utilize the entire whale in their modern factory ships. With the right technical information, there is no biological reason why these species cannot undergo sustained harvest at conservative levels indefinitely. There is today, however, a growing group of persons promoting the preservation of whales who do not care to see whales harvested in any amount, no matter how carefully it is done. Their objections are moral and ethical and cannot be debated.

The following charts were compiled by the International Whaling Commission:

SPERM	ANTARCTIC					REMAINDER OF WORLD OCEAN				
	BLUE	HUMPBACK	FIN	SEI	SPERM	BLUE	HUMPBACK	FIN	SEI	SPERM
1946	3,606	238	9,185	85	273	69	255	1,837	662	3,181
1947	9,192	29	14,547	393	431	110	261	1,948	738	6,015
1948	6,908	26	21,141	621	2,622	249	489	2,887	952	7,228
1949	7,625	31	19,123	578	4,078	156	3,364	2,640	1,277	4,938
1950	6,182	2,143	20,060	1,284	2,727	131	2,920	2,842	1,187	5,456
1951	7,048	1,638	19,456	886	4,968	230	2,714	3,363	2,147	13,296
1952	5,130	1,556	22,527	530	5,485	306	2,467	3,078	2,593	6,072
1953	3,870	963	22,867	621	2,332	348	2,365	2,714	1,587	7,245
1954	2,697	605	27,659	1,029	3,879	312	2,550	3,676	1,462	10,664
1955	2,176	495	28,624	569	5,790	319	2,218	3,561	1,371	9,804
1956	1,614	1,432	27,958	560	6,974	373	2,448	3,538	1,516	11,616
1957	1,512	679	27,757	1,692	4,429	263	2,517	3,900	1,446	14,727
1958	1,690	396	27,473	3,309	6,535	305	2,527	4,207	2,361	15,311
1959	1,192	2,394	27,128	2,421	5,652	250	2,661	3,824	3,119	15,646
1960	1,239	1,338	27,575	4,309	4,227	226	2,238	3,489	2,726	16,117
1961	1,744	718	28,761	5,102	4,800	243	2,122	3,155	2,683	16,330
1962	1,118	309	27,099	2,196	4,829	137	2,127	3,056	3,608	18,487
1963	947	270	18,668	5,503	4,771	482	2,488	3,248	4,046	23,087
1964	112	2	14,422	8,695	6,711	260	316	4,731	4,995	22,544
1965	20	0	7,811	20,380	4,352	593	452	4,540	5,074	21,196
1966	1	1	2,536	17,587	4,555	242	58	4,156	5,480	22,823
1967	4	0	2,893	12,368	5,960	66	4	3,507	6,648	21,464
1968	0	0	2,155	10,357	2,568	0	2	2,930	6,742	21,512
1969	0	0	3,020	5,776	2,682	0	0	2,300	6,204	21,455
1970	0	0	3,002	5,857	3,090	0	0	2,055	5,338	22,752
1971	0	0	2,888	6,151	2,745	0	0	---	---	---

11-0 1. World whale catches, 1946-1971, as compiled in International Whaling Statistics, published annually by the International Whaling Commission, Oslo. The effect of the Commission's quotas may be seen. Assessment of blue whale stocks and recommendations on levels of sustainable catch was begun in 1961, for example.

SPECIES	NUMBERS BEFORE COMMERCIAL WHALING	ESTIMATED NUMBERS TODAY	PERCENTAGE REMAINING TODAY	INTERNATIONAL WHALING COMM. CATCH QUOTAS 1975-1976	INTERNATIONAL WHALING COMM. CATCH QUOTAS 1976-1977
Blue	210,000	13,000	6	0	0
Humpback	100,000	7,000	7	0	0
Right	50,000?	4,000?	?	0	0
Bowhead	10,000?	2,000?	?	0	0
Fin	450,000	100,000	22	585	344
Sei	200,000	75,000	38	2,230	1,995
Bryde's	100,000?	40,000	?	1,363	1,000
Sperm, (M)	530,000	230,000	43	11,070	8,214
Sperm, (F)	570,000	390,000	68	7,970	3,777
Gray	15,000	11,000	73	0	0
Minke	360,000	300,000	83	9,360	11,926

11-D 2.

It was agreed that in the 1973-1974 season, quotas would be set by species rather than by total blue whale units as they had in the past. In 1972, the Commission extended indefinitely the temporary ban on the taking of blue and humpback whales. In 1976, the fin whale also received protection. Since 1971-1972, then, the quota statistics, as reported by the International Whaling Commission, have been as follows:

	1972/73	1973/74	1974/75	1975/76	1976/77
<u>Antarctic</u>					
Fins	1,950	1,450	1,000	220	0
Sei and Bryde	5,000	4,500	4,000	2,230	1,863
Minke	5,000	5,000 (a)	7,000	6,810	8,900
Sperm (male)	8,000	8,000	8,000	5,870	3,894
Sperm (female)	5,000	5,000	5,800	4,870	897
	<u>24,950</u>	<u>23,950</u>	<u>25,800</u>	<u>20,000</u>	<u>15,554</u>
<u>N. Pacific</u>					
Fins	650	550	300	0	0
Sei and Byrde	3,000	2,000	2,000	1,363	1,000
Minke	*	*	*	*	541
Sperm (male)	6,000	6,000	6,000	5,200	4,320
Sperm (female)	4,000	4,000	4,000	3,100	2,880
	<u>13,650</u>	<u>13,550</u>	<u>12,300</u>	<u>29,663</u>	<u>8,741</u>
TOTAL	<u>38,600</u>	<u>37,500</u>	<u>38,100</u>	<u>29,663</u>	<u>24,297</u>
			(a) Japan and Russia disagreed with the Minke quota and allocated themselves a quota of 4,000 each		
			* No quota		

11-D 3. International catch quotas.



## **II-E The Role of Estuaries, Their Inhabitants and the Effects of Man**

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Among many attempts to define an estuary, one may find the description "an arm of the sea where fresh water mixes with and measurably dilutes the sea water." This is a rather broad definition but one that is becoming more and more widely quoted. Of course, if one pushes this definition to an extreme, the North Pacific Ocean might be classified as an estuary. Another definition of an estuary is that area common to any beach-shore situation, where three boundaries meet: air, water and land. It is at the interface or boundary of these three regions that much of man's activities take place.

An estuary serves many needs including that of entrance-exit for man's commerce by sea throughout the world. It serves as a living place for local populations of marine organisms many of which represent a delicacy in human food supply. Many mobile forms move in and out of the estuary with the tide. Larger fishes classified as nekton may sporadically move into an estuary seeking the local marine inhabitants as a food supply. In New England, for example, the bluefish is an exciting sportfish as it moves into coastal New England estuaries as a young predator in late summer. Seasonal migrants through the estuary may include the herring-like alewife which enters the estuary to spawn upstream in New England ponds, or the eels which pass through the estuary as adults to spawn out to sea. Another migrant commonly passing through estuaries is salmon. On both coasts of the U.S., estuaries serve as the connecting passageway between the salmon's spawning beds in the rivers, and the open sea, the sea serving as a pasture within which fish

populations grow and mature; salmon populations throughout the world are a part of this picture.

If one examines the distribution of life on our planet Earth, one finds that it is distributed in concentrations along edges or discontinuities between the air, land or water. Human beings, whether we like it or not, must spend almost all of their lives in a thin six-foot layer of air on the surface of the earth (people with claustrophobia don't like to think about it).

People tend to congregate along the seashore, along the edges of rivers, or around the edges of ponds or lakes. This is very evident from a high altitude as one flies over the land and can observe human population distribution; the concentrations tend to be along the edges of the discontinuities. This distribution relates to commerce, industry, fishing, recreation and, in general, easier or more pleasant living.

It is to the seashore that one goes in New England or New York to escape unpleasant temperatures during the summer months. One has only to compare the temperatures in July or August in Providence, R.I. and Point Judith, R.I. to realize why the coast is so popular during these months (speaking as a native Rhode Islander). If one adds to this the multitude of recreational possibilities, the attraction of the coast is very evident.

This high influx of seasonal visitors represents a big and desirable business -- in many instances, the major support of local coastal communities. However, in recent years the business community, government and larger numbers of conservation-minded people have come to recognize that the coast is an area that must be carefully treated so as not to disrupt or despoil these very advantages. Thus in recent years, coastal zone management has been a developing concept, addressed more and more by alert coastal communities.

In contrast to the geographic concentrations of humans, the distribution of man's enterprises including agriculture, mining, livestock rearing, etc., are many times spread out over large areas and at considerable distances from one another. Many products are destined for interchange between nations separated by large bodies of water -- the oceans. Consequently, one becomes aware of a funnel effect in

trade, related both to fortuitous geographic locations of seaports and the drive of economics. Products are funneled from a great expanse of country into confined localities -- seaports -- from whence a reverse funnel again spreads them via shipping to diverse countries. Repeatedly, at each foreign seaport, the funnel tapers down to a narrow passage before again fanning out as the products are distributed throughout that particular country.

In short, seaports represent a bottleneck where people prefer to live or vacation and through which agricultural and industrial products are transported. The bottleneck is fostered by a particular geometry of land and water climate, and the drive for economic efficiency.

It is thus not surprising that calculated on a unit-area bases, temperate coastal zone areas probably comprise the most valuable real estate on earth from a purely economic point of view.

The use of estuaries and man's activities in the coastal zone has undergone several transitions in recent history. The presence of shell mounds in certain marine coastal locations give evidence that food has long been gathered there. These sites are concomitant with availability of fresh water and firewood. Estuaries have served more modern man as a landing site and trading center, or as a link with the hinterland. Local food gathering became less important at these locations, and consequently less attention was paid to man's effect on the environment. Growing civilization, clearing the land, taking lumber for construction, and the development of industry, led to extreme changes in fresh water runoff, siltation, and the introduction of toxic materials inimical to marine life. Much of this probably occurred through ignorance, neglect, and the lack of need for the natural local estuarine products.

Today, the "largess" of cheap arable land has diminished, and gradually man has recognized the effects not only of toxic materials introduced into estuaries, but also of engineering designed for the short-term gain. The damaging effects of home-sites and industrial locations, while simultaneously developing multihomed marinas with man-made embayments is appreciated. Attention has come back to estuaries for what they represent and serve.

## CHARACTERISTICS OF AN ESTUARY

Specialists have sub-divided estuaries into categories in order to compare and contrast measurable differences. The system describes positive and negative estuaries. Positive estuaries have an excess of fresh water, and the water becomes progressively fresher as one moves upstream from the ocean entrance. Estuaries such as these are commonly found in the Pacific Northwest. Negative estuaries, by contrast, are those in which the salt content of the water increases as one proceeds upstream from the ocean. They are found in regions typified by high air temperatures and limited to little rainfall. Estuaries may be further classified on a basis of the degree of mixing of the fresh river water and the ocean salt water. Mixing may range from very little, with a layer of fresh water overriding a salt water layer, to a well-mixed almost homogeneous water column. The degree of mixing can change with season; it is influenced by fresh water runoff and the tide in conjunction with the geometry of the estuary basin.

The direction of flow of water is modified by the rotational effect of the earth, sometimes referred to as the Coriolis effect. Such an effect was noted in the 1800's by Fridtjof Nansen. In the drift of the historic research vessel *Fram* during his exploration of the Arctic Ocean, Nansen observed that drift ice deviated to the right of the wind. He attributed this to the effect of the Earth's rotation. His observations were later confirmed by mathematical calculations. Thus, water flowing into an estuary from the ocean in the northern hemisphere would be expected to flow toward the right bank, as one observed the water looking upstream, and river runoff moving downstream as a surface layer would tend to be displaced toward the opposite bank (again to the right bank looking in the direction of flow). Inferences from such information strongly suggests placing industries which might have serious pollution effects if some kind of spill occurred, on the side of the estuary with the seaward-flowing fresher water to minimize the contamination of the entire estuary. The ocean, just because it is a larger body of water, would dilute the contaminant more, in a shorter period of time and in an area less critical to so many organisms.

Additional information on feeding habits and the feeding location of plankton-feed-

ing fish has been deduced from the Coriolis deflection of water in and out of an estuary. An illustration was provided by research on the feeding of herring in Yaquina Bay, Oregon, investigating the variance of gut contents with plankton species, abundance, size and availability. At times when the "normal" zooplankton populations in the water were in low numbers the herring gut contained large numbers of a small bivalve-like crustacean (ostracods) in combination with small bits of wood chips. The data strongly suggested that when the normal food supply of the herring in the bay was low, the herring were opportunistic feeders and would accept whatever they could find as food. The data further suggested that the ostracods were in higher concentrations and nearer the bottom on the north (outward flowing) side of the bay intermingled with river-run bits of wood very similar to the sediments on that side and quite unlike sediments on the south side of the bay.

In the last 20 years and particularly during the last decade, there has been a strong conservation effort, unorganized at times, within the United States. One intent of this movement is to take a new look at our utilization of estuaries, past and present. This has led to the concept of producing "impact statements" before proceeding with new or greater utilization of estuaries. The hope is that our nation will utilize estuaries to a full extent but in a more intelligent manner so as to serve the greatest good of mankind. Much progress has been made; much remains to be done cooperatively by a troika consisting of the citizen who desires to use an estuary, the researcher who develops a good picture of the results of certain uses, and advisory personnel who act as the liaison between these two groups. Contributions by researchers whose positions are a result of the land-grant concept in U.S. Universities have shown the wisdom and the fruitfulness of this approach. The newly developed U.S. sea grant universities will be following similar pathways in developing concepts of the best uses of the seas. The following is offered as an example of the kind of pathways being examined that are in need of further study for the highest and best uses of the sea by man.

## FACTORS AFFECTING THE SUCCESS OF A POPULATION

Prior to requirements for impact statements, requests to fill in a portion of an estuary to create parking spaces for sport-fishermen were not uncommon. But entrepreneurs wishing to develop their business can not always see the effect one action might have on the entire population of an estuary.

In temperate-latitude coastal waters and estuaries, in particular where the water is shallow, seasonal changes have a strong impact on the cycles of abundance of local marine inhabitants. A typical food chain might start out with nutrient enrichment of the water by the seasonal overturn of the water column produced by winter cooling. The spring warming and concurrent increase in water temperature leads to rapid reproduction of the microscopic plants or diatoms in the nutrient-rich water. Subsequent steps in the food chain in Pacific Northwest coastal waters may lead through small crustaceans (copepods), herring, and adult salmon in a dependent series.

The very nature of such a chain is the *dependent* relationship between each link of the chain; the success of the higher levels of the chain depend on the integrity of the entire chain up to their level.

Building the parking lot could develop into a scenario as follows. The fill dirt was lacking in the first place because of local water currents. Addition of the fill will therefore be removed by currents if it is not specially protected and such special protection is very expensive so might be underbuilt. Some of the fill might then be picked up by the currents and become a sediment load in the current, resulting in lowered transparency of the water column. With the reduced light transparency, both the numbers of photosynthetic microscopic plants in the water column and the attached algae could be reduced in population. The small crustaceans feeding on the plant populations may be reduced in numbers and their absence as a food supply for young downstream-migrating salmon would adversely affect both the numbers and physical condition of young salmon going to sea. With reduced numbers or poor physical condition of the young, there would be a negative effect on the numbers of adult salmon returning to the estuary in question, leading to poorer fishing for the sportsman. When the fishing gets poor the parking lot will not be

needed.

Without realizing it, the entrepreneur could be killing the goose laying the golden eggs by filling in the estuary.

A similar chain of events could be true for herring who spend their early life within estuaries and return to the same estuary as adults. Herring perhaps to a lesser extent, have a homing instinct similar to salmon. Herring move into Oregon bays about February, or late winter, to lay their eggs. Most of the eggs are destined to become food for predators, gulls among them, because the fish lay a large number of their eggs above the low tide line where the gulls can get them. Enough eggs are laid below the low tide level for the population to survive, however. After hatching, the young herring will stay in the bay for much of the year before they migrate to sea, thus what goes on in the bay is very critical to that population. It is the success of that year class that determines the size of the future herring population. After the end of the first year they go to sea, where they stay for two to four years. Data indicate that populations from different bays do intermix at sea, but then as they mature the fish from different places tend to resegment and migrate back to their home port. Inasmuch as the herring tend to be specific to each bay it is important that they be given proper protection to insure a continuous crop, both for the herring and for the fish feeding on them which they attract and "hold." Their predators may represent another important local crop, such as salmon.

The activities of man in estuaries or coastal zone areas may not be the only strong negative effect on a local marine population. Sometimes the unfortunate timing of a natural event can take a toll. As an example, one might examine the effect of wind on the numbers of adult crabs of the popular edible species, the Dungeness crab (*Cancer magister*). Along the Oregon coast, northwest winds, common in the summer, cause an offshore movement of the surface waters. The Dungeness crab has larval stages, referred to as zoea and later megalopa which represent early and later developmental stages respectively, and both are planktonic or free drifting in the water column.

If there is a stronger than usual northwest wind, one which blows longer than usual or sometimes at an unusual period, it could cause a greater seaward movement of sur-

face waters than normal or a seaward movement at an unusual time. If such an event occurs when larval Dungeness crab are at maximum numbers, these larvae could be carried more than 100 miles offshore. The strong possibility exists that many or most of these larvae would not find their way back into shore regions to mature into adults in the coastal area. As a result, perhaps five years later, there could be an unusual drop in that year class of the mature crab numbers available for commercial or recreational harvesting. Other data suggest that a strong northeast wind in winter months producing upwelling at this unusual time has been related to the lower numbers of larvae of the pink shrimp. It is unfortunate, but nature is not perfect either.

Understanding the critical time relationships between natural conditions and life stages of marine populations is essential to predicting future harvests from the sea. This understanding depends strongly on research into the food chain of which each organism is a part.

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## **II-F The Floor of the Ocean-- Mineral Deposits and Conflict**

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### INTRODUCTION

Man has extracted minerals from the ocean for thousands of years. Only recently, however, has the importance of ocean minerals become a major factor in global ocean politics. During Law of the Sea negotiations, the potential value of minerals has become a major factor in treaty negotiations. The wide distribution of manganese nodules on the deep sea floor has become a source of contention. Conflicts concerning ownership of minerals, rights to extraction, sharing of extraction technology and other aspects of deep sea manganese nodule exploitation have fueled other general international political conflicts.

Locally, the potential extraction of minerals poses potential conflict with other uses of the ocean and with the preservation of a high quality marine environment. Such conflicts are not limited to manganese nodules, but involve all types of minerals which are, or may be, extracted from the ocean for profit.

This paper will briefly review some aspects of our knowledge of the geology of the ocean basins and of the minerals which occur in the ocean. Resolution of ocean mining conflicts must rest on an understanding of the character of the minerals and of the processes by which they were formed. Briefly, we will consider our present knowledge of the sea floor within the context of the theory of plate tectonics and the evolution of the earth's surface. The nature and occurrence of sea floor min-

erals will be addressed, and finally, attention will be directed to conflicts involving the extraction of such minerals.

#### THE CHANGING SURFACE OF THE EARTH

During the past two decades, our knowledge of the surface of the Earth, particularly that of the sea floor, has increased immensely. Advances in geophysics and geology now permit measurement of the sea floor and of the Earth beneath the ocean floor previously impossible. As a result of these studies, new hypotheses and theories have evolved. One of the major scientific revolutions of all times concerns the evolution of the Earth's surface. A major unifying geologic theory, the theory of plate tectonics, has recently evolved. This theory is based on studies of major segments of the lithosphere and of the dynamic relationships of large lithospheric segments or plates.

An examination of a bathymetric chart of the oceans reveals that, for their size, the ocean basins are relatively shallow. Except where the sea floor has been covered by sediments to form a smooth surface, numerous hills and seamounts are apparent. Through the center of the Atlantic Ocean, the Indian Ocean and across the South-eastern Pacific Ocean extends a long linear range of mountains. This mountain range, commonly referred to as the mid-ocean ridge, is the site of earthquake activity, vulcanism, and hot spring formation. Geologically speaking, it is active.

Along the margin of much of the ocean, particularly in the Pacific, Southeast Indian Ocean, and Southwest Atlantic Ocean, deep trenches occur. These trenches, thousands of kilometers long, hundreds of kilometers wide and tens of kilometers deep, are the deepest parts of the ocean floor. They are associated with violent earthquakes; frequently they are near areas of active vulcanism. Generally they can be regarded as the most geologically active areas on the Earth's surface. The trenches are separated from the mid-ocean ridges by deep abyssal plains and by abyssal hills.

Continental margins consisting of a relatively flat shelf and a somewhat steeper and more irregular continental slope constitute the transition from ocean to continent. Continental margins vary in width

and internal complexity.

As a result of many different studies, geophysicists and geologists now recognize that the outer portion of the Earth, including the surface, consists of a number of plates. These plates are bounded by areas of earthquake activity. Normally they stretch from a mid-ocean ridge to a deep sea trench. The earthquake activity is caused by movements of the plates away from each other, toward each other, or alongside each other. The edges of the plates consist of mid-ocean ridges, areas in which the plates are spreading apart; deep sea trenches where the plates come together; and fracture zones (transform faults) where the plates slip alongside each other. It was recognized early in the evolution of the plate tectonics theory that new crust was added along the mid-ocean ridges as the plates spread apart. At the trenches, one plate moves beneath another. This process is called "subduction." At these boundaries, ocean floor crust is removed from the surface of the earth. The rate of removal of crust beneath the trenches is about the same as the rate of addition of new crust at the mid-ocean ridges or spreading centers. Reversals of the Earth's magnetic field through time are preserved in the rocks formed at the mid-ocean ridges. The preservation in the rocks of these magnetic reversals has enabled geophysicists to determine the rates of movement of the ocean crust away from the mid-ocean ridges and toward the trenches. Over geologic time, these rates are of the order of a few inches per year. In many places oceanic crust which is formed at the mid-ocean ridges gradually moves toward the trenches where it is ultimately destroyed as it moves beneath the adjacent lithospheric plate.

Plates may include both continental and oceanic segments. Where such is the case, the continental margin may lie near the middle of a plate and is regarded as a "passive margin." The continental margin along the east coast of the United States is such a "passive margin." In other cases, where the edge of one plate is continental and the other plate is oceanic, the continental margin is the area of interaction between the two plates (e.g., the western coast of North and South America). In these cases, the continental margins are "active margins." They differ in character from passive margins. Active margins are generally characterized by folded, faulted, and uplifted sedimentary rocks; passive



margins are more typically flat-lying, undisturbed, sedimentary rocks.

The seafloor as well as the continents is in constant motion, each move giving rise to earthquakes. As a consequence, the shapes of the oceans and the continents are constantly changing. Mineral deposits occurring both on land and in the ocean have evolved as part of this type of active-Earth system. An understanding of the genesis of such mineral deposits depends to some extent on an understanding of the overall concept of plate tectonics. Further, a knowledge of plate tectonics may provide clues to the occurrence of presently unknown mineral deposits, both on the continents and on the sea floor. In the following section, mineral deposits of the sea floor and their relationship to the divergent and convergent margins of the plates will be considered.

#### OCEAN FLOOR MINERAL DEPOSITS

Any theory involving major elements of the Earth should account for the distributions of significant mineral deposits. Although not all of the mineral deposits occurring on the sea floor are a direct result of the processes of plate tectonics, they can all be described within the context of plate tectonics. The minerals which are considered here are those which either have potential for exploitation or are presently being exploited. Only those mineral deposits which occur on or beneath the floor of the ocean are considered. Extraction of substances from sea water is not discussed. Mineral deposits are considered according to their location with respect to divergent margins (areas where the seafloor is spreading apart), convergent margins (where two plates encounter each other), and intra-plate locations.

*Divergent Margin Deposits:* Mineral deposits which occur in the vicinity of the mid-ocean ridges, or spreading centers, have been sampled in a number of places. Perhaps the most spectacular example of minerals associated with the rise of molten material to form new crust are those which have been discovered during the past two decades in the Red Sea. The Red Sea is considered to be an extension of the mid-ocean ridge extending through the Indian Ocean. Along the axis of the Red Sea are a number of deep linear basins with depths of approximately 2000 meters. The waters in these basins are comparatively warm due

to a relatively high flow of heat from the Earth's crust. The sediments occurring in these basins are high in metal content. Investigators of the Woods Hole Oceanographic Institute estimated that the upper ten meters of sediments include a total dry weight of about eighty million tons of sediment with metallic content as high as 29 percent iron, 3.4 percent zinc, 1.3 percent copper, and 0.1 percent lead. The values of this metal in terms of 1970 dollars is estimated at about \$2.5 billion. A high percentage of these minerals are sulfide compounds in the sediments of the floor of the Red Sea. Similar deposits, but not of such dramatic quantity, have been sampled from the mid-ocean ridges in the Atlantic and the Pacific. According to the concept of plate tectonics, these minerals will be moved from the mid-ocean ridges across the ocean basins as the plates move toward the deep sea trenches. Thus, these sulfide deposits, although presently occurring in divergent margins, will become intraplate deposits and subsequently will be involved in processes of subduction at the convergent margins.

*Intraplate Deposits:* The primary interest in mineral deposits of the plates themselves focuses on manganese nodules. These nodules, which were originally discovered during the *Challenger* Expedition of 1872 to 1876, are present in quantities of trillions of tons. Nodules, between the size of peas and potatoes, are brownish-black in color, and relatively soft. With their fairly low density of 2.1 to 3.1 grams per cubic centimeter, it seems that it may be possible to lift them from the floor of the ocean to the surface by some mechanical means. Most of the nodules are somewhat round. Frequently they include a central nucleus surrounded by layers of various iron-manganese minerals. Many nodules average about 15 percent iron, 19 percent manganese, 0.3-0.4 percent nickel, and 0.2 percent cobalt. The present economic value is primarily in the nickel, rather than in the iron and manganese content.

Although the origin of the nodules is unknown, it is known that they are concentrated at the surface of the sea floor and that they are extremely abundant. Bottom photographs and samples have indicated concentrations of as much as eight pounds of nodules per square foot (equal to more than 100,000 tons of nodules per square mile). The potential value of these de-

posits has become a major factor in Law of the Sea negotiations inasmuch as the nodules are located outside the jurisdiction of the coastal nations and are generally regarded by many nations as being part of mankind's common heritage.

*Convergent Margin Deposits:* It is at the continental margins that the mineral deposits of immediate potential occur. The continental margins are the shallowest portions of the oceans; they are the richest biologically, and, for the present, are easily the richest in terms of surface and subsurface mineral deposits. Deposits at the convergent margins are of three general types: sand and gravel, which has been moved by waves either in the past or at present; phosphorite nodules, which form directly from seawater in areas where sand and gravel are absent; and hydrocarbons, which have been formed at some time in the geologic past and are now trapped beneath the surface.

Phosphorite nodules, including from 25-30 percent  $P_2O_5$ ; have been looked at for some time as a potential source of phosphate fertilizer. These nodules occur near the outer edge of the continental shelf in areas of little deposition. Attempts have been made to recover phosphorite nodules from the continental margin off southern California, but without economic success.

Sands and gravels of the continental shelf have been extracted for some time on a local basis. The value of the marine sand and gravel resource for the construction industry around the United States amounts to about \$100 million annually. In addition, in many places sand and gravel include placer deposits of more valuable minerals. Gold has been mined from shelf sands off Rome, Alaska; tin has been extracted from placers in some areas near Indonesia. All of these deposits are well within 200 miles of the coast. As a result of their location, they have not become a major factor in international politics. The same cannot be said for the remaining convergent margin deposits -- hydrocarbons.

It is not an accident that the hydrocarbons that do occur in the marine environment are found along the margins of the ocean. Current thinking has oil and gas originating from marine life and forming liquid hydrocarbons as a result of complicated relationships between a number of

factors during and subsequent to the deposition and burial of the organic material. It is generally believed that the organic matter which forms oil and gas originated as phytoplankton die and are deposited at the bottom. In order for preservation to occur, bottom waters must be low in oxygen content, thereby permitting the dead organic material to accumulate rather than be oxidized. Concurrent with the accumulation of organic material, rapid deposition of detrital sands and silts is necessary to protect the organics from further rapid decomposition. With burial by sediment, pressure and temperature increase to critical levels whereby the organic materials are regenerated to form fluids, either liquid or gas. Once in fluid form, these materials migrate from their source beds into a permeable rock which serves as a reservoir. Reservoir rocks possess both porosity and permeability, enabling the fluids to flow through the rock. The hydrocarbons may be trapped within the reservoir rock beneath some type of impermeable barrier.

It is amazing that oil and gas have been generated and preserved in the rocks of the earth's crust. Nevertheless, this has happened in many places throughout geologic time under circumstances which occurred near the margins of the then-existing oceans. The constant evolution of continents and ocean basins has resulted in the occurrence of hydrocarbons in rocks which are now many miles from the edge of the ocean. The high value of hydrocarbons in today's civilization makes the occurrence of these "mineral deposits" of critical importance with respect to nationalistic and international concerns.

International political concern has been expressed concerning the distance from shore a coastal nation may claim ownership of such hydrocarbons. The question "At what point do these hydrocarbons become part of the common heritage?" still remains to be answered.

#### CONFLICTS

Potential conflicts involving ocean floor minerals include conflicts of ownership, conflicts with other uses of the ocean, and conflicts involving pollution, destruction or alteration of the marine environment as a result of mineral extraction or transportation. The question of ownership has kept marine lawyers busy for

some time and will continue to do so in the future. Conflicting uses of the oceans have created problems for the guardians of the fisheries, as well as the guardians of the beauty of the oceans. Extraction of materials from the sea floor may or may not involve pollution, related coastal or sea floor erosion, or deposition. Both positive and negative examples of the effects of extraction can be cited. It was long thought that the construction of offshore platforms by the petroleum industry would be detrimental to the fish populations. In many cases, however, it was found that the platforms provided habitats for fish. Ultimately, an increase in fish populations in areas of high petroleum productivity was found as a result of the construction of drilling platforms.

Quarrying of sand and gravel from the sea floor may so effect the wave regime along coastal areas that intense erosion or deposition takes place in areas previously relatively free from these processes. pollution of the environment can be caused by addition of drilling substances to the ocean, or by stirring up bottom sediments which have remained on the sea floor for thousands of years.

The value of ocean minerals has served to highlight the overall value of the oceans. Negotiations concerning a common "Law of the Sea" have been underway for more than a decade. Scientific investigations of the seas have been in full swing for more than a hundred years. Virtually all of our knowledge of the oceans to this point in time has been developed through a free system of scientific exploration. Scientists have been at liberty to investigate the ocean without political constraint during most of the history of oceanography as a science. It has been only since the late 1950s that political constraints have been imposed on ocean scientists. The Continental Shelf Convention of the late 1950s prevented scientists from taking bottom samples from the continental shelf off the coasts of other nations. During the last half decade or so, restrictions on the conduct of ocean science have increased considerably. There has been more and more awareness of the potential wealth of the oceans. Coastal nations have unilaterally begun to claim as theirs the neighboring coastal ocean. They have insisted that science be conducted in these coastal waters only with their consent. The exclusive economic zone (200-mile zone) which is proposed in the negotiating text

of the Law of the Sea, will include many constraints on scientific activities in this part of the ocean. Thirty-seven percent of the entire ocean lies within the 200-mile zone. If the present text of the Law of the Sea negotiation is adopted, it will mean that scientists will no longer be free to engage in research in this portion of the ocean, but that they will need to obtain the consent of the coastal nations before carrying out scientific activities. In international politics, science is not a major player. Although our knowledge is to a great extent based on the past freedom of science, science is now engaged in a bitter conflict to maintain itself as a free enterprise in the world's oceans.

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# **PART III:**

## **An Economic Framework**



### III-A The Ocean Fishery: The Common Property Resource Problem

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Aspects of conflict and conflict resolution over the use of resources may be closely related to the nature of the property rights associated with 'ownership' of these resources. As background to a discussion of the common property (or 'open access') issue in the ocean fishery, I would first like to consider the relationships among the price mechanism, the strength of property rights, and conflict resolution.

Let's suppose a situation in which an individual, A, happens to own several freshwater ponds, and another individual, B, happens to own some property on the Oregon coast. B approaches A for trade, perhaps because B wants to get into the business of producing trout in ponds. They bargain. *Conflict takes place between A and B over terms of trade.* Nonetheless, once the bargain is struck -- ponds for coastal property -- both are better off (*otherwise, there would be no trade*). Thus, exchange is a way to *resolve conflict*. (Alternative: B *steals* A's ponds. This is likely to be rather costly to B, inviting retaliation by A, the wrath of the community and, perhaps, physical violence. In most cases, one would expect B to regard trade as a less costly alternative.)

Now introduce an *alternative* set of assumptions. A owns these ponds; B owns coastal property; C owns a pear orchard in Hood River. B wants the ponds for trout while C wants them for catfish. Both approach A. Now there is conflict between B and C. They will bid against each other for A's ponds. Who gets how many ponds, and on what terms (price), will depend on: how

badly A wants orchards, relative to coastal property or relative to his own ponds; how badly B wants to raise trout relative to keeping his recreational property; how badly C wants to raise catfish relative to raising pears; and, finally, how many of their respective resources each of A, B, and C owns.

The point is that, following the bargaining among A, B, and C, this three-person society will have made decisions on the use of resources (including labor) in the production of pears, catfish, trout, and the services of recreational property. (Notice that the same principle applies again: *all* will be better off than before. B will bid against C until he finds that the expected gain from acquiring more ponds is less than the expected costs of giving up more recreational land.)

Now this discussion has been concerned so far with decisions regarding the *use* of resources. Once A, B and C are producing from their resources, it may be that additional trade is possible. A, who formerly owned the ponds, may find that he would like to purchase some trout for consumption. Thus, he may trade trout for pears with C. Again the same principle applies -- there may be conflict over terms of the trade but, after the bargaining, both will be better off. Recognition of this gain provides conflicting parties with an incentive to use trade, rather than some more costly alternative, to reconcile differences emanating from dissimilar tastes and resource endowments.

*Thus, price is a way of resolving conflict.* This is also true among nations. This is important because it is often believed that, in international trade, one party must *gain* and the other party must *lose*. The fact that United States imports of seafood products are increasing does not necessarily mean that the United States is worse off than if she were producing her own seafood. If the United States can import seafood products more cheaply than she can "produce" them herself, then the United States may be better off in devoting those resources to the production of other goods and services.

In my example I noted that all of this bargaining among A, B, and C would result in some allocation of resources which placed the parties in a position which was "preferred" to the one in which they found

themselves before the trade. If we speak of an economy containing many A's, B's, and C's as well as many other members, we would expect the amount of, say, catfish being produced per acre-foot of pond water to depend upon the quality of the water, the particular production techniques used (hand feeding versus mechanical feeding), skills of the various managers, etc. If all of these factors were approximately constant over all producers, we would expect the yields to be about the same for all producers. In fact, the data suggest that this is, indeed, approximately the situation. On the average, catfish ponds in the United States produce approximately 1000 lbs./acre/year. Although data are sparse, I suspect the same is true with respect to trout. And I would, further, expect that the productivity of labor in catfish production is approximately constant throughout the country, and that the same is true for trout.

It is instructive to contrast this situation with comparable data on oyster production. Table 1. shows data on labor productivity as related to private land usage in oyster production by selected states for the year 1965.

There are many factors which can explain these differences: biological factors, alternative opportunities for labor and other productive inputs, degree of siltation, quality of labor, degree of subsidization (e.g., provision of seed oysters) by the government, water depth, weather conditions, disease, water temperature, etc. However, I would like to suggest that an important factor lies in the *strength of property right*. It turns out that one can classify property right structures on the East Coast into:

1. leaseholds: oyster-growing (subaqueous) land which is leased by the state and can be used exclusively by the lessee for oyster cultivation; and
2. common rights -- open access fishery for state residents.

As can be seen in the following table, the proportion of oyster-growing land which is leased varies among the states.<sup>1/</sup> Now why

<sup>1/</sup> The use of data for a single year restricts the analysis considerably. For a more extensive discussion, using data for a number of years and underlying the argument advanced here, see Agnello, R.J. and Donnelly, Laurence O., Property Rights and efficiency in the oyster industry, J. Law and Economics, October, 1975, pp. 521-533.



State	Pounds of Oysters Harvested per Man-year	Percentage of Oysters Harvested from "Private" Land
New York.....	3,922	77
Connecticut.....	4,655	97
Maryland.....	2,133	17
Virginia.....	2,791	65
North Carolina.....	1,225	10
South Carolina.....	15,229	100
Alabama.....	646	13
Louisiana.....	5,933	89

III-A 1. Labor productivity and private land use in oyster production by selected states, 1965. (Compiled from BCF, Fishery Statistics of the United States, 1965.)

should such variation make any difference? Well, consider the "open access" (or "common") property. Suppose you were a commercial oyster harvester using such "property." In order to raise oysters, it is necessary to make an investment in "cultch." Oyster larvae attach themselves to this cultch after a free-swimming stage and then, other things equal, grow to maturity. However, if this is "open access" property, how can the individual who "plants" the cultch guarantee that he will be the one who harvests the mature oysters from it? (This problem is sometimes addressed by requiring that harvesters or processors return the cultch to the oyster grounds, or by the state's doing so itself.) In any event, the private incentive to invest is reduced because of the absence of clearly defined private property rights. Also, because there is no individual seeking to maximize the return from these oyster grounds, there may be some congestion on the grounds because no one is curtailing the amount of harvesting effort -- a conflict situation! And finally, for the same reason, there is an incentive to harvest oysters before they reach maturity. No individual has the incentive to leave the oysters alone to reach maturity, because there is no guarantee that someone else won't harvest them before he does. (This may manifest itself

in lower prices than would otherwise be the case.) For all of these reasons, one would expect a different level of productivity from communally-held grounds than from privately-leased grounds. This expectation appears to be borne out by the oyster data in the above table.

In the case just discussed we have a situation in which the nature of property rights is determined by the state. This may not always be the case. In the Maine lobster fishery, territorial claims, despite being unrecognized by the state, are "well-established and backed by surreptitious violence."<sup>1/</sup> This has also been true, to some extent, in the Columbia River salmon fishery.

I have been speaking here of *property rights*. It has been argued that "rights" in property (and here I'm speaking property in a broad sense to include any resource -- land, labor, water, etc.) develop over time in response to changes in the *benefits* and *costs* associated with protecting and exchanging that property. One text has described property

<sup>1/</sup> Acheson, James M., The lobster fiefs: economic and ecological effects of territoriality in the Maine lobster industry, *Human Ecology*, 3(3): 183-207; 1975.

rights as "the expectations a person has that his decision about the use of certain resources will be effective."<sup>1/</sup> Thus, *property rights can be thought of in terms of how strong they are, rather than in terms of whether or not they exist.*

One factor which importantly affects the benefits from establishing property rights is the demand for the goods and services which could be produced by that property. For example, when the western part of the United States was settled, if a cattlemen discovered a valley suitable for grazing cattle, but also found cattle already there (presumably someone else's cattle), he looked elsewhere for range. But, as more people came west, the demand for land grew. This increased the value of land, and, thus, increased the benefits associated with the *definition* of property "rights" and the *enforcement* of property "rights." By forming a Cattle Growers' Association, cattlemen could control access to water (thereby effectively controlling use of land), and could put pressure on the government to control access. I suggest that we are presently seeing an increased demand for living resources from the sea, accounting, in part, for the increased activity to try to get stronger property rights established in the ocean.

Technological changes may also affect the costs and benefits associated with defining and protecting property rights - e.g., barbed wire in the case of the American West. This reduced the cost of protecting property rights. The same phenomenon occurs with respect to pen culture of salmon in Puget Sound, or techniques for closing the life cycle for certain marine species so that they can be raised under controlled conditions. While only a small percentage of the world's seafoods is currently harvested through aquaculture, I submit that, with technological changes and increased demand, an increased percentage will come from aquaculture.

Meanwhile, by far the bulk of our seafood comes from an "open access" property -- the world's oceans. This is explored further in the next paper. (Rettig, The Economics of Open Access Resources: Ocean Fisheries.) While substitutes for the

ocean's products are advancing (through aquaculture), there are, simultaneously, efforts being made to resolve conflict, through the establishment of regimes which would yield stronger property rights (Law of the Sea, Extended Jurisdiction) and increase the role of markets. It seems to me to be important to keep this in mind: While there is, indeed, conflict over how these rights are to be established (who will gain and who will lose), other conflicts, namely those which take place on the fishing grounds, which can become international in scope may be resolved, or at least reduced. I am not arguing in favor of strong property rights, but I am suggesting that, once established, they may permit more conflicts to be resolved through the price mechanism. Whether you like this depends, of course, on your own values.

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<sup>1/</sup> Alchian, A.A. and Allen, W.R., Exchange and production, theory in use. Belmont and Calif.: Wadsworth: 158.

### III-B The Economics of Open Access Resources: Ocean Fisheries

by R. Bruce Rettig,  
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The key to "the fisheries problem" is that each resource user affects the future available supply of the resource and yet has no incentive to consider the adverse consequences of her/his actions upon other resource users.

If a fisherman releases an "immature" fish or a female (spawner), it might get larger and/or it may reproduce, but that fisherman has no reason to believe that he/she would catch that particular fish when it is larger or its offspring, later. Therefore, he/she has no incentive to let the fish go.

With a small number of fishermen, vessels, and gear exerting effort on a specific fish stock, one would expect a relatively small catch. As more fishing effort is introduced into a fishery, landings will initially rise markedly, but may later decline somewhat.

Two sustainable yield curves are shown in Figure 1. For any given fishing intensity, the value given by the yield curve is the annual or seasonal harvest at which the fish resource maintains the same level of abundance (apart from the effects of environmental variation) in succeeding seasons or years. Maximum sustainable yield (MSY on the graph) is an average over a reasonable length of time of the largest catch which can be taken continuously from a fish stock under current environmental conditions.<sup>1/</sup>

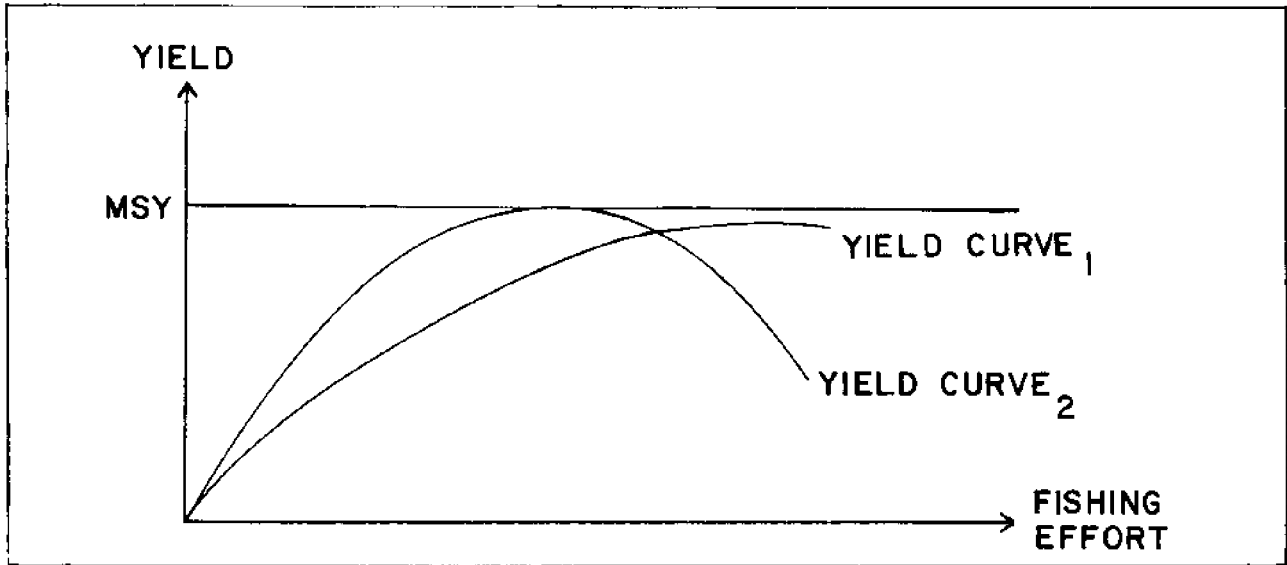
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<sup>1/</sup> This MSY definition is taken in large part from working papers of the Scientific and Statistical Committees of the Pacific Regional Fishery Management Council and the North Pacific Regional Fishery Management Council.

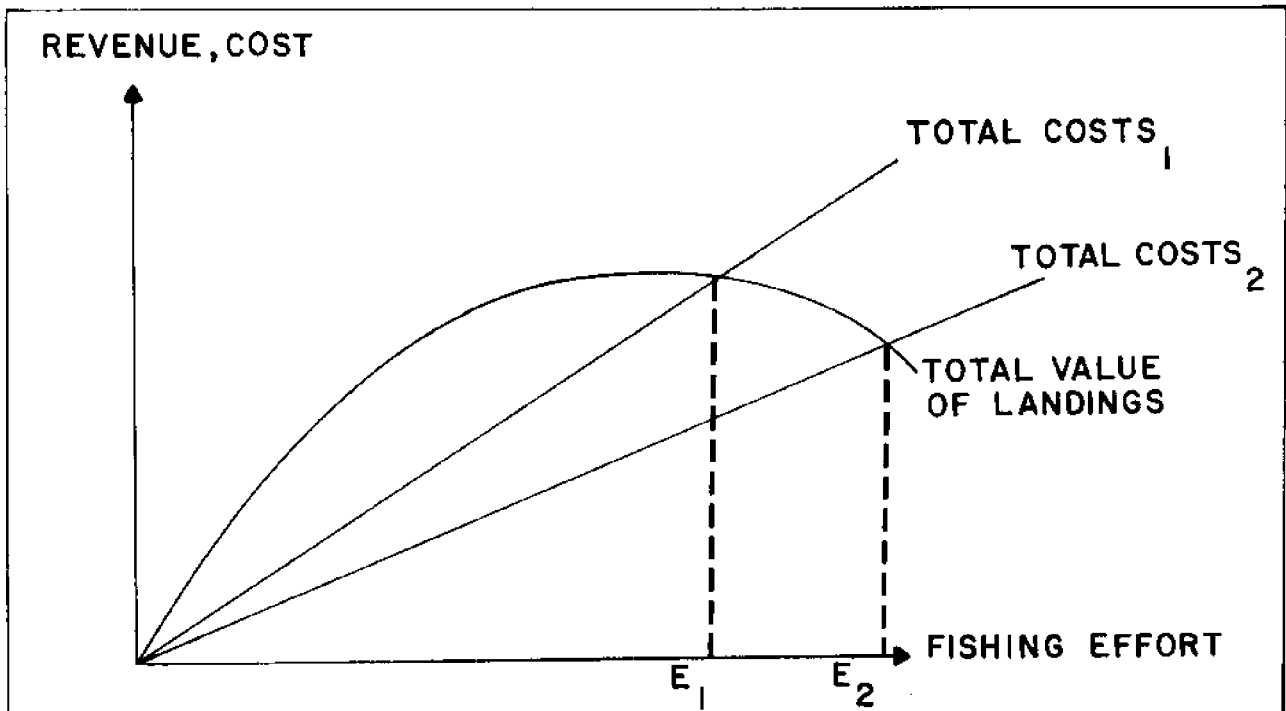
In the case of yield curve 1 (which partially describes the Dungeness crab fishery), MSY is the limit to the catch as more effort is added to the fishery. Yield curve 2 shows another case (such as Pacific halibut) where increasing fishing intensity either reduced the available spawning population such that new recruitment to the

biomass is retarded, or many fish are caught when they are young and still have significant growth potential.

The relationship between normal or long-term costs and the value of landings is illustrated by the revenue curve in Figure 2. Assuming that the price of fish does



III-B 1. Yield-fishing effort relationship for two types of fisheries.



III-B 2. The relationship between costs, revenue and fishing effort.

not change very much with changes in quantity landed (i.e., assuming demand is price-elastic), this curve will look rather like the yield curve and will peak at the same fishing effort level.

As more fishing effort is exerted, total fishing costs also rise. These are normal, long-term costs. Cost is used in two meanings here and these two costs are assumed to be equal. One is the cost to fishermen: their outlays, capital costs, plus the value they place on their working time. The second is a broad interpretation of opportunity cost: the measure of goods and services which would be available somewhere else in the economy if the fishermen held other jobs, the resources used to produce boats had been used to produce other capital goods such as plows and tractors and so on.

If the total value of landings exceeds costs of taking those landings, the industry will attract new entry. If total receipts are less than costs, the usual analysis indicates that effort will tend to decline. With a competitive fishing industry, effort will tend toward the level  $E_1$  on figure 2.

When cost per unit of fishing effort is low relative to value per unit of landings, there may be so much fishing effort exerted that the quantity landed is less than the maximum sustainable yield (see low per unit cost curve  $TC_2$  in Figure 2 leading to  $E_2$  fishing effort). This is referred to by biologists as overfishing. This is illustrated by Jim Crutchfield's case (Crutchfield: Marine Resources) about a group of valuable fisheries in the North Atlantic where a greater weight of catch could be taken by far less fishing effort.

Whether "biological overfishing" is documented or not, industry equilibrium under open access is considered wasteful, using an economic efficiency criterion. Why? Suppose the fishery had not yet reached equilibrium (efforts were less than  $E_1$  in Figure 2). Some number of fishermen are engaged in the fishery and are tending to make profitable incomes. A potential entrant makes an estimate of his/her expected landing value, looks at her/his expected costs, and decides to begin fishing. Perhaps biomass density declines; perhaps reproductive capacity suffers; perhaps a larger percentage of fish are caught before growing to "mature" weight -- all factors increasing costs to fishermen already in the fishery. Yet this new entrant has no

incentive to consider costs imposed on others. Consequently any increase in industry revenues may be greater than the "private costs" of the new entrant but could still be less than the "social costs" of that fisherman plus all the other fishermen. The fisherman enters -- he gains but society loses.

While academic economists would tend to support the notion of limiting effort in many fisheries, those fisheries with significant biological overfishing have recently generated widespread consideration and adopted selected schemes for holding down fishing effort, most commonly vessel license limitation (salmon fishery in British Columbia) and fishermen's license limitation (salmon fishery in Alaska).

A general recognition of the issues discussed so far played a key role in the new consensus that fisheries should be managed for "optimum yield." In this new regime, fishery management objectives must be established. An important one is economic efficiency, but, by law, it can not be the sole objective. Other objectives would include stability of relevant ecosystems, community social stability, distribution of income (especially avoidance of windfall gains and wipeout losses of large magnitudes), freedom of access as a social, as opposed to economic goal, and many others.

Management alternatives are to be evaluated for their impact on these several objectives and a "most preferred" outcome must be selected. The yield associated with this preferred choice is, by definition, the optimum yield of that fishery. For practical purposes, it can be approximated by maximum sustainable yield in a number of fisheries, but all of the considerable problems of social choice frequently get meshed into its actual determination.

The notion of managing for optimum yield is extremely difficult for a single nation managing a resource under its jurisdiction; if the fishery resource must accommodate the market value of two or more nations, management decisions are made even more complex.

Just considering economic efficiency, nations placing different market values on a fish species and/or with different costs would prefer different levels of total catch. For example, Japan values Alaskan pollock highly and is able to catch it at fairly low costs. Consequently Japan

would like to see Alaska pollock harvested at the maximum sustainable yield level. On the other hand, establishment of a significant U.S. fishery for Alaskan pollock would be facilitated by a lower harvest level resulting in lower costs in harvesting fish in a more dense stock and possibly selling the fish at a higher price.

Consideration of noneconomic objectives further complicates agreement among nations. The role of ocean fishery management in national security, concern for preserving life-styles and so on vary widely among nations.

There are other problems in reaching and maintaining agreement among nations. One problem is the free rider problem. A group of nations may agree that they would all be better off if they were to all reduce fishing effort. However, a single nation could be even better off if all the other nations reached an agreement and reduced effort but stayed out of the agreement and maintained or even increased its fishing effort.

A related problem is posed by the interloper. Suppose a group of nations W, X, and Y carefully controlled their joint fishing effort for tuna. There would be an incentive for nation Z to enter the fishery.

Finally, agreements "carve up the pie" by some rules. No matter what rule is chosen, each nation will have an incentive to "beat the rules." For example, suppose that a group of nations agree to set quotas based on total tonnage held on each nation's fleet. Each nation might then invest in boats attempting to increase its share. The rapid increase in foreign fishing off Alaska shortly before the United States established unilateral extended jurisdiction could be partially explained as an attempt to establish historic rights.

I would argue that the world-wide movement toward unilateral declarations of extended jurisdiction is due, in part, to the growth of the problems set out above and, in part, to a reemergence of territorial imperative. Westward (and Eastward and Southward) Ho!

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# **PART IV:**

## **Prospects for Ocean Resource Management**





## IV-A Conflicts Generated by the Grab for Ocean Resources

by Courtland Smith,  
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University.  
and Larry Rogers,  
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Economics, Oregon State University.

### INTRODUCTION

Conflict among individuals and groups is as old as society. Over time, societies have devised various ways to resolve conflicts. Wars, domination, discourse, legal procedures, terrorism, trade, and take-overs have all been used to resolve conflict.

In a broad sense, this paper is concerned with conflicts over the use of the world's ocean resources. Specifically, it focuses on two conflicts.<sup>1/</sup> One is the conflict between less developed nations and developed countries over distribution of ocean resources. The second focuses on the neighbor-to-neighbor conflict over migratory fish populations.

### DEVELOPED VS. LESS DEVELOPED NATIONS: THE LAW OF THE SEA

The nations that are organized in the "Group

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<sup>1/</sup> Smith's lecture dealt with several additional conflicts including: 1. neighbor-to neighbor conflicts stemming from ecological and hydrological considerations relating to fish and pollution migration and 2. conflict involving the mining of manganese nodules, and fish stocks. Because of space limitations, these conflicts, as well as many examples, were not included in this paper.

of 77" are suggesting a change in the world's economic order to bring about a more equitable distribution of wealth and resources.<sup>1/</sup> The problems of wealth redistribution and of preventing national take-over of some of the world's last remaining unclaimed ocean resources, were factors that brought about the Law of the Sea Conference.

Some economists suggest that the pricing mechanism of the marketplace, if allowed to work freely, would resolve many conflicts. However, it seems that the marketplace may not always resolve conflict.

I have a simulation game that I want you to play which shows how market exchanges may heighten, rather than resolve conflict.

I've brought along a number of 35 mm film canisters. I will distribute them to each of you along with the name of a country that you represent. The canister distribution will be according to the *per capita* consumption of energy of the country you represent. You might think of each canister as representing a barrel of oil. The countries are located along the Western Atlantic Ocean.

Starting with Central America, Mexico gets 13 canisters, Cuba 12, Guatemala 2-1/2. Since Haiti has only three-tenths of a canister, I'll give the representative just the top.

For South America, Venezuela gets 28 and Brazil 7. I will represent the United States, therefore, I get 110 canisters.

Let's assume that energy consumption is roughly equivalent to wealth. Each of these canisters, then, represents your ability to participate in the market at this particular time. How do you feel when you compare your pile of canisters with mine? How do you feel about the goods

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<sup>1/</sup> The "Group of 77" is an unofficial, voluntary association of some of the participants in the Law of the Sea Conferences. This "Group" is composed primarily of less developed and land-locked nations. Originally the "Group" consisted of 77 countries. In recent years the "Group of 77" has grown to about 110 members. The total number of participating countries in the Law of the Sea Conferences is currently around 150.

and services my canisters will purchase? Certainly in a free market you can offer some good or service and improve your relative position. But who is likely to be your major consumer? Where will you get the capital to develop the project you have in mind? Where will you purchase the needed technology? Do you feel that you can attain equality with me? Do you know of any set of free market arrangements that will enable you to attain greater equality?

The canisters are meant to give you the feeling for what it is like from the point of view of a developing country. Do you feel a sense of equal power and opportunity?

If you want greater equality, what advantage do you have as a group over me? Couldn't you attain equality faster through some type of voting block against me? This is the tactic used by the "Group of 77" at the Law of the Sea Conference, and these political alliances also operate in the General Assembly of the United Nations. A more rapid way to achieve greater economic equality may be political rather than economic.

#### NEIGHBOR-TO-NEIGHBOR CONFLICT

One of the unplanned results of the Law of the Sea Conference has been the unilateral extension of coastal boundaries to 200 miles by many coastal nations. While this take-over of resources has solved some problems, such as control over near shore resources by coastal nations, other problems cannot be solved. One conflict that is likely to increase is the one between coastal neighbors over the use or control of economically important migratory fishes. This conflict can be called neighbor-to-neighbor conflict.

First of all, what happens as various nations extend their boundaries to 200 miles? The result is removal of foreign fishing vessels from areas which contain the majority of the ocean's fish. Over 85 percent of the world's catch is made within these boundaries.

While distant-water fishers are now prevented from usurping these fish, those fish that migrate into coastal waters of other countries are not continuously under the control of any one nation. This problem can be illustrated by examining the movement of fish along the West African coast. In Figure 1 movement of several commer-

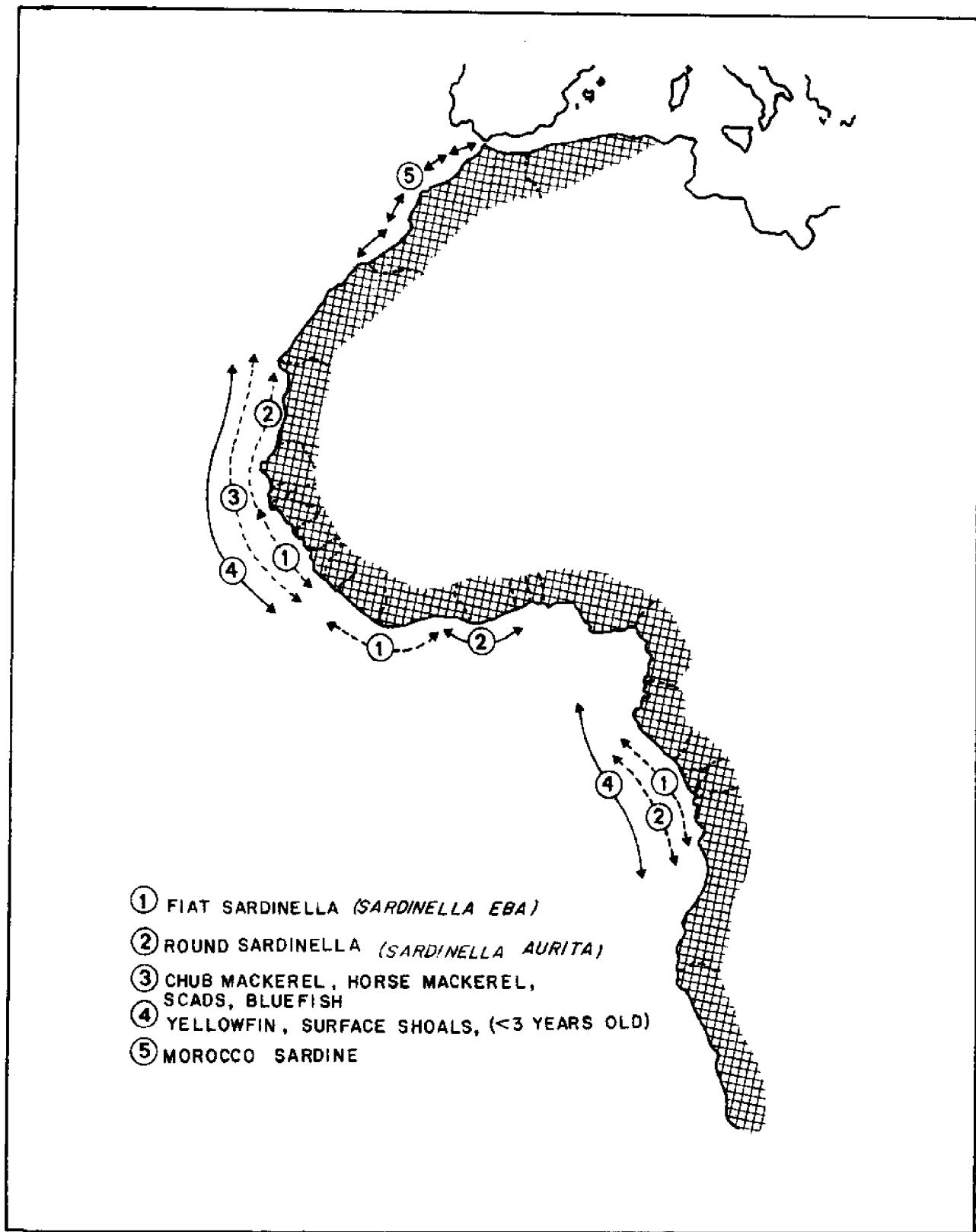


Figure IV-A 1. Fish migrations crossing extended national boundaries. Migration of sardinella, mackerel, scads, bluefish, yellowfin, and sardine. (J. A. Gulland, Population Dynamics of World Fisheries, University of Washington Sea Grant, 296; 1972.

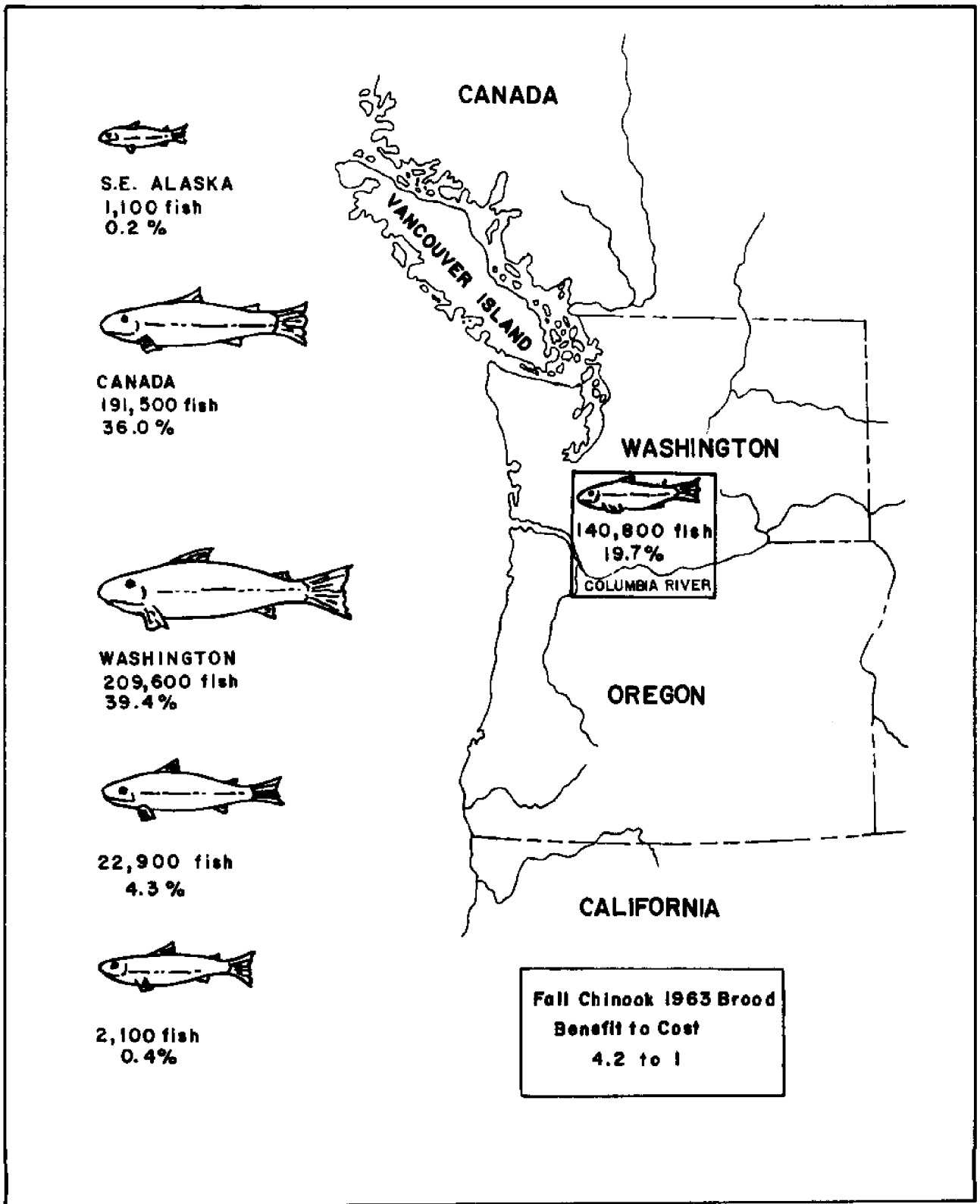


Figure IV-A 2. Distribution of catch of 1963 brood fall chinook from Columbia River Hatcheries. (National Marine Fisheries Service).

cially important species is shown. Each of these species crosses through the 200-mile zone of several countries. What belongs to one country today may belong to another tomorrow. Figure 2 gives another example of the migration of fish stocks between nations. Shown in Figure 2 is the catch of fall chinook salmon by U.S. and Canadian fishers.

Coastal nations whose neighbors extend their jurisdiction have no choice but to negotiate new boundaries. The national self-interest and expectations that led to demands for extended jurisdiction have inflated the value and expectations for offshore resources. Thus, perceptions of loss rather than gain are increasingly likely. Individual nations perceive their boundaries in terms of their national self-interest, not in terms of the final compromises that will have to be worked out. Most have not taken into account the cost of developing data to define and maintain extended ocean boundaries, nor have they considered the cost and technology required for enforcement. As the gap between actual compromise and initial expectations widens, the feeling of being cheated becomes more probable. Thus, dissatisfaction among neighbors is likely to increase.

Extensions of national jurisdiction will occur. They will involve extensions of land-based boundary concepts and principles into the oceans. Oceans are fluids and pose problems of location, visibility, fluidity, and relations to ecological processes, all of which have a bearing on the location of fish populations. Extensions of national jurisdiction will cut ecological boundaries and systems but fish do not respect national jurisdiction, and their movements will require neighbor-to-neighbor bargaining over definitions of boundaries and the distribution of resources that cross these boundaries.

Potentially better relations between distant-water fishing nations and coastal states are possible with extensions of jurisdiction, since the rights of each can be clarified. Yet, there is also the potential for increased neighbor-to-neighbor conflict as new boundaries are worked out and as institutions to manage fish and other resources which do not correspond to national boundaries are initiated.

## CONCLUSIONS

The grab of ocean resources heightens the possibility of international conflict. Less developed and land-locked nations will perceive greater inequality. Coastal neighbors will have difficulty defining boundaries and allocating migratory fishes.

Key to resolving these conflicts are concerns about distribution of wealth, national self-interest, and new international political institutions.

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## IV-B The Law of the Sea: Some Unresolved Problems

by Jon Jacobson,  
School of law, University of Oregon

The Law of the Sea Conference has become so complicated now that I have trouble even stating the resolved and unresolved issues. This is an important conference, attended by 150 nations. The purpose of the conference is essentially to write a constitution for the ocean (including the air space, the water, and the sea bed). Oceans cover 70 percent of the earth's surface. The conference has been going on for a long time without anything of a legal nature coming out of it directly. The question arises at this point: is it going to succeed?

There are some Americans who say: "Why should we care? We're the sea power. We have more 200-mile economic zone space than any other country, and it is rich space. Let's just go our own way." One of my themes tonight is that we *should* care because there are some important things that would be sacrificed if the conference failed.

First we need to establish what the Law of the Sea is. It is easier to describe what it was two years ago or to predict what it will be in the future than to describe the present status because things are changing so fast. Until a few years ago the Law of the Sea was based essentially on the four treaties resulting from the first Law of the Sea Conference in 1958. There was a law of the sea before then but these four conventions simply codified the generally understood rules about the use of the sea that had existed prior to that time.

There are two primary sources of international law. The first is the customary practice of nations -- these are the rules

derived from interaction within the community of nations. The second source is international agreement: agreements between governments of nation states. Other countries sometimes refer to these agreements as "treaties," but in the United States we have a constitutional problem with that. Only some international agreements are formal treaties and the rest are executive agreements. The important distinction here is that generally in international law customary laws are applicable to all nation states, whereas an international treaty is binding only on those nations that have become parties to it either by a process of ratification or accession. I will refer to these two types of law as "custom" and "treaty." I use "treaty" loosely to mean all kinds of international agreements.

The first Law of the Sea Conference in 1958 resulted in four conventions involving 35-40 parties: the Territorial Sea Convention, the High Seas Convention, the Continental Shelf Convention, and the Fisheries and Conservation Convention.

In the Territorial Sea Convention the discussion included even waters that are not technically ocean waters. Internal waters are those waters of a nation state landward of the coastline, including rivers, streams, and lakes, and of course bays. These waters are subject to the complete sovereignty of the coastal nation. The territorial sea is the next zone out -- from the coastline out to an unagreed upon (in 1958) maximum. Within this zone the coastal nation exercises complete sovereignty, the only exception to which is "innocent passage," a doctrine meaning that non-hostile passage through territorial seas must be allowed. The territorial sea technically includes the sea bed, the waters, and the air space above it, but interestingly enough, there has never been a doctrine of innocent passage for aircraft. You must have permission to fly through the airspace above a territorial sea of another country.

Next to the territorial sea is a zone called a contiguous zone. Within the contiguous zone the coastal nation can exercise rather limited rights: the right to enforce its laws applicable to the territorial sea with regard to customs, sanitary regulations, immigration, and fiscal matters. Notice that as we're moving out away from the coast line we're chipping away at the coastal nation's control.

Starting at the boundary of the territorial sea, overlapping with the contiguous zone and going out beyond it, is the high seas. In this zone, freedom of the seas was defined to include at least four freedoms: freedom of fishing; freedom of vessel navigation; freedom of overflight; and freedom to lay submarine cables and pipelines. "Freedom" is the catchword; when you are talking about the rather hostile environment (for man) of the ocean, freedom of the seas means freedom for those that are technologically capable of exercising it. The number of nations that exercise it on a large scale has always been relatively small.

The next zone out has not been defined in terms of distance from the coast but rather in terms of depth -- 200 meters. A 200-meter depth is on the average just over the edge of the physical continental shelf. The legal continental shelf -- the area over which the coastal nation has sovereignty over the natural resources -- was defined by the Continental Shelf Convention as at least the area out to the 200-meter isobath. This was considered a good place to draw the boundary, although it very seldom coincides with the physical continental shelf. There were several countries that didn't like that limitation, particularly those countries on the west coast of South America where a 200 meter depth is very close to the coastline. The result was that they added an exploitability test to the 200-meter depth to define the legal continental shelf. The continental shelf was defined to a depth of 200 meters, or beyond that to "where the superadjacent waters admit to the exploitation of the natural resources of the said areas." The exploitability test essentially says that if a nation can exploit some resource out beyond the 200-meter depth it can push its boundary out. This concept gives every coastal nation an inherent right to resources beyond the 200-meter depth because anything discovered there would belong to the coastal nation.

Both the exploitability test and the 200-meter depth test presented conceptual problems: What about trenches in the continental shelf? Can the 200-meter depth line jump these anomalies in the coastline? Suppose the exploitability test is carried to its ultimate extreme; would the "continental shelves" of the coastal nations cover the whole ocean bottom? No one has ever seriously proposed that that's what the exploitability test means, but there isn't any explicit limitation in it. Neither concept is a workable one, but the parties to the



Continental Shelf Convention live with them.

The fourth 1958 convention was the Fisheries and Conservation Convention. It is the least important of the four because the principal fishing nations did not become parties to it. For those nations that did become parties to it, it would allow a temporary assertion of emergency conservation fisheries management rules further out than the territorial sea -- an exception to the usual freedom of fishing on the high seas. The United States became a party to that but the Soviet Union, Japan, and a number of other fishing nations did not, and so it hasn't been considered a very effective convention.

Despite the fact that the convention was not applicable to non-parties, which included the distant-water fishing nations, and despite the fact that the High Seas Convention to which we were a party included freedom of fishing beyond the territorial sea, in 1966 the United States claimed a fishing zone by legislation. This expanded U.S. fishing jurisdiction out beyond the territorial sea (within which we exercise complete sovereignty over the fish) to 12 miles. There is a question as to whether that action has ever been technically legal under our obligations of the High Seas Convention; nevertheless, nobody really complained about it. So until 1977, when we claimed the 200-mile limit, this is what the legal geography of the ocean looked like: territorial sea - three miles for the U.S., six or twelve miles for other countries; contiguous zone - out to a 12 mile maximum; high seas - from the territorial sea on out; continental shelf - the 200-meter isobath or beyond that to the point of exploitability (usually no more than 12 miles).

In 1966 the second Law of the Sea Conference met and tried to decide on the issue of the territorial sea boundaries, which was the main problem left unresolved from the 1958 conference. It came close to deciding on a six mile territorial sea plus an outer zone of another six miles for fishing. This joint United States-Canada proposal failed by one vote to get the necessary two-thirds of the total needed for passage.

Another big problem of the 1958 conference was that it had established no set of rules or legal regime for the seabed. The High Seas Convention applied to waters and the

air space, but the International Law Commission which drafted the 1958 treaties, specifically ignored the seabed. No one was concerned with it then -- it was thousands of feet down and nobody thought there was anything of value there anyway. This was a big gap in the structure of the 1958 High Seas Convention.

The catalyst for the Third Law of the Sea Conference was the mid-1960s realization that the manganese nodules, which had been discovered over 100 years ago, were not potentially very valuable when coupled with existing technology. In 1967 Arvid Pardo, then Ambassador to the United Nations from Malta, had made his famous speech to the General Assembly suggesting that the sea bed and its minerals and resources were the common heritage of mankind. He urged the United Nations to set up a conference establishing a regime to regulate mining of the manganese nodules and to prevent military uses of the sea bed.

The General Assembly though this was a good idea and passed in quick order three relatively important resolutions:

1. a moratorium resolution that prevented mining of the nodules until the establishment of an international regime;
2. a declaration of principles stating that the seabed beyond national jurisdiction and everything in it were the common heritage of mankind;
3. a conference resolution calling for a new Law of the Sea Conference to set up this international regime.

The General Assembly formed at that point the Committee on the Peaceful Uses of the Sea Bed and the Ocean Floor Beyond the Limits of National Jurisdiction (the Sea Bed Committee). Since then the Sea Bed Committee has been meeting twice yearly in Geneva and New York to discuss the establishment of an international ocean regime.

By the time the third Law of the Sea began in 1973, it was to come up with a legal scheme for international ocean law and for the management of all ocean uses. Everything which had been provided for in 1958, which was itself a codification of things started 350 years before that, was to be set aside. Everything was to be considered anew. The conference started in 1973 in New York City for a short meeting to set up the organization and procedural rules for the conference and then moved the next summer (1974) to Caracas where it did nothing but debate for ten weeks. In

the spring of 1975 it went to Geneva for another eight-week session, most of which was spent in more debate. At the end of this session, under orders from the president of the conference, the chairmen of the three main committees came out with a proposed informal single negotiating text. One of the problems in the first two sessions was that there was nothing to focus on. Everybody just submitted their own proposals day after day. It was just a big pile of papers floating around, and it was very frustrating. The single negotiating text was to provide a focal point for discussion. Delegates could look at one single document and make amendments to that.

This negotiating text was a fairly substantial document, with about 500 articles, and was to form the basis for discussion on the next session in 1976, in New York. Nothing came out of this eight-week session, except a revised single negotiating text, which is the most significant document that has ever come out of the conference.

It helps to understand the complexity of this conference if we realize that there are 150 nations involved discussing 93 major ocean issues. Actually, it is even more complicated than these numbers might suggest; there is also the north-south split (developed countries vs. developing countries). The developed countries tend to occupy the Northern Hemisphere and the developing countries the Southern Hemisphere. "Developed" countries in this context means essentially the maritime countries (the United States, the Soviet Union, Japan, and a few others), so we could also call it a maritime country-non-maritime country split, although even that is an oversimplification.

The developing, or Third World, countries are represented by the Group of 77, a fairly loose coalition which began with 77 members but now has over 110. The Group of 77 has come out with what looks like a fairly uniform position on various topics, but even within this group there exist substantial differences in viewpoint. For instance, landlocked countries without any coastline are not apt to support the 200-mile limit as much as the common heritage concept. Closely aligned with the landlocked states are some geographically disadvantaged countries, not quite landlocked but with minimal coastline. Together these landlocked and geographically disadvantaged nations can form a blocking

third on certain issues (a two-thirds vote being required to pass anything). Coalitions between these groups of nations are formed and disbanded. It is very complex and difficult, at least for the non-political scientist, to understand what's really going on.

Now let's consider the progress that has been made. I am going to borrow a bit from an article in *Foreign Affairs* written by Jonathan Charney<sup>1/</sup> in order to clarify the issues. He divides the issues under discussion into three groups.

First, there has been a re-affirmation of rules that already existed. These rules will be left unchanged because there is general agreement over them, such as the territorial sea baseline rule (essentially the low water mark), the continental shelf principle (a coastal nation owns the resources adjacent to its coastline), right of access to the high seas by landlocked states, and the rules for drawing boundaries between opposite and adjacent states. These are only some of the rules that will remain essentially unchanged.

Second, there has been a development of new customary rules by state practice outside the conference that has been spurred by the negotiations within the conference. The 12-mile territorial sea is fairly well agreed upon, but the United States still technically claims a three-mile territorial sea. The United States is a maritime power, and wants as much freedom of navigation as possible for its military and maritime fleet. A three-mile territorial sea doesn't make that much difference in the open ocean, but it does make a lot of difference in the straits, because with it several straits have a high seas lane right in the middle. The best example of this is the Strait of Gibraltar, which at its narrowest point is about eight miles wide. If Spain and Morocco each have a three-mile territorial sea this leaves a two-mile high seas gap. What difference does this make? The innocent passage rule affects submarines in a special way: they can't innocently pass through a territorial sea without surfacing to show the flag. For the United States this means that missile submarines will be seen at crucial points. The Pentagon and

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<sup>1/</sup> Charney, Jonathan I., *Law of the Sea: breaking the deadlock*, *Foreign Affairs*, 55 (3): 598-629; 1977.

the State Department would rather have a rule of international law that allows submerged passage through international straits, and this means keeping the territorial seas narrow. Except for this rather narrow perspective of the United States, however, 12-mile territorial seas are a reality. If the conference fails, this will be the customary rule.

Another new customary rule that has become accepted without a treaty is the 200-mile exclusive economic zone. As well as rights to mineral resources and fish, the zone will also carry the right of the coastal nations to require consent to do scientific research within it.

A possible new customary law will be the definition of the outer limit of the continental shelf as the continental margin, rather than the 200-meter depth or the exploitability test. By continental margin I mean the shelf, the slope, and the rise. The combination of that outer limit and the 200-mile exclusive economic zone gives coastal nations control over most of the richest areas of the ocean.

These issues -- the 12-mile territorial sea, the 200-mile exclusive economic zone, and the outer limit of the continental shelf -- will be here with us even if the conference doesn't progress beyond this point.

Third, there is a group of unresolved issues that won't be settled by custom without the continuance of the conference. One of these is the question of free transit through international straits even for submarines. Free transit would not result as an international rule without the convention. Each of the straits (and there are at least 116 of them, although not all of them are strategically important) would have to be negotiated separately.

Another issue that would be left standing is the protection of the marine environment. There would be no of the Sea rule on protection of the marine environment as a customary rule. There has not been consensus on that as there has been on the 200-mile limit.

Also left unresolved would be the matter of revenue from the resources beyond 200 miles, the "common heritage of mankind." The idea behind this was that the resources of the deep sea bed would be developed essentially for the benefit of developing

countries, but there will be no revenue sharing or transfer of technology without a convention.

Finally, let's look at the deadlocked issues because those are the things that not only are unresolved but also are holding up progress in the conference. Some of these issues might be decided if the conference failed, but most of them would not, at least by international law.

One major issue is access by landlocked and geographically disadvantaged countries to their neighbors' 200-mile limits for fishing, mining, etc. The blocking third group wants built into the treaty a guaranteed right to participate in resource exploitation on their neighbors' continental shelves. Without a treaty this might not be a part of international law.

The next issue is the scope of national jurisdiction within 200 miles. Jurisdiction within the 200-mile zone is a reality for minerals, fisheries, and scientific research. But there are other uses whose jurisdiction is still in question, such as navigation, pollution, and some still unforeseen uses. For these it will be a matter of residual law applying to new uses that come along. The maritime countries have taken the position that 200-mile limits will be exceptions to the high seas. (The zone will still be considered high seas with the exception of fishing and minerals, so that any other use that arises will be treated under freedom of the high seas.) The developing countries, most of which of course are not maritime nations, want the 200-mile limit to be defined as theirs, i.e. high seas to start on the outer edge of the 200 mile limit, and all uses within 200 miles to be under their control. It's the old maritime versus non-maritime nations dispute. The maritime nations want to retain as much of the high seas as they possibly can -- they want the 200 mile limit to be an incursion into the international arena. The developing coastal nations want the 200 mile limit to be theirs and the international arena -- the high seas -- to start beyond that. A definition proposed as an alternative to either of these is to treat the 200-mile limit as *sui generis* -- of its own kind -- neither high seas nor territorial sea. This still doesn't address the new uses problem, and this is still a deadlocked issue.

The third and major deadlocked issue concerns the deep sea bed minerals. The

framework within which all this is happening is the Revised Single Negotiating Text which is based on a 1970 proposal by the United States for management of the deep sea bed mineral resources. This would be done by a three branched International Sea Bed Authority consisting of an Assembly ("legislative" branch), Council ("executive" branch), and Tribunal (judicial branch), with an Enterprise, an operational arm that would under certain circumstances do the mining itself.

That is just the framework; the deadlock is over who will control access to the deep sea bed minerals. The United States wants control in the Council where there would be weighted voting. The Group of 77 wants control in the Assembly where there would be one nation, one vote. The mining companies represented by the United States want very few controls. They want to be able to exploit the minerals under much the same mineral law as in the United States -- by paying rent and a royalty and taking some profits. The developing countries want to set up a powerful sea bed authority that will strictly control the mining operations and even do some of its own mining, with a substantial share of the profits channeled into development of the lesser developed areas of the world.

Also involved in this controversy is the concern of land-based producers of minerals, many of which are developing countries. Zaire, for example, produces most of the cobalt in the world. The whole economy of Zaire depends on the exportation of cobalt. Cobalt is one of the important minerals in the manganese nodules, and although mining the deep sea bed will not destroy Zaire's markets, it will at least bring the price down enough to hurt them.

This is an important deadlock, and it is part of the whole economic reorganization effort going on throughout the international arena. The developing countries are fairly well united in opposition to what they consider to be the overreach by the developed countries to get more than their share of this resource. It has become as much an ideological issue as a mining dispute.

One consequence of the impasse on this issue has been the proposal in the U.S. Congress of an act that would license American companies and the consortia in which they're involved to mine the sea bed. The proponents of this act are upset by

the lack of progress within the Law of the Sea Conference. They are looking to reciprocal leasing legislation in other countries in the hope that the countries with mining capability will set up among themselves a leasing scheme that would obviate the conference altogether. This would be only an interim measure -- it would stop whenever the conference decided on a regime -- with some insurance provisions to cover any losses resulting from a change in the leasing process. There are questions as to what the effect of the legislation would be. Would it destroy the conference? Would it encourage an expansion of claims to the deep sea bed areas by developing countries to cover those areas of manganese nodules that would be leased by the developed countries -- setting off a whole chain of extended jurisdiction? Or would it even speed up the process of forming an international regime? I am coming around to the point of view that this legislation might be desirable for this reason alone, although I am not very sympathetic to the handful of U.S. companies that will stand to gain from this sort of thing.

The deadlock in these issues leads us to ask: Should we care if the Law of the Sea is successful?

Consider what we would have without it. Customary rules would develop, as they already have, but there would be some gaps. I have already referred to some of them. There would be no free transit rule, and this would require the maritime nations to negotiate, nation by nation, transit through international straits covered by 12-mile territorial seas. There would be no common heritage concept; instead there would be a good chance of increased national expansionism in the ocean. There would likely be at best a haphazard development of environmental protection rules in the ocean, although the Law of the Sea Conference is not likely to settle that anyway. There would be no dispute settlement requirement of ocean issues, and that would be a mistake, I think.

It is better for all parties involved to compromise on these deadlocked issues than to let the whole thing fall apart. There are bigger issues involved. If we can find a way to compromise -- if 150 nations can nearly unanimously agree on 93 issues and establish a constitution for the world ocean -- it could provide an example of global cooperation for other areas as well. This would probably be the most important benefit of a successful conference.

## DISCUSSION

Q: You have mentioned the "package deal" aspect of these 93 issues to be settled, but doesn't it really go beyond that? In order to understand what is happening in the U.N. Law of the Sea, don't we have to understand more than the ocean?

A: You are right. It goes far beyond that because of the issues in deadlock. The main deadlocked issue is the ideological dispute that revolves around the new economic order, so in order to understand the conference you have to understand that too. It is enormously complicated.

Q: You mentioned compromise. It may be that compromise is taking place, but it may not be apparent within the context of the 93 issues.

A: Actually, even within that context compromise is taking place, on a majority of issues. Some people have said that even within the sea bed issue 95 percent of the regulatory mechanism is agreed upon. What is not agreed upon is who will control access and actually do the mining. It has become a power struggle, a matter of principle. But if you look at the agenda you can see agreement and compromise on practically all the other issues.

Q: How important really is the issue of a deep sea bed regime to the United States?

A: It really isn't that important to most of us. The few (maybe four or five) companies that will do the mining see it as a crucial issue. It is the principle of the thing to them. New figures coming out indicate that perhaps the mineral resources aren't that important after all, or at least won't be for a very long time. All the minerals involved are plentiful from dry land sources. We even have stockpiles. The mining companies are fond of saying that we import a majority of these important minerals -- copper, nickel, cobalt, and manganese -- when in fact we choose to do that. We have plentiful sources within our own boundaries, so it isn't as if we would run out of these things if we were suddenly cut off from the land-based sources of other countries. Our source of nickel, for example, is Canada and we don't worry too much about that. But the

companies argue that we need to make it a domestic source.

Q: Is the conference addressing the solutions to the problem of the Antarctic Ocean and its resources?

A: Yes, at least there is an agenda on polar regions which are not covered in the other 1958 conventions. As you may know, there is a lot of new activity down there partly because the water off Antarctica is pretty rich in living resources. Now that we have pretty much done away with the blue whale, the krill are a plentiful potential resource. But Antarctica is now under a sort of "King's X" treaty. There are several nations that claim some sort of territorial rights down there. Scientific research stations are bringing in lots of new people and getting ready to reassert their claims, some of which overlap. I would guess that before the treaty's 30 years are up it will fall apart, and nations will be claiming offshore areas as well as some land territory. I think that the conference has assumed that the treaty is going to take care of it, but it is becoming fairly apparent that the treaty is not going to last.

Q: It seems as if the Southern Hemisphere countries might jump on that as something to hold over our heads in the negotiations?

A: Yes, but of course we are talking about a hostile environment that requires a fairly high level of technology to do research or anything else down there. All the Southern Hemisphere countries can do, I suppose, especially Argentina, New Zealand, and Australia, is claim on some basis of contiguity. Most of the claims are going to be made on the basis of activities that have occurred prior to the treaty. It is called a "King's X" treaty because everyone says, "We won't abandon our claims, but we'll agree to hold them in abeyance." That was easy to get when the Antarctic was seen as less valuable than it is now.

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