SCIENCE, POLITICS, & FISHING:
a series of lectures

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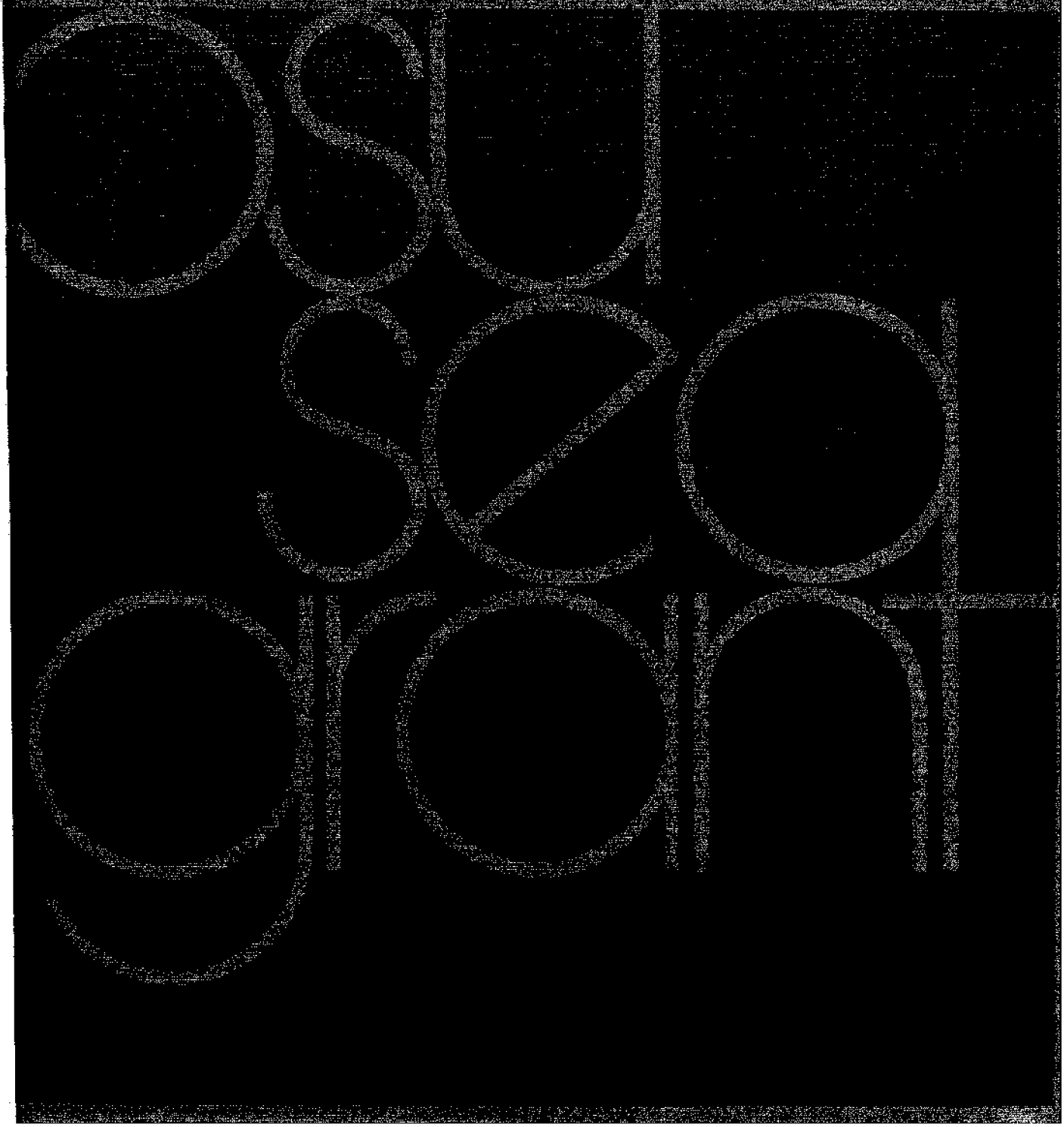

SCIENCE, POLITICS, & FISHING: a series of lectures

Frederick J. Smith
Jon L. Jacobson
Jerry E. Jurkovich
John R. Donaldson
William Aron
Spencer Apollonio
Allan D. Guimond
William H. Stevenson
Patrick J. Doody
James Joseph
Donald A. McCaughran
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Developed by Robert W. Schoning

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INTRODUCTION

Tough, frank, and direct talk from nationally and internationally recognized fisheries authorities--these men are in the forefront of current fishing questions making and influencing decisions which will affect how, to what extent, and by whom ocean resources will be used.

This lecture series resulted from the efforts of Robert W. Schoning, visiting Professor of Fisheries at Oregon State University, to bring to the campus a wide variety of experienced fishing professionals to address contemporary problems dealing with science, politics, and fishing.

These discussions demonstrate the close interrelationship of biological, social, and economic considerations, domestic and international law, and politics in fishing, fisheries research, and management. Out of this fast-paced struggle to use and profit from the ocean resources come some very different points of view on matters of common concern.

The message is clear that biology is important, but so are many other factors in finding, catching, controlling, and using these valuable resources.

Progress is being made, but it is not without disagreement, conflict, and sometimes failure. Examples of all are presented, discussed, and evaluated. Admonitions, warnings, and predicitions are included.

Many of the speakers freely expressed strongly held views and philosophies on widely ranging fisheries subjects. The basis in each case was personal experience. A cross section of direct

quotes is enclosed to indicate frankness of the speakers and variety and scope of the material covered.

"You simply can't set up a giant fence around our 200-mile zone..."

"Those fish belong to nobody while they're in the ocean..."

"...there was a strong feeling among fishermen that it's not necessary to worry about the fish at all,..."

"...the goal should be a political-social-economic one rather than the biological preservation of the stock."

"Overfishing is not a concrete concept; it's a relative matter in terms of one's objectives."

"There's more to this world than money and there may be legitimate management objectives other than maximum profit."

"Many of those regulations were contradictory, self-contradictory, confusing, difficult to understand, and in some cases unenforceable."

"It is estimated that there are trillions of tons of them (manganese nodules) ...The bottom of the ocean (may by) literally paved with incredible wealth."

"...the scientific committee (of the International Whaling Commission) was at one time a powerless group whose advice was accepted only when (it was) consistent with the needs of the whaling industry."

"The North Slope Eskimo is being asked to pay an extraordinary price for the misdeeds of others."

Economic Aspects of U.S. Commercial Fisheries

Frederick J. Smith, Professor
Agricultural & Resource Economics
Oregon State University

I'm going to talk today about economic relationships that exist within U.S. fisheries markets. Specific numbers, facts, and figures related to the current state of the seafood industry would quickly become obsolete, and for those who want the statistics, they are widely published.

We might describe the state of fisheries markets by considering the interaction between the fundamental parameters. At the biological end there is the fish stock, a "given". At the economic end there are the tastes and preferences of the consumer (Figure 1).

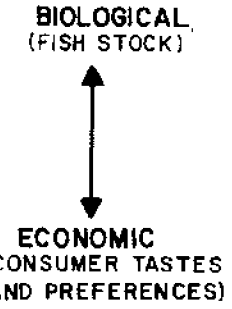

Figure 1. Fundamental Parameters of Fisheries Economics

These are the extremes of the system on which I am going to talk. I'm an economist, and I'm going to concentrate on the economic end.

The steps of this system form a conceptual framework. Understanding this framework

should help you understand the discussions on fisheries policy that you will hear from other speakers in this series.

Let's start with the stock-recruitment relationship.[1] The relationship between the number of parents in the particular population and the number of offspring, or recruits. According to Kicker, that relationship looks like a parabolic curve that originates at the zero intercept. This simply means, no parents, no babies. If you get more parents, you get more recruits. That's not hard to understand; however, at some point the parents begin competing with the recruits for space and food. In some stocks cannibalism may occur.

Kicker and others say that the number of recruits that can be harvested from a population without destroying the parent-recruit balance varies depending on the number of parents in the population. According to Crutchfield, the minimum number of harvestable recruits is described by a 45-degree line on the graph above (where the two axes have the same scale). Kicker says there is some kind of linear relationship where recruits equal parents, and that any surplus recruits are available for exploitation (Figure 2).

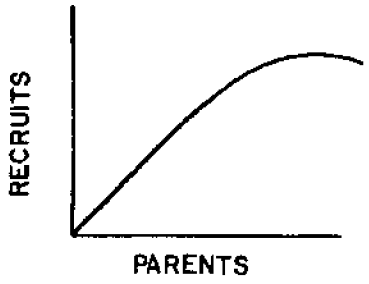

Figure 2. Recruits-Parents Relationship

Like the relationship of offspring to parents, the relationship between the harvest, or yield, and the effort of people who are harvesting fish is also a parabolic curve (Figure 3).

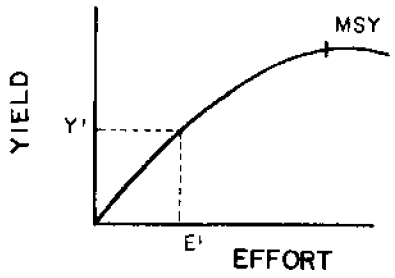

Figure 3. Yield-Effort Relationship

This says that given E' boats, fishermen, days of fishing, efficiency of gear, etc., we can extract, year after year, Y' fish from this population. Here we are beginning to tie biological relationships to human behavior. This is starting to get into the realm of economics.

Economists like to call this a production function rather than a yield effort curve. A production function is the output forthcoming from a given combination of inputs. Yield is the output and effort is the input.

"This simply means, no parents, no babies."

When we construct a production function, economists assure that the components of effort, that is the size of the boats, the days of fishing, the size of the crew, investment in the gear, etc., are combined at every level of effort in a least-cost manner. If this were an economics course, I would give about four lectures on the proportions of the components arranged in a least-cost manner at different yield levels. For example, there may be twice the investment in boat as in crew at a higher yield than at a lower yield. That may still be the cheapest way to attain that level of effort.

Given a smoothly functioning system with minimum interference from public institutions, the yield would tend toward the least-cost manner. But we don't really have a smoothly functioning system, and effort is not really ever produced in a least-cost manner.

There is a maximum to this curve when the harvest, Y', is at a maximum for that stock. This maximum is the MSY--maximum sustainable yield (Figure 3). The concept

1 For a good discussion of this, see Kicker. Computation and Interpretation of Biological Statistics of Fish Populations. Chapter 10.

of maximum sustainable yield has been around for a long time. To many people, maximum equals optimum. Until the Fishery Conservation and Management Act of 1976, the MSY was construed as the optimum by managers as well as fishermen. It meant you were getting the most fish possible out of that population, year after year, so you managed for that. It was really all we had to work with.

In fact, MSY is only one kind of an optimum, a biological optimum. It's an optimum from the standpoint of getting the most fish without destroying the stock. But is man governed strictly by biological criteria? No. You're not taking this course for biological reasons. You're going to college for social or economic reasons; you don't need to go to college to survive. Actually the biological reasons probably represent the least of your needs. Similarly, fishermen interact with fish populations primarily for economic or social benefits, not for biological benefit.

I'm not strictly a developmental economist. I do recognize that man has biological needs. Man needs to be kept warm, safe, be fed. These are biological needs. He needs a feeling of accomplishment, reward, challenge. These are social needs. He has economic needs which are more difficult to define.

The stock's biological optimum, the MSY, coincides with man's economic and social optimums only by chance.

Let's change our axis a little and see just when it coincides with the economic and social optimums. To describe the economic, and to some extent the social, I will change one of these axes to dollars. To make this conversion, I'm going to take the product, fish, and multiply it by a constant per-unit price (Figure 4). We'll continue to call the horizontal axis effort. The graph shows physical input producing dollars-worth of fish. For every level of y then, we just multiply that value by the unit price of y. That just shifts the scale of the curve upward. The curve still goes through the ordinate.

This curve is no longer a yield-effort curve. It's what economists call a total revenue (TR) curve.

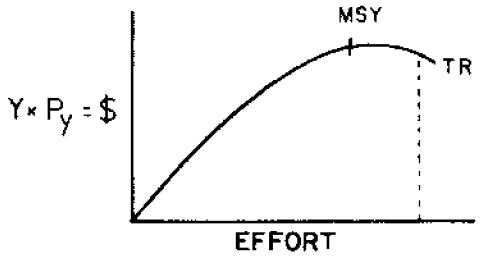

Figure 4. Revenue-Effort Relationship

At every level of effort, the cost of each unit of effort can be calculated. We usually think of total cost curves as exponential, that is, increasing at an increasing rate, but let's assume the cost curve is linear and that each unit costs $1000. The straight line on the graph below (Figure 5) is a feasible, possible, maybe even a likely total cost curve. It might and it might not go through MSY. Maximum is still MSY, and that is reached at the same level of effort as when we plotted effort against yield. All we've done is multiply times dollars, and lo and behold, total cost equals total revenue beyond maximum sustainable yields (Figure 6)!

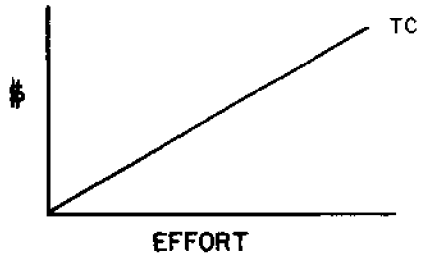

Figure 5. Cost-Effort Relationship

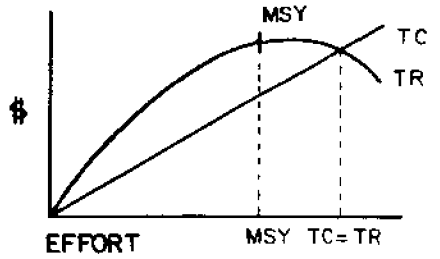

Figure 6. Relationship of Effort to Cost & Revenue

Why are we interested in the point where total cost equals total revenue? That's the break-even point. On the average, fishermen just cover their costs, or just survive at that point.

Question: *It seems to me that if you have a linear effort curve, the total revenue is going to be greater at a point earlier than where the effort curve intersects the other one. You're going to be actually making money and you don't have to continue increasing effort in order to break even.*

Reply: Good for you! You're exactly right. You've recognized that any effort expended in this range will produce profit, or rent. We use the term profit when talking about the firm, we use rent when talking about society, or a collection of salmon fishermen (Figure 7). Another reason that we use the term rent is that it is a common property resource. Now we're getting to the answer to your question. Those fish belong to nobody while they're in the ocean--they really belong to everybody. If somebody takes the fish and makes a profit, that profit could be construed as ours as well as the individual's who took the fish. That's why we call it rent. In other words, it's the rent we should be extracting from ownership of that resource in common. It's like the rent you pay in an apartment: you're utilizing a resource owned by your landlord.

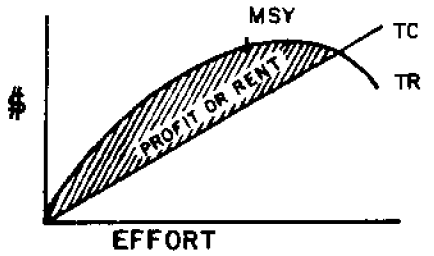

Figure 7. Relationship of Effort to Cost, Revenue, and Profit

If the revenue is higher than the cost before the point where they are equal, why do fishermen so often expend their effort to the point where total cost equals total revenue? It's because individually it's in their best interest to do so. If they don't get the fish, somebody else will. They perceive that if they stop at a point short of the intersection of the curves, someone else will take the extra fish, and they think, "He's taking my fish," which is true. It's a logical behavior on the part of the individuals.

And there's another factor. When a fisherman attempts to calculate his break-even point, he almost always underestimates his cost because he cannot calculate the impact on himself of the other fishermen dipping into the same pot. It usually takes him longer than he figured to take the fish that he is aiming for, therefore, his costs are higher. Even if he tries to maximize profit, he usually winds up worse off because of his inability to take into account the increase in costs caused by other fishermen's efforts.

Let's say the Oregon Department of Fish and Wildlife gives the fisherman an estimate of how many salmon will be running, and he calculates, on paper or in his head, that if he operates his boat for 180 days and catches a certain amount of fish per day, he'll maximize his profit. Then suppose a lot of fishermen come down from Washington, where fishing is poor that year, and it takes our fisherman 190 days or 200 days to take the anticipated amount of fish. His cost per unit has gone way up.

> ***"Those fish belong to nobody while they're in the ocean."***

For those two reasons, there is constant pressure in the fisheries to move toward the intersection point of the cost and revenue curves, which is an equilibrium point. Sometimes a particular fishery will shoot past it...stocks and effort are changing all the time, so that equilibrium is zig-zagging back and forth. From a management viewpoint, we know that it's natural for fish stocks and fishermen's effort to interact and converge at that point.

Now, along comes Crutchfield, Zellner, and others, who say, "This is irrational and senseless from society's standpoint". For the same amount of fish, the same revenue, we could expend much less effort. Look at the savings that society could collect. There's lots of potential for profit, or rent, when you're talking in terms of a common property resource if the effort, and thus the costs, were reduced. This is the concept behind limited effort programs. Generally, limited entry programs aren't advertised as aiming for this goal, but this is the general principle behind them.

The economic optimum is that point where the distance between total revenue and

total cost is greatest. That point is going to be where a tangent to the total revenue curve has the same slope as the total cost vector.

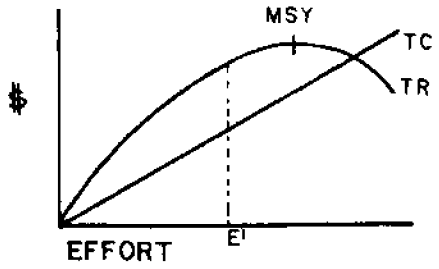

Figure 8. Relationship of Effort to Cost, Revenue, and Profit

The level of effort, E", produces the greatest difference between total cost and total revenue. From society's standpoint, that's an economic optimum.

Now we've talked about biological and economic optimum. And we've discussed the equilibrium point where the cost and revenue curves intersect and toward which the natural effort of fisheries tend. The only other point where those two curves intersect is at zero. We know that equilibrium is only going to occur at MSY, the biological optimum, by chance. So we've seen that the natural human effort almost always carries us away from the biological and the economic optimum.

The social optimum is a little more difficult to specify. I'm not able to show the social optimum very effectively on these coordinates because the dependent variable is in dollars. What we really need is an index combining satisfaction, happiness, and so on. I'm simply incapable of doing that. We have no numbers that would allow us to guess what the shape of that curve would look like.

"Fishermen are satisfying their economic needs minimally and their social needs maximally."

Court Smith, a cultural anthropologist on this campus, has a hypothesis that social optimum actually occurs at equilibrium, wherever that may be. Court's argument is: When people pursue their goals unregulated out to the equilibrium point where total costs equal total revenue, then happiness, flexibility, freedom, and all the other perks that come from participating in fisheries make up for the lack of profit. Fishermen are satisfying their economic needs minimally and their social needs maximally.

There's nothing unique about fishermen in this behavior. Look at cowboys--the Marlboro man. Grossly underpaid, but it's romantic.

Fishermen are also willing to give up opportunity costs in order to gain the social benefits of participating in fisheries. These are the costs, in terms of income lost, of not pursuing a more profitable line of work. The fisherman might make more driving a bus for Tri-Met in Portland. His opportunity cost is the difference between bus driver's salary and the earning he chooses to make as a fisherman.

Some argue that social optimum occurs at MSY. There's an interesting interaction here. From all the years we've talked about MSY as being optimum, it has in part become a social need of fishermen. They feel they're doing a good thing if they're doing something for the fishery. It's part of their social need.

Question: It seems that most fishermen are not so much interested in social needs or in just breaking even, but in getting as much money as they possibly can--every last dollar. Do you agree?

What Court Smith says is that the social optimum is probably closer to E", the point of equilibrium, than to E', the economic optimum (Figure 9.) So non-regulated fishery people are probably going to maximize their social optimum.

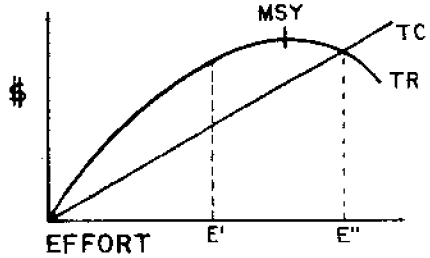

Figure 9. Relationship of Effort to Cost, Revenue, and Profit

This graph does not represent costs versus revenue for one individual. It is for a whole fishery, which may include from two

to 5,000 participants. Assuming they are all trying to maximize profits, their individual behavior, when added up, will produce this amount of effort. How can that be? It's because of the common property resource. If they owned the resource, or if they were paying a rent--if they had to buy all the input, and fish is the most important input--they would theoretically be more likely to wind up at economic optimum. But because the most important resource in fishing is common property, they will continue to expend effort beyond economic optimum because they're "getting the fish for free," and they'll drive themselves all the way out to equilibrium where it's not as profitable.

Question: Are fishermen actually profit maximizers as you suggest?

We honestly don't know. We observe all kinds of behavior. In addition, we don't know whether individuals are not maximizing profit because they don't have the skill or because they don't have the will. We don't know if their response is a rationalization. There is an extreme range of profit making; one fishermen may be making five times what his neighbor makes.

Conflicts between biological, economic, and social optimums are resolved in a political framework. The biological optimum was accepted for years and years as most important until the FCMA was passed and said the objective of fisheries managed by the councils shall be "optimum yield" (OY) not MSY. For a couple of years we struggled with what was meant by this. But in the meantime we had to make decisions so we developed a political process to establish a balance. The fishery management councils interact with the National Marine Fisheries Service (NMFS) and the state agencies to weigh criteria and come up with one optimum yield. This optimum will fluctuate through time, I believe. People will become concerned about fish populations and that will be weighted heavily. We will get into recessions and economics will be weighted heavily. Things will be good economically and everyone will have a lot of food and social considerations will be weighted heavily. Who knows if we'll ever come up with one criterion. I'd be disappointed if we did. If we ever do, you might not have a job when you finish school.

However, let me return to the yield-effort curve. Earlier, we converted this to a total revenue curve by multiplying each pound of fish yield by the unit price of fish, shifting the curve upward. Now I want to leave the yield in physical terms and talk about effort in dollar terms. That's why I made such a point before about effort at every level being in the least-cost manner. In the least-cost manner, there is a cost at every level of effort. For E' we can calculate how many boats and men and the cost of the boats, fuel, gear, and earnings of the crew. For each level of E we can calculate a cost that represents the least-cost way to produce that level of E (Figure 10).

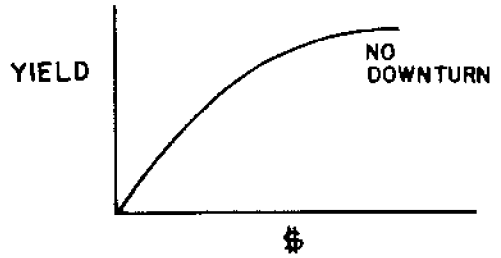

Figure 10. Yield-Cost Relationship

When we multiplied the vertical axis by a dollar value it shifted the curve upward. Now I'm multiplying the horizontal axis by cost value representing the price of labor and price per gallon of fuel, etc. and I'm stretching my curve out to the right. Sometimes it might turn down, but that is less likely because the cost per unit effort is going to go up at greater effort levels and that's going to force the curve to flatten out.

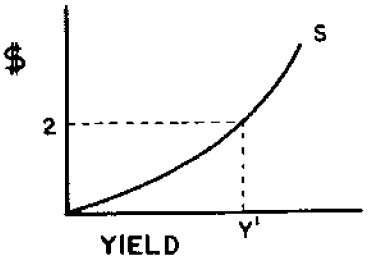

Figure 11. Relationship of Fish Landings to Price Offered to Fishermen

Here is some sleight of hand. This is a curve that represents the total cost involved in producing each level along the Y' axis, or yield. This is the the cheapest way to produce each level of Y'. If I turn this curve over, I have output on the horizontal axis, or Y' on the horizontal axis, and cost on the vertical axis in dollars (Figure 11). This says that you cannot accomplish any level of Y' for any

less cost. By ignoring the fisherman's profit I can relate the least cost value to the market price at which the fisherman must sell his produce.

This curve is a supply curve. At two dollars per pound we can identify the break-even amount of fish. That's the supply function for this fishery at the dock. It shows the quantity we can expect to be landed at each price. If more money is offered, we can expect more to be landed. It predicts the behavior of the fishermen.

The processor buys the whole fish and converts it into a marketable product leaving 23 percent of the whole fish product as waste. Right away, the price is almost 25 percent higher to the processor. He also has to pay shipping, brokerage, etc., as well as paying for the waste. He sells to the wholesaler. The wholesaler may repackage the product, which costs money, as well as pay brokerage and shipping costs. He then sells to a retail outlet. The retailer has to pay store clerks and storage costs. Eventually the product gets to the consumer.

The supply curve to the consumer is derived from the original supply curve. It is shifted by the costs of moving the product and changing its form. We may wind up with a differently shaped supply curve--flatter if it includes the effects of some consumer switching to substitutes (Figure 12).

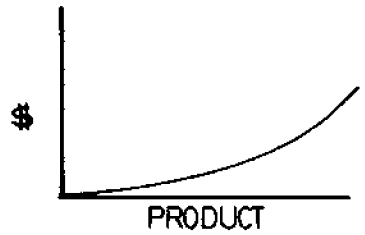

Figure 12. Relationship of Fish Supplied, to Price Offered by Consumer

For any retail price change, the quantity of the product available on the market may change. It does this to a greater degree at the retail level than it does at the dock. The retail market has another alternative. It can store a product in the freezer for six months, then supply a greater quantity with a small increase in price. This responsiveness results in a curve that is generally flatter for the retail sales level than the curve for the dock sales level.

Another factor which affects the shape of the curve is how well the system itself is working. Do the people involved at all levels behave in a rational or market-sensitive manner, or do they behave in a market-irrational manner by stockpiling or dumping product? Is information flow accurate?

Let's go back to the fundamental parameters of the fisheries economic system that I pointed out at the beginning of this talk. You recall that I indicated an interaction between the biological parameter, the given fish stock, and the economic end, the consumers' tastes and preferences. Let's look at this again beginning at the other end with the consumer.

Some consumers have a preference for shrimp, but as the price goes up, they find other ways to spend their money. When the price goes down, shrimp becomes more attractive and they may buy more readily. Their behavior is illustrated as a demand curve (Figure 13). I don't know what the particular demand curve for shrimp looks like, but I do know it is downward-sloping to the right--just about all demand curves are. Where it intersects the vertical axis depends on tastes and preferences. Do people like shrimp? Is it really special? It must be because they pay $6 or $7 per pound for it. They won't pay that much for hamburger. Of the 250 pounds per capita of animal protein consumed annually by Americans, red meats make up 180 pounds and seafood 12 pounds.

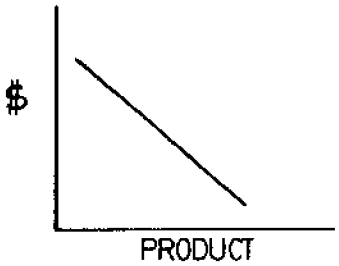

Figure 13. Relationship of Fish Demanded by Consumer to Price

If the slope of the curve is steep, it means consumers are "tied into" that product. They don't respond much to changes in price. As price goes up, they'll buy a little less. Hamburger is a flatter curve than shrimp. If you raise the price of hamburger much, consumers will switch to chicken.

Most seafoods characteristically have a fairly steep demand curve, particularly the high-priced items. Seafoods are in a special category, not for everyday. Consumers are determined to have them, although not very often. Also, the majority of high-priced seafood is sold through institutions --restaurants. Restaurants have much less response to price changes. Once customers are seated in a restaurant, they tend to order as usual, even if the price is higher on the menu. Thus, the buying habits of the restaurants are fairly constant, despite wholesale price changes.

From retail demand, let's work back to dock price. Most demand curve work has been based on data taken over time, called time-series data. That's harder to work with these days because prices change so rapidly. It was easy in the 1950's and 60's. Now we look at wholesale prices, and in this area information is notoriously bad. As a result, estimates are often embarrassingly inaccurate.

The retail demand curve interacts with the supply curve; it's the classic textbook relationship (Figure 14). If the price were six dollars per pound, wholesalers would supply a certain quantity of shrimp, but consumers would take less off the shelves. Retailers would find themselves holding the difference. Wholesalers would like to move the larger quantity at six dollars per pound, but the consumer says, "Heck, no!"

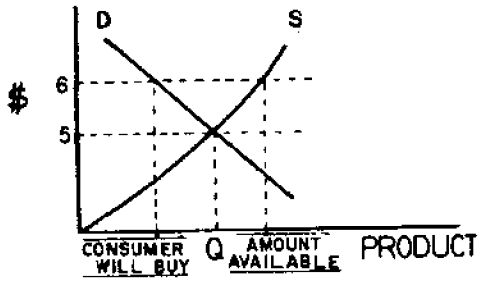

Figure 14. Relationship of Market Price to Supplies of and Demand for Fish

In response, the retailer holds a special on shrimp, at $5.50 per pound. Consumers buy some of the surplus, but there is still some left. So the retailer grinds it up and sells it for catfood. Sure enough, he gets rid of it for five dollars per pound and an equilibrium price is reached again.

If the retailer were to reduce the price to four dollars, consumers would storm into the store. The retailer would run out of shrimp and the manager would call his broker and demand another truckload for which the wholesaler would ask a higher price.

Of course, it all doesn't work that simply. These curves are going all over the place all the time. Quite often, a price is institutionalized in the marketplace over a period of time. Retailers don't care a lot about seafood it's such a small item. It's a profitable item, but a nuisance. They just set a price and hold to it, which makes what I'm telling you not entirely applicable.

Theoretically, however, from demand at the retail level you can set demand at the dockside level. You would think that the demand curve would have the same general shape, but because of inadequate information, the structure of the market, and the high level of concentration, the demand curve at the dock may look like Figure 15.

It is a difficult step-function. It doesn't respond easily to changes in supply, so while catches go up and down quite a bit, the price will remain the same. Then the fishermen say, "We're going on strike..." That's what generates the level of Q--the stairstep function--which then generates the level of E, and tells where you end up in the parent-recruit relationship.

International Law of the Sea & Other Legal Implications of Fisheries Management

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First, a disclaimer: I don't know what international law of the sea is right now, and I challenge anyone to define it. I can tell you what it's going to be, in most aspects, in a few years. But at this instant, we are in a rapid state of change. So I'm going to describe it as it was in the near past, and tell you what it probably will be in the near future. That is what is most likely to concern you anyway.

I'm going to discuss aspects of the law of the sea that apply to fisheries, but before I can do that it will be necessary to cover some non-fisheries aspects.

> *". . . international law (of the sea) doesn't exist because there really is no way . . . to enforce it."*

International law of the sea is a branch of public international law. Some people say international law doesn't exist because there really is no way to impose sanctions in order to enforce it. Right now (January 1980), just about every sanction that exists under international law is being exercised by the U.S. with respect to the situation in Iran: economic sanctions, Security Council, General Assembly, and International Court of Justice actions. We could probably legally take military

action. But most people would still say, "All that isn't as effective as having a policeman arrest you and throw you in jail."

Being thrown in jail is what happens to individuals in our society when they break the law. If it's a private law matter, some papers may be served and the individual may have to go to court and pay damages, or else.

There isn't really an "or else" in international law. We won't consider that too deeply here; however, we'll just agree that in the modern context everybody knows that there is such a thing as international law. It's not quite the same as the domestic law with which we are familiar, which has the force of a superior sovereign, but rather it consists of a lot of rules governing to a large degree the relationship of nation-states to each other.

The primary sources of these rules are two: treaties and other international agreements (there's a distinction in U.S. nomenclature between treaties and executive agreements); and international custom. Treaties, or conventions, another name for them, are contractual agreements. The Vienna Convention, signed by 127 nations in addition to the U.S. and Iran, is what is at stake legally in the present Iranian situation. International custom is more difficult to establish and to explain. You can see that nations interact with each other according to custom by observing the way they conduct themselves; their behavior is evidence of a rule.

The law of the sea is affected heavily by both sources.

". . . nations interact with each other according to custom."

I can diagram the local oceanic zones and the boundaries as recognized until a few years ago by the international community of nations (Figure 1). Both custom and treaty established this diagram. It's principal source is a set of treaties that were negotiated and adopted by the first U.N. Conference on the Law of the Sea in 1958: the 1958 Geneva Conventions on the Law of the Sea. All together, they either restate what custom had already established by 1958, or they provide rules that the nation-states agreed would be appropriate at the time. The Conventions still exist; the U.S. is a party to all four, although by no means is the whole world community a party to all four. Nevertheless, these treaties are said to represent customary law which is binding on everybody.

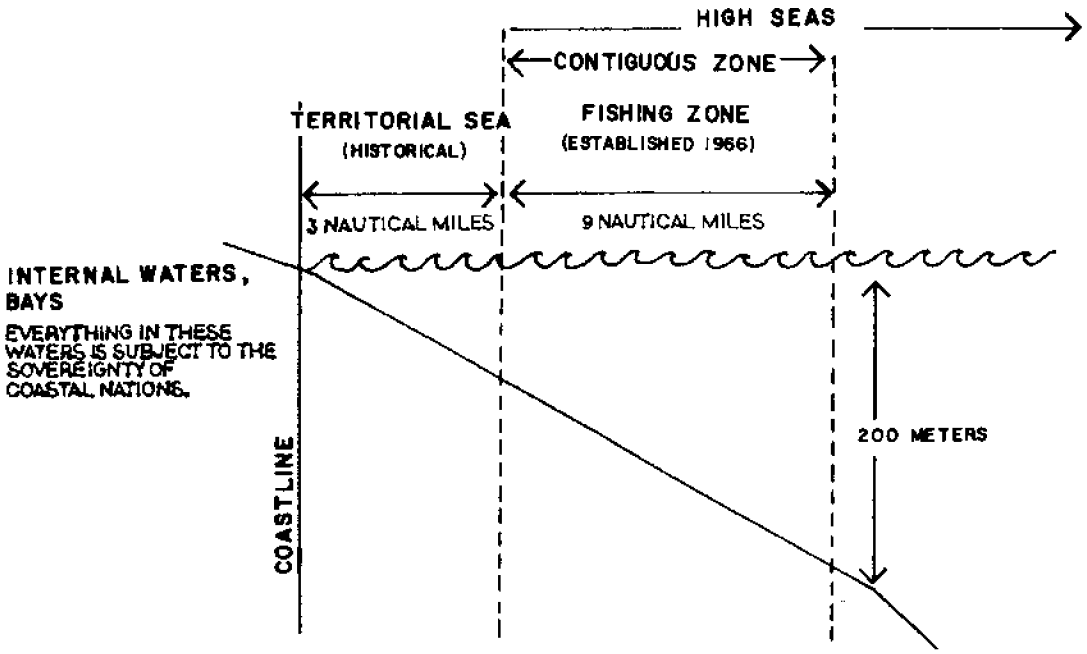

Figure 1. Legal Zones in Waters off the U.S. Coast in the Early 1970's

We might assume that this diagram represents the continental shelf of the United States in about 1970. As we discuss the jurisdictions shown here, you'll see national sovereignty dribble away as we move out to sea, until we get to an area that has been traditionally called an area of non-sovereignty where freedom of the sea reigns.

I'll begin with the coastline, the boundary between sea and land, between oceanic waters and internal waters. You know, of course, that coastlines don't stand still, they are in constant motion over time. This fact is the source of some law of the sea. In addition, we have features such as bays. San Francisco Bay is one of the best examples of a bay. "Bay" is a term in international law. Puget Sound is a "bay". International law would allow drawing the "coastline" straight across the mouth of San Francisco Bay. Everything shoreward of that line is part of the internal waters of the coastal nation. As far as international law is concerned, the world community cedes complete sovereignty of internal waters to coastal nations: everything in them, above them, under them, and dug into the soil. Ships must get permission from the United States to enter the Golden Gate.

Things get a little trickier as we start moving out to sea. You may not have realized that the U.S. has never claimed a territorial sea wider than three nautical miles. Not only that, we claim that no other nation can claim any more. I don't want to talk about the cannonshot rule which supposedly established the three mile limit. Maybe it did, maybe it didn't. But three miles is what we claim. At present, we're clearly in the minority among the world's nations. The more popular claim for a territorial sea is 12 miles wide.

If international law recognizes that custom has established at least a 12-mile territorial sea, why don't we have it? Well, first, what does a territorial sea mean? Within the territorial sea, the coastal nation has absolute sovereignty as it does over its internal waters, with one exception. Other nations have the right of innocent passage. They have the right to pass through the territorial sea in vessels on the surface, showing the flag, and exhibiting non-hostile conduct. Even warships can innocently pass. There is one very important rule about innocent passage. Submarines are not passing innocently if they are submerged. They must surface and show the flag.

Well, you say,"I'm not going to fish in a submarine. Why do I care?" Perhaps you won't, although I have seen drawings of submarine trawls and maybe some of you will be using them someday, but that isn't why I mentioned it. Most submarines today are warships, many armed, and many of those carry nuclear missiles. The executive branch of our government considers submarine-launched nuclear missiles a very important second-strike capability. Submarines are for the most part hidden. Consequently, surfacing and showing a flag is obviously an undesirable requirement.

The three mile territorial sea limit becomes necessary for keeping submarines hidden in certain narrow straits such as the Strait of Gibraltar and about 115 others around the world. If the U.S. recognized a 12-mile territorial sea our submarines would have to surface whenever they passed in or out of the Mediterranean, since the Strait of Gibraltar is only eight miles wide at its narrowest point. In addition, we would have to obtain permission for each of our aircraft to fly over the strait, because there is no right of innocent passage over territorial seas. That right applies only to surface vessels passing through those waters. Therefore, we claim a three-mile territorial sea and we claim that no one else, Spain or Morocco, for example, whose coastlines form the Strait of Gibraltar, can claim any more.

The right of innocent passage is the only exception on the absolute sovereignty of the coastal nation. Resources, mineral or living, including all fish, are all subject to the absolute sovereignty of the coastal nation. One nation's fishing vessel could not pass through another nation's territorial sea with its trawl in the water unless it had permission.

Since the 17th century, all the ocean seaward of individual nation's territorial seas has been defined as the high seas. On the high seas there are no restrictions on vessels, submarines, or airplanes. Freedom of the seas reigns. In the High Seas Convention, one of the 1958 treaties on the law of the sea, four specific freedoms were listed: freedom of vessel navigation on the surface or underneath; freedom of fishing; freedom to lay submarine cables and pipeli-

"Within that zone (3-mile), we claimed the right to take all the fish."

nes, which has never caused too much difficulty; and freedom of overflight. With a three-mile territorial sea, even at the eight-mile wide narrow point of the Strait of Gibraltar, there are still a couple of miles of high seas through which submarines can pass and over which planes can fly.

Until this century, these were the two main ocean zones: the territorial sea, which varied in breadth over the years although three miles was considered the rule for a long time; and beyond that, high seas. Therefore, the vast majority of the planet was a free and accessible open area, with a small, narrow belt under the sovereignty of coastal nations.

Question: In territorial seas, do monnitoring devices violate the right of innocent passage?

Reply: You mean for scientific research?

Question: Well ... not exactly.

Reply: You're talking about surveillance, spying? No, that wouldn't be innocent.

You've got to just be passing through. Warships can pass through, although there are special rules: you can't have your guns trained on the shore; submarines have to surface; that sort of thing.

There are other rules about what you can't do. You can't fish. No, you couldn't conduct scientific research. You certainly couldn't spy. That is, you probably could, but it wouldn't be legal.

Question: How do they check up? Is there a right of boarding?

Reply: Certainly. Sovereignty means that. You can board, search, inspect. You can't interfere, though. That's the tricky part. Balancing those things becomes rather tricky. Now, in the U.S. Fishery Conservation and Management Act (FCMA) of 1976, there is a provision that allows federal officers to board anyone's vessel within the 200-mile limit with no restrictions at all. But that's getting ahead of my story. It is sufficient to say that in territorial waters you can't interfere with innocent passage. Supposedly you would have to have some reason for boarding and searching the vessel. If you're wrong, you may have violated international law.

How come we talk about a 12-mile limit if we don't recognize it? Well, that is tricky, too. In 1966 (this is not under the 1958 Geneva Conventions on the Law of the Sea) the U.S. Congress instituted a nine-mile exclusive fishing zone starting at the outer boundary of the three-mile territorial sea. Essentially it kicked all foreign fishing vessels out. Within that zone, we claimed the right to take all the fish. This extension of U.S. control was for the purpose of fisheries management only, however. This was not sovereignty. Sovereignty implies all kinds of power. In the nine-mile fishing zone, power was for a limited purpose. Furthermore, it was not firmly established in international law; it was only a claim.

The High Seas Convention says freedom of fishing exists on the high seas, and it defines high seas as anything beyond the territorial sea. Technically, the U.S. was claiming the right to limit fishing where freedom of fishing supposedly reigned. It's still not clear that we had any right to do this. In my mind, it was an illegal act. However, no other nation objected.

Why? Well, many other nations already had similar arrangements: 12-mile territorial seas, or three-mile territorial seas with nine-mile exclusive fishing zones, or six-mile territorial seas plus six-mile exclusive fishing zones. The U.S. didn't want to endorse the 12-mile territorial sea concept because it would limit our military actions, as I've described. But we liked the concept of limiting other nations' activities off our shores, as they limited ours, so we claimed a nine-mile exclusive fishing zone, and got away with it.

"What if we end up exploiting everything, everywhere?"

As for jurisdiction over the seabed, something else had already happened. In the 1958 Geneva Conventions it was agreed that international law recognized the right of coastal nations to the resources, living and nonliving, of the adjacent continental shelf. This included what are called the "sovereign right to the minerals" and the living resources of the sea bottom and the subsoil out to the depth line of 200 meters. Of course, the 200-meter depth line does not define the physical continental shelf. The continental shelf is the part of a continental land mass that's covered by water before it breaks and starts its descent to the deep seabed. The continental shelf boundary was too hard to find so 200 meters was chosen. (Two hundred meters is also close to 100 fathoms, which is a dark line on most navi-

gational charts.) Within that boundary coastal nations exercised legal rights over minerals and sedentary species of life. Sedentary species are those which at their harvestable stage are either immobile or can only move while in constant physical contact with the seabed.

The U.S. has long claimed that "sedentary species" includes certain crabs and lobsters, even though biologists say it can't include anything besides worms and kelp. Crabs and lobsters jump off the bottom now and then. Nevertheless, since crabs and lobsters are much more valuable than worms and kelp, we claim the right to them as resources of the continental shelf. Our continental shelf extends, I believe, an average of 45 miles from the coast, a considerable distance beyond a three-mile territorial sea and nine-mile exclusive fishing zone.

Furthermore, at the 1958 conference, the question of exploitation beyond the 200-meter depth in the future was raised, although the possibility was thought to be incredible at the time. The conferring nations tacked on a flexible extension provision saying the legal outer boundary of the continental shelf will expand with exploitability. In other words, the definition of the continental shelf includes all coastal area landward of the 200-meter isobath and if a country can exploit the shelf resources seaward of that, the shelf will include more.

That raised a lot of questions. If a country can exploit one mineral, can the shelf be considered expanded for the exploitation of all natural resources? Can every country do this? How far can a country go? To the middle of the ocean? Until it meets the continental shelf coming from the other side? What if we end up exploiting everything everywhere?

There have even been maps drawn on that basis (Figure 2). The color lines tell

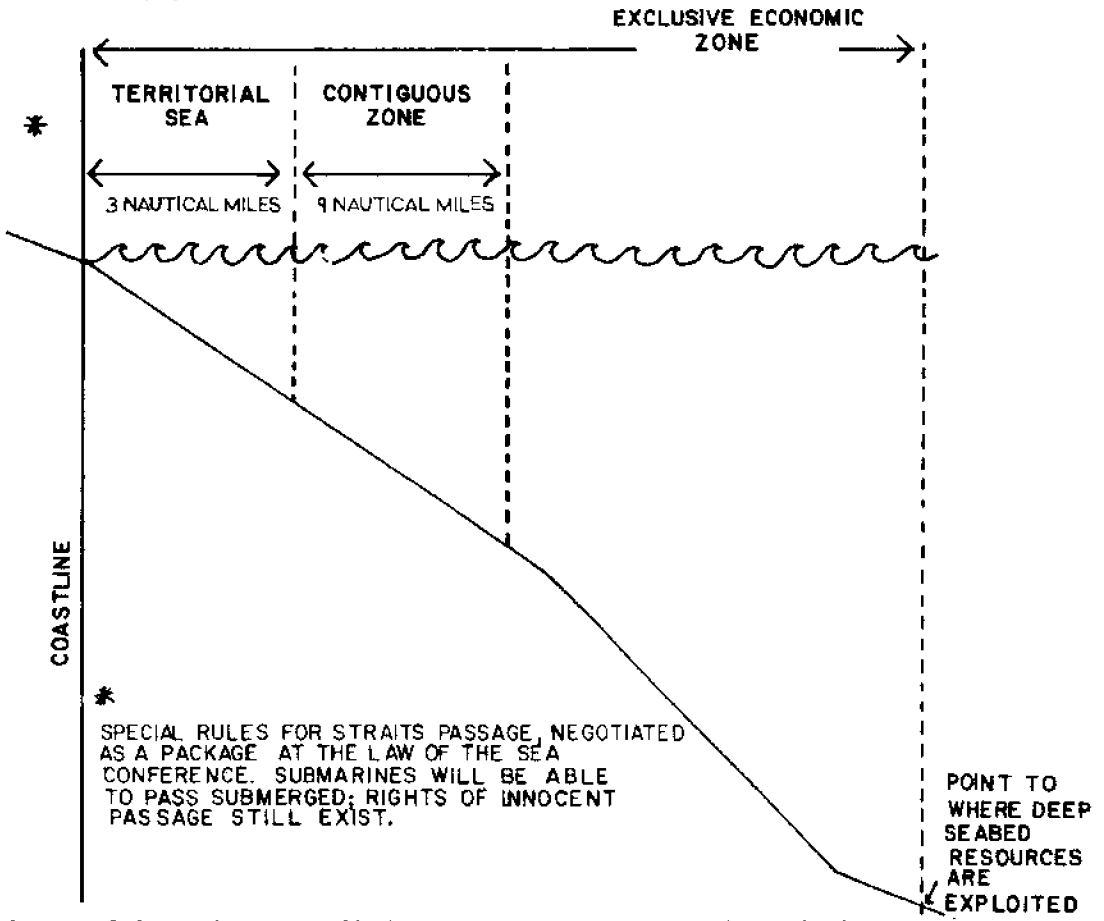

Figure 2. Legal Zones in Water off the U.S. Coast as It Is Likely to Be in the Near Future, Post-Law of the Sea Treaty

you what the bottom of the ocean would look like if we extended continental shelves until they met continental shelves coming from the other side of the oceans, as defined under the exploitability test. Islands count just as much as continents, so you've got names of countries in funny places. Norway, the United Kingdom, France, all the old colonial powers, show up in funny parts of the world because they have little island possessions. Boundaries are drawn on an equal distance principle. Every line is an equal distance from the nearest adjacent or opposite country. Look what would happen if we divided up the seabed this way: the Soviet Union wouldn't get much.

Nobody seriously proposed this. It was drawn as a joke.

It was considered that the limit of the continental shelf expansion allowable as a result of the exploitability test would be the abyssal plain of the deep seabed. That wasn't formally decided at the convention, but it seemed to make sense. The word "adjacent" used in defining the continental shelf means next to, or near, so a boundary is implied. As one of my research assistants some years ago said, the boundary is where the ball stops rolling. The exploitability test ends with the continental margin. Imagine if you divided the whole ocean between coastal countries. However, if the definition of the continental shelf were extended including the continental slope and rise, the coastal countries could still claim a large part of the ocean.

There's one other zone I ought to mention before I leave the near past and begin discussion of the near future. The same nine-mile exclusive fishing zone bill defines a zone off the coast of the U.S. called the contiguous zone. This is not a very descriptive term; it simply means that the zone is next to the territorial sea. In this zone, coastal nations are able to exercise certain limited enforcement measures for limited purposes. For example, the Coast Guard can enter this zone to deter smuggling by its presence alone, or by making arrests. These enforcement measures are allowed only for very limited purposes.

What we're seeing, if you haven't noticed already, is that recently the old, simple division of the ocean into high seas and territorial seas has been quite complicated.

It is true, or at least it's an accurate perception, to view the outer edge of the territorial sea as the outer edge of coastal nations sovereignty on the seaward side. But you can see that beyond that outer boundary, international law has been recognizing the right of coastal nations to exercise certain limited jurisdictions for certain purposes. The definition of the continental shelf deals with natural resources of the seabed and subsoil. The definition of the contiguous zone deals with its limited purposes, none of which really has anything to do with fishing. The definition of the fishing zone, to the extent that international law recognizes it at all, only concerns fishing and not navigation. Navigation, just pure navigation of vessels, including war ships, is the one thing which is not controlled out there. That was just fine and dandy with the U.S. As a sea power, we wanted as much freedom of navigation on the high seas as possible for our naval fleet, especially for submarines and for over-flights. Therefore, we still make the claim, rather ridiculous now, but its largely a negotiating position, that a three-mile territorial sea is the maximum that anybody can claim. We act on that position when sending our fleets into various parts of the world and when sending our submarines through the Strait of Gibraltar.

Since 1970, that has basically been the international law picture. As far as fishing was concerned, freedom to fish existed beyond the 12-mile limit in 1970, despite the claims of the Latin American countries to 200-mile territorial seas.

As you probably know by now, most species of life in the ocean have to be classified as coastal species. They exist relatively close to shore. They may migrate up and down the shore, crossing national boundaries in that way, but the middle of the ocean is, relatively speaking, a desert as far as life is concerned.

There are, however, several fish which are exceptions to this and which raise special legal problems in determining jurisdiction over resources in the sea. Examples are anadromous species and highly migratory species. The first is a scientific term; the other is something the lawyers have cooked up.

Anadromous species are exemplified, of course, by salmon, which are unique in that they spawn in fresh water, migrate widely throughout the open ocean, and return to

spawn and to die in the same fresh waters where they were spawned. That unique characteristic has to be taken into account in managing that resource. In some places in the North Pacific, salmon migrate as far as 1,000 miles from shore. This apparently doesn't happen in the Atlantic.

Highly migratory species have been essentially divided into two groups, tuna and whales, although there are others. Some species of tuna migrate widely throughout the ocean, the high seas, and throughout coastal waters of several nations. Whales migrate throughout the ocean, too.

> ***"The notion was that the bottom of the ocean was literally paved with incredible wealth."***

I should clarify further a point I raised before. The 1958 Geneva Convention did not define the maximum breadth of the territorial sea. They spent a lot of time trying to get consensus on that in 1958, and failed because even by that time there were claims for territorial seas of 200 miles, 12 miles, and several distances in between. Representatives at the convention were not able to decide what the maximum breadth should be. This lack of consensus still enables the U.S. to say that the traditional late 19th century-early 20th century claim of a nine-mile territory is the rule. In light of international practice over the past several decades, however, that's not really upheld by the world community. As a matter of customary law, we probably have to admit that 12 miles is the true maximum, not 200 miles.

The U.N. held the Second Conference on the Law of the Sea in 1960 to try to establish that maximum breadth and to discuss the question of fishing zones beyond the maximum breadth. Again, the countries represented were unable to agree on either of those topics although it was very close -- one vote short of the required two-thirds majority.

We're now in the midst of, hopefully toward the end of, the Third United Nations Law of the Sea Conference which started in 1973 and has gone through eight formal sessions and many informal meetings. It will convene again in March 1980 in New York and is scheduled to go on for a second meeting this year in Geneva. It will alternate between Geneva and New York, although not always consistently.

I'll tell you how the Third Law of the Sea Conference came about and what is happening to law of the sea both as a consequence of the conference and through nation-state action outside the conference. But first, I'd like to discuss a fascinating discovery that profoundly affected the law of the sea conference.

In the mid-1960s, John Mero, a graduate student at Berkeley, picked up a manganese nodule that the Challenger Expedition had dredged from the seabed almost one hundred years before, and discovered that it contained not only a lot of manganese, which wasn't too important since there is a lot of manganese lying around on dry land, but also important traces of nickel, cobalt, and copper. The Challenger Expedition had determined that the nodules existed in vast quantities over huge areas of the very deep seabed, the abyssal plain, especially in the Pacific. They occur in large areas falling roughly on either side of the Equator, in water 15-20 thousand feet deep. It is estimated that there are trillions of tons of them.

Manganese nodules of the deep seabed are not fish, and you won't go fishing for them. But the story of manganese nodules is fascinating. I don't think anyone yet knows quite how they are formed, except that they somehow must come together from elements in the water itself.

When that discovery was made in the early 1960's it caused quite a stir. The notion was that the bottom of the ocean was literally paved with incredible wealth, if we could only get it. But 15-20 thousand feet is an awfully long way. You can't just put on your scuba tank and go down and scoop them up. The U.S., Japan, Germany, the Soviet Union, France, Belgium, and the United Kingdom began to search for ways to do the job. All this wealth exists beyond the boundaries of any national jurisdiction, at least beyond the boundaries by the traditional rules. The Law of the Sea Conferences had provided no rules for the deep seabed. Who cared?

Well, suddenly in the mid-60s some people started to care. In a speech before the General Assembly in 1967, Ambassador Arvin Pardo from Malta proposed that the seabed beyond the boundary of national jurisdic-

tion be set aside for the common heritage of mankind. He suggested that the wealth it contained be set aside for peaceful purposes and that the U.N. General Assembly provide for management and the mining of the manganese nodules. Further, he suggested that the proceeds of this venture be used to help in the economic sense, the poorer regions of the planet, and to finance the U.N. There were lots of plans for spreading the vast wealth.

> ***"... the seabed beyond the boundary of national jurisdictions (should) be set aside for the common heritage of mankind."***

All of this met with general approval in the U.N. Most of the member nations felt by that time that the nodules belonged to the poorer part of the planet. Even the developed countries went along with the notion that this was the common heritage of mankind and ought to be developed on that basis -- not that the first company to arrive on the scene should be allowed to take as many nodules as it wanted, somewhat the way commercial fisheries operate.

Freedom of fishing means that when fishermen go where the fish are free for the taking, whatever they land is theirs. Manganese nodules might have been managed the same way but for Pardo's very stirring speech in the General Assembly. The General Assembly responded by setting up a committee to plan a third law of the sea conference to agree on regulations for mining the deep seabed and maintaining it for peaceful purposes, and on how to use the proceeds to upgrade the economic status of the underdeveloped parts of the world. That was the articulated reason.

There were other reasons why some nations wanted a third conference. The U.S., still claiming a three-mile territorial sea, could see the handwriting on the wall. If the 12-mile territorial sea were to be a reality, the U.S. wanted a new law of the sea conference to establish special rules for international straits so submarines wouldn't have to surface and show the flag. The Latin Americans, having claimed 200-mile territorial sea limits in the late 1940s and early 1950s, decided another law of the sea conference would be a good way to sell the concept to the rest of the world and establish the legitimacy of those claims. The 200-mile limit had not been widely accepted outside of Latin America, and in fact had been castigated and ridiculed by most other nations.

The committee setting up the conference tried to adopt an agenda starting with the notion of managing the deep seabed, the manganese nodules, and so forth. As the committee kept meeting year after year, the agenda kept getting bigger and bigger. Eventually it reached a point where it contained over 90 items concerning every known and some unknown uses of the oceans.

The U.N. committee aimed for a conference meeting in 1973 to adopt a treaty on all of these issues. Originally they were going to meet in Santiago, Chile. The overthrow of the Allende government there interfered with that plan so the first substantive session was reset for Caracas, Venezuela in 1974. A preliminary meeting in December 1973, at U.N. headquarters in New York, established some procedures for the conference.

In Caracas it became apparent very quickly that it was going to take more than the eight or ten weeks set aside to reach conclusions on all the items. It was agreed as a matter of procedure that no single item of the 95 issues would be adopted without agreement on all of them: a package deal approach. They were going to negotiate across the whole board and come up with a giant package, one comprehensive law of the sea treaty, a constitution for the ocean, and if they couldn't deal with all the issues, they would deal with none of them.

It ended up being a very popular and unique conference. It had virtually all nations of the world in attendance, at least theoretically trying to deal with all aspects of the use of 70 percent of the earth's surface. It's an incredible effort in the area of international cooperation. If it works it will be tremendously significant just for that reason. So far it hasn't worked, although you will read statements optimistically expecting success by sometime this year.

I have observed the conference from a relatively close distance, I usually try to go to two or three weeks of most sessions, and in the past couple of years I have been an advisor to the U.S delegation, and I'm an optimist. I give it about one chance in three of succeeding. Because of the tremendous problems -- 150 nations, 94 or so issues concerning 70 percent of the earth's

surface, the current state of the international community -- how could we possibly expect that it would work? Yet much has been done.

A negotiating text has been developed which is considered by those who have been involved to reflect world community opinion in most respects. It is a negotiating text, not a treaty, although it looks like a treaty. We might consider it a fairly detailed draft treaty. If there is a treaty, much of this will be in it.

The part that they're still wrangling about is the part that started it all, the deep seabed. Unfortunately, I think the conflict has become more ideologically centered than economically or resource management centered. Industrialized, developed nations are lined up against a majority of developing nations. The deep seabed issue has become one of the battlegrounds of the war for a new international economic order. A new organization will be set up to manage the deep seabed. What are the conditions under which private or state-owned companies will be allowed access to the deep seabed for mining? The question involves many issues."

Something like Parkinson's Law is in operation here: the more you negotiate something, the more you find to negotiate about. The agreed-on negotiating procedure keeps all the chips in the air at once. Each time a party requests a point, the others go into a huddle to decide on a request of equal weight. Over time, this gets complex. The basic issue of access to the deep seabed by private or state owned companies has not been resolved, although the conference is said to be crawling towards a resolution. If so, it's at a snail's pace, a worm's pace, or a kelp's pace.

As a matter of principle, I think virtually every nation in the world says the deep seabed including the manganese nodules are not free for the taking but are the common heritage of mankind. The U.S. takes a somewhat more complicated position on it. The General Assembly originally passed a resolution that there will be no mining in the deep seabed unless and until the conference is successful in establishing a mode of operation: a moratorium resolution. We didn't vote for that. We say it is not a rule of international law, and until the conference reaches an agreement we have the right, the freedom of the seas, to mine -- recognizing that the nodules are the common heritage of all nations. That is, we will voluntarily set aside part of the proceeds of each mine in a common heritage fund. You might watch for that in the newspapers because for several years there has been one version or another of a bill in Congress to allow mining the deep seabed. It would confer no claim to the deep seabed, it would just keep the mining areas separated. The notion behind it is that other industrialized countries that have mining capability, or close to it, will pass a similar law and we'll sort of work out our own scheme. So far Congress has passed nothing, largely because the State Department delegation to the Law of the Sea Conference has consistently said this would interfere with the negotiations. Last year former Attorney General, Elliot Richardson said, "Uh, you'd better do it, we're not going very quickly on this thing." So Congress geared up and then this year he said, "You'd better hold off again because the gearing up scared everyone enough so that we're really negotiating now." If such a bill passed it would be interim in nature and would recognize the common heritage principle. It would terminate when the international management organization is established by the U.N. Law of the Sea Conference.

Question: How binding is the moratorium resolution?

Reply: That was discussed in detail at a recent session of the American Society of International Law. They talked about whether U.N. resolutions can create law. There is a general tradition saying they can't. The situation concerning this moratorium resolution in particular, however, may have some features allowing a different interpretation. The vast majority of representatives in the General Assembly voted in favor of it, although the U.S. and some other mining countries voted against it. There is apparently an even division, even among the so-called objective experts, on whether it has created law or not. Traditionally you would have to say that a country that voted against it certainly wouldn't be bound by it. U.N. resolutions are not law. At the time the charter was adopted the Philippines proposed that it establish a legislative body that would bind everyone by majority vote legislation. That was rejected, however, we can say that the United Nations was clearly not intended as a legislative body. Under some circumstances, a vote such as the adoption of the moratorium resolution may not demonstrate what the international community feels is the rule. On the other hand, if an issue looks like it's got a lot

of diverse countries voting for it, it might be deemed to represent customary law. But most experts say that if there is a clear division, especially when those who vote against it are those whose interests go against it, it can't reflect international law, but there is still considerable debate about that. Is the moratorium law or not? That is a good question.

Question: How close is the technology?

Reply: It's not clear because it's all in private hands and they're not telling. At present, there are private companies from several countries in consortiums competing against each other. We do know some things about what's going on, however. There are essentially two methods, probably there are more, but for popular purposes there are two. One is to drop a great big vacuum cleaner down there to suck up the nodules. The other, introduced by Japanese companies, is a continuous line of buckets. Both sound very simple until you realize how much cable or how much tubing it takes to operate at 15-20 thousand feet. It would be an incredible engineering feat to do it at all, much less to do it profitably. There is an American company that has filed a claim on an area a thousand miles off the coast of Baja California. They have asked the Secretary of State to provide diplomatic protection for that claim. Henry Kissinger refused, saying that it might jeopardize the Law of the Sea Conference. The company, which used to be called Deep Sea Ventures, is out there now working. They can bring up nodules; the only question is can they do it in a profitable way? I don't know. I'm sort of leery of some claims I hear from private companies that they could be doing it profitably if only the lawyers would let them go out there and do it. I'm not convinced that it's profitable yet, or that it's going to be for a very long time.

Certainly private companies need a better set of legal rules to get the money from the bank. They claim 500 million dollars is necessary to get a mining site started. Not having an acceptable set of rules for the deep seabed presents a considerable obstacle. In any case, the technology exists, although it may not be very cost-effective yet, especially since the bottom fell out of the copper market. If there were some gold in those nodules we would all be working on our scuba tanks.

The nodules are important because they sparked the Third Law of the Sea Conference and they also remain the major obstacle for the conclusion of the Law of the Sea Conferences. If there is a successful conclusion of the conference we can say with some certainty that the fisheries rules already contained in the negotiating text will be part of that treaty. Even if the conference were to fail today.

It's on the basis of the negotiating text and what's been going on outside the conference that I'm about to draw the jurisdictions of the ocean for the near future.

The coastal nations' zones of jurisdiction have expanded considerably to 12-nautical-mile-wide territorial seas but there are special rules negotiated into the package regarding passage through straits. In international straits, areas of high seas, foreign nations will be able to navigate without the same sort of strait-passage restrictions that would normally apply to territorial seas. In other words, submarines will be able to go through submerged, aircraft will be able to fly over, surface vessels will be able to pass without innocent passage restrictions. Instead of innocent passage restrictions there will be other restrictions requiring submarines to pass expeditiously through in the normal mode. Training guns on the shore, fishing, spying will be prohibited. So far, that's what the U.S. wanted out of this conference, and it's in the document.

Beyond the territorial sea, there's another 12-mile zone, the contiguous zone. It's nature is as we discussed before, only its boundary is 24 miles from shore. It is a limited extension of jurisdiction and allows the coastal nations to enforce certain rules within this limited area.

Now we get to the startling part. The legal definition of the continental shelf has been vastly expanded to at least 200 miles from the coast line. The resources of that area will be under the control of the coastal nations out to at least 200 miles and further, to the extent that the continental margin, slope, and rise go beyond that. In many parts of the world, that can cover a lot of deep seabed, especially around the islands of the Pacific which have no physical continental shelves. Treating most islands as continents for this purpose will result in them having r^2, minus the area of the island, square miles of seabed, where r equals 200 miles plus the average radius of the island. An island that qualifies to have a 200-mile zone would have as much area in that zone

as a 628-mile straight coastline. It's deep seabed; much of it has manganese nodules.

In many cases the continental margin in areas controlled by the governments of the adjacent continental land masses extends beyond 200 miles, and the coastal nations have control there. In the future, coastal nations may have to share part of the proceeds from exploiting the resources with the common heritage fund. But 200 miles itself is a massive extension of continental shelf jurisdiction over what existed before. Of course, the exploitability test takes it way out there to where the ball stops rolling anyway, potentially. But they're not waiting for exploitability to be shown anymore, they're going to stake out the boundary in any case.

Question: What do those rights include: fishing? conservation?

Reply: They include mineral resources like oil and gas, other mineral resources of the sea bottom and subsoil, and sedentary species of life, which we still say means crabs and lobsters. The definition is life that must maintain constant physical contact with the bottom or remains in place at the harvestable stage -- rather a dumb definition but that's it. As you know, the Latin Americans were very succesful in selling their 200-mile limit. Now the 200 miles, at least beyond the territorial sea, will be called the exclusive economic zone. All resources there will be subject to sovereign rights of the coastal nations. There will be an obligation to conserve but use living resources except for mammals, to allow foreign fishermen access. That's strictly controlled, however.

One important aspect of the exclusive economic zone is that coastal nations will be able to keep oceanographic projects out of it. They will have the right to deny consent for a project, although the negotiating text admonishes that consent should not be denied under normal circumstances.

The most valuable oceanographic research takes place within that area. The most valuable fishing takes place within that area. The most valuable mining of the seabed aside from manganese nodules takes place within that area because the most valuable among the new resources are oil and gas of the continental shelf. Geologists say it's unlikely that any oil or gas deposits exist outside of continental land masses.

So the future holds a considerably different picture from the past. The exclusive economic zones plus the territorial seas off the continental land masses and islands encompass a considerable part of the world's oceans. A significant part of the ocean will no longer belong to the international community, but will be subject to important controls and sovereign rights of coastal nations. So far, navigational restrictions have been limited to the 12-mile territorial seas, principally through the efforts of the U.S., along with other maritime nations. So despite extensions of sovereign power for other purposes, navigation over, on, and under the ocean will be restricted to the least possible degree within the exclusive economic zone. There will be some pollution control by coastal nations which will restrict navigation to some degree in this zone.

"We claim fewer rights in our 200-mile (zone) than any other country."

If the conference succeeds, there will be a new international organization called the International Seabed Authority, a huge government bureaucracy that will do some mining itself, will control private miners from capitalist countries and state miners from socialist countries, and will represent a fairly significant accomplishment in the area of international cooperation. It will be a significant precedent for any future attempts at resource management on a broad international scale.

On the other hand, if the conference fails, and some people say it's failed already, that's a disastrous precedent for international cooperation. That's why it's important that the conference succeed.

If it does fail, all of these zones will still exist. I can't tell you what's going to exist beyond that. There probably would not be an international Seabed Authority and the mining nations would probably go ahead and mine on their own. The U.S. would probably claim the straits passage articles that have been negotiated represent customary international law, but that may not hold up without a treaty.

The exclusive economic zone, on the other hand, probably would continue to exist. I take the position, as do a lot of my colleagues, that the exclusive economic

zone exists right now, as a matter of current international law. It was very clear at the first session in Caracas that virtually everyone except the Soviets and Japanese thought this was a good idea. Then when the U.S. adopted its own 200-mile limit in 1976, the Soviets followed almost immediately, and eventually the Japanese and others followed also. So there is enough state practice that we can now say it's law. That was one of the things Professor Schoning wanted me to address, and I hope I've addressed it. The 200-mile limit is legal today: our 200-mile limit, at least.

We claim fewer rights in our 200-mile limit legislation than any other country. We claim only the exclusive right to manage the fish, not ownership of the fish themselves. We say that beyond the 12-mile limit the fish are an international resource that badly needs management. Therefore, we take it upon ourselves to manage it on behalf of the international community. In return, we claim preferential use of the resources there. But that also means we have an obligation to manage the resources beyond the share that we can take with our vessels for the benefit of other nations, especially those who have traditionally fished there. Unless we're mad at them, in which case we cut off their allocation. That's been done recently to the Soviet Union and there's been some question about whether that's legitimate or not.

"In fact, at the time we claimed a 200-mile fisheries jurisdiction, it probably wasn't legal."

Question: About the Fishery Conservation and Management Act. What will happen to the FCMA if the conference succeeds?

Reply: For one thing, the Act doesn't say that it terminates when the conference treaty goes into effect. It authorizes the Secretary of Commerce to change any regulations within the FCMA to conform with the treaty. Earlier versions of the bill said the Act would terminate if and when there is a successful law of the sea conference ending with a treaty. That's a complicated question you raised and I'm glad you raised it. I don't know if any of you have seen The Washington Law Review, published by the University of Washington Law School. In Volume 52, Number 3, 1977, there is a whole series of articles on the FCMA and legal and economic problems surrounding it. After Senator Warren Magnuson's foreword, the first article is entitled, "Potential Conflicts between the Future Law of the Sea Treaty and the FCMA," by Jacobson and Cameron in which we talk about that problem for several pages. We take the position that the new treaty will supersede the Act to a certain extent. The part where it doesn't match very well is with regard to anadromous species. The U.S., in the FCMA, claims exclusive right to manage the salmon which originate in our waters. The only people fishing salmon on the high seas are the Japanese and we have re-negotiated the International North Pacific Fisheries Convention so that they're able to catch fewer of our salmon. The new law of the sea treaty will say there is going to be no fishing for salmon beyond the exclusive economic zones unless prohibition results in economic dislocation for other countries. That exception was written only for the Japanese. By the time that treaty goes into effect, the Japanese will not be fishing our salmon very much and there will be limited economic dislocation. Therefore, there will in effect be a rule that you can't fish for salmon beyond the 200-mile zone. Our current act claims that jurisdiction now, but it is probably not legal. In fact, at the time we claimed a 200-mile fisheries jurisdiction, it probably wasn't legal. There weren't enough nations claiming it. We did it, though, and since then many other nations have done it, and by now, January 1980, it is legal.

Principles and Innovations in Commercial Fishing Gear

Jerry E. Jurkovich, Gear Specialist
Northwest and Alaska Fisheries Center
National Marine Fisheries Service

I'm going to present to you both the historical and present-day uses of certain net-type commercial fishing gear. Net-type gear is my specialty; I not only study its construction and operation, I design it. I'd therefore like not only to discuss the state of the art, with reference to the laws that have influenced gear development and use, but I'd like to touch on certain technical innovations that will change future gear use. These innovations, very recently developed or under development, will make net-type gear more efficient and will make it easier for the fishermen using it to comply with modern regulations.

"... tuna and porpoise seem to remain together, no matter how long they're chased."

Purse Seines

A seine is a net used to encircle fish at the surface. Lamparas are small encirclement seines used for catching herring, squid, anchovies, and tuna bait. A lampara is constructed of two wings and a bag with an apron across the bottom (Figure 1). It has no rings. The wings are of 7-inch mesh and the bag is usually 1/2-inch mesh. One purpose of the small mesh on the bag is to produce resistance when the net is dragged through the water to keep the net round.

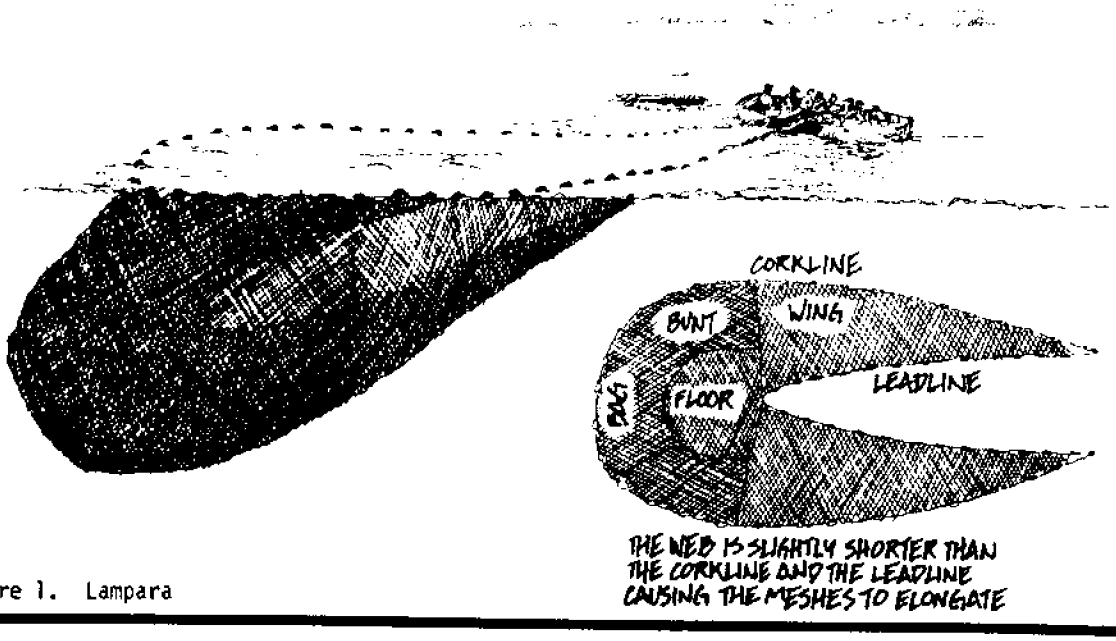

Figure 1. Lampara

The net is pulled through the water by two people. When the two wings are pulled taut, the 7-inch mesh in the wings is elongated and the fish cannot get through. Once the operators start pulling this kind of net they don't stop because the meshes would drop open.

Encirclement nets, such as lamparas, are employed for 65 to 70 percent of the world fish catch. They are very popular gear throughout the Mediterranean and off Africa, and are also used to collect anchovies for bait in the albacore fisheries off our Pacific coast from Washington to Mexico.

The lampara would be an effective method of catching salmon, were it not illegal to use it from Washington, through Mexico, Central, and South America.

Southeastern Alaska Purse Seine

In the southeastern Alaskan salmon fishery, a large purse seine is used (Figure 2). Opposite the bunt, where the fish are trapped, a breast line or gavel is linked to the net by rings. The main strips of the net are usually 100 meshes deep (referred to as a strip of web). A typical southeastern Alaskan seine is symmetrical top to bottom: border strips 25 meshes deep (MD) bound two main strips, each 100 MD, and in the center is a 50 MD strip which tapers toward the bunt end. I have devised a method of calculating the proper taper that works well for altering old seines or constructing new nets (see "A Method for Tapering Purse Seines," Sep. No. 802, Department of the Interior, U.S. Fish and Wildlife Service). Along the bottom of the lower or leadline border strip, are 50-65 bridles with rings through which the purse line runs. Each salmon fishery uses a special size seine, for example, a Kodiak salmon seine would be approximately 200 fathoms long, two strips deep, and would have narrower border strips than shown in Figure 2. West of Kodiak and north of the Bering Sea shallower 300-fathom long seines are used because the Bering Sea is so shallow.

Salmon seines used in Prince William Sound are generally the same size as those used in the Cordova area, and on Kodiak Island. Purse seines used in Canada and in Washington State are among the largest being used. They typically measure 275 to 310 fathoms in length, and for four and a half to six and a half strips in depth.

Only Canadian salmon seines used in the outer Strait of Juan De Fuca near Port San Juan are larger.

The purse seine is stacked at the stern of the purse seiner with the bunt end on top. The bunt end of the seine is attached to the seine skiff. A special modified pelican hook attaches the skiff to the larger boat. When the captain says "Let's go." the "pinman" releases the skiff by tripping the pelican hook and the seine is dragged from the vessel by the drag of the skiff against

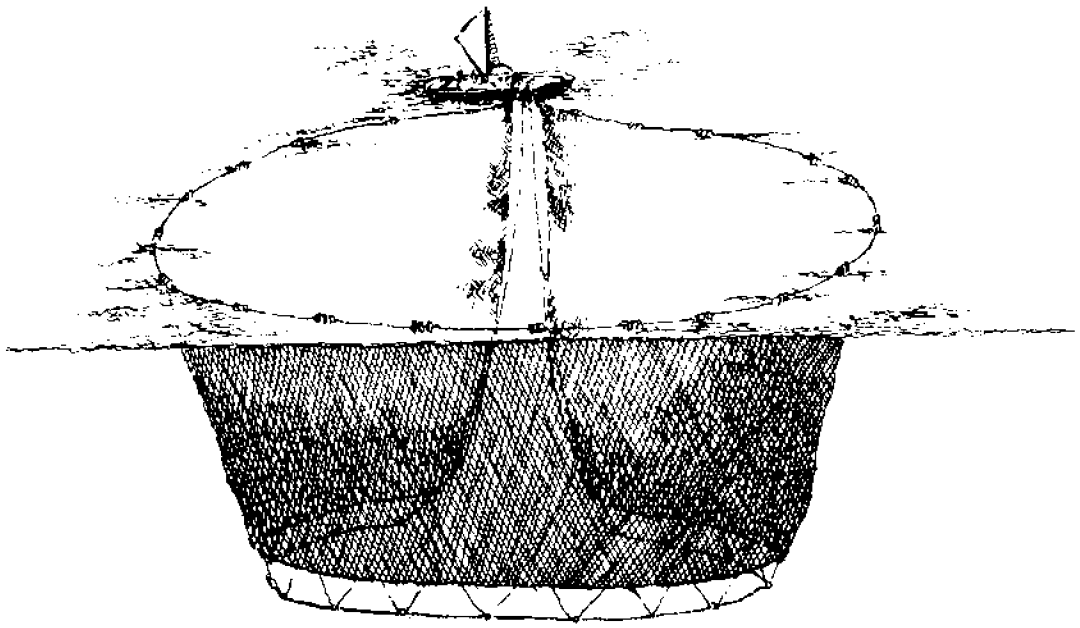

Figure 2. Southeastern Alaska Purse Seine

the pull of the main vessel moving ahead under power. Sets can be made slowly or at top vessel speeds.

If the fish and the tides are moving in one direction (Figure 3), the skiff pays out a little net called a lead (pronounced "leed") which directs the fish into the hook of the net. Sometimes the tide will be moving in the other direction and the fish will be moving against the tide, so the set is scooped downtide. In shallow water areas, such as in the Port Moller area of the Bering Sea, wind-caused breakers continuously hammer the beach causing an offshore bar to develop. When the lead is used, it is necessary for the skiff to move as close to the beach as possible. Often it will pass over the sand bar. This can be dangerous, especially on ebb tides, because the seas can break over the bar and capsize the skiff. On calm days, the skiff will pay out lead netting until the bow of the skiff touches dry sand. Many salmon try to go through the gap under the skiff, and the two skiff men jump out of the skiff in hip boots to drive every last salmon back into the lead.

Herring are fished in much the same way as salmon, but the mesh size is different. One and 1/8-inch mesh is used in the strips as opposed to the 4-inch mesh used in salmon seines.

Tuna Seining

Seining for tuna has some unique features. From the crack of dawn until the last ray of light, men scan the horizon with powerful binoculars while their vessels run wide open, at about 18 knots. When they spot birds, often 15 to 18 miles away, they run right at them. As they close in on the birds they look for porpoise. Close up, they may see the spotter or spinner porpoise that usually accompany tuna. Spotter porpoise usually are associated with more tuna, hence are the more desirable. The vessel speed is dropped to

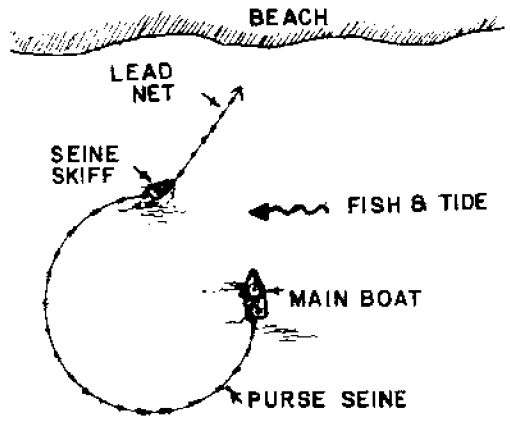

Figure 3. Setting a Purse Seine

eight knots and four speedboats are lowered. These speedboats are all-aluminum one-seaters that can move at 35 to 40 knots and are equipped with one-way radio headsets. The captain of the larger vessel has complete control of the speed boats from the crow's nest. He directs them to herd the porpoise into a ball. Then the seine is cut loose and the net is set around the porpoise by the seine skiff and the main vessel. Once the two ends are brought together, the bottom of the net is pursed, essentially putting a floor of webbing under the fish.

The tuna and propoise seem to remain together no matter how long they are chased. The porpoise can be herded into a tight ball and encircled by the purse seine along with the school of tuna. The net is manipulated to free the porpoise. This is referred to as backing down. The captain watches from the crow's nest until the tuna charge toward the boat. From his vantage point this resembles a breeze ruffling the water. He orders the main vessel engines backed, or reversed, pulling the seine floats below the surface at the end of the net away from the boat. The porpoise can swim over the net and escape. When the tuna try to do the same thing, however, the engines are stopped and the corks surface, preventing the tuna from leaving. The backing down process is repeated as many times as necessary to release the remaining porpoise. Following backdown, the seine is pulled aboard the larger vessel until only the bunt remains in the water with the skiff supporting the cork line on the outer side. The bunt section is made up of heavy twine netting to support the weight of the tuna. Tuna are then brailed out of the bunt onto the main purse seine vessel.

Prior to the development of backdown techniques, the Medina panel, and superapron, approximately 320,000 porpoise were killed annually, by purse seining for tuna. Using new equipment and techniques 15,000 animals or less are killed annually, approximately a 95 percent reduction in porpoise mortality.

Recent Innovations: Power Blocks, Drum Seines, Tapered Nets, and Nylon Netting

The use of power blocks to haul in seines has reduced the size of the crew needed from nine to seven men in the Pacific Northwest salmon fishery. Drum seines reduced the number of men needed from seven to five. Drum seines are legal today in British Comumbia and Washington, but they are prohibited in southeastern Alaska where is was felt they were too effective.

Formerly, most nets were rectangular but rectangular shapes are difficult to keep taut at the ends of the seine. Draping of the strips sometimes caused rollups which resulted in great time delays and were a direct cause of porpoise mortalities in tuna seines. Now, many nets are tapered (Figure 5). This poses a new problem, how to cut the net to get the best angle on the taper. Tapers are described in terms of bars and meshes. Two bars are equal to one mesh. The way the tapers are cut can be crucial to keeping the net taut at the ends.

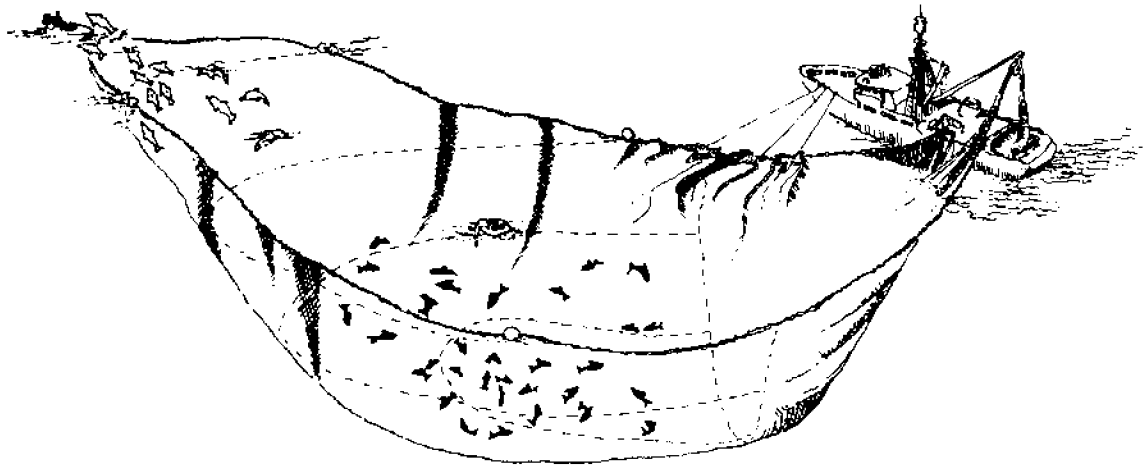

Figure 4. Tuna Purse Seine

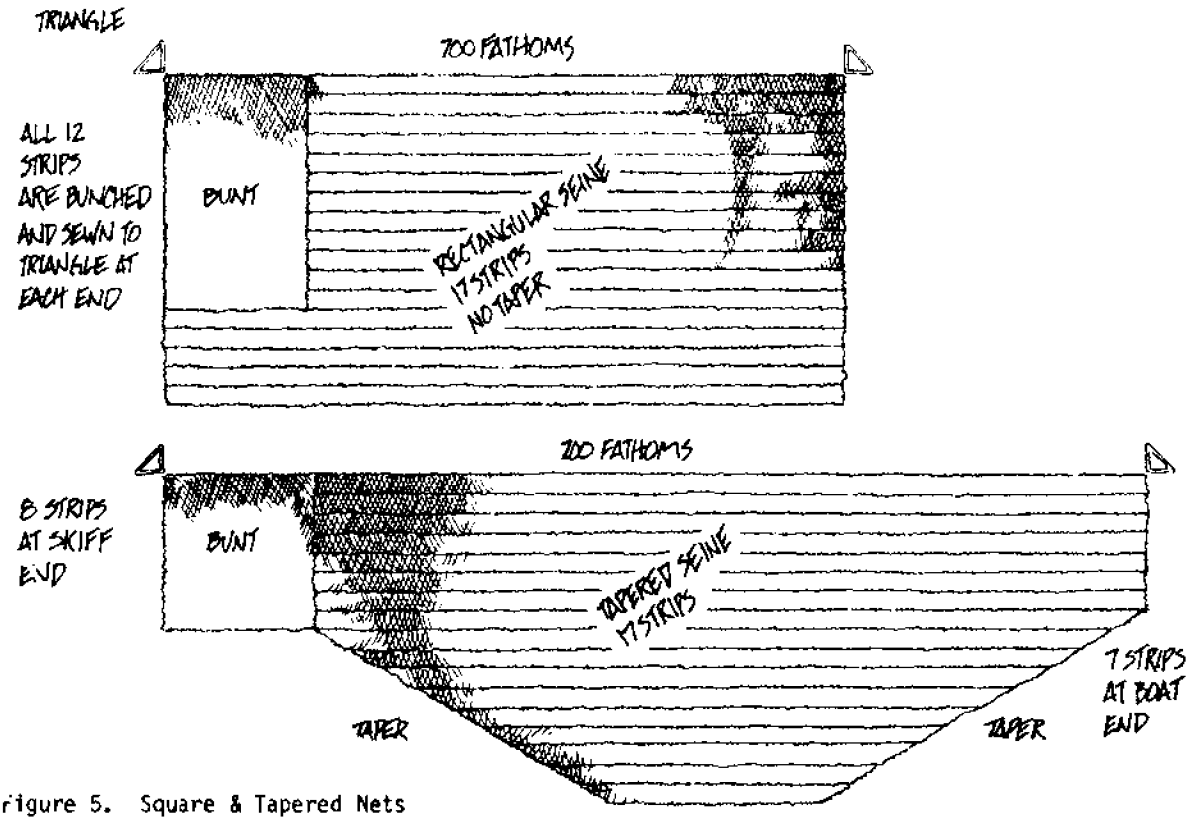

Figure 5. Square & Tapered Nets

The introduction of nylon netting in about 1954 revolutionized the seine industry. Before then, seine nets were cotton. They were heavy, and in warm water they rotted quickly which caused severe problems in the tuna fishery. Even tarring the nets only preserved them for one year. Extremely high air and water temperatures promoted bacterial growth in cotton nets. Fishermen often had to replace rotting nets twice a year, at a cost of $20,000. Replacement costs have been substantially reduced since the advent of nylon nets. In the early 1950's a tuna fisherman's average annual investment for seines was about $70,000. On the other hand, I have seen 10-year-old nylon nets still working very well, although they had turned a tattle-tale gray color and looked worn out. The newest ones are braided twine, made with knots, dyed black, then tarred. These are superior in strength to the older nets. The purpose of the color is merely psychological--the netting always appears to be new.

Question: *What is the difference between tuna seines and salmon seines?*

Reply: Tuna seines are much larger and much heavier than salmon seines, although in mesh size the two are very close: 4-1/4-inch mesh for tuna seines and 4-inch mesh for salmon seines. Tuna seines are pursed using 5/8-inch diameter wire rope purse lines, while salmon seines use braided nylon purse lines. Salmon remain alive in purse seines until they are brailed aboard the vessel. Before 1953 when the Puretic power block came into use, tuna seine retrieval was very slow and all the tuna drowned. Most tuna seines were made with three bunts for easier hauling.

The use of nylon netting and the introduction of the Puretic power block revolutionized the tuna industry. Tuna are now kept alive in tapered and deepened seines until they leave the water. The entire operation of setting, pursing, and retrieving the seine is completed in about an hour or two depending on the amount of fish captured.

Traps

Traps were once used to catch salmon in Alaska, Puget Sound, and the Columbia River. They were voted out in Washington State in 1934 by initiative, and were classified illegal in Alaska when it achieved statehood.

Today traps are used legally in Alaska by the natives of Metlakatla, who operate only because a Catholic priest once wrote a set of laws that prevented the State of Alaska from outlawing their traps. The law established a protected area one mile outside the island perimeter in which traps are legal. The State of Alaska cannot supersede this law. In addition, two or three traps are owned by the Swinomish Indian tribe near Laconner, Washington. These are the last in existence.

When salmon traps were legal, two types were popularly used. Permanent traps were made by driving piles with pile drivers, and then attaching lead web, jiggers, hearts, pots and spillers (Figure 6). Floating traps were anchored into position after they were wired and stapled together in quiet bays. They were towed into position and anchored with heavy anchors and heavy cable lines.

In several ways traps were an ideal method of catching salmon. The traps could be closed and the fish kept alive until brought into the cannery to be processed. The canned product was better looking than fresh, iced fish and no refrigeration was needed. Salmon can live 30 to 40 days in traps, although they usually weren't kept that long. In the old days, they closed the traps from Friday afternoons until Sunday mornings, a weekly 36-hour closure imposed for conservation.

Reef Net

The reef net, an Indian invention, is also a kind of trap. Two canoes would anchor about 20 feet apart in a good saltwater location, and a net would be stretched between them. In front of the two canoes would be a kind of weir made of rope that would funnel the salmon into the net. Reef nets are still legal in the State of Washington. This is a small fishery, principally by non-Indians today. Most reef nets are located on the West shore of Lummi Island, Washington, and around San Juan, Lopez, and Stewart Islands in the San Juan Island Group in Puget Sound.

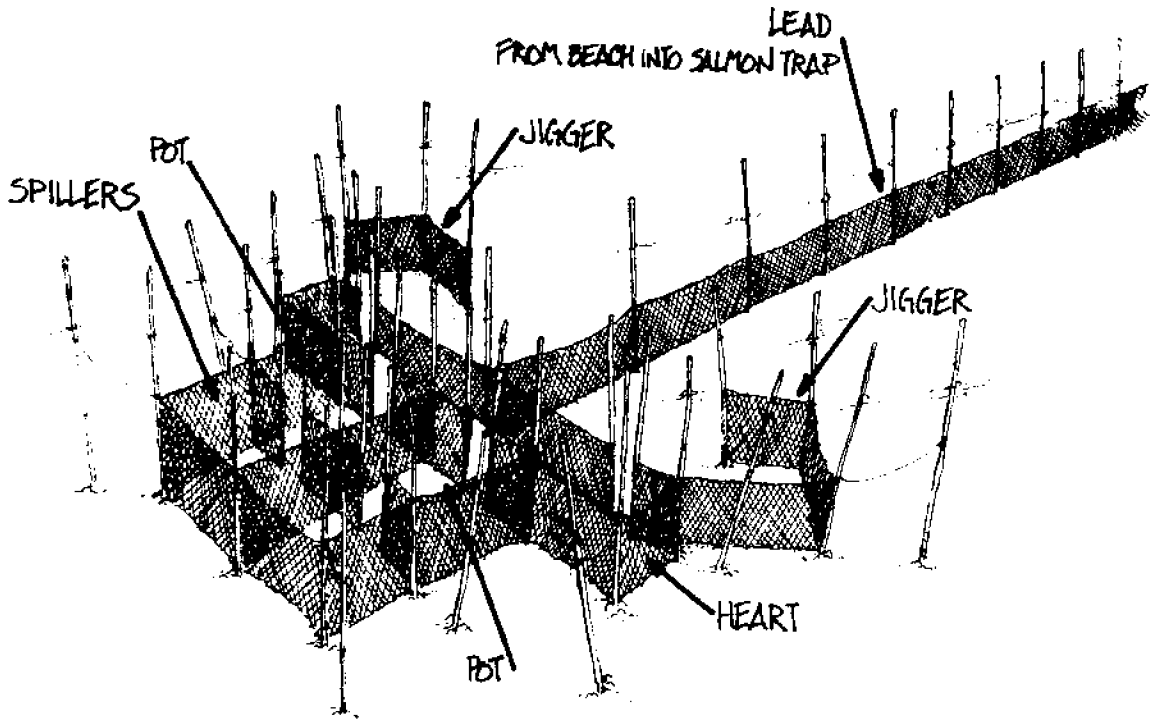

Figure 6. Salmon Trap

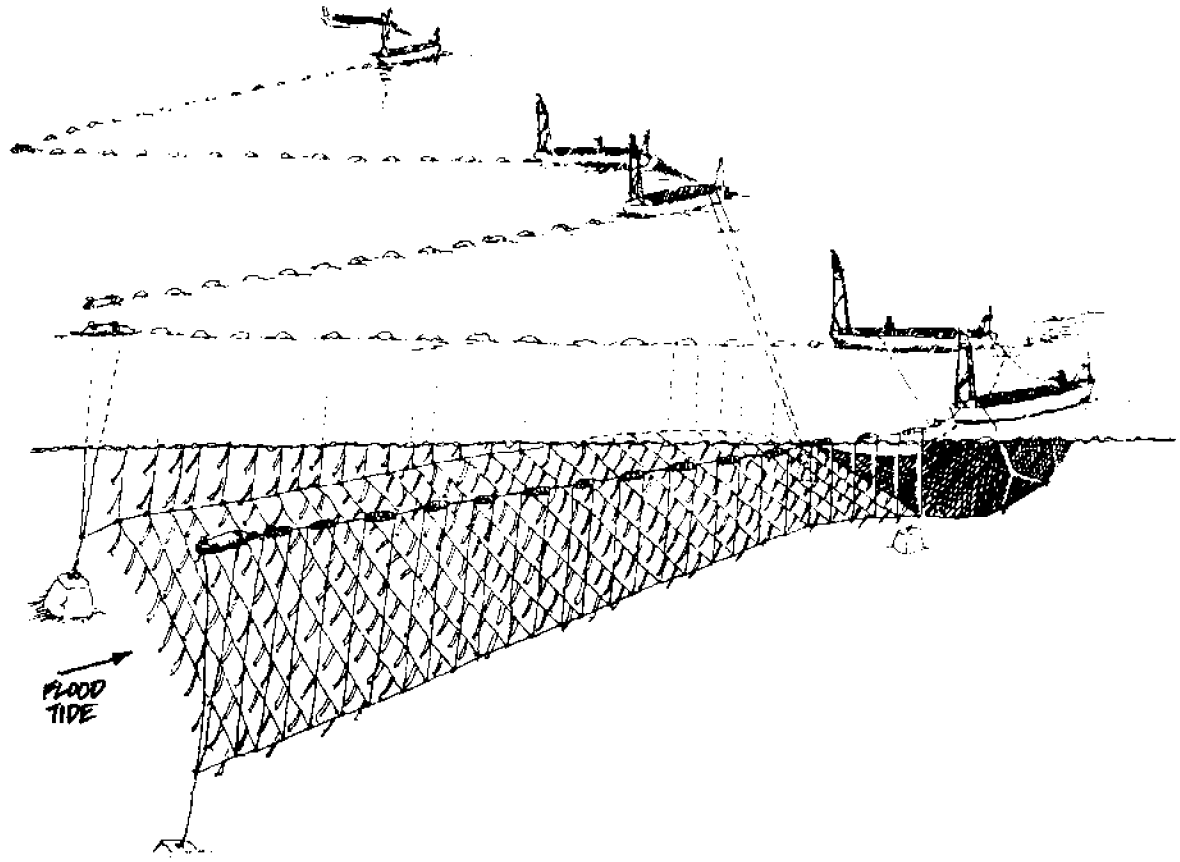

Figure 7. Reef Net

Gillnet

A normal gillnet in Puget Sound is 300 fathoms long (Figure 8). The mesh size is very critical; being off by a quarter of an inch could mean the difference between a successful season and an unsuccessful one. Five and 3/4-inch to 6-3/8-inch mesh is used for silver salmon and 7 to 8-3/4-inch mesh for king salmon in the Puget Sound fishery. If the mesh size is right, the salmon are trapped by their gill covers just behind the head. A few may slide through as far as the dorsal fin, but catching very many by the dorsal fin would indicate mesh size is too large. They are removed by hand by backing them out tail first after the net is pulled aboard the boat. Pushing them through head first can damage the flesh. In heavy fishing areas such as Bristol Bay, Alaska, the fish are removed from the net, as fast as possible to permit setting the net again.

Gillnets are usually of three different panels of gillnetting, two trammel panels and a center section or back wall. The back wall generally has the smallest mesh. For instance in a fall season gillnet the back wall will be 5-3/4-inch to 6-3/8 inch mesh. The trammels are 24-inch to 48-inch meshes and are located on each side of the back wall. The cork and lead line relationship is critical, and requires adjustment until the net skips lightly over the bottom.

The Columbia River gillnetters use two types of gillnets: floaters and divers. Floaters are used mostly at the mouth of the river. The floats are nearly always visible at the surface. The lead line on the lower edge could be on the bottom or higher in the water column, depending on the web-depth preference of the individual fisherman.

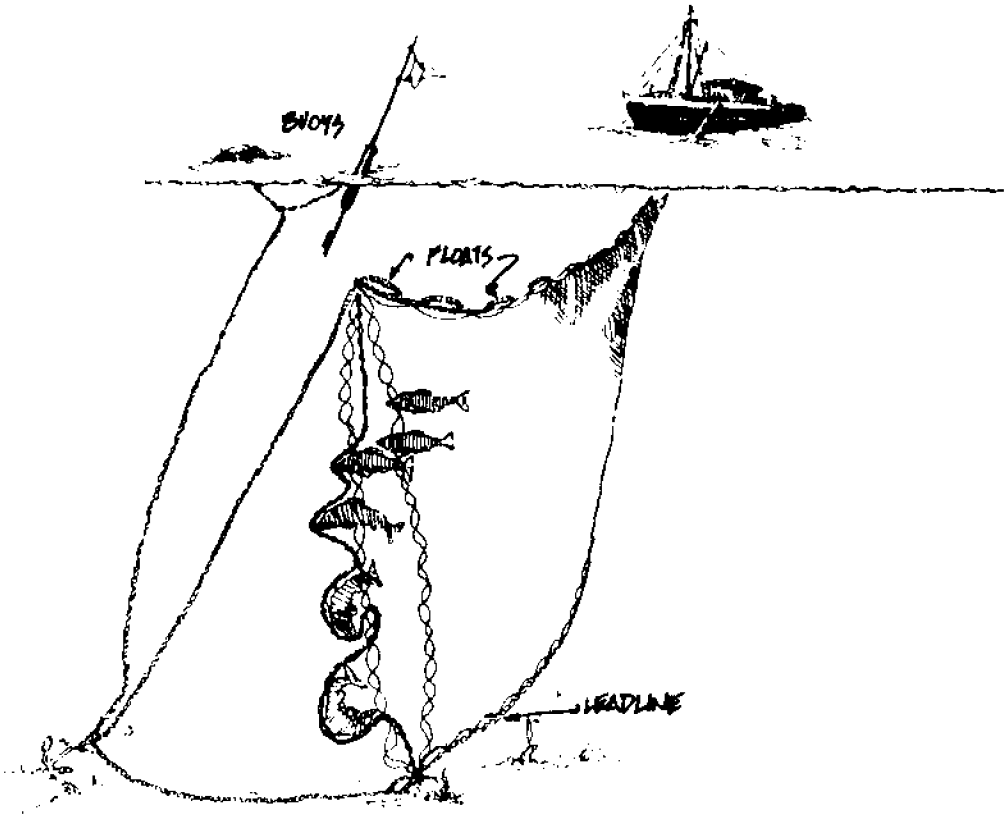

Figure 8. Gill Net

Divers are very effective salmon fishing nets. They capture all sizes of fish, more so by entanglement than by gilling. Pushing the small-meshed back wall, the fish pass through the larger meshes in the aprons, forming pocket traps.

Diver drift rights are highly valued and the rights to a location are protected and regulated by specific by-laws imposed by the fishing families that historically established them on the Columbia River. Diver locations are referred to as "drifts," such as Woody Island Drift, Cathlamet Drift, or Clifton Drift. Each drift has a select group of 8-15 fishermen.

Trawls

Trawls are sack-like nets towed beneath the surface. Trawl fisheries started on the west coast around 1939, just prior to World War II. The western box trawl, composed of four seams, was common then. About 1940 or 1941, the 400-mesh eastern trawl was introduced (Figure 9). This was still used in the 1950's. Later, it was still used in the two-seam Norwegian trawl that caught groundfish pretty well but did not catch flatfish or sole. Sole and ling cod cling to the bottom; snappers may be up or down in the water column.

At one time we thought we could make a combination bottom and midwater trawl, called a universal trawl, but it did justice to neither.

I didn't like the 400-mesh eastern net because of the 4-inch meshes and because its vertical opening is only 6 to 7 feet at maximum. At the urging of the Oregon Otter Trawl Commission, I recently designed a better one which is three times more efficient even though it contains the same number of meshes and is the same size. I used some trigonometry and geometry to figure out the tapers and the length of head rope and foot rope needed to achieve a mesh that formed diamonds comprised of four 30-60-90-degree triangles.

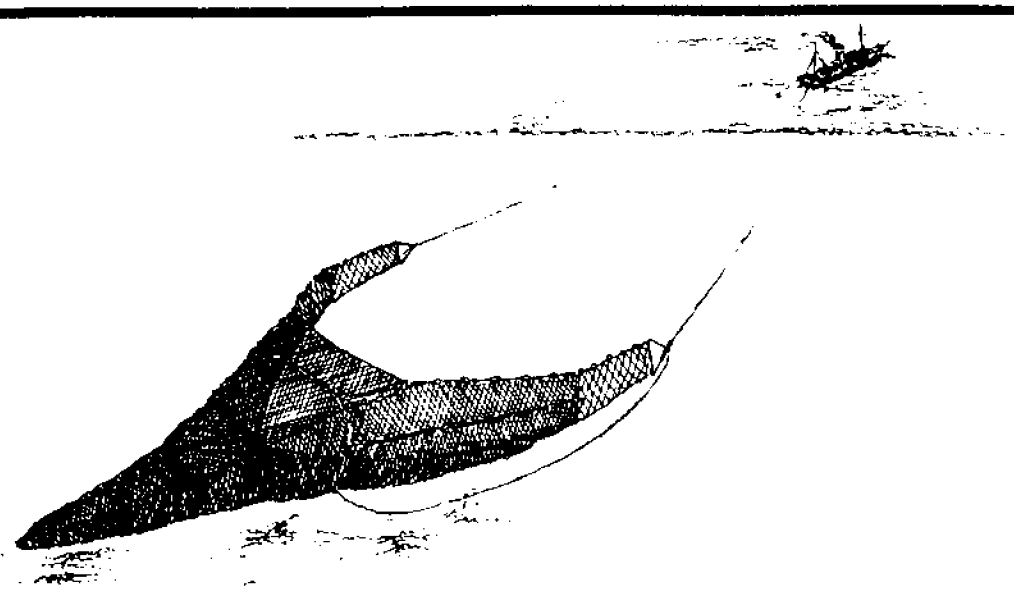

Figure 9. Eastern Trawl--2 Seam

Midwater Trawls

Most midwater trawls can catch anything from salmon, to any of the midwater fish, to herring. Midwater trawls are quite large, with meshes that reduce insize moving aft. (Figure 10).

The old eastern trawl, with a 400 mesh circumference, screened approximately 139 square feet of water, measured at its mouth. The modified eastern trawl uses the same foot and head rope dimensions but screens approximately 399 square feet of water.

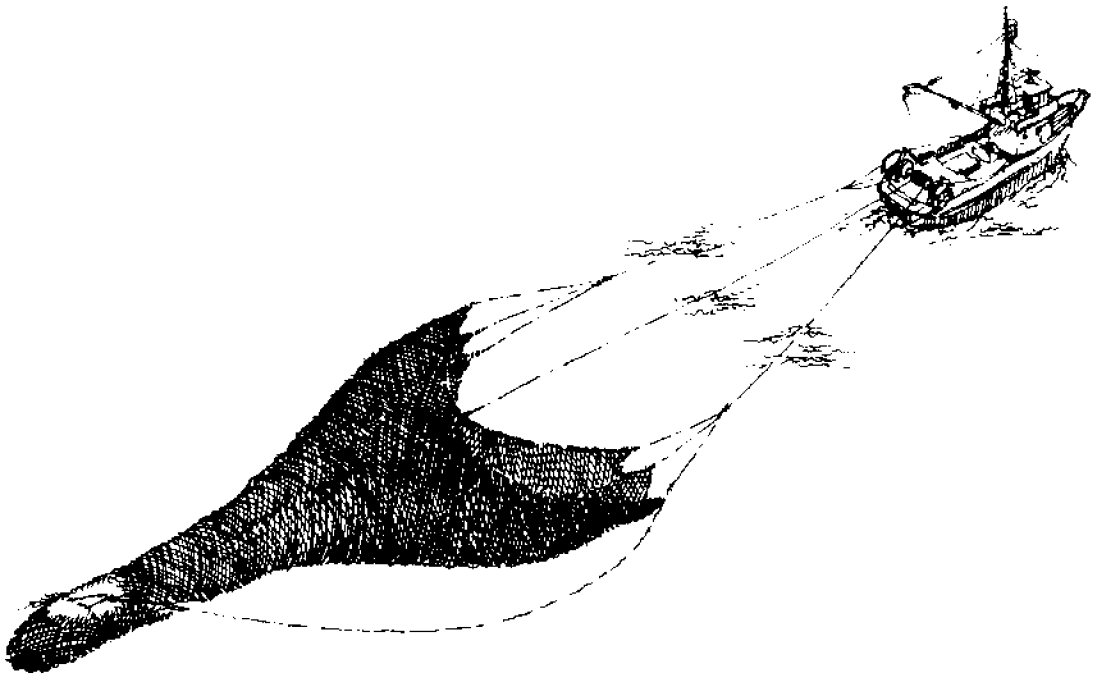

Figure 10. Midwater Trawl

The fish swim down the center of the trawl, approximately two meters away from the netting. As they move deeper into the trawl the walls of net begin to close in on them. At the entrance end, the webbing can be 6-foot stretch mesh. When the fish can see all four sides at once, however, they will attack the netting, trying to escape. At that point, the meshes have to be small enough to contain them.

A midwater trawl defies legal description, because all trawls being lowered or retrieved can be considered midwater trawls even though they may be operated strictly on the bottom. Therefore, any legal description of midwater trawling must contain the word telemetry because it is telemetry gear that permits fishermen to locate the trawl so as to intercept midwater fishes.

The latest midwater trawls are Polish rope trawls constructed of all parallel ropes in the front portion. Super-mesh trawls with 6-foot to 12-foot mesh are preferred by the Norwegians.

Midwater trawling is rapidly becoming more important to our West Coast and Alaskan trawl fisheries because it increases trawl fishing efficiency and contributes to geater economic returns.

Oregon's Salmon Future

John R. Donaldson, Director
Oregon Department of Fish and Wildlife

On August 3, 1976, when I had been the director of the Oregon Department of Fish and Wildlife (ODFW) for two days, I was initiated into crisis management. It was at the fall meeting of the Columbia River Compact, the body that jointly manages the Columbia River commercial fisheries for Oregon and Washington. Nontreaty fishermen--for want of a better term--who made up the lower river gillnet fleet, were there in great numbers. Treaty Indian fishermen were there in great numbers. The sportsmen, too, were strongly represented. The audience filled the room at the Oregon Museum of Science and Industry Forestry Center in Portland, and the proceedings were extremely heated.

From the onset, the decision being proposed was viewed by some as dismal, ridiculous, or insulting. Every possible type of testimony was given and tempers built. The ire of one individual in the audience was ignited by an exchange between Don Moos, then Director of the Washington Department of Fisheries, and a person who had testified. The chap waved his fist and his arms and I heard him say clearly, "I'm going to go out and get my rifle and shoot you!"

The chairman of the Oregon Department of Fish and Wildlife, Oregon being the host state, was doing an admirable job of keeping things in control. As usual, Oregon State Police, who are responsible for fisheries and wildlife enforcement in Oregon, were in attendance. In a matter of minutes, three officers had surrounded the angry man and the trouble was contained. That was the level crisis management on the Columbia River had reached at that particular time.

Several days later we were in Federal Court, and there followed a period when I knew the inside workings of Judge Robert Belloni's court better than my own office because I was there so often. I submit to you that nothing can be managed effectively from inside a courtroom. Judge Belloni had been entertaining the Sohappy case since 1978. The case concerned Indians on the Columbia River who had sued for special considerations because of their treaty fishing rights in Oregon and Washington.

From 1968 to 1976 the allocation arguments between treaty and nontreaty fishermen led Judge Belloni to request a comprehensive management plan. We gathered a small group of about half-a-dozen from ODFW and the treaty Indians and began working out a 5-year comprehensive management plan for allocating the harvest of fish stocks from the Columbia River. It was not a perfect document--it's very seldom that such a document can be--and nobody has been absolutely happy with it. But except for minor adjustments, we have stayed out of court for the better part of three years. Any arrangement that can be arrived at outside of court is going to be better received and regarded by all parties than a court-decreed settlement.

What has happened to the salmonid fisheries in Oregon? I'm going to speak here almost exclusively on salmon although steelhead are also included.

When the 1975 Oregon legislature merged the former Oregon Fish Commission and Oregon Wildlife Commission into the ODFW, it put all the responsibility for the fisheries and wildlife resources of Oregon under this new agency's direction. The salmon problems combined made up the largest single issue to face this agency. It might even be classified as a salmon crisis.

There are five species of Pacific salmon and each of these has varieties; this diversity makes management complicated. In addition, salmon have a very complex life history, migrating from freshwater to estuaries, to the ocean, and back again. They suffer environmental competition with human development of electric power, forestry, agriculture, industry, and domestic water systems. The mixed-harvest fishery has developed problems because of decreasing supply and increasing demand for salmon.

I'd like to focus on two areas of the state where the problems typify these of the salmon fisheries in general, pointing out how the ODFW views possible solutions. First let me relate the story of the Columbia River salmon fishery. Then I'd like to talk about what's wrong in the coastal coho fishery.

Columbia River Salmon Fishery

What is a fishery? It begins with naturally occurring, self-replenishing natural stocks. At some point, a use is discovered --sustenance, commerce, recreation--and development follows.

Oregon's salmon fisheries started a long time ago; Lewis and Clark found the Indians fishing at Celilo Falls in 1805. Not long after that, settlement began at Astoria. Amazingly, stocks of summer chinook in the Columbia were over-exploited before the turn of the century. Lower river stocks of fall chinook are still in a rather healthy condition so it can be seen that the period from initiation to overexploitation is variable.

In the early part of this century the era of dams began on the river with Rock Island, Bonneville, and Grand Coulee Dams. By 1975, the upstream passage of fish was blocked at Chief Joseph Dam on the Columbia River and at Hell's Canyon Dam on its major tributary, the Snake River. The Clearwater River is closed at Dworshak Dam. Although the flow in the main stem of the Willamette River was not shut off, many of its tributaries have been blocked by dams.

The Columbia River salmon stocks must navigate up and down through a total of nine structures in order to complete their life cycle in the headwaters. The fish in the Snake River system must negotiate eight dams in their migration.

While managing the river with dams has brought many benefits to the Northwest, it has also engendered conflicts. The biggest single conflict in managing the Columbia is between use of the dams for hydroelectric generation and to provide agricultural irrigation. Other conflicting uses are navigation and flood control.

> *"... fish have no legally recognized rights to the waters of the Columbia River."*

Amid all these uses, the fish have no legally recognized rights to the water of

the Columbia River. A sufficient flow of water to bring the young fish down river is critical.

There are fish going up or coming down the river year around. There is never a period of time when a salmonid is not migrating. All five species of Pacific salmon spawn in the Columbia basin. There are four varieties of chinook salmon, the spring, summer, and two types of fall fish--the upriver bright and the lower river tules. The coho is predominantly in the lower river while small numbers of sockeye still go upstream. The pink and chum salmon are almost completely gone from the river. In addition, steelhead trout run in winter, spring, and summer.

The several types of gear used to take salmon from the river contribute to the complex situation: Indian fishermen and lower river non-Indian fishermen using gillnets, and sport fishermen in the river as well as trollers and sport fishermen offshore. Three-quarters of the Columbia River salmonids that are caught are taken in the ocean, mostly off Washington and Canada, and even farther north off Alaska. On the average in recent years, Oregon fishermen have taken 15 percent of the Columbia River fall chinook in the ocean, Washington fishermen have taken 38 percent, and Canadian fishermen 34 percent.

Management of the Columbia River Salmon Fishery

I know there are many fishery users who view management as a scourge, a blight, something in the way of their pursuits. What is salmon management? It is perpetuating the use of a stock through regulation and enhancement.

Management authority is granted, first and foremost, legislatively. The authority of the ODFW is in the Oregon Revised Statutes (ORS), generated in the legislature, and the Oregon Administrative Rules (OAR), passed by the Oregon Fish and Wildlife Commission. The courts are also a basis of management authority. Litigation has fixed how we are to manage in many instances, especially on the Indian treaty issue.

Once authority is granted, a data base is required. Without question a data base is all-important to management. Do we know the life-history of the stock? What is the stock size? What are the harvest rates and distributions? Management and research staffs develop the data base. Landing statistics compiled from the tickets the commercial fishermen fill out, contribute a great deal of information to the data base.

With authority and a data base, the managers can regulate particular fisheries. The seasons that are set depend on whether the fishery is in the early developmental stage, at maximum yield, or overexploited.

I classify regulatory processes into two categories: inefficiency actions and allocation among users. Inefficiency actions are closing a fishery in time or area, restricting gear, or restricting size or sex of the catch. To protect the inside chinook stocks on the Columbia River for example, we set a 28-inch minimum size in the ocean troll fishery. Dungeness crab are well regulated on the basis of their sex: only males above a certain size may be taken.

"I feel that limited entry is inevitable in all resource harvesting."

Allocation of fish stock among users has been much debated. It is an essential part of good management, both biologically and socio-economically. The 5-year comprehensive plan agreed to among the Columbia River treaty Indians and the states, and ordered by Judge Belloni in February 1977, is an example of how such actions can work.

I feel that limited entry is inevitable in all resource harvesting. The problem of a finite, even a dwindling habitat base and a demand for the resource that is practically infinite eventually necessitates some rationing scheme. Even now, we have limited entry in the Rogue River sport fishery for part of the year. There is a ceiling on the number of people that can drift the river each day. In the Deschutes we do not have limited entry, but we have reduced the take of fish until it's almost a catch-and-release situation. We're doing that to forestall the day of the limited entry program. It is not long off.

In addition to regulating, management may be directed at enhancing a stock. The ODFW is committed to spending considerable time and money on salmon enhancement. Our methods are habitat restoration and recruiting animals into the stock; in other words, stream rehabilitation and operating hatcheries. We also try to prevent habitat losses, for example, by taking action when a decision is in the making which will

block a fish run with a new dam. We have learned to file an intervention in the state and federal licensing process. We are then included in the licensing discussion and we can argue our case without resorting to court action. With the power shortage we face today, we can anticipate more hydroelectric projects and more fish losses as a result. The ODFW will have to balance its management objectives with those of other state and federal agencies.

To illustrate how salmon management works on the Columbia, let's take a journey down the river with a spring salmon smolt from the Salmon River country. As the fish passes downstream in the spring of the year it encounters Lower Granite Dam. Here it may have one of two fates. It may pass over or through the dam; or fisheries workers may trap it, barge it, or truck it downstream. The Corps of Engineers is spending a great deal of money to do this, and the program is showing some success.

Our smolt is on its own at the next three dams on the Snake River. On the main stem of the Columbia it encounters four dams: McNary, John Day, The Dalles, and Bonneville. Each of these has its own passage problems. Some are easily solved, and some we're researching to find devices to get the fish through. We're not totally successful, and we're a far cry from being finished with the job.

In 1977, the Columbia basin experienced a 100-year low runoff. We begged and pleaded with the water managers to provide the fish some water. We obtained what we call a fish flush--a mass of water running down the river from dam to dam that allowed passage for the month of May. We also operated the barges and trucks at Lower Granite, but it wasn't very effective because so little flow came down the reservoir that we couldn't get the fish out of the system. To a large extent they stayed in the reservoir behind the dam. Without the flow given us by the water managers, however, we would have lost the entire run for that year. The cost to the energy users of the Northwest, and there's always a cost, was 0.2 percent of the average energy-producing flow for the whole system --a very low cost when balanced against the savings to the fisheries. It was definitely cost-effective to do this.

Three states, two federal agencies, and the inter-tribal fish commission are represented on the Columbia River Fisheries Council, a non-regulatory body. It meets to discuss management techniques, problems, and policies. Fisheries regulatory power lies with the three states and through the Columbia River Compact, which I mentioned earlier. In addition, the Army Corps of Engineers, the Bonneville Power Administration, and the Bureau of Reclamation regulate the water.

Should there be something new in the way of a fishery management system on the Columbia? It is often pointed out how cumbersome this system is; it is difficult to resolve fishery problems in a timely, efficient manner. This question leads to recognizing the ever-present dilemma between state and federal authority on the Columbia--but to resolve it by establishing a federal management agency is not the best solution in my opinion.

Litigation is another complicating factor in managing the Columbia. I have described the 5-year agreement that resulted from the U.S. vs Oregon and Washington case. Several years ago, the state of Idaho sued Oregon and Washington in the U.S. Supreme Court for the right to be a member of the compact. The Court denied Idaho's suit, while essentially giving its blessing to the state suing directly for the right to fish in the Columbia. This suit has been proceeding before a federal judge (hearing master) in Denver for several years. It was recently passed on to the Supreme Court with the hearing master's recommendation that the U.S. was an indispensible part of the case. However, the federal government refuses to be a part of the suit. The government's entrance into this suit would involve the water regulators of the Columbia, the Corps of Engineers, and the Bonneville Power Administration, as well as the Bureau of Indian Affairs, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service--the whole cast of actors that have a part in the river management scene.

"Coho are experiencing the effects of both . . . environmental stress and over-harvest."

The U.S. Supreme Court denied the hearing master's recommendation and sent it back to him for settlement. We are now back in court in Denver, but we are hopeful for settlement out of court. Oregon authorities want to settle this out of court--

Washington is moving more slowly--and I think if two of the three states agree, the federal hearing master will probably tell the third to settle. The gentleman is in his 80's; he's been hearing interstate litigation through his whole career. He says such cases usually go on for 15 to 20 years and he does not want to wait this one out.

There is another suit pending which few know of involving Wakiakum-Chinook Indian rights. The Wakiakum-Chinook are a lower river nontreaty tribe. They claim to be part of the Quinaults, although the Quinaults don't claim them; neither do their neighboring tribes. They are claiming rights on the lower river, which means claiming a right to 50 percent of the fish. Curiously, four treaty tribes of the upper river, the Warm Springs, Yakima, Umatilla, and the Nez Perce have joined the defense in this suit because they stand to lose by the amount taken out of the lower river for other treaty tribes.

Besides litigation, legislation is critical to the Columbia River. Just now, the Northwest energy bill seems to be the best alternative for getting some water for fish, and the ODFW wants a voice at the table when arguments are made as to how the river will be managed. We'd like to see the bill amended to give the fish some rights.

Next week I'll testify before Senator Magnuson who has proposed a $90-million enhancement package for the Puget Sound area: $50-million in enhancement and another $40-million in buy-back funds to nontreaty fishing fleets and development dollars for the Indian fleet. The ODFW is seeking an attachment to that bill which would include the Columbia River in the funding.

Coastal Coho Salmon Fishery

The second of two salmon harvest areas I want to discuss is the Oregon coast. Here are found three of the five Pacific salmon species: chinook, coho, and chum. The coastal chinook runs are in good shape, and the ODFW has allowed rather generous fishing seasons. On the southern Oregon coast we've even allowed some extra-long seasons on the Elk and Chetco Rivers for both commercial and recreational fisheries because the chinook stocks are abundant.

The coho runs are not in good shape; that's the bad side of the story. Coho are experiencing the effects of both common causes of salmon abundance problems: environmental stress and over-harvest. Environmentally, coho are competing with human enterprise for space. Logging along the Oregon coast has been a major environmental stress, although recently this has been controlled to a degree with a tough forestry practices act. Another environmental problem is the receptivity of the ocean to the natural stocks of coho and those we put out from our hatcheries. It appears that timing of the ocean upwelling affects the survival and growth of young coho migrating to sea. If northwest winds blow early and forcefully, we have good survival and growth. If they're late we have a poor run.

"No one likes to be regulated."

The commercial and recreational harvest rates also contribute to the declining coho runs. In the ocean, where hatchery-raised and wild salmon stocks co-mingle, the catch rate applies indiscriminately. This rate normally runs about 70 to 80 percent, and sometimes up to 85 percent. While public hatchery-raised fish can tolerate a rate of 90-plus percent, wild fish can in no way tolerate this. Our best information indicates wild fish can be harvested at about a 65-percent rate in order to preserve a sufficent cushion of adult spawners. So while we've allowed a harvest rate that reduces a surplus returning to the hatcheries, it is decimating some of our wild stock.

Why preserve the wild stocks? Scientists justly defend the value of their genetic diversity. These fish have developed over eons to survive in their environment and they possess enough variation in their gene pool to permit them to continue this development, should conditions change. When we raise fish in hatcheries we tend to reduce that diversity and encounter the monoculture problems that are often seen in agriculture.

We realized the plight of the wild fish stocks while investigating the causes for the 1977 collapse in the coho fishery. We thought the vigorous public hatchery program, pursued since the early 1960's in Oregon, would continue to yield the bonanza runs that culminated in the record 1976 coho run. So we had no ready explanation for the 1977 run, the lowest in 15 to 20 years. Tentatively, the reduced levels in the coho look like the combined result of inadequate upwelling conditions in the

ocean, which are occurring again this year for the fourth straight year, and of a harvest rate too high for the wild stocks.

Some audiences, especially fishermen, claim that the ODFW's regulations have been a major problem in the coho fishery. No one likes to be regulated, and I certainly understand the problems that imposing restrictions can cause. However, we feel certain that our coho regulations are sound. They are based on predictions of run sizes that have proved quite accurate, within our statistical confidence limits.

Last year, in 1979, the ODFW closed the coho fishery rather suddenly, raising fishermen's ire. As the season had progressed, the run size remained within our estimated limits, 1.1 to 1.5 million fish, but we became concerned with the harvest rate. During the latter part of the season it rose unusually rapidly. The returns of the wild stock to the rivers were low, and too many fish were being taken. An emergency session of the commission was called and a decision was made to close the fishery. We didn't close the fishery because our predictions were wrong; we closed it because of the small run size. We predicted and measured the second poorest run in 16 years. I think we could be accused of erring in not taking enough time for adequate public input, but time was short; the coho resource was in trouble.

After the fishery was closed the returns of wild stock to the rivers were somewhat better--they were considerably better to the hatcheries--but the wild fish did not get back in the numbers we would have liked. Our stream surveys had shown a definite decline in spawners for a number of years. The index is up a little this year, which is encouraging.

Coho Legislation

Some heated discussions on coho salmon took place in the 1979 Oregon legislative session. They were valuable discussions; everyone learned from them. The stock assessment and nutrition programs that we proposed were debated very heavily. We also wanted increased restoration through enhancement of the natural spawning stocks.

A fingerling release program proposed by the legislature was not one of our priority programs. At present we are using our hatcheries to their full capacity raising smolts. Believe it or not, this is the most cost-effective use because we get the best return from smolts even though they are more expensive to produce. Fingerling plants are less cost-effective and egg plants are least cost-effective. However, we do have the capacity to raise more fingerlings in our hatcheries during this early stage without affecting our eventual smolt program. It does take some time and effort to plant the fingerlings properly where they won't impact existing wild stocks.

We also gained a salmon advisory committee from the last legislative session. I'm not totally excited about advisory committees; we have a commission, we have the public, we have the legislature, and I think that's enough of a sounding board. However, we have welcomed the committee, and it has been effective. It meets once a month to look over the whole salmon program with members of my staff and user groups and will relate their observations to the commission at the end of the biennium.

Litigation and Legislation

Some issues involve both the courts and the elected bodies. As you may know, the Siletz Indians were restored as a teaty tribe in 1977 by an act of Congress. The ODFW contested that legislation because we feared establishing special Indian hunting and fishing rights along the Oregon coast. We proposed an amendment which would take these rights from the Siletz. However, this Congress will not take hunting and fishing rights from an Indian tribe. In the Northwest there may be some support for this, but in Congress the votes are from the East, and the East is not facing this kind of problem.

The Siletz came to us because they were encountering constant harrassment from user groups over hunting and fishing issues. Actually, the restoration bill was quite neutral with regard to hunting and fishing rights; it stated that it granted no rights or procedural advantages, but neither did it take any potential rights away. The bill also allowed the Siletz two years to recommend a reservation plan to the Congress.

After the bill had been passed, however, we were advised by the Attorney General that the Siletz had a very good chance of regaining their hunting and fishing rights in court. The Siletz' fear was that suing for their fishing and hunting rights might antagonize their neighbors and make establishing their reservation more difficult. Instead, they were willing to enter into a consent decree permitting them limited, highly controlled hunting and

"I feel most optimistic for the future of Oregon's salmon."

fishing. It's a very interesting concept under which they forego their right to sue in court for extra hunting and fishing. This is a hard concept to get across to the public which is accusing the ODFW of selling out. We've proposed a version of the agreement to the commission, but there has been no commitment. There's a possibility of legislation as well.

Unfortunately, the measure of a good decision these days is one which makes every one equally mad. If someone is happy, something may have been given away unnecessarily. These are troubled times; people are distrustful, frustrated, and feel impotent when it comes to getting their message to the bureaucrats who run the system. The public and politicians feel they gain stature when they kick an agency--it's a popular thing to do. They want more benefits with less government, and that's pretty hard to achieve. In summary, I feel most optimistic for the future of Oregon's salmon despite some of the things I've said. If I weren't, I'd find something else to do in a hurry.

International Whaling Management

William Aron, Director
Office of Marine Mammals
National Marine Fisheries Service

In an ideal world, marine mammal managers would have a complete understanding of the animals they manage. They would make decisions based on population and harvest rates, make allocations of the resource to proper users, and make sure each population remained healthy, growing, or at least stable.

> *"I believe that the majority of people in the U.S. believe it is wrong to kill marine mammals."*

In the real world of managing marine mammals there is a mitigating factor. I believe that the majority of people in the U.S. believe it is wrong to kill marine mammals. This view, which I would describe as religious or ethical, adds a whole new emotional and political dimension to marine mammal management. The American public is particularly concerned about whales; it also cares about porpoise and seals.

Before I discuss the management of international whaling, let me review the species of whales and closely related porpoise and dolphin species with which my office is concerned:

Table I

Dahl's porpoise	05-10,000 individuals killed per year--low in relation to population	Incidentally taken in Japanese salmon gillnet fishery.
Harbor porpoise		American salmon fishermen think this species eats a lot of salmon --I'm not sure it does.
Beaked whale		A biological curiosity; of no importance to fisheries.
Pilot whale-- "pothead whale"	Sometimes herded into fjords (Northern Europe), killed and eaten.	
False Killer whale		
Orca-- Killer whale		
Fraser's dolphin		
Common dolphin		We closed the annual quota on the Northern Common which were taken in the fishery for tuna February 1980.
Spotted dolphin		
Blue whale	Population is probably growing slightly	Endangered but I don't think really threatened with extinction.
Fin whale	Population at 20% of initial stock estimate	Barred from commercial fishing except in small area of North Atlantic.
Bryde's whale		Was once treated as the same species as the sei whale.
Bowhead whale		One of the most endangered.
Humpback whale	Once badly overfished; now completely protected.	Found in U.S. off Alaska, Maine, N.E. coast, and Hawaii.

To understand the International Whaling Commission, you must first know a little of its history. The Commission was created at an international meeting held in Washington, D.C., in 1946; the Convention it developed went into effect in 1949. A history of the International Whaling Commission is contained in "International Management of Whales, Dolphins and Porpoises," by James E. Scott, Ecology Law Quarterly of the University of California (Volumn 6, Nos. 2 and 3, 1977).

"The real objective of its (IWC) designers was not the conservation of whales . . . (but) . . . to control the supply and price of whale oil."

You must realize that although the Convention looks like a conservation document, the real objective of its designers was not the conservation of whales. The IWC's predecessor had evolved from a group whose goal was to control a tremendous glut of whale oil on the international market.

Its historical identity was as an international cartel to control the supply and price of whale oil. Proof of this is that the commission adopted the Blue Whale Unit on which to base its system of measuring all whale kills. A Blue Whale Unit did not just equal one blue whale, but a given number of all other whale species: six sei whales, two and a half humpbacks, two fin whales. This system did not really manage the whale resource, it managed the oil. The use of the Blue Whale Unit clearly resulted in the overfishing of some stocks.

During a period in the late 1950's, the IWC's Scientific Committee urged that quotas be reduced substantially. However, one member of the committee, a Professor E. J. Slijper asserted that the committee's data were no good and did not prove the need to reduce the harvest. His interpretation suggested that there were many more whales in the ocean than the committee believed. Slijper was from the Netherlands, a major whaling nation. He told the whaling companies what they wanted to hear, and the high harvest rate continued.

It was clear that something was amiss though, and the IWC appointed what is now known as the "Committee of Three" to investigate. The three were Douglas Chapman, at present Dean of the College of Fisheries, University of Washington; Sidney Holt, just now retiring from the U.N. Food and Agriculture Organization (FAU); and K. Radway Allen, recently retired from the Australian fisheries group in CSIRO. The Committee of Three soon expanded with the addition of John Gulland now of FAO to become the "Committee of Four." They examined the whaling data and expressed the view that the whale catches were too high. That information was still not acceptable to the industry, and excessively high catches continued.

It will be helpful to note here some specific problems in marine mammal management practices and in the gathering of hard information about marine mammal populations. Most marine mammal populations are relatively inaccessible, and even the best population estimates inevitably will be weak. In addition, the amount spent for most studies is insufficient to develop hard information about these populations. In the early years of the Commission it became clear that not only were our population estimates and knowledge of the animals' natural histories weak, our management practices were poorly founded also. We were managing whales as if they were fish. If you understand something about recruitment and recruitment rates, you will also understand that you cannot treat a population of mammals that mature very late in life and produce a small number of young in the same way you treat a fish population of early-maturing individuals that will produce very large numbers of eggs. Managing fish and managing mammals really require very different techniques. In most (but not all) fish populations, there is very little relationship between recruitment and the size of the spawning stock, whereas in most marine mammal populations the relation between recruitment and stock size is strong. When you reduce a marine mammal population you impact recruitment. When you reduce most fish populations, codfish, for example, the reproductive capacity of that population will generally remain quite high; a small number of spawners can rebuild that cod population quickly.

". . . the scientific committee (of the IWC) was a powerless group whose advice was accepted only when it provided a quota consistent with the needs of the whaling industry."

All this was poorly understood in the early days of the IWC. Right through the 1960's when absolute disaster hit the whaling industry--they had virtually run out of whales--the Scientific Committee was a powerless group whose advice was accepted only when it provided a quota consistent with the needs of the whaling industry.

I attended my first Scientific Committee meeting in 1972. Weak as it was, the data clearly showed that severe overfishing of whales was taking place. There was no question that many of the committee felt the quotas should be severely cut, but they were desperately afraid that the industry would not accept such recommendations and that the Commission would set quotas based on the industry's needs, not on the advice of the scientists.

In May 1972, the U.S. sent a delegation to Stockholm to attend the U.N. Conference on the Human Environment. Heading the delegation was Russell Train, at that time head of the Council on Environmental Quality. Among its members were Dr. Robert White,

the Administrator of the National Oceanic and Atmospheric Administration (NOAA), and a man who was then the Governor of Georgia, Jimmy Carter. The U.S. delegation proposed and won virtually unanimous support for a total moratorium on whaling. The vote was 53-0 with 3 abstentions. The next month, June 1972, the IWC held its annual meeting in London. Evidently the Commissioners did not have clear signals from their governments, because despite the fact that many of the IWC member-nations had been present in Stockholm and had voted for a moratorium, the U.S. moratorium proposal at the IWC failed to carry.

The IWC, you must realize, is different from most fishery commissions. In other fishery commissions, for example, those regulating salmon, halibut, and tuna, the member-nations are involved in the fishery. In the IWC, a number of the member-nations once whaled but no longer whale, such as the U.S., New Zealand, and England; other member-nations have never whaled at all, such as Mexico, Panama, and Argentina. All members, however, no matter what their size or involvement in whaling, have exactly the same voting power. If you think negotiating in that kind of forum is easy, you're wrong. Some people at the poker table are playing with real money and some are not.

Some--the U.S., for example--have nothing to lose in terms of their economic capacity, but have much to lose in terms of public concern for whales. In 1972, when the Marine Mammal Protection Act was in Congress, the White House received more mail on this issue than on any other apart from the war in Viet Nam. We cannot ignore the concern the American public has for marine mammals. It's a legitimate concern which is essentially an ethical, religious view based on the belief that these animals are special. It is quite different from the view that might be held by a wildlife manager who is concerned with rational use of living resources.

Within the U.S., pressure groups display a wide range of philosophies. For example, the National Wildlife Federation defines the term conservation as rational use, while Citizens for Humane Legislation, a group involved with the protection of animals, is composed of many members who feel it is morally and ethically wrong to take a life.

In 1972, the U.S. was beaten soundly at the IWC. There was certainly a sense in the IWC that the "whale issue" was raised by little old ladies in tennis shoes who would go away if they were ignored. By 1973, one of those little old ladies in tennis shoes on the U.S. delegation was Dr. Elvis Stahr. He had been president of two state universities, Kentucky and Indiana, dean of a law school, Oxonian, and Secretary of the Army. The dignity he and others leant the issue began to make it clear to other countries that the concern for whales was not a fad, but was much more serious than had been thought. By 1974, the Japanese delegation included two full-ranking ambassadors as well as the usual delegates, consisting of fairly senior members of their fisheries service. After every key vote our delegation was queried, "Are you satisfied?"

The Commission has now given up the Blue Whale Unit, and further, is managing not only by species but by stock as well. Wildlife managers will recognize the importance of this. At one time, for example, single quotas existed for the whole Southern Ocean for minke whales, sei whales, and fin whales. Now the Southern Ocean is divided into six sectors for the harvest of baleen whales, each with separate quotas, and nine sectors for the harvest of sperm whales. The North Pacific now has two sectors, east and west. The whaling industry used to be able to take the entire quota for a species in one ocean area, concentrating ships where the whales were. They can no longer do that. Whaling fleets must range much more widely. When they have taken their quota in one sector they must move on to another. With the price of fuel what it is, this has presented the industry with a substantial difficulty which has worked to the advantage of whales.

During the mid-1970's the International Whaling Commission's attention became focused on a new problem involving not only the survival of whale populations but the survival of a human population as well: the fate of the bowhead whale hunted by Eskimos of the Alaskan North Slope Community.

In 1977, I became the U.S. Commissioner to the IWC. At the time, Dr. White, who was the IWC Commissioner and Administrator of NOAA, had announced his resignation. His successor, Richard Frank had not yet joined NOAA. For three years, since 1974, concern had been building in the Scientific Committee about the fate of the bowhead whale. At the 1976 meeting, the IWC had supported this concern by passing a resolution asking the U.S. to take steps to reduce the struck and lost rate and to cut back the increas-

ing number of boats involved in the bowhead fishery.

The National Marine Fisheries Service had difficulty in complying with this resolution. Also, quite frankly, I think it is fairly clear that we did not react strongly enough to the Commission's recommendations. We were heavily involved in the tuna-porpoise issue at the time, and we did not take the bowhead issue seriously enough. A further difficulty had been in our relationship with the North Slope Community Eskimos. Let's face it, as difficult as it may be to enforce regulations on a Japanese ship, it is easy compared with the extremely formidable task of restricting people in a distant part of the U.S. whose tradition has depended on this whale and who do not really trust the Federal government. Knowing that the North Slope Community would react adversely to any Federal presence directed at reducing their bowhead kill, our people tried to raise the question with the Eskimo in a very gentle way. In one case, the mayor of the North Slope Community made it very clear that the IWC was not going to tell the Eskimos how to conduct their life.

"I thought it inappropriate to commit the U.S. to an action which might be domestically illegal."

A recent study by two sociologists from the University of Pennsylvania, done at the invitation of the Eskimos, further demonstrates the complexity and seriousness of the situation. The study measured alcoholism in the community. If the study results are correct, close to 72 percent of the adult community--people age 15 and older--are alcoholics or near-alcoholics. You must know that the community has disavowed the results. Even leaving the study aside, though, the North Slope Community is in social transition. The breakdown of its traditional society, probably begun by the early Yankee whalers and missionaries, was accelerated with construction of the DEW line in the 1950's by North Slope oil development. The oil development has been particularly serious because of the new money it added to the community.

Let's look at how this has affected the bowhead hunt. During the 1950's and 1960's the average bowhead take was in the order of 10.3 whales per year. Only the senior citizens of the community could participate because it took some affluence--$5,000 to $6,000 in hard cash--to assemble a crew. Tradition charged the captain with providing food for the crew and with outfitting the boat with ropes, harpoons, and other equipment. As it does today, the harvest involved using an umiak, a skin boat 20-25 feet long, to take a whale that may be 50 feet in length. Thus, the captain of a whaling boat had to be a mature man who had served in the crew of many other whaling boats. He was experienced, knowledgeable, and usually very capable.

The 1970's produced a major change, North Slope oil exploitation began, and suddenly an enormous amount of money poured into the community. Young 18- and 20-year-old men could afford to have their own whaling crews. From the average of 10.3 whales taken per year, suddenly they were landing 30-40. In 1977, when I attended the IWC meeting in Australia as U.S. commissioner, I had to report that in the spring hunt the Eskimos struck 104 whales.

This large number generated great concern and anger. The Scientific Committee recommended a zero quota on the bowhead. This recommendation was passed unanimously by the Commission. I abstained. According to my instructions, I could not vote against the Scientific Committee. At the same time, I could not vote in favor of the zero quota because I was not sure we had the legal authority to enforce such a quota. The Marine Mammal Protection Act (MMPA) provides an exemption for native people; and as a representative of the U.S. government, I thought it inappropriate to commit the U.S. to an action which might be domestically illegal.

At a special meeting held in December 1977 in Tokyo, the U.S. managed to get the zero quota, which would have had a terrible impact on the Eskimo communities, revised to permit the landing of 12 and striking of up to 18 bowheads. In succeeding years, new data showed a larger population than the size upon which the initial zero quota had been based. In 1977, the best estimates had indicated a population of between 800 and 1,500 whales. The field season in 1978 was extremely good--the weather was perfect--and based on the data we collected we now think the population is between 1,700 and 2,800, with 2,200 the most probable. With that estimate, we were able to convince the Commission to increase the quota to 18 and 27 in 1978. A slight reduction to 18 and 26 was adopted in 1979.

The first of the two figures in the quota is the permitted number of actual landings. The second figure is the number struck. We are dealing with a primitive fishery, and not all whales struck are actually landed. However, because the harpoon has a grenade at its tip, we estimate that about half the whales which are not landed actually die.

From the management point of view, it makes no difference whether the whale is landed or whether it sinks to the bottom. From the Eskimo hunter's point of view, his esteem in the community grows substantially if he lands his quarry. Bringing a whale in makes him a hero.

The U.S. delegation to the IWC has a diverse membership representing government departments and the private community. It includes protectionists who care primarily about the whale and others concerned with human cultures. In 1977 in Tokyo, and in 1978 in London, the delegation included representatives of the Alaska Eskimo Whaling Commission, a native group. In December 1977, in a very dramatic moment, one of the senior members of the community, Arnold Brower, explained the importance of the bowhead hunt to the Eskimo. Here was a man who was not very articulate but who had whaled all his life, speaking to an international meeting comprised of representatives of countries from Australia to the Soviet Union. It was a very moving experience for everyone present.

The Eskimo culture experiences six months of darkness every year. During that period the Eskimos plan and talk about the hunt. Unlike duck hunting or seal hunting, the whale hunt is a community activity. According to anthropologists and sociologists, it is a force that binds the community together. The Alaskan Eskimo culture may or may not survive the trauma of modern civilization, but there's no question in my mind that ending the bowhead hunt could be a fatal blow.

"The only biologically safe course with bowhead is to permit a zero kill."

On the other hand, there is also no serious question in my mind that the scientific Committee is right. The only biologically safe course with the bowhead is to permit zero kill. We are, however, trying to balance the risk to a human population against the risk to the whale population. I can assure you the Eskimos feel that the quota of 18 whales is much too low to meet their needs, and they are very angry about it. In fact, when we went to the 18 and 28 quota, they refused to go to London with us; they thought we had sold them out. However, they have abided by the quota despite their anger. Last year, the quota was 18 and 27, but the Eskimos were only able to take 12 before the 27th whale was struck and we closed the season. The abominable weather on the North Slope probably accounted for the large difference between whales landed and struck. The real reason the bowhead is in trouble stems from the period of Yankee whaling from about 1840 to 1910. The baleen plates of the bowhead were used for corset stays, critical to female fashions of the time. Unfortunately, the availability of spring steel and the change of fashions did not take place in time and the bowhead population was reduced by the commercial whaling fleets to well under 20 percent of its initial stock size. The North Slope Eskimo is thus being asked to pay an extraordinary price for the misdeeds of others. The anger of the North Slope community is both understandable and justified, and we can only be thankful that we have so far enjoyed such a high degree of cooperation by the community, both in response to our research efforts and in the compliance with the annual quotas.

Disputes about the management of marine mammals, which are almost always heated, will inevitably continue as long as our basic understanding of their interrelationship with the rest of the ecosystem, including man, remains uncertain. Until we understand the significant features of the relationship between marine mammals and other critically important marine resources, it will be difficult to strike a balance between our needs and desires to protect marine mammals on the one hand, and to rationally manage and conserve other oceanic resources on the other. We must know, for example, the real impact of marine mammal feeding behavior on commercially important fish, their role in serving as a vector for parasitic infestations that impact adversely the value of human food fish, etc. It is the role of the research scientist in fisheries to provide these answers. New tools and approaches, ecosystems modeling and field studies--and these two must go hand in hand--make me optimistic about our ability to discover the facts we need. The quality, enthusiasm, and basic interest of the new generation of young professionals lend further confidence to my optimism.

Comparison of Fishery Management Entities in the Northwest Atlantic

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This year, 1980, is the 500th anniversary of fishing in the Northwest Atlantic. There is documentation without any reasonable doubt that fishermen from southwestern England were fishing off Newfoundland, and probably off Nova Scotia, in 1480. I can't verify it, but I suspect that that fishery is probably the oldest continuous fishery anywhere. The only other that might compare in longevity is the herring fishery that took place in the Baltic Sea.

There's not one single issue, not one management technique, that has been proposed, discussed, or implemented in the last 15 years--since the Russians showed up off New England--that was not tried at one time or another in the last 500 years. For example, the second act of Congress in 1783 was to create a subsidy to the New England groundfish fishery because it was in such terrible shape. In the bicentennial year, President Ford signed the Fishery Conservation and Management Act (FCMA) largely because the New England groundfish fishery was in trouble. The moral is, KNOW YOUR HISTORY.

In the waters off New England there are six separate and distinct jurisdictional levels that any fishery manager must take into account: town, state, interstate commission, fishery management council, U.S. government, and Canadian government. For other Atlantic states we must also add

the county and the regional compacts such as the Potomac River Compact. The activity of these entities and their effects vary from area to area. But they do exist and must be taken into account.

On the east coast of the United States are 15 states with a very broad, very productive, and highly-varied continental shelf. There are a large number of valuable and highly-migratory species ranging through the territorial waters from North Carolina to the Canadian border. These include lobster, shrimp, river herring, menhaden, striped bass, bluefish, shad, mackerel, ocean herring, spotted sea trout, and others. Many commercial fisheries operating in the Fishery Conservation Zone (FCZ) are highly dependent on the estuarine systems of the various states. These characteristics of the east coast are the background of much of what follows.

ICNAF--An International Commission

The International Commission for Northwest Atlantic Fisheries (ICNAF) was established in 1949 at a time when fishing and management efforts were relatively light in the Northwest Atlantic. Fishing was pursued by countries that had traditionally fished that area for several hundred years: Canada, U.S., Spain, Portugal, France, and one or two others. ICNAF became extinct for all practical purposes in 1977 when Canada declared its 200-mile territorial sea limit. In its 26-year history ICNAF attempted, reasonably successfully, to manage more than a dozen nations fishing with very different motives on the mixed-species North Atlantic resources.

Let me interject a comment on motives of fishing because they underlie what I believe are the difficulties of groundfish management in New England and are an essential point in any management scheme. Motives of the 17 nations that participated in North Atlantic fisheries varied greatly. U.S. fishermen fished in order to make a profit. Russians fished for protein. Portugal probably fished to provide employment for as many people as possible. A number of other nations, for example African nations, fished to obtain investment capital.

To illustrate this last motive, consider for example, Sri Lanka. Sri Lanka fishes shrimp. It's not primarily interested in a sustained shrimp fishery but in developing a high-value fishery product which can be exported to the U.S. and quickly turned into dollars. With the accumulated capital, Sri Lankens can reinvest in something in which they have a greater long-term interest. We've heard a lot about the evils of pulse fishing, but if your motive is to amass capital then pulse fishing makes a great deal of sense; the fishermen maximize their economic return with minimum investment rather than trying to sustain the fishery.

ICNAF was the first international commission, I think, to face such a variety of legitimate motives, and it required complex management policies. In the last 10 years of its existence, when resources were clearly depleted, ICNAF closed areas to protect spawning fish, required mandatory reporting for at least the second time in Northwest Atlantic fisheries, and implemented below-deck inspection to verify reported catches--even the Russians finally agreed to that. It put into effect overall species and catch quotas for specific nations and what was called the two-tier system: overall catch quotas that were substantially less than the sum of the individual species quotas. This recognized the biological reality of species interactions and interdependency within marine ecosystems. It was the first international convention I know of that took that step. In addition, ICNAF implemented international enforcement of regulations.

You can hear a good deal of protest in New England that none of this meant anything because no one was reporting the catches properly anyway, and that the quotas were seriously exceeded by various countries. No, we don't know how much overfishing there was, nor how much misreporting of catches. Probably it was not as serious as you might be led to believe. No doubt it happened; there's no question about that. It is happening now. There is no question that there were bound to be difficulties in the implementation of an innovative, restrictive system of that kind. Also, you must remember that the two-tier quota system was instituted in the very last two or three years of ICNAF's life. There was not time for things to settle down and for it to become a generally accepted part of management.

"ICNAF's most significant failure may be the depletion of herring on George's Bank."

ICNAF also started a very successful international cooperative research and assessment program that probably produced at least as much information as any other fisheries research program ever undertaken.

Several of these achievements, such as the two-tier quota system and below-decks inspection, came shortly before its demise-too late to save ICNAF from its fate. Despite the fact that fishermen, at least New England fishermen, generally condemned ICNAF, their representatives did participate actively in the negotiating process. It's difficult to see how U.S. industry participation might have been more influential than it was in the complexity of 17 nations striving for management of a resource free to anyone who cared to fish on the high seas. ICNAF's legacy was great. It stimulated a small army of highly-qualified fisheries scientists, an immense body of fisheries data, new assessment techniques, an awareness of species interactions, and a tradition of international cooperative fisheries research that continues today, three years after the demise of ICNAF.

ICNAF's most significant failure may be the depletion of herring on George's Bank. That stock by all accounts today is in very poor condition, but until Canadians or Americans actually try to fish herring on George's Bank we won't know if it has suffered the same fate as other North Atlantic herring stocks.

I'd like to go briefly into the advantages of one of the most innovative points in ICNAF's legacy, the two-tier system. The two-tier system, as I mentioned, recognized that it is impossible to attain maximum sustainable yield (MSY) for all species in a biologically-interacting, mixed-species system. You can't have MSY for whiting, plus MSY for pollock, plus MSY for cod, plus MSY for herring, and expect to achieve them all. That's not the way this kind of biological system works. The MSY for the total system has to be less than the total of the MSY's for species in the system.

The two-tier system was the first international plan I know of that tried to deal with this problem, and it had relative success. It may be a very tentative, primitive step towards solving a complex management problem, but it is important that it became a formally established, internationally agreed-upon approach.

The system did not prevent serious stock depletion, but it successfully controlled effort. Numbers of vessels were substantially reduced, from almost 1,000 at one point. In its final years, the two-tier system appeared to control removals successfully if misreporting was not excessive. Total catches off New England were reduced from about 1.2 million tons in 1968 to about 0.75 million tons by 1976.

It is entirely possible that these accomplishments of ICNAF paid off in the prosperity the New England fishing fleet has reached during the last few years. The harvest of 1975 and 1976 year classes of cod and haddock has been extraordinarily strong. Remember, the 200-mile limit was not implemented until 1977. We cannot claim that the recent prosperity is a result of it.

THE NEW ENGLAND FISHERY COUNCIL

The New England Fishery Management Council, (NEFMC) established under the FCMA and responsible to the Secretary of Commerce, was initially composed, largely, of former advisors to and severe critics of ICNAF. Many of the people who participated in the many and difficult meetings of ICNAF in this country and abroad, and watched foreign fleets catch excessive numbers of fish, within sight of the New England coast, blamed the NMFS scientists. This is ironic, I think, because it was largely because of the NMFS scientists that ICNAF was able to document stock depletion and thus substantially reduce the foreign effort off the U.S. and Canada.

With this background, the New England Council began its work in 1977, and as you perhaps know the Council's progress has been marked by difficulties of various kinds. It cannot be faulted for not trying; it has worked far harder than anyone had expected a part-time Council could work. Its difficulties arose from factors that nobody anticipated.

For two years I served as the Council's executive director, and for one year I've been a voting member of the Council. I have difficulty in stating succinctly the cause of the Council's difficulties. Probably the major factor is the diversity of interest involved, which make it difficult to establish a commonly-perceived and agreeable management objective. I remind you of what I said before concerning the multiplicity of motives of the 17 nations that fished George's Bank. This has been an obstacle to agreement on the

purpose of management. Compounding this is the multiplicity of federal review and approval procedures which no one--certainly no one on the Council--fully understands and which may not perform their intended functions.

Difficulties have been most apparent for the principle groundfish fisheries: cod, haddock, and yellowtail flounder, which are the high-value species in New England. The Council has been moderately successful in its herring management plan. We are relatively proud of that one, and you probably haven't heard much about it because it has been successful. To understand how the New England Council works, let's consider our herring management plan.

There are at least three migrating and intermixing herring stocks to consider in Northwest Atlantic waters: a Canadian stock that we call Southwest Nova Scotian, which moves down the Maine and Massachusetts coast; a potentially large stock on George's Bank estimated to be capable of yielding on the order of 120,000 tons (at one point it yielded close to 300,000 tons to foreign countries, but it is now seriously depleted); and finally a rather small and partially depleted stock in the Gulf of Maine. The intermixture of these stocks varies by season. They are exploited by offshore purse seiners, inshore purse seiners, mid-water pair trawlers, inshore stop seiners, and by fixed-gear or weir fishermen.

One segment of the herring industry is the 100-year-old Maine sardine industry which is primarily interested in rebuilding itself to former levels. The fishery began in 1872 as a result of the siege of Paris by the Germans.

In 1950 the coast of Maine had about 45 sardine plants; at the moment it has 13. Most of the reduction of plants came in the early and mid-1960's, largely because of the lack of fish. This was probably a result of the 300,000 tons of herring taken off George's Bank, and a considerable amount from the Jeffrey's Ledge area in the Gulf of Maine. Consider what a reduction of this kind means to the economy of the eastern Maine coast. There's nothing else there except lobsters, herring, blueberries in season, and perhaps some wood in the wintertime. With a reduction of this kind you have a serious sociological problem because people depend on work in the canneries when the sardines are there.

Another segment of the herring fishing industry is directed toward entering the European herring market, primarily in West Germany. In developing the New England herring plan, such diverse goals as reviving the sardine industry and entering the European market must be reconciled. People in Maine, obviously, are interested in seeing those sardine stocks rebuilt and in restoring sardine production; and there's an inherent intuitive conflict in their minds between the catching of sardines on this coast and the catching of adult herring offshore. The brood stock interrelations between the adults and juveniles among these stocks are not understood.

The New England herring plan is unique as far as I know in that it was conceived and written entirely by the staff of the New England Council. Development of the plan involved close and frequent discussions with industry. It's clearly-stated and understood that, management objectives were to rebuild the depleted Gulf of Maine adult herring stock, and at the same time to preserve the traditional northern Massachusetts offshore adult herring fishery, a goal which was encouraged by the NMFS several years ago in its attempt to alleviate the problem of foreign overfishing.

Accomplishing these objectives required conception of a new herring stock intermixture model by the Council staff and quota-setting by area, by season, and de facto, by gear-type for adult herring in the FCZ. The relatively successful first year of implementation was expanded to take into account probable Canadian catches of the highly-migratory adult herring stock and to provide greater flexibility in seasonal catch quotas within the specific optimum yield. What the Council staff basically did was estimate the migration paths and the probable degree of intermixture of these stocks by season and by area and then set quotas in such a way that no fishing was taking place directly on a spawning stock. Instead, it confined fishing during the early fall spawning period to a time when Canadian fish were mixed into New England waters, therefore focusing, we hoped, on a mixed stock containing Nova Scotian fish rather than focusing on the congregated spawning stock. It was a new conceptual approach to setting quotas based upon what we thought we knew the fish were doing.

I should note that as the Council was establishing an optimum yield and quotas for the adult herring fishery there was considerable concern because the state of Maine was not doing the same thing for the juvenile herring or sardine fisheries in its territorial sea. Maine did establish its own herring management program but without quotas, arguing that the catch was effectively constrained by the severely depleted processing capability, as in fact was dramatically demonstrated to be the case in the summer of 1979.

This question of Council jurisdiction in the FCZ versus state jurisdiction in the territorial sea is a continuing, important, and difficult one, not only for herring, but for groundfish and probably many other species also. In some cases the difficulty comes from a lack of familiarity with the realities of the fisheries inside and outside the territorial sea. An example is the true limitation to Maine's sardine fishery exercised by the available plant capacity and availability of people to process the fish if they should be landed. Despite assurance to the Council that these were adequate restraints and quotas were unnecessary, the Council remained skeptical until the superabundance of sardines in 1979. Only a modest catch was sufficient to prove the point.

In other fisheries, difficulties result from differing management purposes. For example, winter flounder is an important component of the commercial groundfish fishery in the FCZ off New England and therefore will be included in developing a new groundfish plan; but it is also the most valuable recreational fishery in the territorial waters of New York and New Jersey, which belong to the Mid-Atlantic Council. Therefore, two very different perceptions of proper management may be focused on this species. Reconciliation of these two points of view obviously will not be an easy task.

"From the scars of that experience (the council) learned that it's most important to have appropriate objectives in view . . ."

As I indicated earlier, probably the New England Council got into serious difficulties with groundfish because of differing views of the appropriate management objectives. Without thinking very much about the implications, the Council adopted quotas for groundfish in 1977 that were really a direct transfer from the ICNAF process. Under ICNAF, almost of necessity, the overall management objectives were biological; either maximum sustainable yield, or maximum yield per recruit, or both were the stated or implied management objectives. Indeed, the biological models available to ICNAF were designed to realize these objectives and probably they are a reasonable common denominator to reconcile the differing economic or social objectives for the nations that belonged to ICNAF. These biological objectives that were appropriate for ICNAF had serious incompatibilities with management under other objectives. Under great pressure, the Council changed biological to economic and then to social management objectives. From the scars of that experience it has learned that it is most important to have appropriate objectives clearly in view, and also that for a fishery as diverse and complex as groundfish it's not easy to develop such objectives.

INTERSTATE COMMISSIONS

In addition to the regional management councils functioning under the FCMA, an older system--the interstate fisheries commissions--still exists amid some confusion. There are three interstate fisheries commissions: The Pacific Marine Fisheries Commission (PMFC), The Gulf States Marine Fisheries Commission (GSMFC), and the Atlantic States Marine Fisheries Commission (ASMFC). The ASMFC was established by Congress in 1942.

The commissions were to encourage fisheries management among the coastal states. Years later, Congress enacted what we call Amendment 1, which empowered consenting states to promulgate and enforce regulations through ASMFC. The GSMFC had that authority included within its original charter, but has never used it. The PMFC does not have such authority. As I understand it, the reason is because California, Oregon, and Washington traditionally, by informal agreement, have been able to develop independent but quite compatible management programs when there was a need. Therefore, the Pacific states have felt little need for an independent management entity.

Even the ASMFC, which attained regulatory authority in the 1940's felt no need to exercise it until 1974 when regulations for

northern shrimp in the Gulf of Maine were promulgated by Maine, New Hampshire, and Massachusetts. The regulations then included a closed season in summer and minimum mesh size. They subsequently included mandatory reporting and, for a couple of years, a total catch quota. These regulations have been in effect in various forms, modified from year to year, for six years. They apply equally in the fisheries conservation zone and the territorial seas of the three states.

The ASMFC has three members from each state: a director, such as myself; a member of the state legislature chosen by the legislature; and a private member who is generally, but not always, an industry member. That person is the governor's appointee. All of these people from the three states have been involved in the promulgation of the shrimp regulations.

The wording of Amendment 1 is rather ambiguous, and it's not clear how the regulations shall be promulgated or whether each state fisheries agency has authority to implement Amendment 1 independently of its legislative process. Maine, New Hampshire, and Massachusetts have pursued independent routes to the same end. Recognizing the uncertainties of actually implementing Amendment 1, after 30-odd years of dormancy, the ASMFC requested and received a Sea Grant study from the University of South Carolina to clarify questions of authority and procedures. The study concluded that the wording of the Amendment was deficient and that the regulations are not valid. This conclusion has in itself been questioned, and there the matter stands.

In spite of this unsatisfactory situation, the fact is that ASMFC procedures seem to work. The states do cooperate on research and enforcement of regulations concerning the northern shrimp. Regulations are generally respected by the industry. Hearings are held with healthy industry participation and something useful is accomplished. Convictions for the violations of the mesh regulation have been attained and fines have been paid. The reason that a questionable procedure works seems to be that there's common agreement by everyone concerned on the need. Industry has been involved from the beginning, and no one wants to challenge the authority that makes possible a commonly agreed-upon purpose.

Most of the industry does not really understand what the ASMFC is. They've heard about it but they don't really know who is behind it. Sometimes they think it's the state, or the U. S. government, or possibly the Canadian government. They also don't really know what Amendment 1 is. But they recognize that in some way it permits the several states to work together.

A year or so ago there was some suggestion that with the passage of the FCMA and with the establishment of regional councils there was no longer a need for the ASMFC. For two reasons I believe that is not correct. First, now that FCMA makes management possible in the FCZ there is greater likelihood for effective interstate management in the territorial seas. Prior to FCMA there was no guarantee that interstate management in the nearshore waters would not be undone by lack of or inappropriate management in the offshore waters. Now there is a much greater likelihood that ASMFC can be effective. Second, management under ASMFC may be a viable and attractive alternative to regional council management, assuming that the uncertainties of Amendment 1 can be resolved, and I'm sure that they can. By this I have in mind relative freedom from excessively-complicated, time-consuming, inflexible management procedures attached to the FCMA process. The ASMFC has the potential for involving those jurisdictions which are appropriate for particular purposes on an ad hoc basis. It has, in general, much greater flexibility, speed of response, and freedom from unnecessary administrative procedures. It is not tied to the concept of optimum yield.

"No other management system requires adherence to such an ill-defined concept."

Under FCMA, establishment of optimum yield is mandatory, and it cannot be exceeded. Everything done must be directed toward the attainment of optimum yield. An obvious difficulty is that no one as yet has been able to define optimum yield. No other management system requires such adherence to such an ill-defined concept.

STATE FISHERIES MANAGEMENT

Fisheries management by state agencies has been the common, most active and most conspicuous of any of the management entities in the United States. I don't dare speak about your successes on this coast. We on the east coast simply note with

considerable envy your well-established and apparently successful data reporting system, and your well-funded state research and management agencies. I understand that these agencies, along with the Northwest and Alaska Fisheries Center of the National Marine Fisherie Service (NMFS) cooperated rather quickly and practically with the council process--the Pacific Council and the North Pacific Council--for the development of fishery management plans. That has occurred to a much smaller degree on the east coast, in part because many of our 15 states have smaller research staffs than are appropriate to Council needs. Our Councils have taken quite different routes from those on the Pacific Coast, and the states have research and management needs quite different from the Councils' and FCMA needs. Two issues on which Atlantic states have focused attention, for example, are large and valuable shellfish resources, for which habitat protection is a pressing issue, and very large recreational fisheries concentrated close to shore. One of these recreational fisheries is striped bass, a fish that's very popular, very valuable, and migrates exclusively in the territorial waters between Maine and North Carolina. Atlantic states have focused cooperative effort on striped bass management for about two years. They have been criticized for slow progress on this issue, but their diversity of interests and political processes must be accommodated, and their progress in this particular issue over two years is not noticeably less than progress by regional councils on a number of other issues.

I think it's well to note that the eastern states have received a measure of criticism for poor fisheries management because perhaps until 1977 we were the only entities with effective management authority in the U. S., except under international agreement, and therefore we had a record. Some serious management failures have indeed occurred. Some of the best known include oyster depletions of substantial magnitude, large fluctuations of striped bass, and fluctuations in menhaden. It's questionable whether these can be attributed to management deficiencies or to factors such as disease, pollution, habitat loss, or natural environmental changes which are beyond the ability of any typical fisheries manager on the east coast to control.

LOCAL JURISDICTION

In New England, local jurisdiction means town jurisdiction. In Florida and parts of the Gulf coast, it means county jurisdiction. In Massachusetts, towns have the authority to control shellfish resources throughout the territorial waters, right out to the edge of the three-mile limit. In Maine, towns have the option to control and manage their clam resources in the intertidal zone. Clams are one of Maine's most valuable fisheries, both in the intertidal areas, and in some cases in the subtidal waters, depending on the original town charter. This situation is a result of the so-called Colonial Ordinances that originated 340 years ago. It was then judged essential for the well-being--even the survival--of the early settlers in hard times that all have equal access to the town's common property shellfish resources. Eating clams still carries a stigma in parts of New England because at one time that was a means of last resort; only those in dire straits resorted to eating clams.

The towns in Maine now have rather wide discretion on how they choose to manage their clams and there is a substantial diversity in the more than forty municipal ordinances which are currently approved and in effect. The most stringent include a form of limited entry in towns where the resources are limited and there are resident commercial diggers. Such a restriction must be supported by rather detailed resource inventories. The courts in Maine have dealt with the issue of limited entry based on residence on several occasions and at the moment basic statutory authority for the program is again under attack in the courts. Regardless of the question of constitutional validity, I think the fact is that many of the towns have done a good job of surveying their resources and setting approximate levels of harvest within the context of their own perceived management objectives.

You might conclude that in New England the situation is hopelessly confused and inefficient and that it all should be swept away and replaced by a single management entity. Perhaps; but, first, it's not going to happen. The political realities are too strong to allow it in the forseeable future. Second, the management situation is not confusing to anyone actively involved in fisheries management. Third, there is little or no duplication; the various jurisdictions are dealing more or less effectively with the appropriate resources. Fourth, I think there is a

strong possibility that if there were only one management entity there would be far fewer dollars and far fewer people available to carry on the various tasks required by the diversity of species in this area. The Maine legislature, for example, is willing to appropriate funds if management research and decisions are carried out in Maine. It would not be willing to subsidize such activities by NMFS in Woods Hole or in Washington, D.C. For the same reason, Maine's many coastal towns are not willing to dedicate thousands of dollars and hundreds of people to clam resource surveys, transplanting programs, and various other relatively effective management programs if the decisions are being made in Augusta rather than in town meetings. Again, it's extremely unlikely that the NMFS, for example, could or would make the effort that the states and towns do collectively on managing the resources of local significance.

JURISDICTION AND MANAGEMENT OBJECTIVES

David Cushing has emphasized the point that effective management came for Pacific halibut and for Antarctic whales when the problem and the solution were clearly presented in a persuasive way to the managers. This certainly happens at the local level when a clam flat is surveyed. Clams stay where they belong; anyone can dig and count them or watch the counting being done, and anyone can judge for himself the validity of such a sampling program for the particular flat in question. These surveys are highly persuasive among local people who make no pretention of being population dynamicists or any other form of assessment scientists. ICNAF was at the other end of the spectrum; it used sophisticated scientific procedures to provide a common basis of agreement for managing a variable and highly-mixed resource that was fished by many nations for a variety of reasons. The managers in ICNAF were attuned to that level of sophistication and were probably cognizant that no other approach could hope to reconcile such diverse interests. In the middle of this range are the regional fisheries councils. They are composed basically of laymen with little or no knowledge of the methods and objectives, or the limitations, of the assessment procedures, and at the same time charged with attaining the undefined objective of optimum yield. It's probably unfortunate that the prevailing policy has been to insist that optimum yield must be expressed in terms of biomass or rate harvested, which once specified by NMFS may not be exceeded. It's equally unfortunate that that rate has been equated with the generally discredited concept of maximum sustainable yield. Such an interpretation puts an unrealistic restriction on the Councils' options for management and, in a sense, transfers the real management authority from the Councils to the assessment scientists. It's perhaps for that reason that groundfish management in New England so far has been relatively unsuccessful.

There was no significant Canadian fishing of any kind on George's Bank until about 1953. In 1953, through a vessel subsidy program the Canadian government stimulated a Canadian scallop fishery on what we call the northeast peak. The scallop fishery was developed by the U. S. in about 1934, and it peaked about 1952. Canadian fishing on scallops began in 1953 and has resurged in the last four to five years. That is the problem. There is an MSY on George's Bank and through the subsidy program Canadian fishermen have essentially displaced American fishermen there since 1953. Needless to say, this irritates the New Bedford scallop industry. Because of the strong significant importance of this fishery in Canada along the shore of Nova Scotia they are very concerned about retaining access to this scallop resource. The Canadians have a very small scallop resource of their own. The George's Bank scallop is the reason why you find a boundary line on Canadian maps cutting through George's Bank. This was to ensure they retain access to that multi-million dollar scallop resource. They are angry at the U.S. because they see no management action to retain the scallop stock, and there's good reason to believe that it is in serious trouble.

Question: How much of a role are the herring stocks playing in the Canadian/American conflict?

Reply: Not very much. The Canadians have a very large resource along the Nova Scotian shores and in 1973 they were given a small quota by ICNAF in the Gulf of Maine. They wanted it but they didn't really fish it and subsequently they are making no claims on that herring resource. They are saying they want up to one-third of whatever is the acceptable biological catch on George's Bank. The U.S. can have the other two-thirds. But it is not a serious issue of contention.

The Canadians are critical of the U.S. for taking too much pollock. Pollock is important to the Canadians; it is not of great regional importance to us. The redfish

issue in Maine is a serious one because companies in Portland and Rockland developed the redfish fishery in the 1930's and 1940's and expanded into the Grand Banks and into the Gulf of St. Lawrence. Subsequently the Canadians got into redfish also. Our industry is hurting badly because we cannot fish in Canadian waters at all. We need approximately 16,000 tons of redfish to support our existing fishery and the Gulf of Maine can only produce about 9,000 tons of redfish a year. It's a very slow growing fish, and therefore in danger of serious overfishing. That's why the Maine redfish industry is the strongest advocate for the treaty, because it guarantees Canadian redfish to the U.S. Successful negotiation is not very likely however, and it's probably going to be a very difficult transition period for fishermen to shift to something else.

New England Fisheries Management

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I'd like to elaborate on the nature of fisheries management problems in New England since implementation of the Fishery Conservation and Management Act, which established the New England Fishery Management Council (NEFMC).

First of all, the problem is not a lack of prosperity in the New England fishing industry. Since 1977, that industry has been characterized by new boats, new fishermen, new processing capabilities, record landings, and a great deal of optimism. That optimism does not extend to fisheries regulations. The New Bedford Times quoted one fisherman after he had read the latest set of regulations, "It was better when the Russians were here." But the fishing problem is not that people are starving to death. I once listed in my own mind fishermen I could think of with a new boat, generally larger and more sophisticated than their previous boat, and that list included every fisherman that I personally knew, with only one exception. In most cases, they'd gone from 45-footers to 55- or 65-footers. The next day I picked up the Maine Commercial Fisheries Newspaper and read that the one exception indeed did have his own new 55-footer. Every yard in New England that can build fishing boats is building them. Probably New England has not had it this good for a good many years.

The problem is not a lack of resources either because we have seen record landings and record values. New Bedford, for example, has achieved record landed values for two to three years running, and until three years ago New Bedford was really never much of a groundfish port.

Historically, mainly scallops and some yellow-tail flounder were landed but since 1976 cod and haddock landings have increased.

Are you going to say if there is no fishing problem, as I have indicated, then what kind of a problem is it? Well it's a management problem, and that may sound rather confusing because if you don't have a fishing problem then how can you have a management problem? It is in fact an elusive problem, indicated mainly by a lot of discontentment--discontentment is a mild word when $25,000 fines are levied.

In order to try to close in on the actual problem, let me begin by summarizing briefly, if I can, the history of fishing off New England. I'm not aware of any other fishery in the world that's had 500 years of continuous fishing. The Northwest Atlantic groundfish fishery started in 1480, and we have pretty good documentation that it's been going ever since. The original national groups, the English, the French, the Spanish, the Basques, and the Portuguese have continued fishing the Nova Scotia, Newfoundland and Labrador Banks for that 500-year period without interruption and have achieved a pretty stable level of yield in the 16th and early 17th centuries. American fishermen probably exceeded the yield off George's Bank for cod in the 1790's and the early 1800's. Cod was in very high demand in Europe in the 18th and 19th centuries. In the early days of this country, it was our only commodity of foreign exchange and it was a very substantial means of paying foreign debts. Fish from Georges Bank and the Gulf of Maine had a premium place in the European market and commanded a higher price than did fish from Canadian waters. Those fishing banks were a 10- to 20-hour trip by sail from Salem, Marblehead, or Gloucester, and yet fishermen spent two weeks sailing to the Gulf of St. Lawrence, the Newfoundland Banks, and to Labrador to catch and sell an inferior fish at a lower price. Why? Because they had overfished the George's Bank and Gulf of Maine resources. That's important to keep in mind when American fishermen say, "Well it's impossible for us, in the 1980's, with supersophisticated electronics and synthetic gear, to overfish the resources in the Gulf of Maine or on George's Bank." Looking back, I think we've done it before.

Another interesting point is that in the early 1800's, assistance from the Federal government could be obtained in the form of a landings bounty, but fishermen had to report their catch, how many days they were at sea, who was fishing for them, how many lines were set, and how many barrels of salt were on board. I wonder if these data still exist somewhere.

There were no foreign fishermen except Canadians on George's Bank until 1953. There were no other foreign fishermen off the coast of New England until 1963. In the period after the Second World War, Americans again overfished the resources. The port of Gloucester very nearly collapsed in the late 1940's and early 1950's. It had been heavily dependent upon ocean perch which is a slow-growing, long-lived fish very susceptible to overfishing, and it had to make a very substantial, rather traumatic transition to a much more diversified fishing effort in order to survive.

With the demise of the salt fish industry in the early part of this century and the development of the fresh fish or frozen fish industry, the Port of Boston became the primary fishing port for New England and for the United States. It boasted very high landings and more than 100 large trawlers, each over 100 feet in length. In 1976, the Oceanographic Institution at Woods Hole studied the causes of the decline in the 1960's of the Port of Boston as a viable fishing port. They based the study on interviews with processors, dealers, and fishermen. The study gave eight reasons for the decline of the port: changing family ambitions, urban development in the city of Boston, taxes, pollution on the waterfront, labor problems, transportation, markets, and other causes. There was not one mention of foreign fishing as a reason for the decline of the Port of Boston. The decline of fish landings in Boston had actually begun in the early 1950's as the result of a very hard-headed business decision to concentrate on fish processing, rather than fish catching, and since then Boston had been going downhill steadily as a port of landed fish. In 1963, the Russians showed up and subsequently 16 other nations arrived, and we all know what happened to the haddock stocks in 1964 and 1965. Because of a very heavy pulse effort by the Russians the catch went from about 40 thousand tons to 6,000 tons in two years, and that fishery collapsed after 50 years as the mainstay of the groundfish fishery in New England. There was a serious problem also in yellow-tail flounder and herring. That, of course, led to the political pressures which culminated in the FCMA in 1976.

In the meantime, there had been the International Commission for the Northwest Atlantic Fisheries (ICNAF) which in 1950 got off to a slow start, and had the luxury of proceeding in a rather leisurely fashion because it didn't have any crises to deal with. Once the crisis arose off New England, it probably acted as effectively and as rapidly as any multi-national fisheries management entity could be expected to act. It implemented a lot of innovative procedures, but it could not act fast enough to overcome the political pressures which did it in and which resulted in the passage of the FCMA.

Those historical points bring us to March of 1977. What happened after that, at least as far as groundfish is concerned, is a rather long, sad story full of trial and error. It involves a lot of misreporting of catch data, waste of probably thousands of tons of fish dumped at sea, deliberate violation of regulations, false reporting, serious criticism of the assessment procedures, and finally erosion of confidence in the whole management process. It involved many traumatic managment sessions, some of them lasting late into the night, and many council meetings.

"Many of those regulations were self-contradictory, confusing, difficult to understand, and in some cases, unenforceable."

That scene lasted for approximately a year and a half, (August 1977 through early 1979). The regulations were changed 20-odd times in a period of about 14 months. Many of those regulations were self-contradictory, confusing, difficult to understand, and in some cases, unenforceable. The council wasn't acting totally stupidly in all of this; it knowingly did some things that it could not justify. It was, in fact, trying to find a solution to a rapidly changing and totally unprecedented situation, working under political pressures from two sides. On the one hand the fishermen were saying, "What are you doing to us?" and on the other was Washington saying, "Get on with the job that the FCMA tells you to do." The people in Washington really didn't know what was going on in the Council and the fishermen really didn't know what the Act said. I think that's part of the explanation for what happened.

"The people in Washington really didn't know what was going on in the Council and the fishermen didn't know what the Act said."

There were a number of things that led to this situation. One was a legacy from ICNAF which had a somewhat different management philosophy and was dealing with a different set of management circumstances than was the Council. Secondly, the fishermen didn't really know what the act said, and they were a bit shocked to find that American fishermen were subject to government management. They felt that the foreign fishing effort was the cause of the overfishing, not their own effort.

I want to try to summarize for you the evolution of the management objectives for groundfish that occurred between February 1977 and about November 1977. I think it's instructive to understand what happened in order to identify the elusive problem I am trying to define.

The first management plan that was developed and implemented under the FCMA was the New England Groundfish Plan. Much of the thought behind that plan came from people who'd been right up to their ears for years in the ICNAF process, were under great time stress, were thinking in ICNAF terms, and turned out basically an ICNAF plan. This plan had a biological objective. It set the quota for each of three species, the bread-and-butter fisheries of New England. The quotas were very restrictive and were designed primarily for rebuilding stock because the presumption was that all of the stocks needed rebuilding.

The haddock and yellowtail quotas permitted only incidental fisheries; the cod quota permitted a very limited fishery. The recommended quota for haddock, the economic backbone of the New England fishery, was zero tons. No fishing was the appropriate amount of fishing to save the stock, to stabilize it, to prevent it from crashing--whatever crashing meant. It was recognized, however, that you can't fish for anything in New England without taking haddock, so the plan provided an incidental haddock quota of 6,000 tons. For cod, the plan provided an 11,200 ton quota; and while the recommended catch for yellowtail

was zero, the plan provided an incidental quota of about 6,000 tons because you can't fish for cod without taking some yellowtail in certain areas. These quotas were based on the catches fishermen had been reporting. One comment at the time was, "In the last five years American fishermen haven't taken 6,000 tons of haddock and they haven't taken 11,000 tons of cod, so there's nothing to worry about." What happened, of course, was just as the American fishermen had accused the Russians, the West Germans, the East Germans, the Poles, and the Japanese of misreporting their catches under ICNAF, our fishermen had been misreporting their catches substantially. It became very clear very quickly that the New England fleet of about 1,000 boats was going to take 6,000 tons of haddock and 11,000 tons of cod within four months. Legal interpretation of the FCMA was that when optimum yield is reached, fishing stops. It was clearly an impossible situation.

In response, the council established quarterly allocations designed to spread the catch throughout the year so that the closures would be only a few weeks in duration. No boat would then be tied up for more than two or three weeks. Clearly, that decision was not based on biological criteria. An arrangement that spreads the fishing throughout the year, as the quarterly allocations were deliberately intended to do, has nothing to do with biology at all. The fish don't care whether they're taken within a month or over a six-month period; the total removals amount to the same thing. Quarterly allocations are purely an economic management measure.

The quarterly allocation system was still unsatisfactory, however, because large boats, working out of New Bedford or Boston or Gloucester, could keep right on fishing during bad weather when small boats had to stay in port. Those quarterly allocations could be taken by the large boats before the small boats ever had a chance to go fishing. So vessel classes were established by tonnage and by gear type, and each of those vessel classes was given an allocation within the overall quota. This management system had something other than an economic objective; it had a social or cultural objective. It was designed to prevent one segment of the industry from crowding another segment out. There's no guarantee, of course, that it will work for every individual, but at least it makes sure that there's something for each class if not for each individual boat.

The biological objective that I mentioned when simple annual quotas were originally established had been explicitly stated, "The purpose of these quotas is to permit rebuilding of the stocks." The objectives for the quarterly allocations and for the vessel class allocations were implicitly stated. Nobody came right out and said, "We are now changing the objective of this management plan to provide economic equity throughout the year, or social equity throughout the fleet," although everybody understood what was happening and these measures were taken at the urging of the industry. The industry was begging, literally pleading with, the Council for these allocation measures--but without full realization of their implications. Remember that the original quotas had been set nearly at zero, therefore the vessel class allocations that were based on these quotas were awfully small because there were a lot of vessels and each class got a pretty small piece of the pie.

> ***". . . there's more to this world than just money, and there may be other legitimate management objectives other than maximum profit."***

What happened in the evaluation of the stated or implied objectives of the New England Groundfish Plan between March and November of 1977 parallels very well the development of management thinking over the last 40 years for fisheries throughout the world. Models developed in the mid-1930's by Graham and Russell provided answers to the question of biological yield and that laid the foundation for maximum sustainable yield (MSY) as the management objective for fisheries. That concept, of course, prevailed through the 1950's. In the late 1950's and early 1960's, economists pointed out the economic consequences of setting a purely biological objective for management. They said, "Look, there's a lot of wasted resource here. You're building your stocks, or you're saving your stocks, but look at the overcapitalization which has come along as a consequence. You're really doing the wrong thing. You should be trying to maximize your net economic yield. Economic yield is the proper objective." Then in the late 1960's and early 1970's, the concept of optimum sustainable yield, or optimum yield came along because people said, "Well, there's more to this world than just money, and there may be other

legitimate management objectives other than maximum profit," which is true, I think. The concept of optimum yield evolved first in the Law of the Sea Conference of 1963, and then it was incorporated into the FCMA.

These problems and solutions I've outlined occurred in Canada also, although that country operates under a different management regime than we do. It's not surprising that similar problems would evolve both in Canada and in the United States because, after all, both countries fish the same kind of resource: a mixed fishery involving flatfish, cod, hake, pollock, and others. Canada has a similar fleet structure to the U.S., and even though the two countries have quite different management regimes, the basic social, economic, and biological characteristics of the fisheries drove both countries to experience the same kind of problems: misreporting of catches, one group of fishermen against another, and small inshore boats against the large offshore boats. Just now, Newfoundland is trying to declare its own 200-mile limit to exclude Nova Scotia, New Brunswick, and Quebec. We have yet to see how that one comes out.

I think it's implicit in what I've said about the changing management objective from biological to economic to social, that everybody became aware very quickly that it wasn't sufficient to worry only about the state of the resource itself. The welfare of the fishermen must be considered, too. It's very easy to manage fish. If you want to rebuild the stock, the easiest thing to do, is stop fishing. The NEFMC very quickly found that that measure alone was not acceptable or sufficient. Unfortunately, there was a strong feeling among fishermen that it's not necessary to worry about the fish at all, that we cannot deplete the resource even though, as I indicated, I think that we've done it at least twice before.

The mandatory part of the FCMA says that management plans shall be developed in order to prevent overfishing. That point was largely overlooked by New England fishermen and is still not accepted by them. They are becoming aware, however, that the rules concerning overfishing are enforced with rather substantial fines. The Council found that the fishermen also had rather serious questions about the assessment process. As I said, the original quotas were set on the premise of serious stock depletion, particularly for haddock and yellowtail flounder, but in mid-summer of 1977, the fishermen were reporting (probably very rightly) an abundance of principally two- to three-year-old fish, that they had not seen for 10-12 years. What they were seeing was a very strong year class production from 1975 and 1976 for both cod and haddock; and it was very difficult for them to reconcile what they saw, with the assessment and with the Council's assertion that we had a resource crisis on our hands.

By November 1977, having gone through the philosophical evolution I outlined, the Council decided to raise the quotas to meet social and economic objectives. However, this rapid change shook everyone's faith in the assessment procedures. If 6,000 tons was the right catch quota to prevent a resource crisis, how could the Council turn around and say, "Instead of closing down you can take 12,000 tons of haddock and 20,000 tons of cod."

Actually, this figure was compatible with stock rebuilding, it turned out, but stock rebuilding at a slower rate. It was intended to permit stock rebuilding for cod, but you catch cod and haddock together. If the fishery were to be closed for cod because the 11,000 tons had already been taken, then obviously it was necessary to raise the quota to keep the boats fishing. But if you are going to fish 20,000 tons of cod, you have to raise the haddock quota.

> ***"Overfishing is not an absolute concept. It's a relative matter in terms of one's objectives."***

The real issue, in my view, is not the validity of the scientific assessments. The scientists, of course, had based their estimates of permissible catches on ICNAF tradition, not on the Council's perceptions of what was proper for the fishermen. Their stock assessments were probably quite valid. The real issue, though, is what you want to do with the stock you've got on hand. That question and only that question--how to use your available resource--is what defines overfishing and should thereby set the limit for quotas and other restrictive management procedures. Let me remind you that overfishing is not defined in the FCMA; optimum yield is not defined nor does it have any obvious defi-

nition. Overfishing is not an absolute concept. It's a relative matter in terms of one's objectives.

Let me go back and talk about the nature of a fisheries management plan. On a number of occasions councils have requested one entity or another, an outside contractor, a university consultant, or the National Marine Fisheries Service, to write a plan for mackerel, or for scallops, or for something else. None of the consultants should have moved until they asked, "A management plan to do what?" Now if I'm a mechanical engineer and you come to me and say, "I want you to design a machine," I'll say, "Okay". Then there'll be a long pause until you tell me or I ask you, "What is the machine intended to do? Is the machine intended to peel apples, or is it intended to go to the moon?" Until it's decided what the intended use of the available fish is, there's not much that you can do towards writing a management plan. Yet that's what happened. We started writing a management plan without clearly deciding what it was that we wanted to do with the fish. While the FCMA mandates plans to prohibit overfishing, it doesn't define overfishing. The attainment of the goal has to be within the context of the objectives of the management plan.

Management objectives for fisheries have shifted over the last 45 years, and councils have the option of choosing their own management objectives. They can choose among a variety of objectives which might dictate quite different optimum yields. Unfortunately, optimum yield has been connected with biological criteria, which limits options rather substantially.

The flexibility with which management can now define program goals is behind New England's fishing problems, I believe, and may I point out that foreign fishing has nothing at all to do with this issue. You know, Pogo once said, "We have met the enemy and he is us." That's the situation in New England. It's a domestic fisheries problem, not a foreign fisheries problem, that's caused all of the turmoil in the last three years. There is foreign fishing going on off the coast, but it has received very little attention because it's not a problem, at least it's not a problem for us. The foreigners are not very happy because they are not catching very many fish, but that's their problem. The problem in the domestic fishing industry in New England has been the diversity and the lack of understanding of the objectives and the procedures.

Let me shift gears now and talk about the foreign fishing problem which we do have, which is the Canadian situation. American fishermen and Canadian fishermen like to say, "If the government would just get out of our hair and leave us alone, there would be no problem." They say, "We have fished with each other for years without problems." That's not true; there've been plenty of problems over the years. There've been vessels seized by each side. The English government at one point, at the request of the Canadian government, sent over men-of-war to seize American fishing vessels fishing off the Canadian shore. If we go back to the Treaty of 1783 which established the United States as a separate country, we find that the United States has an inalienable right to fish in Canadian waters. For 150 years Americans did fish on Canadian shores, subject to revision and modification of where, when and how they could fish, but all was not peaceful and tranquil in that period. There were notes back and forth, vessels seized, and vessels shot at. At the moment, a new situation exists. Canadians cannot fish in U.S. waters and Americans cannot fish in Canadian waters. The issue is Canadian access to very valuable scallop resources on George's Bank. With one exception, Americans don't have a great interest in fishing Canadian waters, but the Canadians have been very hard-nosed indeed about pushing to ensure their access to scallops on George's Bank. In attempting to reach an agreement, an extremely complex system of joint management has been proposed. U.S. fishermen object to the treaty, quite rightly I think, saying it would seriously erode the intent of the FCMA in New England waters. It would reduce American management of fisheries in the U.S. 200-mile zone. The treaty as presently written would give Canada very substantial influence in management decisions on pollock, cod, herring, scallops, and haddock, right up to the shores of New England, right in to the beach. They would have an active voice in how those fisheries were managed. There's a veto provision, so in some cases they'd have an overriding influence. Regardless of the merits of the Canadian claim to the scallops on George's Bank, this treaty would change Congress' intent in setting up the 200-mile limit in the first place. Congress never intended to have strong Canadian influence in the management of stocks very important to New England, and it clearly was not the intent of Congress to permit Canadian influence right to our beach.

The FCMA sets up what probably are totally unrealistic administrative procedures for reaching agreement between the two countries. It overlays a burdensome administrative procedure under the treaty on an already burdensome administrative procedure under the FCMA and triply compounds that problem.

Let's think a bit about the implications of Canadians having a strong management influence, in groundfish for example, in the areas where the United States has a strong interest. The Canadians have a different view of management than the United States. They equate optimum yield, a phrase which they also have adopted, with MSY. In their mind there's no difference between the two. In our view there's a lot of difference. We're supposed to start from MSY and then modify it according to social, cultural, economic, environmental, and other factors as appropriate, and the modifications and therefore the departures from MSY can be rather substantial. That means that the Canadian definition of overfishing could be very different from ours. From the point of view of administrative procedures it would be a very difficult treaty to put into effect.

"The Canadians have a different view of management than (we in) the United States."

Right now the odds are that there will be no treaty with Canada in the foreseeable future. That probably will have the most serious negative effect on Maine because a substantial part of the Maine fishing industry desperately needs access to its traditional fishing grounds in Canadian waters. This is the only segment of the American fishing industry that is as desperate for access to Canadian waters as the Canadians are desperate for continued access to scallop resources on George's Bank. The solution to this foreign fishing problem, in many people's view, is first to establish a clearer boundary between the two countries. That will probably have to be done by the World Court because each side is rather inflexible. Once the boundaries are drawn, we will be in a position to trade off access to resources. There's no question that there'll be trade-offs, but the grounds for the trade-off right now are not secure. I suspect this matter will be taken to the World Court, and it will take five to six years to establish national boundaries. Then the two countries will begin again to negotiate the terms under which one country has access to the other's waters.

I really don't know how domestic groundfish problems in New England will be resolved. The Fishery Management Council staff now is trying to develop what's called an Atlantic Demersal Finfish Plan which takes into account the mixed-species nature of the fishery, and works toward a multi-year analysis of recommended yields--not quotas, but recommended yields--which will give the greatest economic return to the industry. The plan will resolve the overfishing of certain species in the traditional way. However, the Council has learned, I think, that you cannot set highly restrictive quotas of this kind and expect that they will be observed and that they will, in fact, result in stock restoration. So it's developing a rather complex, so-called multi-species management plan, which is just a glib idea at this point, I fear. I'd like to note three phases here; they have something important in common. First is multi-species management, second is optimum yield, third is limited entry. These are all generalized solutions to fisheries management problems that nobody has yet figured out how to apply in a practical sense. There must be some kind of psychological law which says that when you come up against a real impasse you go around it by developing a phrase of this kind. It sounds good in general terms, but it becomes very difficult indeed to apply specifically to a practical management problem. I think these phrases all have that characteristic in common. I may sound overly cynical, but certainly in New England that is the situation. The Council is talking about multi-species management without really knowing what it means by that phrase. The Council is keeping its fingers crossed, hoping that by considering all of the catches of all of the groundfish together, and that's about eight species, it will find a solution to the problem of imposing quotas on one species at a time.

Question: How did the Council communicate with the fishermen on these policy shifts that you were making? Did you just rely on the newspapers, or what?

Reply: Announcements of the changes were done by mailing to all holders of licenses issued by the National Marine Fisheries Service and to each groundfish license holder. In addition, the Council has its own mailing list of 600 people. Of course,

there were newspaper announcements. Finally, there was a notice in the Federal Register, which doesn't really count.

Question: Was there any reasoning included on how you set the quotas, or did you just announce the figures?

Reply: The answer to your question is yes. There is a statement giving the reason, but in a relatively short news release of a couple of pages it's been found difficult to really give the rationale behind each decision. Each one had hours of discussion and many items of consideration behind it. So the answer is both yes and no. In a technical sense, yes, but from a realistic point of view, probably the reasons were not given adequately.

As you know, Council members are appointed for three years and may or may not be reappointed. That means that in three years, theoretically, the composition of the Council can change completely. At present we are trying to do away with quotas of any kind in groundfish management in New England, at least on an interim basis. Some of the Council members are new members who were not there in 1977 and 1978, did not live through that experience, and have no recollection and no real understanding of the many, many difficult hours we had. They don't understand. They say, "What's wrong with the quotas, why are you trying to get rid of them?" And we've gone over and over that ground with them, attempting, if not to persuade them, at least to instill within them an understanding of the whole sequence of events which led those of us who were around at that time to recommend that we do away with these kinds of quotas.

Question: As I remember, it looked like you were going to reach the quota in October of 1977. The industry said they couldn't live through a three- to five-month shutdown. They said it was an economic emergency and the act allowed the secretary to take action. The legal people said they weren't sure if an economic crisis constituted an emergency, but a biological crisis did. The administrators asked for a limit that would let the industry fish some more and not hurt the resource. The scientists said the fishermen could take another X tons if it was clearly an economic emergency, as long as the limit was X tons lower the next year. "Clearly if you won't do that you're going to hurt the resource," they said. It was my impression that the Council and the Secretary acted with that commitment, that the quota would be X tons less the following year than it would have been if the stock assessment indicated that the stock were the same size. And it was agreed. Then, as I remember, in November or early December, they said, we have another economic disaster, and what are we going to have for Christmas, nothing? They wanted the limit raised a second time. That time, the government stood firm and said no. So the Council came up with a new concept, and that was the approach of turning back the clock. That was the first time I'd heard that phrase in biological management. The concept was to start each new year afresh, not carrying over any limit agreements.

Reply: Let me put another perspective on that. You are quite right. The Council did say that. They said, "Look, we guessed wrong. The administrators, the managers, the Feds, the Council, the bureaucrats all guessed wrong. Don't penalize the fishermen for our wrong guesses." And there's a certain validity to that argument. The fishermen were saying, "We have more fish out here than we know what to do with." That was one of the reasons the Council proposed turning back the clock, setting new quotas.

Even though in 1977 the reported catch had substantially exceeded the 6,000 ton quota (later revised to 8,000 tons and later revised again) in 1978 an acceptable quota of 18,000 tons was permitted and biologically valid. In October 1979, the environmental statement indicated that the haddock stock, for all practical purposes, was reestablished on George's Bank enough to permit a quota of 23,000 tons. The comeback was less dramatic, but similar, for cod: 11,000 tons in 1977, 32,000 tons at present. The 1979 quota of 32,000 tons is very close to the 40-year removal average of cod from George's Bank.

Question: Are you saying that the stocks have gone back up, or are you just saying the quotas are set at levels as if the stocks were at the long-term average?

Reply: The environmental impact statement says these stocks are up and are at the long-term average; therefore, these are perfectly acceptable removal rates.

Question: What is the MSY for haddock?

Reply: About 30,000 tons.

Now let's talk about what actually happened in the 1979 fishing year. The fishermen did not reach the quotas; they caught less

than the acceptable biological catch based on the biomass assessment. Indications were that the fish weren't there. On the other hand, the quota for yellowtail flounder for the western part of southern New England was 5,000 tons. This quota was set to permit a catch that was considered unavailable and hasn't changed in three years. However, 13,000 tons of yellowtail was taken last year although the quotas for cod and haddock were not reached. There's yellowtail flounder all over the place off southern New England. It's a strange, ironic situation that at the moment nobody can adequately explain.

Question: With the Council pushing for quota removal, do you think that the fishery is going to go back up to its long-term average and not exceed that?

Reply: Yes, probably. First of all, if the stocks are near the long-term average, as the assessments indicated they were last fall, what's the point of quotas anyway? The original purpose of quotas was to rebuild the stock. Okay, the stock is rebuilt: why have quotas?

Question: You don't feel that there's a possibility of fishing pressure causing a crash, or of so many small fishermen getting into the market that it will become economically unfeasible to operate?

Reply: That's a possibility, but it's a possibility which is less unacceptable than is the cost of the quotas, the trip limitations, the vessel class allocations, and the quarterly allocations. The costs of those should not be underestimated. We have paid for them with the validity of the commercial landings data base in New England. The National Marine Fisheries Service depends upon that data base as part of the stock assessment procedure, and since 1977, it's been distorted by false reporting: cod reported as pollock, yellowtail reported as black-back or pollock. You've got to go pretty far to report yellowtail flounder as pollock, and it's been done. Nobody dares use the data base anymore. And that's one of the costs of the quotas and the trip limitations.

Question: Isn't the major thrust of the FCMA protection of the major resource, based on the best scientific data available, no matter how bad that data?

Reply: I'm sorry I don't have the Act with me. I'd like to be able to quote it exactly. It uses the phrase, "to prevent overfishing." What I said earlier was that you can only define overfishing in the context of the management objectives that you set up in the first place.

I find it difficult to believe that we must abide by any data, knowing it may indeed be quite bad.

Question: Maintain and rebuild?

Reply: Maintain and rebuild, that's right. All right, the stocks are rebuilt.

Question: Maintain?

Reply: Okay, maintain, well, who's to say if the stocks were rebuilt after the foreign fishing onslaught when they took 1.3 million tons in 1968, they're not going to maintain themselves under the present fishing effort by the United States. They may not. This morning, Alan Guimond was asked how to get fishermen to report data accurately if it's in their best interest not to do so? One good way is to allow a stock-collapse of which they are undeniably the cause. A collapse that can't be blamed on the Russians or the West Germans or anybody else. That may be the cost to get the kinds of data that are going to be needed to really understand the condition of the stocks. It's kind of drastic, but we've had a bad experience for three years.

Question: During those trying times when all the regulations were changed at such frequent intervals, do you think the Council was providing leadership?

Reply: No, the Council was reacting in a very harassed fashion.

Question: Were they providing the scientists in Woods Hole with clear-cut objectives?

Reply: No. But the scientist's job is to provide assessments, not to manage the fisheries. The assessments are not dependent upon management objectives.

Question: Another thing I'd like to bring up is that I sort of have to disagree with some of the things you've said, especially about stock rebuilding to achieve long-term averages. The haddock stock, for instance, may be at its long-term average in terms of its weight, but there's only one year class represented out there.

Reply: Three, three year classes.

Question: The '75 year class of haddock is the only substantial one that's been recruited in the last...

Reply: Seventy-six was also strong, and '78 is a strong year class, too.

Question: Seventy-eight is, but it won't recruit until sometime late this summer.

Reply: But it's there.

Question: That's true. The '76 year class is one of the lowest on record, if I can correct you.

Reply: I'm sorry; you're probably right. I'm thinking of cod.

Question: I was responsible for that haddock assessment, so I know pretty clearly what...

Reply: Okay, then I won't argue with you. Your point is well taken. You're saying that even though the biomass is up, it's based on a fragile foundation.

Question: The other point I'd like to make is that I think the assessment group in Woods Hole has over the years maintained a record of solid assessment work that could be checked.

Reply: I have no quarrel with the accuracy of the assessments; that's not my point at all. The problem is what is done with the assessment. There's been a lot of turmoil and talk about the validity of the assessment, and even though the Council has been involved in that to a degree, it has never really refuted an assessment from the Center. It has reluctantly accepted them and then made some modifications as the Act says it shall.

Question: Addressing the points that were just made, one thing that troubled me greatly when I was more closely associated with the situation was the apparent reduced concern for the needs of the resource by Council members if it meant curtailing fishing. In theory, if a quota is reached before the year is out, all fishing that will take that species must stop. I think it's a problem that Congress deliberately built into the Act, and it is difficult to live with it. I think probably the most distressing example was the one in New England that Spencer just addressed. In that case, the Council clearly understood the situation before the vote. You can't fish any other species without catching the ones that are in trouble; therefore, all fishing will stop for the rest of the year. Everybody understood that before they voted. Then in November, when it looked like they were going to exceed the quota and the NMFS was going to close the fishery, some voices protested, "Well, if we thought it meant that, we never would have voted that way."

This built-in conflict of interest caused by users making decisions was a deliberate part of the Act. I remember one highly-regarded leader on the Council, when asked if he would defend a biologically sound quota, saying, "I would let the people continue to fish, and overfish the resource rather than have them stop fishing for some period of time in the year. Raise the quota so they don't have to discard fish while fishing for another species. I think they should continue to fish throughout, even if it's at the expense of the resource, based on the best assessment data you have." Again, I'll never forget talking to a fisherman with whom I was very impressed, a highly regarded, articulate, highliner. He said, "Whatever you do it's not rational to stop us from fishing. Some of us will have to stop fishing before the resource is damaged, so don't worry about having to stop us." He said, "Economics will eliminate the weak, and the more successful ones will stay right to the end, and it won't hurt the resource." Could you address that issue for a moment, based on the views that you were offering us today?

Reply: Well what you are saying is that by definition, taking 11,000 tons of cod--the optimum yield--is overfishing. But as it turned out, 11,000 tons was set to rebuild or rather to increase a cod stock at a certain rate. Now, if you should choose to rebuild a cod stock at a faster rate, then the quota should be set at 8,000 tons; or if you should choose to rebuild the cod stock at a slower rate, the quota should be 12,000 tons. In which case 11,000 tons is not overfishing, is it? Choosing the rate at which to rebuild the cod stock is a social decision. Overfishing is only defined in terms of what it is you're trying to do. As I mentioned this afternoon, if you're fishing in the North Sea and your management objective is to increase the yield of protein from the North Sea, then you should fish out all of the cod, right down to the point where there aren't any significant quantities of cod left. This would reduce competition between cod and herring and as a result the North Sea would probably yield more protein than when we were catching both cod and herring. That's not overfishing; that's a

perfectly proper, legitimate management procedure to accomplish your stated objective because reducing the cod will increase the protein yield from other species.

> *"We accept the fact that doing away with quotas may result in serious depletion of one or the other stock . . . that may be the price we have to pay to re-establish sensible management."*

Question: You are saying that there are good years and bad years for the stocks and every year is going to be a good year. Now that's a nice optimistic view.

Reply: You mean in terms of recruitment, placing a lot of faith on a good year class coming along? Yes.

Question: It seeems the philosophy underlying doing away with the quotas is that every year is going to be good, and you know that that's not true.

Reply: The underlying philosophy of doing away with the quotas is not that we're very optimistic about future recruitment but that the quotas that we have now are not accomplishing anything useful and are disrupting data collection, disrupting confidence in management, and so forth. We accept the fact that doing away with quotas may result in serious depletion of one or the other of the stocks. That's certainly a possibility. But we recognize also that that may be the price that we have to pay to reestablish sensible management.

A Fisherman's Perspective of the Politics of the Fishery Conservation & Management Act

Allan D. Guimond, Executive Secretary
Atlantic Offshore Fish and
Lobster Association

President
Stonington Seafood Products

The New England fishery, like no other fishery, is diversified in geographical make-up, ethnic background, the type of equipment we use, and how and where we use it. In some areas of the New England coast people are essentially fishing the same way they fished 300 years ago. We have two distinct types of fisheries: the mobile gear fisheries and the fixed fisheries. Mobile gear includes trawlers of all sizes from small ones which can fish right on the beach to the larger offshore vessels. The fixed gear fishermen are the longliners, the crabbers, the potmen, and gillnetters.

In the New England area we have essentially eight major ports (Figure 1) and except for Boston, as you go down the coastline there is close to an equal distance between the ports. There are many smaller ports but these eight account for the majority of the offshore landings, and handle the bulk of all of New England's catch. New Bedford lands twice the value of fish of any other port--some 70 million dollars worth of product in the last year.

We have two very distinct types of fishermen bringing fish into these ports. Day-boaters go out from 12 to 24 hours, maybe a day and a half. Others who go out from 4 to 12 days, depending on the fishery

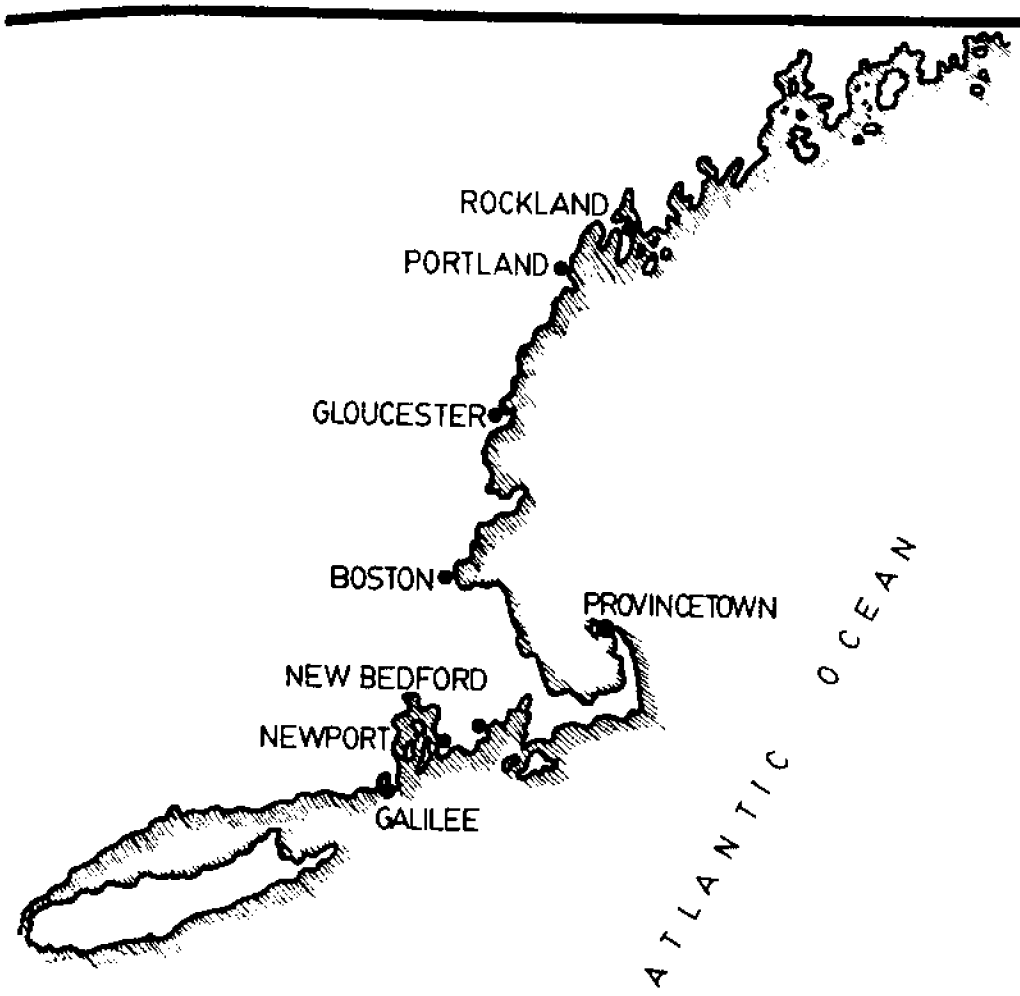


Figure 1.

and the weather. The levels of effort vary from small, individually-owned vessels to larger, company-owned vessels. My brothers and I are primarily involved in offshore lobstering. We have five 74-foot boats, and we fish a four-day and five-day cycle, usually between 32 and 35 trips a year. We fish some 100 miles off the coast in 120-190 fathoms on the average.

The difference between the offshore lobster fishery and the Maine lobster fishery is: the number of people fishing in the offshore fishery is in the neighborhood of 90 to 100, but the Gulf of Maine and southern Massachusetts inshore lobster fishery has 12-15,000 fishermen. Maine accounts for the vast majority of lobsters landed. Maine also accounts for a fair amount of groundfish.

Very rarely do these vessels venture down below Cape Cod. From Provincetown to New Bedford and Newport and Point Judith, there is more of a flatfish fishery. Sea scallops are another major item. Although Boston has a considerable number of landings, the amount is deceiving because Boston handles a tremendous amount of fish that comes in by road from Canada. The number of vessels that go into Boston is somewhat limited.

We've heard a lot of discussion about the FCMA and why it came about. Well, prior to the FCMA, foreign fleets were fishing off the New England coast literally uncontrolled even though there was an international agreement. They pretty much fished where and when they wanted. The U.S. did not have much say in what happened because it had only one voice in the international scientific community. That com-

munity included some of the eastern European block nations who were literally out only to catch the resource. I personally do not believe that they had any real regard for the resource itself. From the late 50's to the early 70's we had anywhere from 400 to 700 dory vessels off the eastern seaboard of the United States. The vessel types varied from 150- to 175-foot stern trawlers to 550- to 600-foot floating factory vessels. Their catches were astronomical. In 1973, the U.S. caught approximately 5 million pounds of codfish and the foreigners caught approximately the same. The U.S. caught 8 million pounds of haddock while the foreigners caught a little over 230 million. The ones for that year that really hurt were herring and mackerel. The U.S. caught 1.5 million pounds of herring while foreigners caught approximately 428 million pounds. The U.S. caught less than 3 million pounds of mackerel while foreigners caught 692 million pounds. The disproportion between foreign and U.S. catches was overwhelming, and 1973 was not the worst year. This situation stimulated the movement to consider extended jurisdiction.

When it actually came time to discuss extended jurisdiction, the U.S. State and Defense Departments were adamantly opposed. At that time, the U.S. fishing effort was weak both on the ocean and in terms of shore-side processing capability. The U.S. government has never looked upon fishing as a very viable part of the country's economy. Other nations, however, look upon fishing as a major industry and were very interested in procuring fishing rights off our coast. The Defense Department was concerned that other countries' jurisdiction would probably restrict military vessel and aircraft access. To the State Department, fishing rights had always been a little extra chip thrown on the table in international negotiations. Negotiators would look at how important it was for, say the Soviets, to fish off our coast, and if their fishing was going to be affected by proposed legislation then that legislation would include a directive that the regional management council and the Department of Commerce establish domestic quotas. The State Department would be directed to allocate whatever was left over to the foreigners. In the extended jurisdiction through the FCMA, the State Department saw a very serious threat to its position of manipulating foreigners through fishing rights. The U.S. had had one voice and one vote in the international conclave, but most people felt that it was not aggressively using its leverage for management purposes. We weren't just sitting down and saying we think the fisheries should run this way, "Spain, if you want other trade considerations, then let's get this together." Instead, the government's policy towards fisheries had resulted in obvious overfishing and virtually non-existent stock conditions that still exist today in some areas.

> ***". . . the argument that if we close them (foreign nations) off from our fishing grounds they are going to starve in the streets is false."***

To give you an idea of what I consider the wastefulness of it, I have some pictures taken on the east and west coasts prior to the passage of the FCMA. One, for example, shows a foreign vessel which has some seven to eight tons of fish on deck. They're keeping the squid but throwing overboard almost seven tons of butterfish. They were not trying to feed the hungry masses; it was an economic situation, it was business. A lot of the fish that foreign vessels caught off our coast came right into this country already processed. Now that's fine. Business is business. But the argument that if we close them off from our fishing grounds they are going to be starving in the streets is false. We are talking about a situation in which if we just take a little bit of care and caution and common sense we have a resource that can be there, literally, forever. It is a situation that no other industry and no other segment of the food producing industry has ever had.

The fishing industry has a greater positive economic benefit to New England than any other industry. Every dollar's worth of seafood that is landed there yields four to four and one half times its value in economic benefit to that region. Now in Rhode Island, where I come from, they claim that jewelry is the number one industry. But the jewelry industry does not produce even eight percent the economic benefit that the fishing industry does. Why? Because they normally have to buy the machinery out of state or out of country, and they have to buy the raw materials, the metals, from other areas, while the fishing industry has the raw product coming in right to the

shoreline. The vessels, service equipment for the vessels, crews, the people on shore that support the fishing industry, are all right here. These positive aspects of the fishing industry helped drive home the need to control the resource better.

Finally there was a move in Congress and we were able to get passed the extension of our fisheries jurisdiction under the FCMA.

Implementing a law is a lot different than passing it. Congress sometimes is very critical. It says why aren't you doing this or that? We gave you the law, now do it. Think of this: in April 1976, President Ford signed the legislation creating the FCMA. There was less than 11 months from the signing of that bill until it had to go into effect. Under the law, we had to have international fisheries agreements with other countries that wanted access to our zone. That meant that the State Department had to negotiate agreements and these had to go through Congressional oversight hearings, and Senate Foreign Relations Committee hearings before ratification. Then we had to establish preliminary management plans on how to manage the resource for each species that we felt had to be managed. We had to establish regional councils. We had to have people nominated by the governor, go through a selection process, obtain clearances for these people, and so forth. So the NMFS went from a very technical, non-involved role of regulating any fishery, to having almost total authority thrust upon it.

The period of time from signing to implementation was one of the most difficult periods the industry faced because of the uncertainty about what was going to happen. We found out that the industry did not have its act together on the east coast, especially up in our area. We still don't, and, because of the personalities involved, I'm not sure if we ever will. But the fishing industry saw the FCMA as an opportunity to get a little more protection than we had had.

However, as we saw the regulations start coming from the State and Commerce Departments, we said, "Wait a minute. Something is drastically wrong." Not only were we not getting additional protection, we were losing some of the understandings between different agencies, and even the suspension of the Bartlett Act was not being picked up by the new regulations. Foreign fishing restriction was minimal. Instead of getting better, things were getting worse. So that's when we started meeting with the NMFS and our local congressmen. Between our congressmen on the Senate and House sides we literally held some of the treaties hostage, which meant no one could fish until we saw some semblance of further protection for U.S. fishermen. In consultation, the Secretaries of State and Commerce made the majority of the changes that we felt, at a minimum, were necessary to afford the U.S. industry some protection.

It is interesting to note that those changes made in 1977, with the exception of one, have subsequently all been dropped or modified for a variety of reasons. However, I'll return to that later.

"The management councils have, can, and do serve a very important purpose."

Now, when you go to your congressman with a problem, he says, "You have a management council. Go work within the framework." The management councils have, can, and do serve a very useful purpose. I personally believe that the council concept is one of the best things that anyone can come up with, but right away, the fishermen were critical of the management councils. Some of their reasons were justified; some weren't. One criticism concerned how you get on a management council. Members are appointed by the governor. Let's face it, the person who happens to be with the right party will be the one nominated. We felt that the majority of people on the earlier council did not have a true sense of what the industry was or was not doing. I used to have the desire to be on the Council; I do not have that desire anymore. I am finding more and more that the types of things affecting the industry are beyond the Council's authority to regulate. The Council's structure, the way it is, the overriding consideration that the Commerce Department can and sometimes does exercise, lead me to believe that you have to be able to do more than you can by just participating in the Council. More and more, what we consider to be the real issues are being decided in Washington with the policy makers and with the administration. That is the place to concentrate some effort. And since we only have so much effort to put forward we have to cover all the bases.

Question: What regulations were decided in 1977?

Reply: The 1977 draft redefined the zones or "windows", as they were called, in which foreigners could fish, and when they were open for particular species. Before 1977, the windows were considerably larger--considerably closer to shore. We felt that at least it ought to be illegal for a foreigner to destroy our gear. So we wanted a system established in which foreigners would: 1) know where our equipment was; and 2) stay out it. We were able to get the Coast Guard to voluntarily take location reports from domestic fishermen of where their equipment was and broadcast this to foreigners. Foreign vessels were then to stay two miles from those areas. If a fisherman did not report his gear, then quite honestly the foreigners could not be held responsible for any destruction. Another regulation concerned an area commonly referred to as a 100 - 200-fathom curve. In some sections this area is less than a quarter-mile wide, and in some areas it's 10 to 12 miles wide, but it has always been the dominant grounds and the reproductive grounds for the lobster, and the over-wintering grounds for certain fish. The scientific community has said this area was extremely critical during specific months and warned against using certain types of equipment at those times. We felt that putting something on the bottom at any time in areas that are biologically critical during certain times could cause irreversible damage. That regulation has been dropped. The two-mile buffer zone is down to a mile. The councils are still trying to come up with regulations for the fixed gear industry that would make reporting gear mandatory in certain areas, as well as marking it so that both U.S. and foreign fishermen will have a good idea of what they're looking at when they come across it.

"We feel that the whole objective of regulation is to allow the U.S. industry to grow while decreasing foreign presence."

Other regulations in the 1977 draft allowed foreign fishermen certain bycatches, and some of the bycatches were of fish that we traditionally catch for the fresh fish market. For example, the Soviets had a bycatch allocation last year of approximately 70 thousand tons. This was predominately red and silver hake, some squid, but 21 thousand tons were of mixed species of fish. Some of these were very important to the U.S. industry. More importantly, we feel the whole objective of regulation is to allow the U.S. industry to grow, while forcing foreign presence. Part of the objective should be to provide incentive to the U.S. industry.

"For certain species, you cannot convince fishermen that the resource is in such trouble, because they are catching the limit more quickly than they could six to ten years ago. Someone's wrong."

Have the FCMA and the council establishment helped? Well, looking at statistics and comparing the U.S. and foreign effort off New England between 1973 and 1978, we have increased our landings in all categories. The increases vary from a minimum of 12 percent to 400, 500, and 600 percent. Foreign effort has been decreased to the point where total allocations to foreigners in 1979 and 1980 are less than the amount for a single species in 1973. So we're seeing a turnaround. There are a lot of species foreign fishermen are not permitted to catch. They are the ones that are in such terrible shape. We're still repairing what was done in the early 1970's by foreigners.

While statistically the situation seems pretty good, questions remain. How much regulation is good? The industry has looked at management plans that have come out specifically in New England. We have had numerous changes in our groundfish plan. We have had closures. We have had the closures lifted through political pressure. We've come full circle to the point where we're saying maybe we should start over. Maybe we should look at this thing entirely differently. In some fisheries, for example, fishermen can only catch a certain amount because the scientists and management plans say there is only a certain number of fish out there to be caught. For certain species, you cannot convince fishermen that the resource is in such trouble, because they are catching the limit more quickly now than they have in 6-10 years. Someone's wrong.

South Atlantic, Caribbean, & Gulf of Mexico Fisheries

William H. Stevenson, Director
Southeast Region
National Marine Fisheries Service

When I talk about the South Atlantic, I'm not going to be talking about the Western Central Atlantic area, I'm talking about the area of the southeastern coast of the United States from North Carolina to Florida and the coastal area of the Gulf of Mexico. First in the management picture, there are no commercial fisheries operating in a vacuum anymore, certainly not in the Western Central Atlantic area. But beside the commercial fisheries, there are many other factors to consider in managing an area. For that reason, in reviewing the Western Central Atlantic area, I'm first going to discuss the living marine resources and man's activities with those resources, including fisheries, fisheries development, habitat protection, and fisheries management. We face some challenges in managing ocean resources in the Western Central Atlantic. I'll end with a discussion of how we are meeting these challenges with some specific new fisheries management activities.

Historic, Geographic, and Social Background

One of the interesting things about the Western Central Atlantic is its history. Historically our interest in this area goes back to the days of Columbus. Our economic and political interest in this area goes back, as a nation, to the Monroe Doctrine. In it we said "What's yours is mine and what's mine is mine, and if not, we'll go take it away."

we still operate fundamentally on that basis in the western Central Atlantic. To the present day, the U.S. has significant interests in the area, reflected in recent statements by President Carter on our relationship with Cuba, particularly concerning Cuba's activities in Africa. Even more recently, the U.S. interest has been obvious in the debate taking place in Congress concerning the ratification of the treaty for the use of the Panama Canal.

The area I'm talking about today is the same as the project area of FAO or the United Nations Development Program (UNDP), generally bounded by 35° N 40° W, with a little added area. It takes in the central part of the North Atlantic Ocean from the eastern tip of Brazil to Cape Hatteras, North Carolina. It's diverse geographically, climatologically, politically, economically, socially, and biologically as far as terrestrial animals are concerned. However, it is one major marine ecosystem, as you will see. It includes major sections of the North and South American continents, as well as extensive island structures; some of the highest and lowest geological formations. Geologically it's formed by glacial deposits, oceanic processes, volcanic actions, and biological formations as well. Climatologically, it's tropical and subtropical. The tropical equator passes roughly through Panama. For those of you not familiar with this part of the world, the climatological equator does not lie along the geographical equator in this part of the world. It is found about 15° north, generally about where the Panama Canal is, then works its way back south. This gives an extensive tropical character to this area. There are about 44 nations with interests in the area, representing all political, cultural and religious heritages of Africans, Europeans, Indians native to the area, and modern civilization. These people have been using the ocean for food, for commerce, and for a sewerage plant for thousands of years.

Economically the inhabitants range from extremely poor fishermen, farmers, and hunters to inhabitants whose standard of living includes the most advanced technology. The most advanced areas include the area around Miami and Cape Canaveral on the coast of Florida, and the north central coast of Mexico, which is highly industrialized. The region includes plush tourist facilities and has a large tourist trade. In sum, the economic profile of the western Central Atlantic peoples goes all the way from the Amazon Indian through people as sophisticated as you and I.

A large part of the area is not economically self-sufficient; most of it is in what is termed the Third World. There are some encouraging economic developments taking place, particularly on the continental masses as a result of the expanded use of natural resources, particularly petroleum in Mexico and Venezuela, but also as a result of the development of fisheries throughout the entire area. Other areas are very limited in their potential for economic development, particularly the islands in the Caribbean area, because they simply do not have extensive natural resources although they have expanded populations. In fisheries the availability of modern technology, both of refrigeration and transportation, has expanded interest in this particular area, even all the way from the State of Oregon.

The U.S. has been utilizing the resources of the area as well as attempting to develop the capability of the area's local people over the years. Recently, we have made some significant inroads. For example, the traditional seafood product sold throughout the Caribbean, baccallu, or salt-dried cod, is being displaced by U.S. frozen products. (Baccallu is a Spanish word, meaning salt-dried fish. I've read of it being eaten by Irish monks going across the North Sea. Perhaps it is of Scandinavian origin.)

Most baccallu is produced in Canada or in Greenland. It's only with the recent advances in refrigeration that the United States has been able to penetrate the market in this tropical area with the distribution of frozen products. These have tended to replace salt-dried fish. The interest in salt-dried fish in countries with subsistence economies is the same as it is everywhere else. If that's all they can get they'll eat it; if they can get anything else they won't.

The social structure in the area includes large, poor population segments who support extremely small, very affluent and sophisticated segments in less-developed countries where less than 1 percent of the population owns or dominates 99 percent of the economic wealth. At the other end of the range are countries with a social order like that of the United States having a large middle class. This variance creates a series of stresses on marine resources, on the principle of the distribution of the wealth of the sea, and also on questions of access to marine resources. For example, the creation of a commercial

fishery may in fact displace a subsistence fishery culture and create very serious social and economic stresses.

Survey of Western Central Atlantic Resources

From the biological perspective, the terrestrial resources are extremely varied, as would be expected in a tropical situation. They tend towards great variations in species with relatively small populations, resulting in a very large biomass but no large single-species populations. The marine situation is somewhat the same. It encompasses a single major ecosystem but has a great biomass of many species. It extends from the eastern tip of Brazil northward through the Caribbean, through the Gulf of Mexico, and along the southeastern coast of the United States to Cape Hatteras, North Carolina (Figure 1). The environmental unity that allows this biological unity is the ocean system created by the division of the western-moving South Atlantic Equatorial Current that divides at the easternmost tip of Brazil, and moves then in a north and south direction. The northern branch is known as the Guyana Current. It moves northwestward along the coast and enters the Caribbean through the Leeward Islands. Small components of the North Equatorial Current enter the Carribbean through the Windward Islands and pass northward through the region. In other words, there are currents passing into the Windward Islands and back out again at the same time. This is a warm, tropical area. Few adults of the species that inhabit it stray northward of Cape Hatteras into colder waters; few larvae drifting in the planktonic gyre survive north of that point. There are some 160 rivers, including some of the largest river systems in the world, like the Amazon, the Orinoco, and the Mississippi Rivers, which annually add a significant amount of nutrients to this area. In addition, there are several significant upwelling areas which also contribute to the enrichment of the area and thus to the support of the large biomass. We find that some of the technical work done in that period wasn't bad, and for the region we're discussing today is still fairly valid.

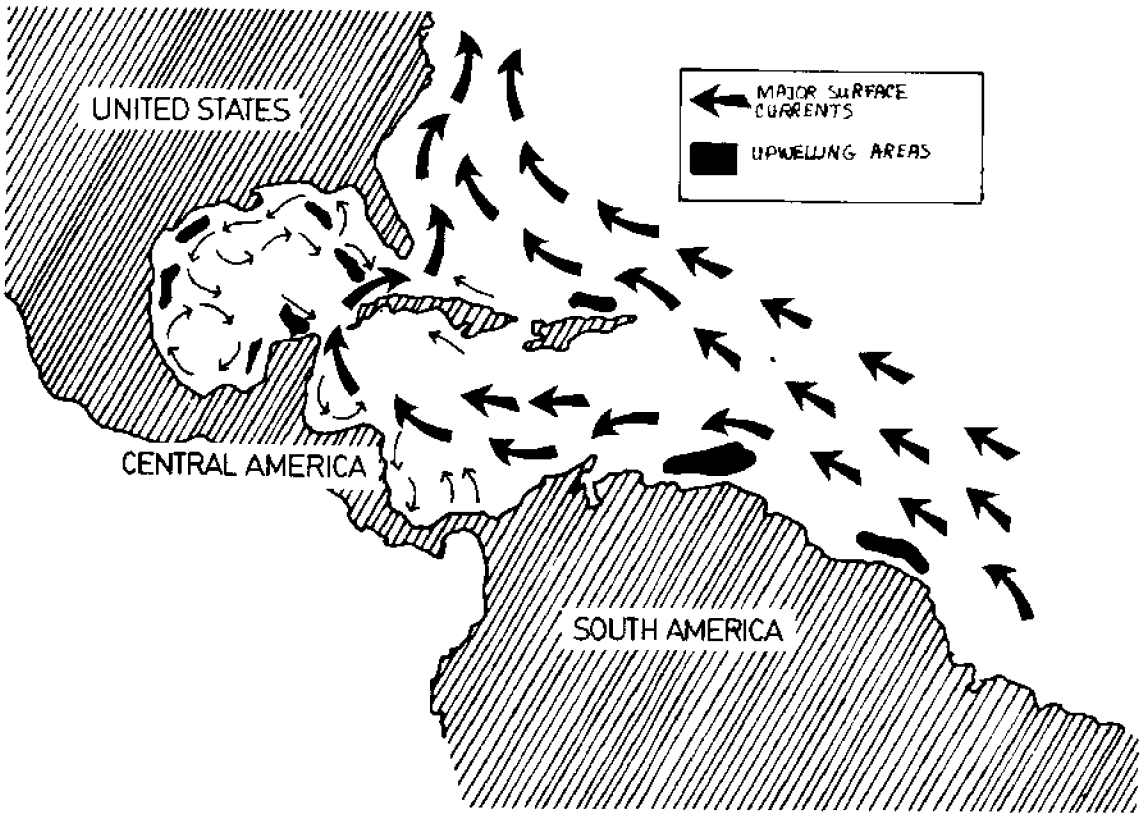
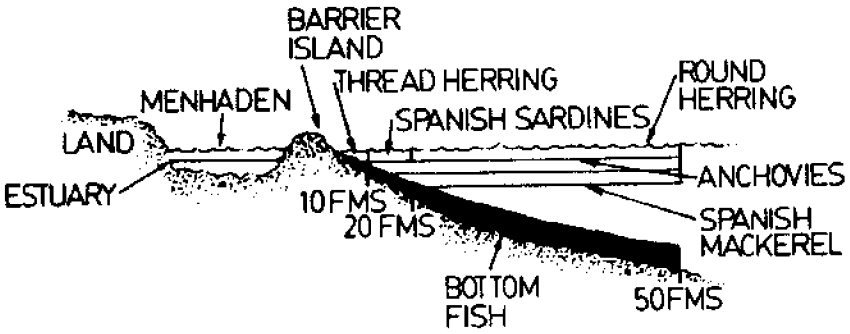


Figure 1. Environmental Characteristics of the Western Central Atlantic

It is our objective to identify, for the Western Central Atlantic, resources which have a large unused potential. In relationship to other areas, Figure 2 gives you some concept of the size of that. Putting numbers on these populations is difficult; numbers I will use in this talk are simply estimates, as specific data are lacking.

We normally divide these resources into two groups. The first is oceanic, which is primarily made up of pelagic tuna, billfish, flying fish, and sharks. I'm not going to dwell on this group today; its distribution is worldwide, and much information is available elsewhere about these fisheries. Our primary interest is focused on the coastal marine resources.

The Gulf and coastal fisheries are tied together by the common physical features of the region, such as the Gulf Stream and the Guyana Current. The concept of upstream recruitment of marine fisheries resources is extremely important in this area, whether you're talking about development of management or commercial fisheries. To substantiate this concept we need to do additional research by observing the larvae of such resources as the spiny lobster and some of the reef fish. These larval forms are carried by the Guyana Current and the Gulf Stream, and develop into adults downstream where they are harvested. This complicates resource management as management success in any one area may depend on management of the area as a whole, including territorial waters of 44 different political entities. Most of the resource information that we have pertains to the Gulf of Mexico. Figure 2 is an idealized cross-section of the Gulf of Mexico. It gives a very simple idea of the inshore to offshore distribution of the living marine resources found in the whole region. Important geographic features include land masses, estuaries, barrier reefs related to specific estuaries, and a long, shallow, coastal plain. We divide the resource habitat into a surface area and a bottom area.



RESOURCE SUMMARY	
SPECIES	BIOMASS (LBS.)
MENHADEN	1,200,000,000 (YIELD)
THREAD HERRING	1,200,000,000
SPANISH SARDINES	500,000,000
ROUND HERRING	1,000,000,000
ANCHOVIES	?
SPANISH MACKEREL	?
BOTTOM FISH	2,000,000,000

Figure 2. Idealized Cross Section of the Gulf of Mexico

The estuarine population ranges to about 10,000 meters offshore, another population ranges between the 10,000 and 20,000-meter perimeter, and another population outside of that. These populations "stack up" into a surface and bottom relationship. In considering management this becomes very important, particularly when looking at the availability of energy sources and the efficiency of harvesting, as energy may become very critical in the "kilocalorie-in kilocalorie-out" kind of formula.

In the estuarine area the menhaden resource in the Gulf of Mexico is a classic. Directly outside of this is a biomass of what we call the thread herring. The menhaden and thread herring are similar. They are both clupeoids which generally occupy the surface area and have a biomass potential of about 1.2 billion pounds per year. Thread herring have less than a two year life cycle from hatching of the egg to the death of the adult, as do menhaden. The data base for this information came out of adult biomass estimates made on egg and larvae surveys taken on the west coast of Florida. All other information we have tends to corroborate this. Our estimates for the entire Gulf of Mexico were extrapolated from this information. Further offshore from the thread herring are the Spanish sardines, which range between depths of 10 and 20 meters. (In the coastal area, 18 meters defines an area about 16 kilometers from the beach.) Outside the Spanish sardines we have what's known as the round herring, again, a resource with a very large biomass, which extends out to about a 90-meter contour. In this particular part of the world, we lose the coastal influence at the 90-meter contour. Here we get into oceanic forms about which there is little known in this area, either for the pelagics or the demersal species. Several species of anchovies range from the coast out to about 90 meters throughout this area. The size of this population has never been surveyed; however, anchovies have been taken in almost every fishery in the area. Feeding on these resources are the Spanish mackerel. The size of this population is not exactly known, but appears to be closely related to the size of the anchovy resource. It is with the Spanish mackerel that the commercialized recreational fishery begins to demand a share of the resource along with the commercial fisheries.

The bottom fish resource starts from the coast and extends out to about the 90 meter depth contour in the Gulf of Mexico, and similarly for the entire south Central Atlantic coast of the United States. It's made up of a very large, complex group of fish both vertebrates and invertebrates, with a total biomass yield of about 2 billion pounds annually. Commercial fisheries are built on both the reef fish and groundfish resources. The reef fish are dominated by the snappers and groupers. Among the crustacean resources, shrimp is the most valuable in terms of dollars, although it is not necessarily the largest. Other crustacean resources include spiny lobsters, blue crabs, stone crabs, and the swimming crabs. The molluscan resources include seven species of squid and five species of octopi that generally inhabit shallow water or grassy flat areas near the beach. Many other species inhabit shallow estuarine water, including oysters, clams, and conches.

The marine resource is very diverse. It is made up of many different stocks and populations, with no large, single population. Figure 3 shows the estimated domestic and foreign catches and unused potential for North America.

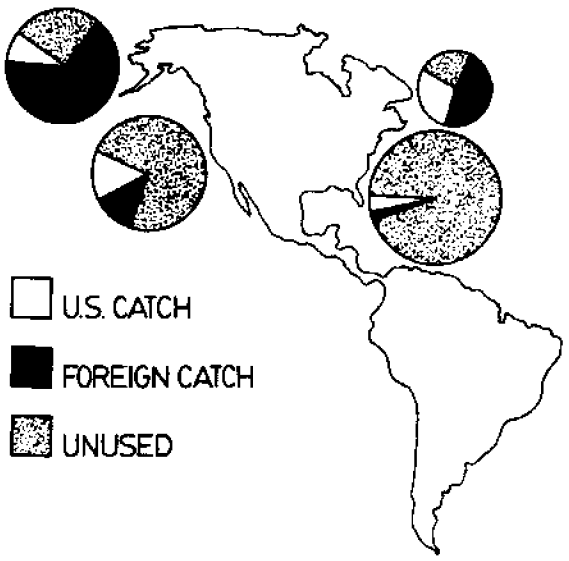


Figure 3. Estimated Foreign Catch and Unused Potential

Area Fisheries

What is man doing with this resource? Three groups participate in the fishery:

1. the subsistence fishermen
2. the commercial fishermen
3. the recreational fishermen.

". . . subsistence-level fishing off many of the islands and lesser-developed countries may greatly exceed (catch) estimates for both commercial and recreational fishing in the U.S."

It's difficult to be specific about the participation of these groups for the entire area because the data base is neither complete nor easy to get.

In many countries of Latin America and the island chains, production is largely for subsistence. Actual quantities for this fishery are lumped with the estimates for commercial landings. However, it's my opinion that subsistence-level fishing off many of the islands and lesser-developed countries may greatly exceed the estimates for both commercial and recreational fishing in the United States.

Having spent a considerable amount of time in these areas, I'm convinced that the subsistence take is substantial. This catch is important to the economic and social structure of the region. It is extremely important when making management decisions for commercial or recreational purposes. There are very few records on this fishery, and that is logical. Most of the catch is consumed by the fisherman's family or within the immediate sphere of his local village. It doesn't enter into any economic system; in many cases it doesn't even enter into a barter system. With the social structure of subsistence fishermen in this area dominated by an Afro-Spanish-Portugese culture, there are few records. The fish seem to dissolve as they hit the beach.

Commercial fisheries in the area are extensive and varied. The most recent Food and Agriculture Organization figures indicate that for 1977 there were 1,429,000 metric tons produced in the Western Central Atlantic. The great bulk of this product was from the United States, where in 1977 approximately 917,000 metric tons, valued at $546 million at the ex-vessel level, was produced. In 1978, the U.S. production was 1.3 million metric tons. This increase caused a significant increase to show up for the entire Western Central Atlantic. Most of it resulted from a boom year in menhaden in the Gulf of Mexico. The total yield of the entire area did not increase in proportion to the increase that took place there. Production of the Western Central Atlantic is slightly larger than the Pacific coast production in metric tons, but has less value. The difference reflects the catch which goes to the oil industry fishing on menhaden, a lower-valued, ex-vessel final product than most of the products coming out of the Pacific.

I'd like to summarize the commercial fisheries by species or groups of species. In doing so, I call to your attention a paper written by Rolf Juhl, which will be published in the Proceedings of the Gulf and Caribbean Fisheries Institute this spring (1980), where much of this information is available.

Mexico and Central and South America have large commercial fisheries for shrimp and clupeoids. There is much artisanal fishing from vessels over eight meters in length, boats under eight meters in length, and even subsistence fishing from beaches and canoes. The inhabitants of many of the Caribbean islands, including the Bahamas, rely on a fairly stable artisanal fishery for reef fish and spiny lobsters. Some islands rely almost exclusively on a single-species fishery, for example Barbados on the flying fish fishery. Cuba, in addition to a large artisanal fishery, also has large commercial fisheries for tuna, reef fish, and shrimp. These larger resources, however, happen to be off other people's coasts.

There is still a dory fishery for reef fish in Cuba, primarily fished by students in the 11 to 14-year age group. They pack 20 kids into a boat and send them off to another country's coast where they're not allowed to land. The boat lies 15 miles offshore and every morning they put a couple of kids over into a little boat to go fishing for reef fish. These expeditions are usually about three months long. They send the kids home telling them, "Now you've graduated." You can imagine how difficult it is to get people to stay in commercial fisheries.

Menhaden off the southeastern United States are the only clupeoid fully utilized in the Western Central Atlantic; the catch is 700,000 metric tons per year. Reported catches for other clupeoids in the Western Central Atlantic are highly inaccurate, as I've indicated. The potential harvest for these species has never been estimated except for a few species in the north-

eastern Gulf of Mexico, although there's common agreement that a large potential exists off Columbia, Venezuela, and northeastern Brazil.

Industrial clupeoid fisheries off the southeastern United States, (that's North Carolina and Florida), Cuba, Columbia, Venezuela, and Brazil, are similar. That is, there are various sized vessels fishing with purse seines for these resources. Fish meal and oil are the major products of the fishery. Along the southeastern United States a small artisanal fishery also exists from shore and from some boats. Beach seines, cast nets, and lift nets are used in conjunction with night-light systems which attract and hold the fish.

Most of these artisanal fisheries are for bait for the recreational fishery. Artisanal fishing occurs throughout Mexico, Central and South America, and the Caribbean areas. Here they use beach nets, cast nets, lift nets, and weirs. In these areas all of these fish are eaten.

The pelagic fishery for this area as a whole has been estimated to range between 1.3 million and 2.9 million metric tons. Oceanic pelagics, particularly tuna, are fished actively by many nations located both inside and outside the Western Central Atlantic region. There is some inaccuracy in this figure regarding tuna because a large portion of the tuna landed in the Western Central Atlantic, particularly the Canary Islands and Puerto Rico, is actually from outside the area, so the number does not necessarily reflect the catch originating from regional stocks. The pelagic fishery stocks are considered to be harvested close to or at maximum sustainable yield, and the commercial fishery consists of large vessels fishing with longlines or purse seines.

Billfish are fished recreationally almost exclusively throughout the area. The billfishing in this area off the coast of the United States is the only directed U.S. fishery for billfish. It is recreational only. These fish are released, or retained and mounted as trophies. In other areas of the Western Central Atlantic, many billfish are caught incidentally by tuna operators--long-lining or trolling--and are generally eaten. Swordfish are caught commercially off the southeastern United States with longline and harpoon by vessels of various sizes. Like the billfish, swordfish are also taken incidentally by tuna fishermen on longlines.

Coastal pelagic resources can roughly be categorized into those with and those without potential for fisheries development. Based on schooling behavior and gear susceptibility, you can pretty well identify those species which do have a potential for commercial fisheries development and those which will probably end up developed as a recreational fishery. Examples of those fish with the most commercial promise are the scads, flying fish, butterfish, and the halfbeaks. These fish occur throughout the area, preferring shelves and regions of upwelling along the continental shelves. They form dense schools, are attracted to bright light sources at night, and are often found in close association with clupeoids. Though no commercial fisheries exist for these fish at present, many are taken incidentally in purse seines with clupeoids off Cuba, Columbia, Venezuela, and Brazil.

A group of coastal pelagics not likely for commercial development are the jacks, dolphins, wahoos, bluefish, and bonita. These are not densely schooled, often solitary, and are active predators. They are seasonally abundant. As recreational fisheries resources they have an excellent potential. Along the southeastern United States there is no direct commercial fishery for any of these species except for a small beach seine fishery for bluefish.

"Most of this expansion is related to politics rather than the availability of natural resources."

An additional species likely to have limited expansion is the Spanish mackerel, which occurs predominately along the continental shelves, closely following the distribution of the clupeoids. The mackerel harvest off the southeastern coast of the United States is believed to be approaching maximum production when the recreational fishery is included with the commercial. The commercial fishery's potential is enormous. It has recently developed new markets for the Spanish and king mackerel. However, it has a major management problem which I'll address shortly.

The bottom fisheries have been divided into reef fish and groundfish. There are more than 30 varieties of commercially important reef fish, mainly snappers and groupers,

fished throughout the Western Central Atlantic area. These fish generally inhabit the hard-bottomed area of the continental shelves, the island shelves, and the oceanic banks at depths less than 250 meters. The groundfish include many species of croaker, drum, sea trout, and spot. The last is a grouper, the others are snappers. Spot are taken on longlines and can reach 40 pounds. They primarily inhabit soft-bottomed areas of the continental shelves.

Of the crustacean fisheries, the value of shrimp far exceeds the value of any other fishery in the area, in fact, of any other fishery in the United States. The shrimp fishery is not a single-species fishery, however. There are more than ten species included in it. The pineid shrimp of the Western Central Atlantic have an entirely different kind of life cycle than the pandalidae that inhabit the Pacific Coast. Shrimp appear to be fully exploited off the southeastern coast of the United States and Mexico, and by extrapolation throughout the rest of the Western Central Atlantic area. There may be some potential for expansion off Guyana and the Brazilian coast, and in deep water. Most of this expansion is related to politics rather than the availability of natural resources, however. The commercial shrimp fisheries throughout the region use bottom trawls. There is also an undetermined amount of artisanal and recreational fishing that occurs in all of the estuaries and lagoons, making use of cast nets, beach nets, and small trawls from boats and canoes. The Caribbean Islands do not have extensive shrimp nursery grounds due to the narrow coastal shelves in most cases. They do not have access to large populations of shrimp. Exceptions are off the southernmost coast of Cuba and the southernmost coast of the Lesser Antilles where there are relatively well-developed shelves and the governments operate both a national and an international shrimp fishery. With the exception of Cuba these are dominated and operated by U.S. interests.

There are two major species of spiny lobsters in the Western Central Atlantic area. They are caught almost entirely by traps, although there is still some free diving. The Bahamas, Cuba, the United States, and Brazil presently harvest the majority of the spiny lobsters. Handmade traps are used throughout the area except by the United States which uses a more advanced type of trap.

The crab resource in the Western Atlantic is dominated by the blue crab. The stone crab is caught off Florida and appears to be in maximum production throughout its range. Both of these are trap fisheries, labor-intensive, with a relatively small amount of capital involved. Other species of swimming crabs in the Central and South American area are presently under-exploited; we're not sure of the production level.

To round out the fisheries picture, let's look at the molluscan resources. The seven species of squid all occur inshore throughout the area and are an unutilized resource for which there is a very low demand at present, both culturally and economically. We don't know too much about this abundance, the life history, or whether this resource has potential for development.

Most of the five species of octopi are taken at the present time either as part of a non-directed fishery or in the lift-net or trawl fisheries operating throughout the area. Countries presently harvesting octopi are Mexico, Venezuela, Cuba, Dominican Republic, and Puerto Rico. Mexico and South America have commercial artisanal fisheries for oysters, scallops, clams, whelks, and conchs. Increased production from these is, again, expected to be very limited since most of the resource is being utilized in a large subsistence fishery. The major molluscan fishery in the southeastern part of the United States is scallops, which I will discuss shortly.

In addition to the commercial fisheries, the recreational fishery is extremely important in the Western Central Atlantic. To give an idea of the recreational fishery in this area, let's look at some statistics. According to the most recent figures, about 8.5 million anglers participate in finfish and shellfish fishing in the southeastern part of the United States. This does not include any recreational fishery outside the continental waters of the United States at the present time. The production from these 8.5 million anglers is about 46,000 metric tons of shellfish and about 160,000 metric tons of finfish. You can see that the production from the

recreational fisheries is a significant part of the action. It raises some very interesting questions about just what a commercial fishery is when we find such high levels of capitalization, investment, and infra-structure required to maintain recreational fisheries. In 1975, a record $933 million worth of goods and services related to recreational fisheries were purchased. I'm not talking about the multiplier effect; I'm talking about the actual commercial value of the fishery. When we see figures that are in a commercial fishery class, I think it's necessary to start looking at the recreational fishery for its commercial impacts as well.

Human Impact on Western Central Atlantic Fisheries

I'd like to turn now to the impact of man's activities in the Western Central Atlantic on the area's fisheries, but I want to be careful not to focus on fisheries management as such. In considering man's activities in the southeast, we have to consider habitat modification, environmental destruction, effective utilization of the resources, and sound management.

In habitat modification, the major issue in the Western Central Atlantic area is the lesser-developed countries. In these countries there is an intense desire to play "catch-up ball" in commerce and in industrial development. As I've indicated, most of the area has extensive coastal plains, with large watersheds contributing to the habitat of most of the coastal species. In the United States we now want to protect these areas; we have passed rigid laws to protect and dominate them. We tell countries like Venezuela, "Be careful how you develop your oil fields near Caracas; be careful how you develop your tourist beaches near barrier reefs so you don't make the same mistake we did and destroy the very environment that you want to utilize."

These less-developed countries reply, "You did all your development and now you don't want us to develop so that you can continue to use your industry to develop our resources. We'll start worrying about the effects on the habitat at the same time you did--after we have our industry developed."

This dialogue is an example of why we can't just limit our scope to management of the stock, but we must also consider habitat and environmental degradation. In the United States we manage this aspect through our permit system with the Corps of Engineers. Just recently the Coastal Zone Management Act has allowed us to begin significant movement in the direction of preserving or rebuilding the coastal environment. We must reduce the amount of wetland that is being converted, modified, or lost in the southeastern part of the United States. In the State of Louisiana alone we are losing or drastically modifying approximately 16,000 acres per year. You may not think that's very much considering there are 2.5 million acres to start with, but this area supports the two largest fisheries in the United States--menhaden with the largest poundage and shrimp with the largest value. The big question is how much can we lose and still maintain present populations? It's an interesting question and one you people are going to have to solve.

Management challenges

We have some very unique problems involved in the utilization of the fisheries resource of the southeastern United States. As I've indicated, the large subsistence fishery is increasing in size. Another problem is the disparity between the food fisheries and the recreational fisheries. The United States for the sake of recreation, "throws away" large quantities of what other countries consider food. In this regard, we have seen some shift lately; some recreational fishermen are selling their catches to the commercial industry. We now can find the fisherman who catches an 800-pound bluefin tuna for sport selling it on the dock to the Japanese commercial industry and still maintaining his fanatical sportsman attitude. We may have to shift our attitude on whether these people are recreational or commercial fishermen.

We find management exists on two different levels in the southeastern part of the United States. One level is state government. There are ten states, Puerto Rico, and the Virgin Islands included. They have managed the fisheries in their coastal areas for years without any assistance from the federal government. The Fishery Conservation and Management Act of 1976 (FCMA) brought three management councils into the system in this area as you're all aware (Figure 4).

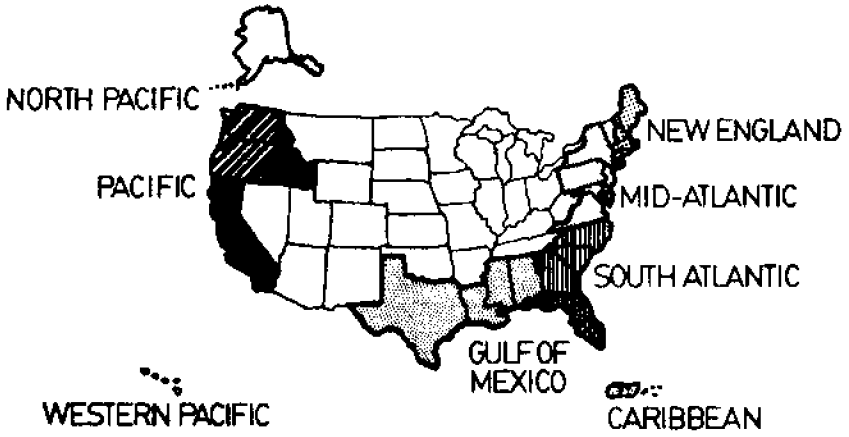


Figure 4. Regional Fishery Management Councils

I am a voting member of the Gulf Council. This group's primary focus is on shrimp, on the coastal pelagics including the Spanish mackerel and other clupeoids with the exception of menhaden. If you recall, menhaden is primarily an estuarine species and outside the scope of the FCMA. The Council is also participating in the development of an offshore, area management plan for billfish.

The South Atlantic Council is more recreationally oriented. For very good demographic reasons, this council's area does not have a commercial fishery; however, as a recreational and tourist area it is being developed rapidly. Its interests are in billfish, snappers and groupers, and in developing shark, king mackerel, and Spanish mackerel into recreational fisheries. Note that the

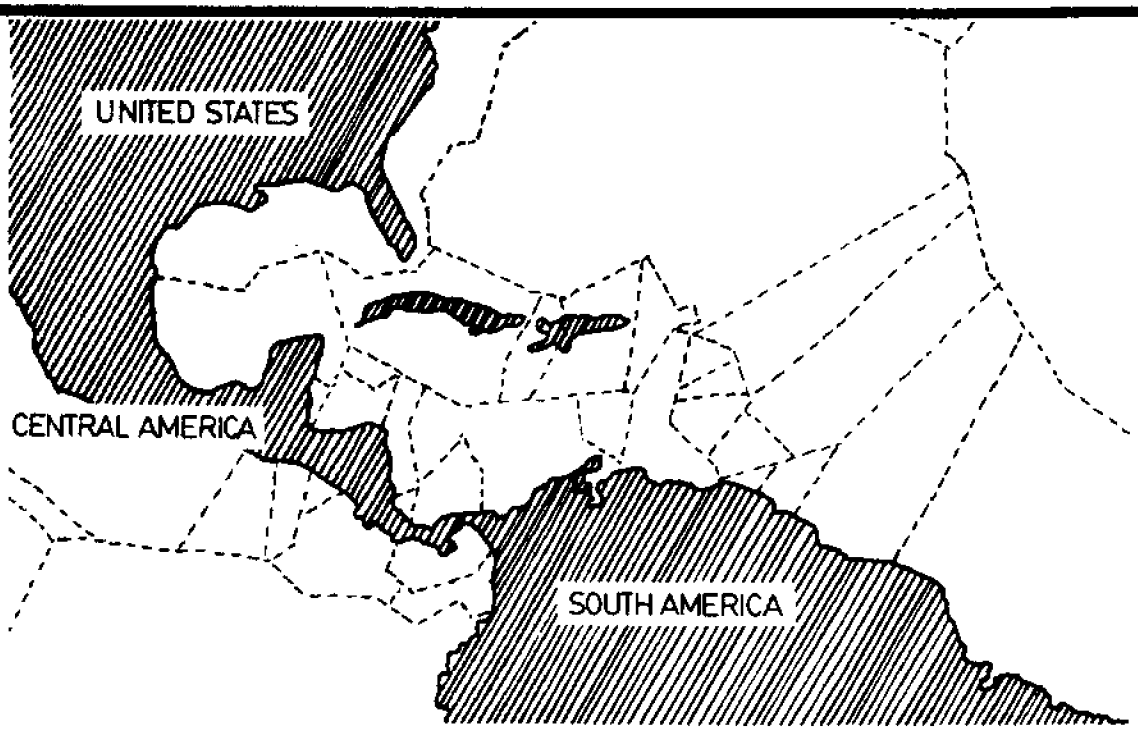


Figure 5. Political Fishing Zones

South Atlantic Council is interested in developing a recreational fishery with the same stocks the Gulf Council would like to develop into commercial fisheries. This presents an interesting dilemma.

The Caribbean Council, a small council with seven voting members, has its own problem in developing fisheries. This problem centers around the overlapping 200-mile territorial areas when they are logically extended out through the Caribbean area (Figure 5). Considering the common ecosystem and the transport of species through international waters, the need for an international management system in this area becomes obvious. The Caribbean Council is interested in managing snappers, groupers, and billfish.

A significant management problem in Western Central Atlantic fisheries is the difficulty in responding to the short life-spans of the tropical and subtropical resources. An example, particularly with regard to commercial ventures, is depicted in Figure 6. There is normally a lag time before a commercial fishery can respond to a rapidly developing population. This causes a loss in the potential harvest. We can look at that lost resource in two ways. We can see it as lost economic power that can never be recovered, or as automatic insurance of the continuance of the resource. There is always a lag in time between the point when the potential of a very large bumper crop is identified and the point when the fishery is mobilized. We're generally talking about annual crops for which the optimum harvest time is so short that the fishery never really catches up to the stock level before it starts to fall off naturally.

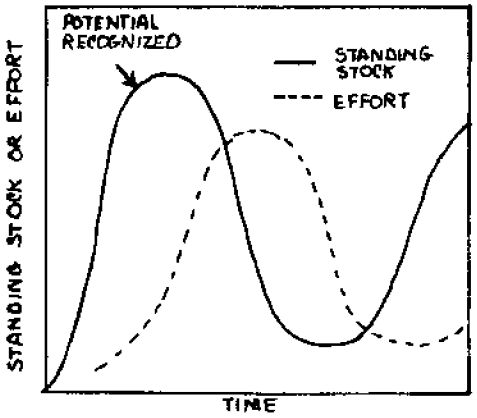


Figure 6. Conceptualized Fishing Inefficiency for Some Tropical Resources

The classical example is the calico scallop. In longer-lived stocks the fishery can take a year or more to develop its commercial capability before losses from natural mortality become great. The effective harvest period of the calico scallop, however, is 60 days; for shrimp, the peak period is about 120 days. It's difficult to be able to expand harvest capability, storage capability, and market within that time frame.

Another option is to develop the industry so that it can handle the peak harvest level and then find some other species to fish during periods of lower production. Figure 7 depicts the classical example of short lifespanned resource production--the calico scallop off the Florida coast. Notice the relatively short period of time it takes production to go from zero to the peak, and the great fluctuations in the abundance of the species and the level of operation.

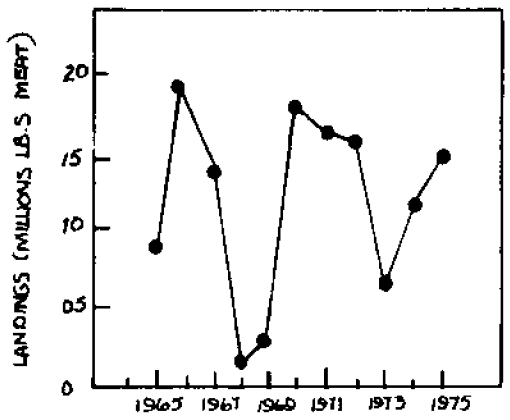


Figure 7. Calico Scallop Landings from Florida East Coast

A very large human population growth, both as a result of immigration and normal growth of the indigenous population, causes other problems in the southeastern United States. This phenomenon is generating conflicts in the use of the Gulf of Mexico and the South Atlantic between industrialization, the development of transportation facilities, recreation, and the natural emergencies which are generated by expanded development.

One would think that the recent blowout of the offshore oil well in Mexico would excite this conflict. Now terminated, this was the longest and largest commercial oil spill in the world. However, from a commercial fisheries standpoint, there was

limited damage in a limited area of the southwestern Gulf of Mexico, all of it in Mexican waters. We have been unable to identify any damage whatsoever to any U.S. resources on either a short or long-term basis, including some of the United States' interests in Mexican waters. Although we've heard so much about the danger and the damage involved, it just hasn't turned out to be there.

With expanding populations and leisure time, conflicts between recreational and commercial fisheries will increase. In Louisiana there are approximately 25,000 fishermen who participate in the first three days of the recreational shrimping season. The shipyards and the local industries have between a 40 and 60 percent absentee rate during the first three days of the shrimp season. Shrimp fishing supplements both food and income; it's serious business.

As I mentioned, there is a major conflict over the utilization of mackerel in this area. On the east coast of Florida they want to protect mackerel for recreation, while on the west coast of Florida and around Texas they want to develop them for commercial purposes. An effort to reserve billfish entirely for the big game sportsmen has created a real problem in the management of billfish in relation to the Japanese longline fishery in the Gulf of Mexico as a directed fishery for tuna. As a directed fishery for tuna it is protected by law, and under the FCMA we are not permitted to manage it. The only management we can exercise is in a secondary manner--we can manage the billfish that are taken accidentally.

We're having some problems trying to fit the principle of the FCMA to the tropical fisheries. In this area we have very rapidly developed fisheries with rapidly developing needs for management. The primary objective of the FCMA is preservation of the stocks; however, most of the stocks we work with have short life cycles and our capability of decimating those stocks is considered almost nil. Therefore, the primary objective of managing fisheries in the southeast is for socio-economic purposes. The exact intent of the statute to manage for primarily socio-economic objectives is unclear as it is presently written.

Another interesting problem is a management conflict between endangered species and coastal fisheries. The conflict between shrimp and marine turtles, one of the most valuable fisheries and one of the most seriously endangered groups of species under the control of the United States, is an example. We have little or no problem with whales in the Western Central Atlantic Area, although there is some problem with porpoise in the southeastern United States.

Concerning foreign fisheries, the southeastern United States faces a mixed problem. The U.S. has an interest in the production and acquisition of the resources of many countries from Brazil through Mexico. We are interested in access to both their resources and markets.

On the other hand, Cuba, Mexico, and Japan are interested in fishing in the Gulf of Mexico and the Puerto Rico-Virgin Islands areas which are under management of the U.S. This includes countries like the British Virgin Islands, the Dominican Republic, and Haiti (Figure 8). We have been unsuccessful in developing a positive relationship with the Bahamian government for access to the spiny lobster resource, with the Dominican Republic for access to their snapper-grouper resources, and most recently we have been phased out of our access to the Mexican shrimp resources in the Gulf of Mexico. I might add that the problem there is not the government of Mexico's desire to exclude the U.S. from their fishery. They fully realize that a large percentage of their market is in the United States and the small amount of product which American fishermen take from Mexican territorial waters is not significant. However, the government of Mexico is searching for a way to remove the Cuban fishing industry from the coast of Mexico and the Gulf of Mexico, where with the assistance of Russia, it has achieved dominance over the years. The U.S. was included in the Mexican government's plan to move all countries outside of their 200-mile limit.

Question: Concerning billfish management in the plan you are developing, how much of the total resource do you estimate actually lies within our jurisdiction?

Reply: Something less than 10-15 percent of the total population of the North Atlantic--and it's unknown what mix, if any, there may be between the North and South Atlantic populations. Part of the debate is whether or not we can manage effectively considering that we control such a small percentage of the resource. The current thinking on the management of billfish on the east coast is that the goal

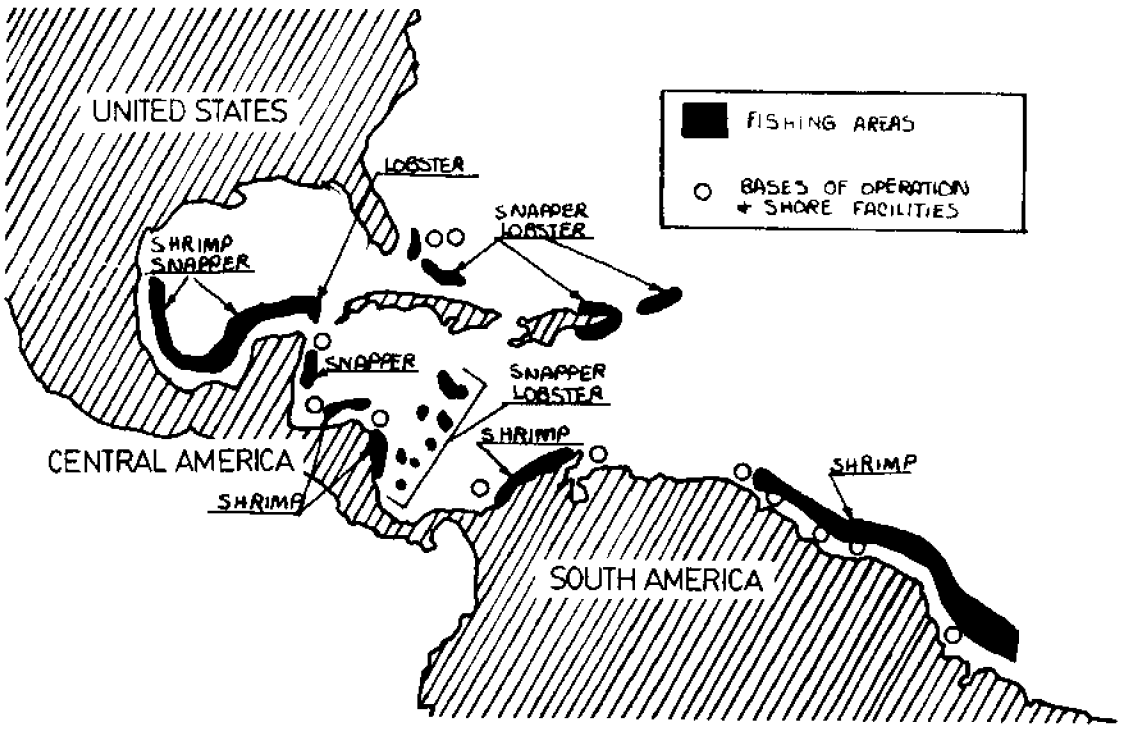


Figure 8. U.S. Distant Water Fishing in the Western Central Atlantic

should be a political-social-economic one rather than the biological preservation of the stock.

Question: *Concerning the recreational value of $900+ million in 1976, is that total economic impact or is that just direct sales?*

Reply: That's goods and services without the multiplier effect. That's talking about bait, ice, fuel, motors, fishing gear, and costs in transportation and food for the estimated portion of the tourist trade that participates.

Question: *How does that relate to the impact of commercial fisheries?*

Reply: In 1978 the economic impact of commercial fisheries was probably $100 million ex-vessel. This difference is creating a very interesting difference in attitudes. In Florida, for instance, where both these industries co-exist, the director of the state department of natural resources recently said that every decision his department makes relating to the management of living resources will be based upon its impact on the tourist industry. Many commercial people see doom in this statement, but you have to listen to what the man is saying. He's not saying recreation interests, he's saying tourist interests. Now, there are more people who are interested in serving Florida seafood in their restaurants and are, therefore, interested in maintaining a commercial fishery, as well as people interested in a recreational fishery. Also, the question is one of balance.

Question: *I'm doing a paper on shrimp separator trawls, and in doing some reading I've learned there is a tremendous bycatch problem in the shrimp trawl industry to the point where the amount of fish thrown away exceeds the actual shrimp catch. How soon will a separator trawl be developed? When can we expect it?*

Reply: Shrimp separator trawls have become significant to us. One reason is that the bycatch-to-catch ratio of shrimp trawls can be as high as 18:1. The second reason is that endangered species are involved. One part of that bycatch is marine turtles. There's a significant interest among managers and among some of the more sophisticated elements of private industry in separator trawls. On the other hand, the great majority of the commercial

industry--which consists of single family operations with one to two boats oriented towards profitability rather than capitalization--are less concerned. We expect a separator trawl with limited capability for marine turtles to be available in about one year. A completely effective fish separator trawl will be developed in the more distant future.

Use of the shrimp separator trawl to protect marine turtles would have to be implemented by regulation, in my opinion. When a fish separator trawl is developed its acceptability will depend upon the economics of the shrimp industry at the time. Without a good market and a simple separator trawl the industry will be reluctant to accept a change. In Latin America there would be even more resistance to overcome because industry there is more labor-intensive than in the U.S. I don't see any hope for a separator trawl there at all.

If anything, as protein becomes more scarce, as the market for those bycatch products expands, I see more and more of them sold for food. This practice has already started in Brazil. Just in the last year Brazilian shrimp fishermen have been required to bring in their entire catch on the last day of the trip and not throw any of the discard back into the sea. This fresh fish catch is sold locally.

Question: Very roughly, in a year, what is the discard of finfish in the U.S. fishery in the Gulf?

Reply: Oh, about 1.5 billion pounds.

Question: Aren't those largely croaker?

Reply: Cyanids and gadids: croaker, trout, spot.

Question: Could you talk a little about Western Central Atlantic Fisheries Committee (WECAFC)?

Reply: The Western Central Atlantic Project, sponsored by FAO, funded by UNDP, is a project started about three years ago to assist the area's underdeveloped countries in the utilization of their fisheries resources. There are two or three different segments to the system. The WECAF Committee, made up of representatives of all the countries concerned, is presently chaired by Cuba. It meets on a semi-annual basis to discuss various projects that the nations could get into collectively. The committee's present focus is the development of statistical systems to acquire additional information about the stocks and their utilization throughout the Caribbean area. WECAF has a scientific arm called IOCARIB. In addition to the technical side of a data collection program, IOCARIB is attempting to develop a program for queen conch aquaculture. Queen conch is a very popular local food product, an algal-feeding conch found in the vicinity of several islands throughout the Caribbean, that is almost approaching threatened or endangered status. There is already a market for it and it appears it might be easily adaptable to cage culture.

We're also working with IOCARIB on the management of turtles; we want to get funding for an international symposium on the status of marine turtles in the region.

Question: You said that tropical marine species are difficult to manage. Is that due to their extreme variability?

Reply: Primarily, yes. It is difficult to build a fishery management plan that will allow for that kind of flexibility. However, there is a legal-philosophical bind in addition. Scientists today say that because of the short life cycle of these species and the variability between fishable areas and non-fishable areas, the chance of depleting many of these stocks through overfishing is small. The FCMA says that the primary purpose for applying many of the act's standards is to conserve the stock; you can't make management decisions for economic reasons alone. Now, if you start with the position that you can't overfish the shrimp stocks then there's no justification for managing shrimp under the FCMA except to insure a positive natural environment. The people who live there, however, want to manage shrimp production. They have good reasons. In 1959 they were catching nearly 100 million pounds of shrimp per year with 4,000 vessels, while in 1978 they were catching nearly 100 million pounds per year with 22,000 vessels. How big does the bubble get? With the price of fuel and labor, there are many people in the industry who want management of the producers and a limited entry program.

Under FCMA limited entry is not permitted exclusively for economic purposes. We have here a fishery that obviously is going to be managed for economic reasons or is going to have a major economic collapse.

Question: If this area is unified from a biological standpoint, why do you have councils with such varied goals?

Reply: That is the result of political institutions that were already in existence before the councils were formed. The Gulf and the South Atlantic, which is treated by the federal government as one region, really operates on two different bases. The Gulf tends to be an area of expanding industrial interests, while the South Atlantic seems to have limited coastal industrialization. It's headed more into tourism and recreation in the utilization of its marine resources. The two regions have different directions, different goals, different "drumbeats." And the Caribbean is entirely different.

Question: What problems do offshore oil pipelines cause for draggers in the bottomfish fisheries?

Reply: In my opinion, the obstruction that I think you are referring to is usually cited out of context. This is an emotional issue that's been going on, to my knowledge, for 10 or 12 years. It recently peaked with the passage of the Outer Continental Shelf Act which gave the oil companies responsibility for establishing a bank, if you will, against which claims can be made by fishermen who have sustained damage because of pipelines.

Initially, when the first offshore pipeline was built 50 years ago, the oil industry was unregulated, undisciplined, immature. It lost barges, had loads of pipe fall overboard, caused all sorts of problems. Out of that grew a conflict with the fishing industry with whom they shared the area. As the Federal government got more involved in management of the oil industry, and the Offshore Oil Association of the oil companies began to realize that they were destroying their own nest, the industry began to clean up its act. We get few reports of major damage of this kind anymore. The oil industries have been absolutely cooperative. If a pipeline is found that has been exposed because currents have changed, they bury it again as soon as they are informed. They don't want any problems.

For the positive aspect of the relationship between the two industries, consider the 16,000 offshore oil rigs in the Gulf of Mexico. If you want to start a problem with the fishing industry, you try to take those rigs out. Recreational fishermen will object strongly because the offshore rigs are ideal environments for hook-and-line fishing.

Industrialization of the Menhaden Fishery

Patrick J. Doody, President
Zapata Haynie Corporation

The U.S. menhaden fishery, located off the eastern and southeastern coasts of this country, has a long history.

The first record we have of a fishery specializing in menhaden is dated 1811 off Rhode Island. The object then was to collect menhaden oil as a replacement for whale oil--a use still viable today.

That fishery moved to the coast of Maine during the 1850's and there an important discovery was made. The processors found that if the leftovers were sun-dried after the oil was extracted, they made an excellent fertilizer.

From that start, Atlantic menhaden fishing has grown until today it stretches from Canada to the northern border of Florida. Sole proprietorships, usually families, dominated the early Atlantic menhaden industry. Initially sailing vessels and then steam-powered vessels were used. The large vessels used today to fish menhaden are still called steamers, even though diesel engines replaced the steam boilers years ago. Wooden-hulled purse boats which set the nets, were propelled by oars.

A crew of 40 to 50 men was not unusual on the steamers. A large crew was needed both to row the boats and to haul the cotton nets. The cotton fabric was too weak to be hauled by powered winches. Nylon netting revolutionized this part of the fishing operation in 1959. Today, mechanical power blocks can haul in a net in 45 minutes instead of four hours, and it requires a crew of 14 instead of 40.

The first menhaden fishery in the Gulf of Mexico began operations around the turn of the century. The industry stayed small until after World War II. However, Gulf fishing now accounts for two-thirds of the menhaden catch in the United States.

After World War II two things encouraged the menhaden industry. One was the growth of new markets and the other was the introduction of new technology.

One of the new markets is the broiler-chicken industry, which has grown substantially in recent years. Enriching the chickens' diet with four or five percent fish meal (the same meal that formerly was used for fertilizer), makes them market-ready five days sooner than they would be on a regular diet. A second new market has developed in Europe based on the discovery that menhaden oil is an excellent margarine ingredient.

We are also finding a use for Atlantic menhaden oil (which differs slightly chemically from Gulf menhaden oil), in the paint industry. One product example is Rustoleum paint. Its penetrating, rust-preventive quality is the result of the fish oil it contains; it does not dry before it penetrates.

Marine technology has, of course, improved since the early 1800's. In addition to nylon nets, we now use all-welded steel, twin-screw, diesel-driven vessels with 1500 horse power in place of wooden-hulled boats under sail.

Menhaden are easily detectable in daylight, and spotter airplanes are another relatively new piece of technology, offering a substantial improvement over the crow's nest. After World War II the aviation industry turned its energy to light planes and businesses such as ours found many uses for them; trained pilots were in abundance. Today the spotter plane is an indispensable part of menhaden fishing.

A final advance in technology is the development of significantly better processing techniques which I'll touch on shortly when I describe a typical processing plant.

The 160-year history of the menhaden industry has seen many changes, but none more sweeping than the transformation of the industry's own internal organization.

Those scores of sole proprietor operations that dominated the menhaden industry well into this century are no more. Once there were perhaps 70 fish processing plants on the Atlantic, with, say 140 boats, two to a plant. Today there are five major corporations, three of them publicly owned, all capital-intensive.

Zapata was the first publicly owned company to enter menhaden fishing with the acquisition in 1967 of two processing plants in Louisiana. Before that Zapata was primarily involved in offshore oil exploration.

In 1972 Zapata expanded by acquiring an old family-owned business operating in Virginia and Mississippi. The combined operations are known as the Zapata Haynie Division of Zapata Corporation.

The other two publicly held companies are International Protein, which bought out a private company in Louisiana in 1971, and a British conglomerate which purchased Seacoast Products. You may know Seacoast Products by another name--the J. Howard Smith Company which operated from Long Island to the Texas coast.

"Today, the spotter plane is an indispensable part of menhaden fishing."

The two surviving family-operated firms are Standard Products and Louisiana Menhaden. Though privately held they are both large companies. The small private operator is a thing of the past in the menhaden industry.

Let us turn now to the modern menhaden fishery and take a brief walk through a typical operation.

An average catch numbers between 50,000 and 100,000 fish. The biggest set I recall involved about 1.5 million fish and required two boats. If you have more than 400,000 or 500,000 fish in a net the operation becomes dangerous.

After the menhaden are netted, they are stored in the ship's hold in refrigerated water. We do not need to cool menhaden as much as food fish, but we find the refrigeration keeps the fish in better shape.

Refrigeration also eliminates a significant shoreside hazard: hydrogen sulfide poisoning. Before refrigeration the fish would sometimes begin to decay, generating hydrogen sulfide gas. Workmen bailing

fish out of the hold could rupture these pockets of gas, be overcome, and sometimes die.

The bailing operation is done with high-pressure hoses. The fish are pumped through a de-watering screen and into a 22,000-cubic-inch rotating drum. When the drum is full it trips a switch and the fish are dumped into storage. Twenty-two thousand cubic inches of menhaden represent 1,000 standard fish. We do everything based on the 1,000 standard fish measure.

After storage, the fish are cooked indirectly with steam, then fed into a mechanical press. The press forces out a fraction that is half water and half fish solids. Pressings are dried in dryers to make fish meal. Our market standard for fish meal is 60 percent protein, less than 10 percent fat, and less than ten percent moisture, all by weight.

The liquid fraction from the pressing operation is also processed. A decanting operation separates a large portion of the suspended solids. The remaining liquid is fed into a centrifugal separator which removes the oil from the water. The oil is further refined and cleaned, resulting in the fish oil which is sent to Europe for use in margarine and other products. Gulf of Mexico menhaden are the major producers of fish oil. Their oil yield is three to seven times higher than the yield of Atlantic menhaden. The temperature of the Atlantic is colder, and it takes more biological energy for the fish to live there.

The water removed from the fish oil in the centrifugal separator has a use, too. We put that into a evaporator and produce solubles that are 30 percent protein, ten percent fat, 10 percent ash, and 50 percent water.

We have been selling the solubles to pig farmers in West Germany. It seems they like the smell, which is awful, and the color, which is almost black. The important thing to them is that pigs thrive on a feed that includes fish solubles. I am not certain how long this market will last, however. Freight costs have quadrupled and at present we cannot get our product into West Germany for a reasonable selling price. As an alternative we are starting to mix solubles with fish meal, drying it again, and calling the product "whole meal."

In the coming year Zapata Haynie will produce 90,000 tons of fish meal, 36,000 tons of fish oil and 20,000 tons of solubles. To do this we have four large plants. Our smallest plant can process 75 tons of fish an hour. Our largest can process a little more than 150 tons hourly, which, I believe, makes it the biggest fish meal plant in the world. Most plants do in a day what we do in an hour.

The menhaden industry is a profitable one, but it is not without its problems. One problem we have is pollution. We are not 100 percent satisfied with either the quality of the air or of the water coming out of our plants. We are making progress, however, as we develop better technology to deal with the situation.

A second problem we have is the rising cost of energy. Menhaden processing is a very energy-intensive business. It may help you visualize this if I remark that the fish come to shore containing somewhere between 60 and 75 percent water, but the products that go back out the door contain only 10 percent water.

As I mentioned a moment ago, shipping costs are cutting into our overseas markets and that is making us take a new look at domestic markets. We are, with government support, proceeding with the scientific work necessary to petition the Food and Drug Administration to approve fish oil as a food additive in this country.

The rising price of natural gas is making artificial fertilizers more expensive. Fish solubles make a good fertilizer, and we may yet decide to re-enter the fertilizer business. As we found with the German pig-farmer market, handling costs may prove high because solubles are half water, but I think that problem can be solved.

Another possible use for menhaden is in the form of fish protein concentrate, generally known as FPC. The primary differences between FPC, which is used for human consumption, and the fish meal that we sell to the poultry industry, are fat and oil levels and plant sanitation. FPC production for human consumption requires fairly sophisticated technology and more stringent sanitary conditions than is necessary to produce livestock feed. It would be very expensive for us to gear up to produce FPC at this time, though it is a possibility for the future.

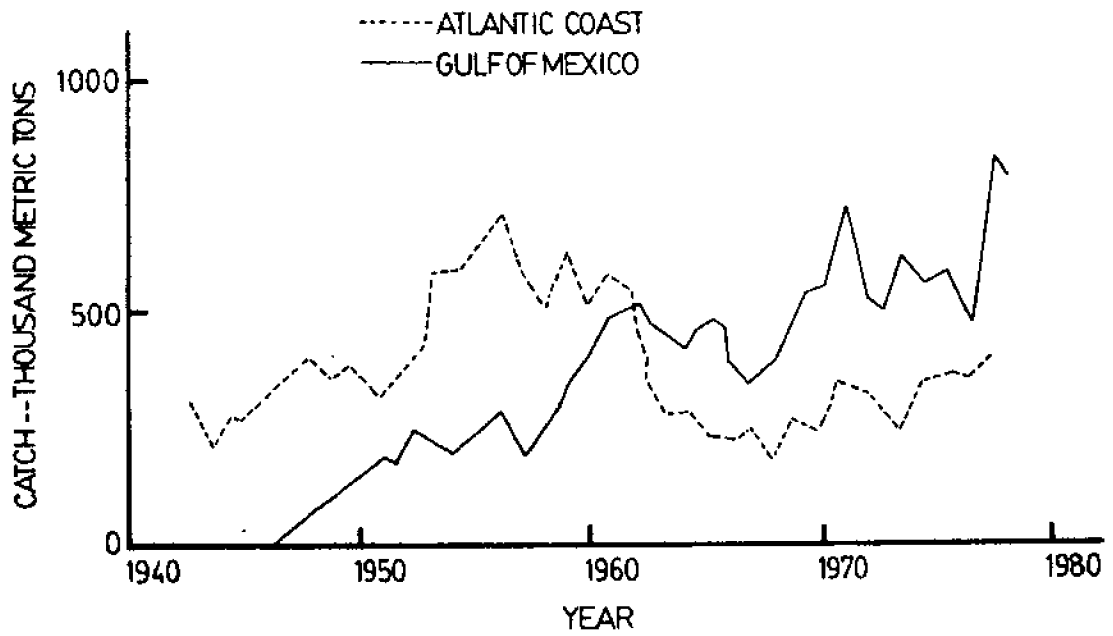


Figure 1. Annual U.S. Catch of Menhaden off Atlantic Coast and in Gulf of Mexico

I have been talking primarily about Zapata Haynie menhaden operations. In closing, I want to describe briefly how we fit into the national and international market picture.

Approximately 2 million metric tons of fish meal and 600,000 tons of fish oil are produced for export by the nations of the world every year. We do not have good statistics on how many tons of fish meal or fish oil are made worldwide for domestic consumption.

The United States produces some 250,000 metric tons of fish meal and 100,000 metric tons of fish oil annually. Zapata Haynie produces one-third of both these totals.

Our fish meal competes with soybean meal on world markets. The fish meal normally sells for 1.6 to 2.2 times the cost of soybean meal, but it is 60 percent protein, whereas soybean meal is 44 percent.

Our fats and oils compete with everything because, except for specialized uses, they are comparatively cheap. We compete with soybean oil from the U.S. and Brazil and sunflower oil from the Ukraine, among others, in the edible oil market. I believe this market is going to continue to grow because fats and oils are a high-demand item for the developing nations of the world.

The menhaden resource is in good shape, and I believe it will be equal to this growing demand. For Gulf menhaden 1978 was a record year with a catch of 820,000 metric tons, and 1979 was only a bit under that (Figure 1). The Atlantic menhaden harvest has stabilized at 350,000 to 400,000 metric tons a year but I believe this yield can be increased by the introduction of newer equipment and state-of-the-art technology.

The future is bright for the United States menhaden industry.

Biological, Political, & Economic Factors in International Tuna Management

James Joseph, Director
Inter-American Tropical Tuna Commission

The Inter-American Tropical Tuna Commission is an international commission formed by treaty. It is made up of a plenary body of government representatives called commissioners who are designated by each member government. This body's responsibility is to manage tuna in the Eastern Pacific Ocean, but because the commissioners have little competence in the field of science and assessment, they hire me, and I in turn hire an internationally recruited staff of scientists to assess the resources and make recommendations.

Commercially, tuna are caught around the world three different ways. These include first and foremost, bait fishing. That is a two-mode fishery. It requires a fishery that catches the bait, keeping it alive on board the vessel that goes after tuna, then chumming the tuna with the bait, catching the tuna by pole and short lines, and putting them in the holds for freezing. That method accounts for the major share of tuna production.

The next most important method is longline fishing. Just as the name implies, it employs a very long submerged line from which baited hooks dangle. These lines are generally 50 to 70 miles long; each line has about 2,000 hooks. It is a very labor-intensive form of fishing, as is bait fishing. Longline fishing is practiced mostly by Japan, Korea, and Taiwan throughout the world. Catch rates are low.

The third important method of tuna fishing is purse seining, a form of fishing that uses encircling nets. The net is from one half to one mile long, about 100 fathoms deep, and has a line on the bottom that is pulled to "purse" it. There are a whole array of other techniques: harpooning in the Mediterranean and North Atlantic; trapping in the Mediterranean, Spain, and North Africa; jig fishing for albacore on the West Coast of the U.S., off New Zealand, West Africa, and in the Bay of Biscay; gillnet fishing; and others.

On the whole these don't account for much of the total catch, however.

When we think of tuna we usually think of the genera *Thunnus*, which includes yellowfin, bigeye, bluefin, and albacore. The billfishes, although they are not in the same family, are very closely related--not only taxonomically but also in a fisheries sense. They are caught with tuna by tuna fishing boats using longlines. The problems of managing them are very similar, so generally when one talks of tuna and tuna-like fishes, and when one looks at the world statistics and FAO statistical bulletins, the billfishes are included. They are all very closely related taxonomically, and this will become important later when I talk about management of fish, and about some laws that have been implemented or are being developed in the U.S. vis-a-vis the Law of the Sea Treaty.

"Tuna have to swim continuously to keep from sinking and to breathe . . . they've been clocked at 70 miles per hour."

In general tuna are characterized by a very high metabolic rate. Their body temperature is generally much warmer than ambient temperature They have a very complicated circulatory system with a highly developed subcutaneous system and a heat exchanger for conserving and dissipating heat when they move up and down in the water column encountering rapidly changing temperatures. Tuna have to swim continuously to keep from sinking and to breathe. They can't stay stationary and float, and they have no musculature for pumping water over their gills, so they must keep their mouth open and swim in order to receive oxygen. Their minimum swimming speed, one tail beat per second, would put them across the Atlantic Ocean in something like 30 days, which is pretty fast. They've been clocked at 70 miles per hour, depending upon the species being measured. Tuna are very complicated animals, characteristically quite migratory. That's important because it sets the tenor for the type of management needed to conserve them properly.

Tuna grow very rapidly. A tropical tuna, like a yellowfin or a bigeye reaches about 8 pounds in its first year of life, 30 pounds in its second year, 80 pounds in its third year, and close to 150 pounds by its fourth year. Many of the tropical tuna don't live very long. In that fishery you don't see many over five or six years old. The temperate tuna, the albacore and bluefin, are longer lived. For example, for the northern bluefin tuna in the Atlantic, 20 to 25 age classes have been recorded. They get very large, 1500 to 1600 pounds. Black marlin get even larger, over 2,000 pounds. If not the largest, the black marlin is one of the largest true fishes in the ocean.

I'd like to list and briefly describe the major species of tuna.

First is the yellowfin tuna. About 450,000 tons of this animal are caught around the world, in the Atlantic, Pacific, and Indian Oceans.

The bigeye tuna is similar to the yellowfin. Unless you are an expert you cannot tell them apart. Fishermen can do it in nothing flat. They can tell them apart in the water just by the color, but fisheries biologists have a difficult time unless they've seen a lot of them. About 150-160,000 tons are caught worldwide. The interesting thing about these animals is that very few of them are caught at the surface. They are mostly caught by subsurface longline gear and we believe they live below the thermocline. As one moves from the western to the eastern Pacific the thermocline shallows. The longline gear hangs in the upper mixed layer in the central and western Pacific and there they catch mostly yellowfin. In the eastern Pacific where the thermocline shoals the hooks hang below the thermocline and that's where bigeye, not yellowfin, are caught. The surface fishery in the eastern Pacific gets mostly yellowfin, but hardly any bigeye.

Skipjack tuna belongs to a different genus. It is the most abundant of the common tuna and quite migratory. About 750,000 tons

are caught around the world. Skipjack never gets very big; probably the average size around the world is about six pounds, whereas the average for yellowfin is around 30 pounds. You rarely see skipjack greater than 10 to 15 pounds.

The albacore, by virtue of its pectoral fin, is called a long-finned tuna. This is the white-meat tuna. In the store you can buy either light-meat or white-meat tuna. In the U.S. albacore is the only fish that can be called white-meat tuna. It's very white in the can, and it is more expensive, but in my opinion it doesn't taste as good as light-meat tuna. This tuna is also distributed world-wide, but it only spawns north and south of the equator. About 230,000 tons are caught annually. It is highly migratory, a temperate-water tuna.

Northern bluefin tuna occurs in the Atlantic and Pacific Oceans, but not in the Indian Ocean. Individuals of this species get to be very large; however, the populations are not great. In the Pacific, 20-30,000 tons are caught annually; about the same amount is caught in the Atlantic. Highly migratory, bluefin travels between California, Baja California, and Japan. The northern bluefin is in the middle of a political controversy in the Atlantic Ocean where sportsmen want it protected and commercial fishermen want to catch it. Nations on both sides fish it, and some consider it to be nonmigratory while others consider it migratory.

The southern bluefin tuna is a different species. It spawns around western Australia, but tagged individuals have been found in the Atlantic, Pacific, and Indian Oceans. This species produces about 40,000 tons of catch per year, Japan and Australia taking most of it. The northern bluefin also has a very restricted spawning area, off Formosa. Most tuna spawn all over, but the northern and southern bluefin, each with small populations, seem to have very restricted areas to which they return.

Bullet tuna may be the most abundant in the ocean; you find the larvae all over. There is a small fishery for it; however, one reason is that it is a small tuna, and another is that it cannot legally be labeled tuna in the U.S., and most of the tuna in the world is eaten in the U.S.

Black skipjack is a more coastal species. We don't know very much about it. Not many are caught, maybe 40-50,000 tons worldwide. These are taken mostly by subsistence fisheries around the world.

Bonita occur in the Pacific and Atlantic. About 100,000 tons are caught annually.

Wahoo is a popular sport fish in tropical waters. It's very big, about 100 pounds, but it doesn't support much of a commercial fishery.

The butterfly kingfish is related to the tuna and tuna-like group of fish. It's only found in the southern hemisphere in very deep water. Not much is known about it.

The striped marlin fishery yields 40-50,000 tons annually. This is a highly prized sport fish and the subject of controversy between commercial fishermen and sports fishermen. It is migratory.

Sailfish are highly migratory.

Swordfish are distributed worldwide. This fish is a highly prized commercial fish and is the object of a budding sport fishery in Florida and Southern California.

The shortnosed spearfish is similar to the sailfish. It is normally found in the high seas rather than in coastal waters.

My reason for listing all these fish is to give you some idea of the variety of tuna and billfish, but more importantly to show you something about their migratory behavior. In terms of managing them, their migratory behavior is extremely important.

About 2 million tons of tuna and tuna-like fish are caught around the world. About 1.5 to 1.8 million tons of these are the major tuna species: yellowfin, bigeye, bluefin, skipjack, and albacore. Although about 60 nations fish for tuna in the world, six nations take about 85 percent of the total: Japan, the U.S., Korea, Taiwan, Formosa, France and Spain. Japan and the U.S. account for 55 percent of the total. It is important to remember that the countries that catch most of the tuna don't catch it adjacent to their own coast. They catch it either on the high seas or off another country's coast.

Two countries dominate the consumption of tuna, Japan and the U.S., who together eat 75 percent of all the tuna caught in the world. The U.S. consumes most of it, 46 percent--more than twice the amount they catch with their fishing boats.

The questions that face society in general are: What is the total amount of tuna available in the ocean? How much can we consistently take from year to year?

I want to touch briefly on assessment. A population assessment is one way we attempt to determine potential abundance. Tuna populations, just like any other living organism, are dynamic. The number you remove determines how many will be there later and how quickly they replenish themselves. In any population of fish you have a usable stock, determined by recruitment and growth rates of individuals. That stock is reduced by natural mortality and also by fishing mortality. We are interested in the natural factors in a population, how recruitment and growth take place, and the natural mortality rate. We evaluate these parameters in order to make a population assessment. Most tuna population assessments are based on the logistics model.

A second way to assess potential abundance is to look at yield per recruitment models.

Those are some of our fishery management techniques, and we have been, up to now, managing the fishery in the name of conservation.

The definition of conservation--wise, rational use--has meant something different to different individuals, groups, and countries, and it has changed over time. At present it is becoming more popular, not only with environmentalists but in writing treaties, for example, the Law of the Sea Treaty, to talk about optimum sustainable yield instead of maximum sustainable yield. Maximum yield implies a maximum benefit to man in terms of physical yield; optimum yield implies maximizing benefits in terms of alternative criteria. Optimum yield allows any generation at a particular point in history to define the objective of conservation in any way they choose so long as the effect of their action is not irreversible.

Most of the major species of tuna being harvested probably can't support any more production than they're supporting right now. For bigeye tuna in the Indian Ocean we might increase production as much as another 40 percent. For skipjack tuna we don't know enough to make a decision. The catch of other secondary species such as the bullet tuna and black skipjack can probably be increased, but how much I don't know. It doesn't look like we can increase billfish production. In fact, some say the billfish have perhaps been hit a little bit too hard; emphasis is going to go into preserving certain sectors of that population for sport fishermen.

What has man done in terms of trying to conserve and manage these fisheries? In the last several years he has established organizations like the one for which I work. There are a couple of species-specific organizations, i.e. the tuna commissions, and there are general organizations that also include tuna in their management. I'm involved in the first species-specific organization created for tuna, the Inter-American Tropical Tuna Commission (IATTC). It was established in 1949 by convention between Costa Rica and the U.S. Its specific objective was to manage the tuna and the baitfish resource--at that time most tuna was caught using live bait. The membership has expanded and contracted. At one time there were eight members, now there are six. The commisssion hired a staff, then set about organizing assessment studies. Early in the game it concluded that the yellowfin resources were probably being hit just about as heavily as they could be, and lo and behold, about 1960, when effort increased substantially, the catch went up and then moved right down exactly like the model then being used predicted. On the basis of that, management was recommended to governments. Although the need for management was clear in 1961, it was 1966 before the governments involved would agree on management steps. Prior to 1960-61, the 120,000-ton tuna catch had been an almost 100-percent U.S. fishery. At that time the developing coastal Latin states wanted to develop fisheries and they would not agree to any management measure unless they received some preferential treatment. Political manipulations to establish management took six years during which time the tuna population continued to decline. When a management plan was finally implemented the population began to increase much more quickly than expected.

"Most of the species of tuna being harvested probably can't support any more production than they're supporting right now."

That's about when I came on the scene. What was going on? It was pretty obvious. The yellowfin fishery was an inshore fishery, and although these yellowfin tuna do move around, they don't move around as much as the other tuna. The fleet was concentrating on one portion of the population, hitting it very hard. At the same

time the fleet was also growing, the season was getting shorter, and competition was becoming fierce. In a matter of three to four years the area of the fishery had increased by a factor of three.

We really didn't know what the population parameters were anymore so we recommended a controlled experiment to try to overfish the stock purposefully. From the rate at which the population should change we would theoretically be able to tell on which side of the production curve the fishery was operating. We've been in that controlled experimental mode for about eight years and the result is that we now think the fishery has been expanded as far as it can be. The model says that on a sustained basis the stock will allow an annual yield of about 175,000 tons, and we've really been taking more.

In the early 1960's the tuna fleet's capacity was 44,000 tons, but with the high quotas while we were in the experimental mode a lot of new boats came into the fishery and now the fleet's capacity is 188,000 tons. However, during this period the average catch per capacity ton dropped from 5.5 to below 2. Now there are a lot of people facing serious economic problems and having a difficult time meeting mortgage payments. Consequently, there is a tremendous amount of pressure on the Commission to raise the quotas even more.

This is a three-species fishery, basically yellowfin, skipjack, and bluefin. Right now the total catch is roughly 350,000 tons. Over the last couple of years the yellowfin catch from within the regulatory area has been about 190,000 tons a year with an additional catch of 15,000-50,000 tons from west of the regulatory area. Skipjack has averaged about 75,000 tons per year historically but in the last few years it has averaged about 110,000 tons. Bigeye and bluefin catches have each been about 10,000 tons.

Scientifically the IATTC is in reasonable shape. We know something about the resource and can make reasonable management recommendations. We've basically carried out the scientific dictates of the treaty.

Politically it's a whole different ball game. The historical concept of resource use, particularly the tuna resource, was that it belonged to whoever could first render it to his own use. These fisheries developed with very narrow territorial sea and contiguous zones, three to 12 miles at maximum. The U.S. has supported freedom of the high seas, so has Japan. The IATTC has allowed the U.S. and Japan to fish for tuna where they wanted. Other coastal nations might not like it but they couldn't do much under the then current international law with regard to fishery jurisdiction. In the IATTC the coastal nations kept maintaining they wanted some form of guaranteed access to a larger share of the resource by virtue of the fact that they were adjacent to the resource, but the U.S. and Japan insisted that there was no basis for that in international law.

"...they can't set up a fence around their 200-mile zones (to keep the tuna in)."

This political situation has been changing since 1971. The voices raised have been from Peru, Ecuador, and Chile in the eastern Pacific, although the one that really started this movement to extended jurisdiction was Harry Truman with the Truman Proclamation in 1945, when the U.S. became very interested in oil in the Gulf of Mexico. In the 1970's the issue really gained momentum. There had been two law of the sea conferences to resolve this issue: one in 1958, which never resolved it and one in 1960 in which a 6+6 proposal--six-mile territorial sea plus six-mile contiguous zone--lost by one vote. After that formalities were dropped and countries began unilaterally declaring 200-mile territorial seas. The issue of resource control has been before the Third Law of the Sea Conference for its duration, since 1971. They have not decided yet on the breadth of the territorial sea; they have general agreement, but no treaty has been signed. In the meantime, most nations, including the U.S., have expanded fisheries jurisdiction to 200 miles. They had all maintained before the IATTC that they had the right to do this, and now some nations are maintaining that a share of the 175,000-ton annual tuna yield ought to go to them no matter who caught it. They want ownership of the resources in their coastal zones. Mexico has been campaigning for rewriting the tuna treaty to be cognizant of the current trends in Law of the Sea; so have the other Latin states. Peru, Chile, and Ecuador want to rewrite the treaty so they have sole ownership of the resource within their 200-mile zones. Mexico is more amenable to an agreement that takes into account the highly migratory nature of the fish, the nature of the fishery, and the problems in managing tuna. It

recognizes that tuna in the eastern Pacific are caught inside and outside the 200-mile zone: 50 to 60 percent of the yellowfin and 70 to 80 percent of the skipjack are caught inside the zone. Mexico and Costa Rica also recognize that if they want to develop fisheries they have to have large fishing boats to go after the concentrations of fish wherever that may be. They recognize these concentrations of fish move from one country's waters to another inside and outside the 200-mile zones. They know they can't set up a fence around their 200-mile zones and manage their own tuna fishery because they may set a quota that they think is reasonable and curtail their own fishermen, but as soon as those fish leave the coastal zone and enter the high seas someone else is going to intercept them and perhaps overfish them. The only way to manage tuna is to make the resource the object of management wherever the resource occurs. Mexico, U.S., Japan, and Costa Rica are trying to solve this problem, as in the Law of the Sea Conference. The Law of the Sea Conference has an informal composite text which covers migratory species in Article 63.

In my work as Director of the IATTC, I have been involved in a study of alternative management schemes. My study concludes that the adjacency of coastal states to the resource ought to be recognized, and that coastal states should have some preferential rights to catching a share of the resource. Because of the nature of the animals themselves, which know no boundaries, the study suggests that a share of the total resource calculated proportionally to how much is caught in each coastal zone should go to coastal states in the form of a preferential right to catch. We have also suggested guaranteed access to fishing grounds because all of these fleets operate the same type of boats and they all have to move in and out of territorial waters if they are to follow the fish. The cost of the licenses now sold by individual countries adds up to quite an expense if a boat fishes in the waters of, say, five countries. A license to fish off a single country, say Ecuador, for a 1000-ton tuna seiner, for example, is going to cost about $50-80,000. Costs to fish off several countries during one voyage would be prohibitively high. So we proposed a use tax on the fishery to be paid by everyone who fishes, coastal states or not. The tax would generate a pool of funds from which an administrative fee would be taken to support the IATTC, now supported from member-nation's treasuries, and the remainder would be distributed to coastal states in proportion to the amount caught in their coastal zones. This would be in lieu of a license. For about the current price of one license a certificate of access would be issued and each boat could fish wherever it wanted to all year. Coastal states would in fact get a larger revenue than they do now because they would not have to police their coastal zone, and all user-states would pay.

All this has been pretty much agreed to. Unfortunately though, we still don't have a general agreement for a new treaty. The difficulties in the treaty negotiations are centered around a dispute over how the season should operate. The fishing season starts January 1, but certain countries have special allocations that can be taken after the season closes. We must hold that in reserve, record what is caught each day in the fishery, and then shut the season when computations show the catch plus the special allocations equal the quota. Also, any vessel that arrives in port prior to season closure is entitled to a last unrestricted trip providing it puts to sea within 3 days of closure. Because there was such congestion on unloading associated with the last trip, the U.S. successfully negotiated to have the 3-day grace period for the boats extended to 10, then to 30 days. It became very difficult for my staff to manage the fishery and to reserve enough for the special allocations and the last free trip, so a few years ago we began recommending getting away from that last trip that had the grace period attached. We never did get that negotiated successfully. In the new treaty the Mexicans don't want any last free trip, but the U.S. wants the last free trip unchanged. So far neither side will budge. If the treaty fails, it will fail because of something that really doesn't mean that much to either country because by reserving enough fish for the last free trip you simply shut the season earlier; if you're not going to have a last free trip, it stays open longer. It doesn't really make that much difference, all it does is protect a few boats who have bad luck, boats that break down at critical times. U.S. fishermen want this badly, however, and they have support in the U.S. Senate, so there is a strong possibility that any treaty that the State Department signs will not be ratified in the Senate unless it includes this last free trip. The State Department knows this so they are not signing any treaty. The only possibility I can see for a compromise occurring is if the Mexicans and Americans back off a little bit from their positions. Some sectors in the U.S industry support that, some do not.

"So far neither side will budge. If the treaty fails, it will fail because of something which really doesn't mean that much".

The law of the sea conferences have recognized that highly migratory species need special international management. When the U.S. passed the Fishery Conservation and Management Act (FCMA) it excluded tuna from jurisdiction on the basis of its highly migratory nature. It said that the coastal state really couldn't manage tuna as it did other species. It is the only nation that has recognized that. In order to give this some force there is an embargo provision in the FCMA that says any nation that siezes U.S. boats on the high seas, which is beyond the 12-mile limit but inside the 200-mile limit, will have its tuna products embargoed, and if that doesn't work, all fish products embargoed. This has been enforced on Costa Rica. However, Costa Rican tuna goes mostly to Canada so that tuna never comes to the U.S. anyway. Mexico on the other hand has a very large, budding tuna industry in Encinada. Mexicans catch about 25,000 tons of tuna, much of which goes directly to the U.S., and about another 40,000 tons offloaded by non-Mexican boats is trans-shipped from Encinada to the U.S. by truck. If Mexico now begins seizing boats, the U.S. will embargo its tuna and there will be some real problems in Encinada. Such action would also impact U.S. canners because Mexican-caught tuna is a big share of what is canned in California. The potential of the FCMA provision has helped to keep the lid on the conflict over renegotiating the tuna treaty as far as Mexico is concerned. If it doesn't work U.S. tuna producers are already talking about lobbying to get shrimp from Mexico embargoed. That would have a big impact on Mexico because the U.S. imports 75 million pounds of Mexican shrimp annually.

If the current negotiations fail and a conservation program is not agreed to several things might happen.

The coastal Latin states may effectively keep all foreign-flag vessels outside their 200-mile limits. This would force the fishing effort where it will be concentrated on the porpoise/tuna stocks. The porpoise problem will be exacerbated and the offshore tuna stocks will be over-exploited. What effect this will have on the inshore stocks is not certain. If coastal states develop large fleets, as they intend to do, then there will also be over-exploitation inshore. The outlook would not be rosy.

If, on the other hand, the coastal states are not effective in policing their 200-mile zones then non-coastal states' vessels will fish unrestricted both inside and beyond the 200-mile limit. Overfishing would be highly probable.

The consequences of no agreement on a new treaty and the resultant failure in maintaining the conservation program are severe. The tuna, porpoise, boat-owners, canners, and consumers from all countries coastal and non-coastal alike, stand to lose. It is imperative that rational conservation and management be maintained in the Eastern Pacific Ocean. This can only be accomplished through international cooperation. International cooperation in the eastern Pacific ocean is rapidly fading.

International Pacific Halibut Management

Donald A. McCaughran, Director
International Pacific Halibut Commission

The Biology of the Pacific Halibut

I'm going to talk about halibut: the biology of halibut, the management of halibut, and the International Pacific Halibut Commission. I'm going to present a picture of its current scientific research and bring you up to date on the latest negotiations between the U.S. and Canada.

Maturation and Growth

Let's start with the halibut egg. Halibut eggs are about 2-1/2 mm in diameter. They are found distributed in both the North Pacific and the North Atlantic (Figure 1). In fact, while the Pacific halibut and the Atlantic halibut are generally regarded as different, many people think that they are not two different species but two subspecies or races of one species.

Halibut spawn in very deep water, usually from 50-100 fathoms but as deep as 250 fathoms. The eggs are fertilized externally. As their specific gravity is similar to the surrounding waters and greater than the specific gravity of the surface water, they drift in the very deep currents.

> *"... in the process of catching 1,000 pounds of ling cod, (a Canadian fisherman) killed 10,000 pounds of halibut and threw it overboard."*

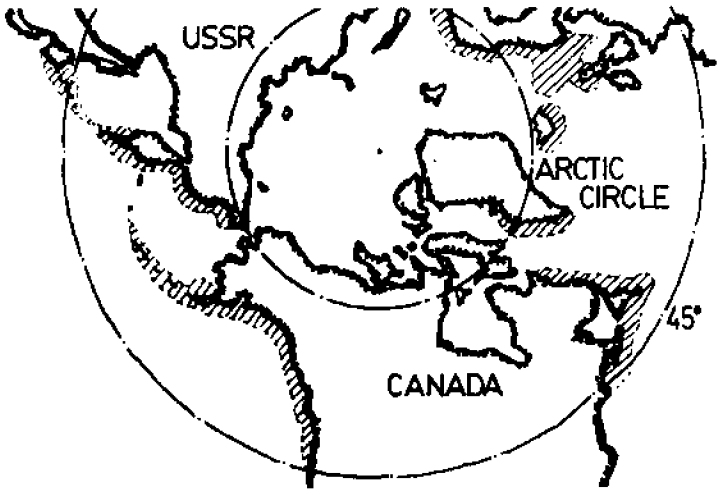


Figure 1. Distribution of Halibut Eggs

About 15 days after fertilization, the first larval stage develops. A newly-hatched halibut larvae is about 1 cm long. It takes approximately a month to reach the post-larval size of 6 mm. At about 2.5 cm pigmentation begins to develop and the left eye starts to migrate over to the right side. Pigmentation develops. When the larvae begin to develop they drift at depths of 100-200 fathoms. As the stages progress, the larvae's specific gravity is reduced and they begin to rise. At approximately five to six months of age the adult form is attained and they settle on the bottom in shallow inshore water.

Adult halibut may have differing coloration on their backs, depending on where they live. Their upper side may be gray/green or brownish. The lower side is usually pure white, but once in a while it is gray. At one time it was thought that the gray-bellies weren't worth as much as the others, and fishermen got less money for them.

Adult halibut often reach a size of 250 to 300 pounds, and have been recorded as large as 500 pounds. These latter individuals are probably 35 to 40 years old, although it's very difficult to determine their age when they get that old. There are not very many of them in the population.

Halibut are extremely strong. When they're brought aboard the boat, the fishermen avoid them. Fishermen have had their legs broken by large, thrashing halibut. Once the fish have settled down, they are easy to handle; they can be placed on a marking table, tagged, and put back over the side with relative ease.

Females grow faster, live longer, and become larger than males. Almost all the older fish you see are females. An 18-year-old female can weigh 80 pounds and can produce 1,400,000 eggs per year. This is interesting in terms of population modeling. However, in order to construct a successful model we need to know the viability of these eggs as well as their numbers. Eggs of older fish may be more viable than eggs of younger fish. Therefore, the presence of many young females may not contribute as much to population growth as originally thought. At the present time we are considering experimentation on the viability of eggs at the Nanaimo Biological Station in British Columbia.

Minimum commercial length is 32 inches. At that size, halibut are 8-10 years old. A one-year-old fish is about four inches long and weighs about 0.5 ounce; a two-year-old fish is about 12 inches long and weighs about 8 ounces; and a three-year-old fish is about 18 inches long and about 2.5 pounds.

I've been working on a model of growth for Pacific halibut, for both males and females, which has never been adequately studied in the past. I have data on growth by five-year cohorts and by different regions back to 1920. There has been considerable change in the growth of halibut in the last 20 years. They are growing very much faster now than in the past. I'm not quite sure what this means. I've tried to relate it to population density, but the correlation is not very strong. This work is continuing and will be reported in the near future.

To determine a halibut's age we remove the otolith, the bone in the inner ear. Otoliths grow rings like trees. The rings of young fish are very distinct, but as the fish get older the rings are much more difficult to count. We feel quite confident about our ability to determine the age of halibut, although in some other fish like Pacific Ocean perch, it's been shown that the otolith curls over and the fish are very much older than had previously been thought. We are investigating this phenomenon at the present time.

It is very important to know the growth rate and age of fish for any population dynamics work. Underestimating age can lead to serious mistakes and finally overfishing. We think we have this statistic correct for halibut.

Food Habits

When halibut are very small, they feed mostly on crustaceans such as amphipods, copepods, and small crabs, or anything they can find. When they become larger, they are very active predators. They eat octopus, pollock, cod, rockfish, and even adult, hard-shell king crab. Like most predators, they are opportunists.

Migration

Halibut larvae drift in the counter clockwise Alaskan Stream that travels up the coast from British Columbia along Alaska and out to the Aleutian Islands. Those that begin at the head of the Gulf of Alaska move in a westerly direction and those that begin along British Columbia and the coast of Washington move in a northwesterly direction (Figure 2). In the five to six months it takes a larval halibut to reach maturity and settle to the bottom as a small adult halibut it can move long distances. A fish that began as a fertilized egg at Cape St. James on the southern tip of the Queen Charlotte Islands could reach the Bering Sea. That's a considerable amount of drift, always to the north and west.

It is well known that halibut spawn at Cape St. James and all the way up the west coast of the Queen Charlottes. We are conducting winter spawning ground surveys at the present time and have just completed surveying the southeastern Alaska spawning grounds. Halibut spawn along the west coast of the Queen Charlottes and we suspect there is a small amount of spawning all the way down the west coast of Vancouver Island and down the coast of Washington and Oregon, although the incidence of halibut on the Washington and Oregon coast is very low at this time.

Juvenile halibut migrate south and east. We've postulated that this is in compensation for the northwesterly drift of eggs and larvae. We are testing this theory with our tagging data. Although the Commission has been tagging fish since 1926, and has about 36,000 recoveries, there are insufficient returns on small fish to draw conclusions. That is because small halibut are very difficult to tag, and have the highest mortality. We tag two-year-old halibut, but we usually don't get returns until they reach seven or eight years of age and are caught by the setline fishery, which provides us with most of our returns. We do get some juvenile returns from foreign and domestic draggers, but not many.

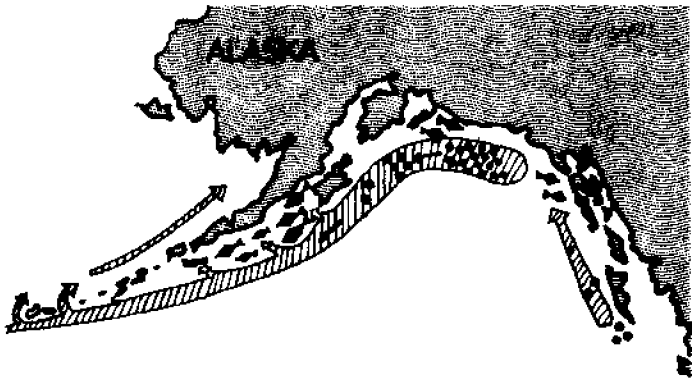


Figure 2. Transport of Halibut Eggs and Larvae

Question: Do you think the problem may be the kind of tag you use?

Reply: The tag we use right now is a piece of stainless steel wire coated with plastic with a number on it. We stick a needle through the preoperculum, string the wire through, and twist the wire up. The needle we use on larger fish is very large and often breaks the preoperculum of very small fish. For small fish, we need a different type of tag. We tried one last year called the Wennisson tag. It looks like the little plastic "T" used to attach sales tags to clothing. We put the tag through the preoperculum with the little "T" on the outside, and it seems to hold fairly well. We don't know what the tag shedding rate will be, but we've done some double tagging to check that.

Last year I tagged 800 juveniles between 17 and 35 cm with that tag, and we hope to get a few of those back. On the other hand, we think we can use the conventional tag with a thinner wire and a smaller needle to tag small fish. This year we hope to tag 100,000 halibut four years old and younger. When those tags are returned, we'll get a much more accurate measurement of the movement of juveniles than we have now.

Adult fish don't move nearly as much as juveniles. After five or six years of age halibut move much less. There is some movement to spawning grounds and to feeding grounds, but more extensive migration ceases. Once they get to the commercial size, they remain pretty much in one spot. In one tagging experiment, approximately 3,000 juvenile fish were tagged just on the other side of Unimak Pass, a good area for juvenile halibut (Figure 3). Recoveries were spread out over the whole coastline of Alaska to Washington. On the other hand, 1,200 adult fish that were tagged at the same location moved differently. Some of the adults moved back up toward the Bering Sea, while some moved south.

The experiment I just described was a winter tagging. Nearly all recoveries of winter-tagged fish are made in the summertime, because the halibut fishing season is in the summer. We feel that a lot of the movement in the winter is to spawning areas and then back to the feeding areas. We're trying to develop programs to test this. I suspect what may happen, although we don't know for sure, is that fish from certain spawning grounds lay eggs, the larvae drift north and west, and then the juveniles move back to the spawning grounds where they originated.

Another interesting fact that has emerged from our years of sampling is that almost no juvenile halibut are found south of Sitka, Alaska. Also, in all the years we have searched for baby halibut with trawl gear in British Columbia and Washington, only a handful have been found. This seems to confirm our hypothesis that the eggs drift north and west, and by the time they settle down they're already north of Sitka.

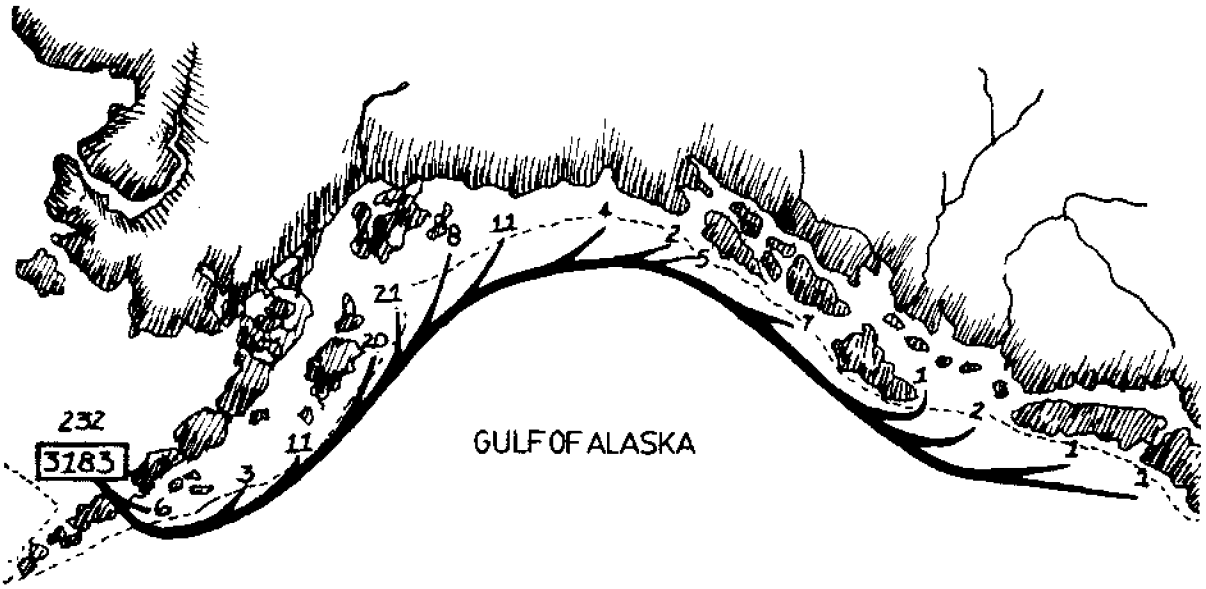


Figure 3. Migration of Halibut Tagged in the Bering Sea

The recovery pattern is quite different for halibut tagged in the summer and winter at the same location. There is very little movement to the northwest, and it represents random movement of fish. In the wintertime we tag spawning fish and we think the summer recovery pattern results from their return to where they live. When we tag in the summer and recover in the summer, we always find a small net movement south and east. Looking at tag recoveries from fish caught in the summer off the Oregon coast, we see a similar picture. One fish recaptured off Oregon was tagged up in the Bering Sea, another was tagged in the Aleutians. Among fish tagged off Oregon in the summer, adults move both southward and northward while juveniles, on the other hand, move strongly to the southeast.

As the fish get older, they move less. To illustrate the juvenile movement, I looked at a series of four-year-old fish that were tagged off northeast Alaska; 57 percent were recovered in British Columbia and south. When I looked at fish six years old and over, 10 percent were recovered to the south.

Question: At what age do halibut first spawn?

Reply: On the average they first mature at about 8 years for males and 10-12 years for females.

Predators of Halibut

When halibut fishermen are fishing in shallow water, they frequently find that adult halibut are taken off their hooks or pieces are bitten out of them by sea lions. Sea lions can be very annoying during tagging. You often see a sea lion sitting there smiling at you with one of your freshly-tagged halibut in its mouth. When you see one waiting for you to throw him a tagged baby halibut you just have to move on.

The other major predator on halibut is man.

Halibut Fishing Gear

Halibut are caught on what we call long-line gear. Two anchors are set on the bottom. Each has a line to the surface to which is tied a big float, a flag, and

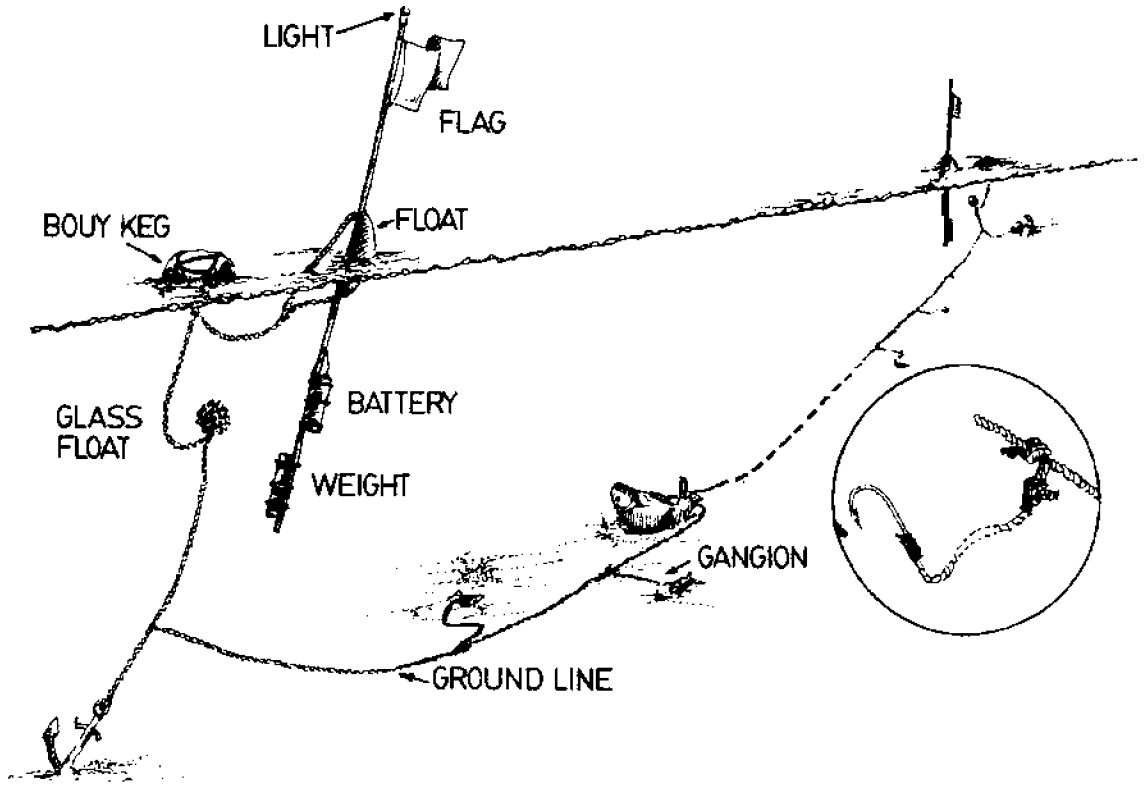


Figure 4. Halibut Longline

often a reflector, so they can later be located. Attached between the anchors is a groundline of heavy nylon rope. The groundline is made up of 1,800 foot-long pieces called skates. Each skate has 100-120 hooks. A fisherman can set as long a line as he likes by tying skates together. One complete unit is called a set. He may tie eight skates in a row, making an eight-skate set. Tied to the groundline are gangions four to five feet long with a large halibut hook on the end.

The hooks are baited with a variety of baits. You know what fishermen are like, they use all kinds of baits and each one thinks he's using the best. Typically used are herring and cod. Salmon tails, heads, or pieces of flesh are used because it is very tough and stays on the hooks very well. Octopus is a very good bait and it also stays on the hooks well. Herring is an excellent bait, but other fish and crustaceans like to eat herring as well as halibut do.

Each skate is baited, coiled, and then set over the stern of the vessel through a chute. The gear is retrieved on a power gurdy. As each hook comes over a roller on the side of the vessel, a fisherman takes off the halibut and cleans off each hook, regardless of what is on it. Another fisherman coils the skate. They work one skate at a time. Each skate is disconnected from the longline and sent to the baiting table to be rebaited immediately. The halibut are cleaned, iced, and put in the hold.

Regulation

Commercial halibut fisheries started around the turn of the century. On the west coast, Canadians and Americans fished out of Vancouver and Seattle. By 1919 the catches were getting lower and the industry sought international control. A treaty was signed in 1923 and took effect in 1924, creating the International Fisheries Commission to manage the halibut resource. At that time there were four commissioners, two from the U.S. and two from Canada.

The terms of the first treaty were considered temporary, but as time went on it became apparent that more regulation was desirable to protect the stocks. In 1930, another treaty was negotiated which allowed the commission to establish regulatory areas and to set quotas for them. In 1937 some adjustments to that treaty were made which dealt with incidental matters and changed the directives of the original treaty very little.

A major treaty was negotiated in 1953 which replaced the International Fisheries Commission with the International Pacific Halibut Commission and set up the six-commissioner body that we have at the present time. The new treaty specified that the Commission was to manage halibut at maximum sustainable yield. It also provided for more open and closed fishing periods. The regulatory areas defined by that treaty were revised in 1979.

In 1976 the U.S. Fishery Conservation and Management Act (FCMA) required that all international treaties in conflict with it be renegotiated. As a consequence, new protocol was placed in effect on March 31, 1979. The new treaty permitted Canadians to fish for two more years (1979 and 1980) in U.S. waters and to catch no more than 3 million pounds in the two years combined. This fishing season, their last, they're to take 1.8 million pounds in order to complete their 3-million-pound limit. In the 1981 season there will be no Canadian boats fishing in U.S. waters and no U.S. boats fishing in Canadian waters. The catch in Area 2, which encompasses both U.S. and Canadian waters, is split 60 percent to Canadians and 40 percent to U.S. fishermen, based largely on historical catch, but formalized by government agreement.

The treaty was signed into effect on March 30, 1979, and it's due to be ratified tomorrow morning in the U.S. Senate (February 26, 1980). We hope it will be ratified immediately in Canada. This treaty does not cover any set period of time. Renegotiation will occur when either country gives one year's notice.

Enforcement

IPHC has no enforcement authority. Enforcement is left to the appropriate agencies of each country: the Canadian Department of Fisheries, or Department of Fisheries and Oceans as they're now called, and the U.S. National Marine Fisheries Service (NMFS). Not being involved in enforcement helps IPHC's data collection and management effort. In fact, we've had fishermen tell us about their illegal activities just to ensure that we get all the information we need. They know we aren't in the enforcement business so they will actually say, I set my gear before the season and I caught this much fish here.

Catches

Based on 1977 catch data, the domestic commercial fisheries take about 22.6 million pounds, the foreign trawl fishery about 5.8 million pounds, the domestic trawl fishery about 2.6 million pounds and the domestic crab pots about 1.5 million pounds (Figure 5).

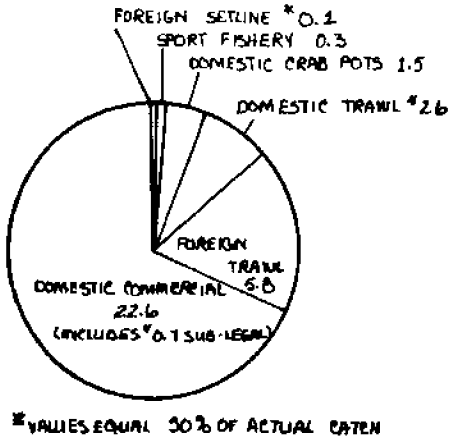


Figure 5. Total Halibut Removals in 1977 in Millions of Pounds

Halibut force their way into crab pots. The way crab pots are designed, that is difficult to prevent. The size of the halibut that get in the crab pots is incredible. They either get chewed up by the crabs and killed, or if they come up whole, they are usually used as crab bait. Legally they have to be returned to the sea, but crab fishermen reportedly use them as bait. In fact, there's an enforcement problem there. A crab fisherman will buy 500 pounds of halibut and when the enforcement officers find halibut aboard, the fisherman shows a bill of sale. There's no way to know whether or not the fisherman has actually used up that 500 pounds. I think the amount of halibut trapped in crab pots is actually in the neighborhood of 3 - 5 million pounds annually, or two to three times the reported amount.

The foreign longline fishery for blackcod and Pacific cod catches a small quantity of halibut, but they must be returned to the sea. However, foreigners are being phased out of the U.S. Fishery Conservation Zone (FCZ) as the domestic fleet builds up.

Atlantic halibut catches have never been as great as Pacific halibut catches (Figure 6). In fact, there's no longer a directed Atlantic halibut fishery. Pacific halibut catches reached a high in the 1960's then declined. The very high incidental catch of juvenile fish by the foreign drag fleets, both the Russians and Japanese, has hurt the Pacific halibut stock.

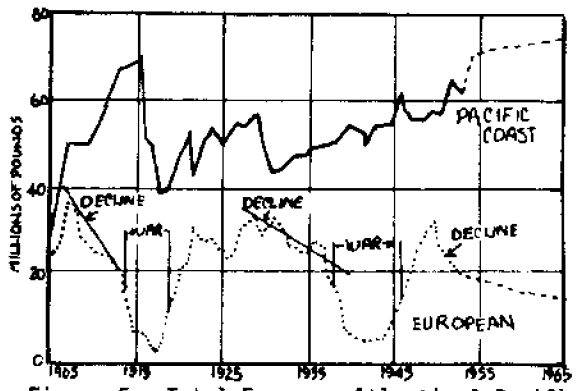


Figure 6. Total European Atlantic & Pacific Coast Halibut Catches

Halibut can be kept only if they were caught on hook and line.

The mortality rate of returned fish is probably higher than 50 percent depending on whether they are caught in a large or small trawl net. Mortality rates of halibut taken by large trawlers are probably close to 100 percent because of the greater volume and weight of fish surrounding the halibut and the longer sorting time.

Very large incidental catches and mortalities of halibut in the foreign setline fishery, the domestic crab fishery, and the domestic and foreign trawl fisheries, are inhibiting the rebuilding of the stock.

The sport fishery is comparatively small, about 0.3 million pounds annually, and not a threat to the stocks.

Question: Now that you have new regulatory areas, are all your previous data still usable?

Reply: We keep data by small statistical areas which are consistent with the new regulatory areas. When the fish are brought to shore, they're examined by port samplers hired for the summertime. The port samplers help the staff determine the ages of the fish in the sample by removing the otolith. They also interview the

skipper and inspect the log book each skipper is required to keep. They determine the size of the catch, the number of skates set, the location, and the depth. From this information we can calculate catch per unit of effort.

Question: What kind of cooperation do you get from the fishermen?

Reply: I would say there is excellent cooperation between IPHC and the fishermen. In fact, it's one of the best cooperative ventures with which I've ever come in contact. The halibut fishermen were very instrumental in forming IPHC in the first place.

Question: How much do you rely on observers rather than fishermen's reports for data collection?

Reply: We've had observers on foreign and domestic vessels in the past. We think more observers are needed. We're making arrangements to get observers on some domestic vessels in Canada to obtain estimates of the domestic incidental catch. We do get excellent observer data from the U.S.; some of the best data is being collected at the present time.

The Commission also had highly trained permanent employees on foreign vessels looking for halibut. Of course, on the large stern trawlers the NMFS observers have a more difficult time. Thousands and thousands of fish come aboard at once; an observer is not able to pick out every halibut but estimates the halibut catch from samples. They are the best data we've got. Although both the IPHC and NMFS wish the coverage were greater, we're pleased that it is as good as it is.

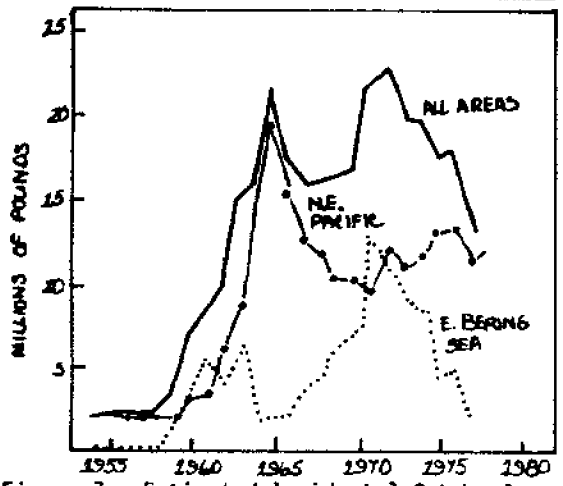


Figure 7. Estimated Incidental Catch of Halibut

Since 1965, halibut bycatches have gone up (Figure 7). The highest estimated bycatch in the early 1960's was about 20 million pounds. In 1978, the total incidental catch was 22 million pounds. Why? There were probably several factors. There seems to be a long-term reduction in juvenile halibut which is independent of incidental catch. We don't know what is causing that. It may be environmental stress. Of course, high incidental catches of juveniles in foreign fisheries have certainly hurt the rebuilding of the stocks. We exceeded equilibrium catches in the 1960's and in fact, we overfished. A combination of overfishing, high incidental catches, and long-term reduction in juveniles have all contributed to the present low stock level of juveniles. It was reflected in the reduced catches by the foreign fleets.

To compensate for the lower recruitment in recent years, the Commission has reduced the longline catch, trying to keep it below the stock equilibrium level. It has attempted to get time and area closures and bycatch controls to reduce the incidental catch. At the present time we think we've turned the trend around.

In 1963, under the International North Pacific Fisheries Commission (INPFC), the Japanese were allowed to retain halibut as an incidental catch when trawling for yellowfin sole in the Bering Sea. There was already a big domestic longline halibut fishery there which was on the increase, and the combination of the two caused stocks to drop dramatically (Figure 8). When the Japanese began trawling there may have been a sustainable yield of at least 4 million pounds. As with most new fisheries, the catch goes up and then drops; just about every fishery that we've looked at has shown this phenomenon. Right now the catch there is back up to approximately a million pounds and I hope we can sustain it at that level.

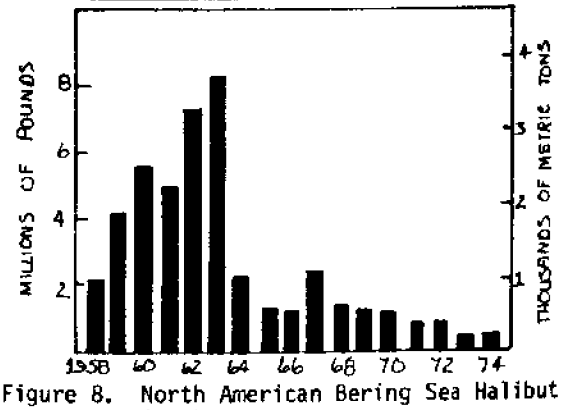


Figure 8. North American Bering Sea Halibut Catch

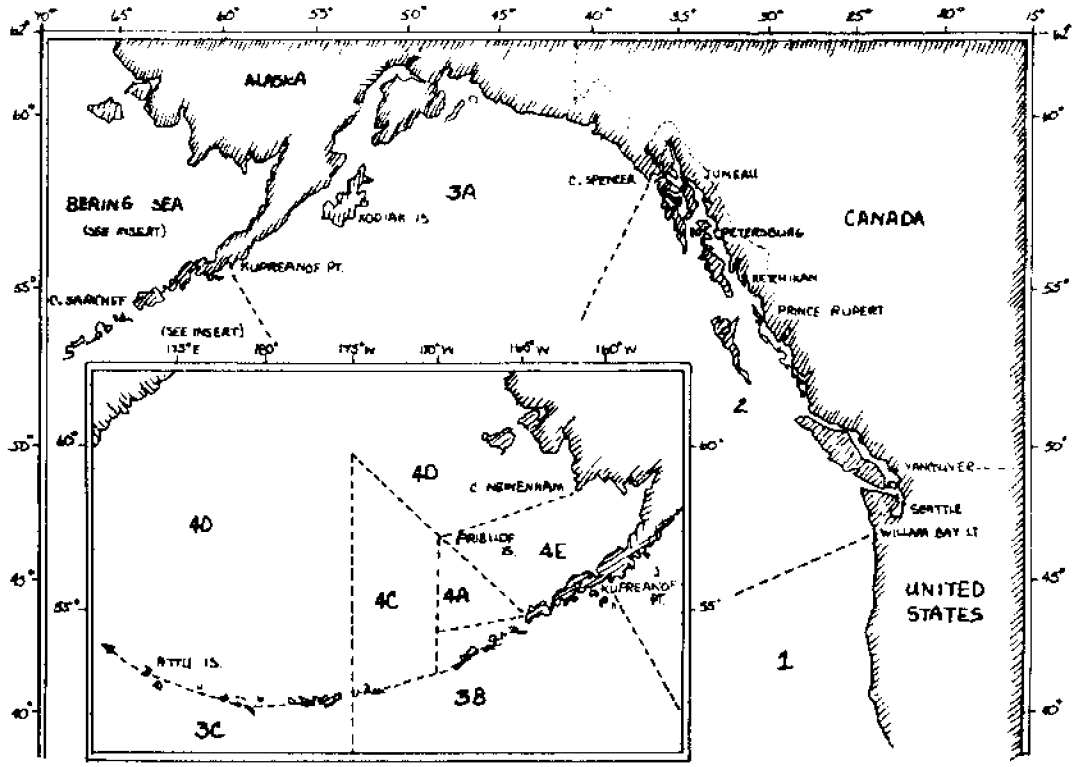


Figure 9. Halibut Fishing Areas

We're still worried a bit about Area 3 but Area 2 looks better. We think that the reduced setline catch has had a positive effect, and we hope to make positive strides in the direction of more control on the incidental catches. Ultimately, the maximum sustainable catches will probably not be 70 million pounds per year, as was taken in the 1960's, but I think we could sustain 35-40 million pounds per year.

As well as having major areas, we have regions on the coast similar to the NMFS regions (Figure 9). We calculate catch per unit effort (CPUE) by region. For example, the CPUE for southeast Alaska was rising until 1977 (Figure 10). In 1979 it seemed the fish were concentrated in the Yakutat and southeast regions. We had a record high CPUE in the Yakutat region, which is a small area. The CPUE rose from about 55

pounds per skate in 1978 to 107 pounds per skate in 1979. In southeastern Alaska the CPUE increased dramatically as well. On the other hand, in nearby regions we experienced some of the lowest catches-per-unit effort ever recorded. It looks like halibut became more available in the area at the head of the gulf, east of Kodiak Island, and down to southeastern Alaska (Figure 11).

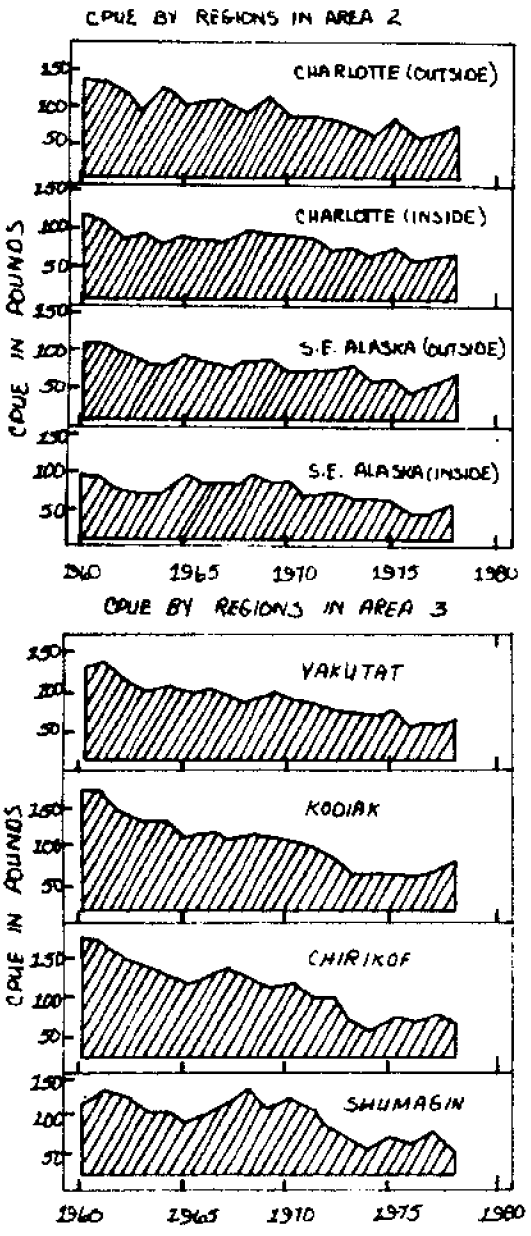


Figure 10. CPUE by Regions in Areas 2 & 3

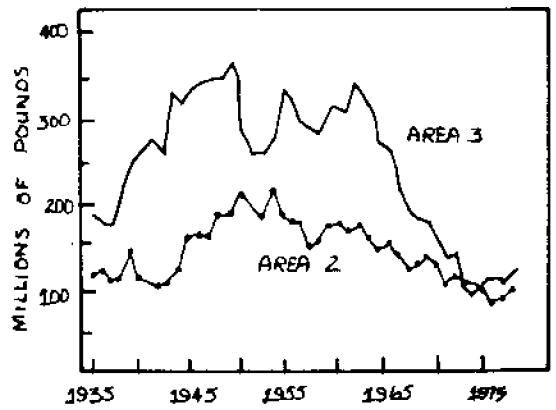


Figure 11. Biomass of Adult Halibut (8 to 20 Year Olds)

Question: You say CPUE is calculated on the number of skates set; does that consider differences in hook spacing?

Reply: The whole CPUE record since 1926 has been readjusted because of hook spacing. A study by the former IPHC director on the effects of hook spacing resulted in complete readjustment of the record so that the catch statistic is now based on a standard hook placement (Figure 12).

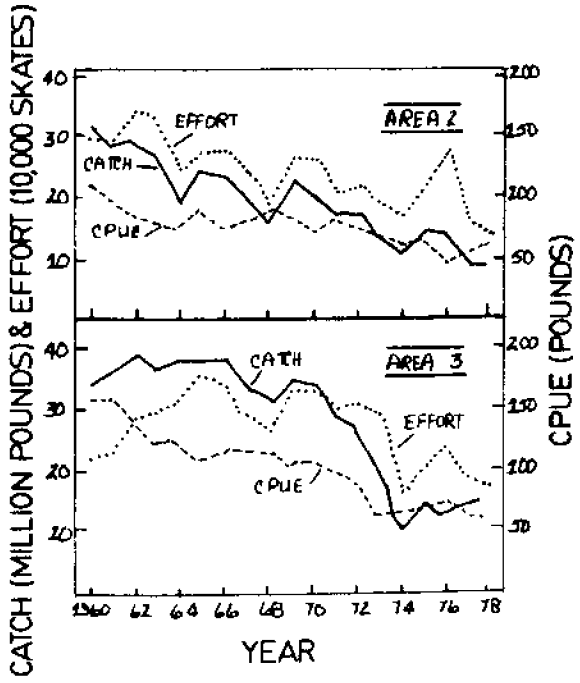


Figure 12. Catch, Effort, and CPUE

Question: How does that change the picture?

Reply: It changed the number of pounds caught per skate. The age structure was unchanged.

The biomass of the 8- to 20-year-olds, the fishable stock, went up in the 1950's and 1960's, then down (Figure 11). Now we think it's starting up again although there have been a couple of drops. The CPUE generally reflects the biomass in both Area 3 and Area 2.

We believe there has been a long-term downward trend in the juvenile population since 1935, and there was no incidental catch to speak of during much of that time - no foreign trawlers (Figure 13). This is one of the real mysteries in halibut management. On the other hand, as the juvenile stocks got smaller, the number of spawners was going up.

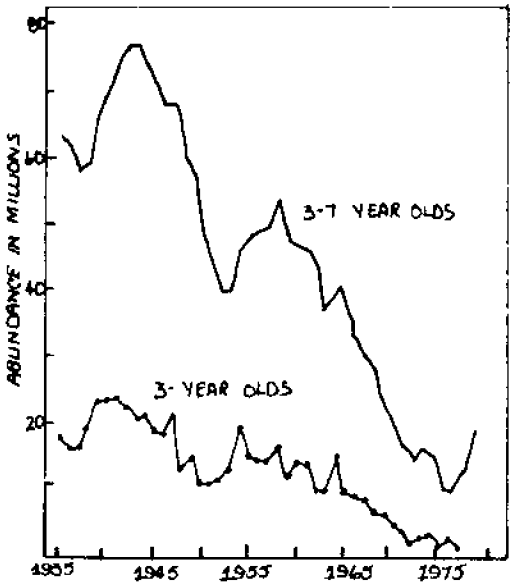


Figure 13. Estimated Abundance of Juvenile Halibut in Areas 2 & 3 Combined

Question: Is this based on the standard trawl survey you spoke of?

Reply: This is actually the result of population dynamics modeling and cohort analysis. We have only conducted the trawl survey from 1955, but the trawl survey confirms the population dynamics model. At first the juveniles went down and the spawners went up. Then the spawners went down and the juveniles went up. From a population dynamics viewpoint, that is hard to explain.

Question: How good are the early data?

Reply: Very good. The Halibut Commission has very old records, some going back to 1920. It probably has one of the best historical records kept on any fishery. We are now getting every piece of datum the Halibut Commission's ever collected into a computerized total information retrieval system.

Question: What are the oceanographic data like?

Reply: Skimpy. We've never been able to relate anything that we've looked at to our fish.

Question: Is NMFS moving towards better oceanographic data?

Reply: NMFS has been doing a fair amount of oceanographic data collection in recent years and intends to do more, but we'll always be lacking in historical data.

Question: How is the cohort analysis done?

Reply: We have a publication describing exactly how we do it. It is a virtual population analysis technique. I say that because it uses catch-age structures of the population.

We're also building computer models such as a Leslie matrix-type population model. We've got pretty good estimates on natural mortalities and fishing mortalities from tagging information and other indirect methods. We use functions of these in the Leslie matrix rather than fixed quantities. A good deal of information can be extracted in that manner. We're also building some nonlinear renewal models which are not published yet. Some of this work is being done at the University of Washington where we're undertaking some very elaborate new models.

But models are only as good as the biological information that goes into them and we still don't have all the biological information we need--things like viability of eggs for different ages of parent fish and proportions of sexually mature individuals of various ages in the population. We're working on these at the present time, but we still need more information.

Question: Have you considered exploitation rates or population trends related to prey species of halibut?

Reply: We do not have some of the necessary interrelationships with possible prey species. But you must realize that from 1935 to 1950 there was very little fishing on any of those prey species, yet the halibut population trend was going down. Population changes during the 1950's were at least partly the effect of a big Japanese trawl fishery in the Bering Sea that was developing at that time.

Size and Length Catch Data and Regulation

Commercial trawlers show a greater selectivity for smaller fish than do setline vessels (Figure 14). Although trawlers do get large fish once in a while, their incidental catch is mostly juveniles. Big fish are able to escape the trawl.

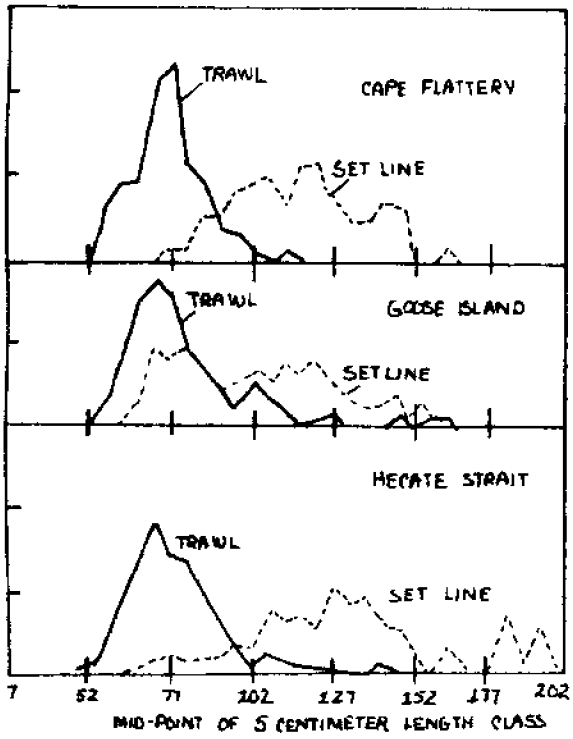


Figure 14. Length Composition of Catches of Halibut by Commercial Trawl & Setline Vessels for 1962

The size and age of fish caught by the setline fishery are much greater, although at one point on Figure 14 you will notice that the catch lengths for the setline fishery are rather small. That would be smoothed out if we took a five-year average. That particular datum may come from what we call the chicken patch on the Goose Island grounds, an area where there are many six- to nine-year-old fish, referred to as chickens in the industry. Goose Island is in Queen Charlotte Sound below the Queen Charlotte Islands, but above Vancouver Island and in towards the coast. It's a big area of sub-recruits. The area is a very productive fishing ground both for halibut and other groundfish, particularly rock sole and rockfish. It's a problem for us because the Canadian commercial fishery is dragging on these grounds. I know of a dragger who went to Goose Island last winter and in the process of catching 1,000 pounds of ling cod killed 10,000 pounds of halibut and threw it overboard.

If the two governments want to keep the halibut fishery, and they certainly have expressed such a desire by creating the new protocol to the treaty, they are going to have to do something about incidental catches. There are ways to trawl with off-bottom trawls. When you trawl for species like pollock, you don't have to have your gear on the bottom at all. There are all sorts of ways to rig gear to avoid halibut, and perhaps there are places like the Goose Island chicken patch that should be closed to dragging. We could accomplish a lot by setting a maximum allowable catch of halibut on the trawl fleet; when they reached that total catch level, all trawling would stop. Trawlers are very good at avoiding halibut when they want to, but they've got to have an incentive.

Question: You seem to have very good relations with trawl captains. If you impose such regulations, do you think this would continue?

Reply: I don't know that we've ever had that much cooperation with the trawlers. It depends on the region and segment of the fleet you're talking about. We know trawl skippers who will take us aboard when we want to conduct tagging in places like Hecate Strait. We'll tag all the juvenile halibut in the catch. But that's not the case with all skippers in the trawl fleet.

Some skippers believe the halibut fishery is inhibiting the development of the domestic groundfish fisheries. That need not happen, but it's up to management agencies to prevent it. We certainly should develop our groundfish fisheries. I think once they are developed there will be some regulations, and I see some signs that people will, in fact, impose the right kind

of regulations to allow both halibut and groundfish fisheries to coexist.

I think the International Pacific Halibut Commission is going to exist as long as the halibut resource continues. Whether the halibut resource continues as a viable fishery will be up to the respective governments. We can urge them to take action on incidental catches and things like that, but we can't force them.

Question: Can you talk about the snap-on gear system?

Reply: About 30 percent of the gear in use is snap-on gear. The fisherman snaps the gangions to a very long groundline as the groundline pays out from a drum on deck. It's difficult to gather accurate statistics on catches when this kind of gear is used. We do keep records on snap-on gear boats, but keep it separately from the regular fixed longline gear records. Usually the smaller boats use snap-on gear rather than the big traditional longliners.

At present a lot of new conventional longline vessels are being built in the U.S. It's becoming very viable fishing for a well-knit group of fishermen. They're going to use automated gear for fishing black cod, and eventually, when the price becomes favorable, Pacific cod and perhaps even rockfishes. There's going to be a longline fleet in Alaska. Meanwhile, however, the use of snap-on gear is increasing.

There's been some recent work done in Norway on the amount of energy expended per pound of fish landed, and longliners show a great advantage over trawlers. We always hear about trawlers being more efficient, but that's not so when you look at energy. A skipper of a very large trawler has to buy 200,000 gallons of fuel for a three-month trip. It becomes very expensive. Right now the foreign fleets are spending one-third of their gross income on fuel. That's going to inhibit those fleets from fishing all over the world one of these days. In the future we're going to have to look to energy-efficient methods for catching fish.

There are methods available to reduce the energy expended for the pounds of protein landed. We could do it with salmon, but nobody dares suggest it. We could catch all the salmon we wanted in traps in the mouths of rivers with very little use of fishing boats but that is not socially acceptable at the present time.

Question: What is the percentage of mortality in the incidental catch?

Reply: It depends on the kind of incidental catch. For longline gear, we're using 50 percent, although we have a variety of estimates. The Japanese would like us to use 30 percent; and in fact, they may be closer to the truth. We've had experience with Japanese longliners; very seldom do the halibut ever come on board. The gangion is cut while the fish is still in the water. The fish shed the hooks eventually, although we do find a few Japanese hooks in halibut caught in our domestic longline fisheries.

For the big stern trawlers we consider the mortality of halibut to be 100 percent. Recently NMFS has really increased its surveillance of foreign vessels. They found one Japanese vessel with 34,000 pounds of dressed halibut aboard, and this is under a regime in which they know there's a good chance they're going to get boarded. The skipper of this particular boat had put the halibut in the corners of the hold and piled blocks of cod up in front of it. Then he had underlogged by about 100 percent. If they're doing it today they may very well have been doing it in the past and maybe some of the stock decline can be attributed to that. There are past unknowns with foreign fisheries and we feel there's always been underlogging. NMFS estimates that, historically, catches of halibut were actually twice what was logged. Underlogging is a very serious matter at the present time.

What makes us suspect incidental catch records is that the Coast Guard and NMFS are getting very good at inspecting these boats at sea and estimating the quantity of fish on board, checking log books, and seeing if the two match. They don't believe underlogging is anything new, simply that they are detecting more of it because their methods of enforcement are better. It's a problem for anybody trying to manage a fishery. We estimate the pounds of halibut per ton of foreign-caught fish; but if the actual catch of the other species was double the estimate, then our figure is half as big as it should be. That will really affect the population dynamics analysis. On the other hand, our size-frequency data are very good.

The NMFS enforcement people tell us that the most difficult thing to enforce is gear regulations. Foreign fishing boats are required to use off-bottom gear in the wintertime, and its use is very difficult

to control. There are observers on about 15 percent of the boats. On the other 85 percent of the boats the fishermen can use the gear as they like, but risk being caught and cited. The Russians are extremely good about using off-bottom gear. Their pollock fisheries have very clean catches, 97 percent pollock, as a result of very good electronics. They wait until the pollock come off the bottom before they zero in. They catch a fair amount of Bristol Bay salmon incidentally. When off-bottom gear is used some salmon will be caught, but no flatfish.

The Koreans and the Japanese, on the other hand, love to fish on the bottom because they use just about everything they catch. They don't throw much away. Even though they're concentrating on pollock, they catch a lot of flatfish and use it.

Question: In regulating the size of the catch, how close will you be this year to staying within the guidelines that the governments have set?

Reply: We'd better come close. We don't want any more problems like we've had in the past. It's very difficult to predict before a fishery starts what the effort and the catch per unit of effort will be. In Canada it's easier, because there is a limited entry program. We know which vessels can fish, even if we don't know exactly how many are going to fish. What we've done this year is to set a series of opening and closing dates for halibut fishermen. We set the length of the first season so that quotas will not be taken, using maximum catch per unit effort and maximum effort. Then we will anticipate which areas or portions of an area are getting close to their quotas. We are confident that no quotas will be exceeded.

This year we have 45 days between the first period and the second period, due to a large Bristol Bay salmon run that will require all the processors' capacity. That 45 days should give us ample time to compile a very accurate data base on the total catch of the first fishing period. Last year the average number of skates fished per day increased by 50 percent between the first fishing period and the second fishing period in southeastern Alaska. This year we are anticipating the same kind of increase and we plan to reduce the second fishing period proportionately. That's a very conservative way of doing it, but it tends to insure that we will stay beneath the quota. If we do, we'll open up another couple of days of fishing in the third fishing period. In this way we'll creep up on the quota.

I use the word quota but I really mean catch limit. These days our so-called quota is really a catch limit. We consider it an upper boundary. We plan on either obtaining it or catching less.

The plan I just outlined applies to Area 2, which includes both the U.S. and Canada. It's feasible to open a short period there because that fishery is a small-boat fishery. If you give the fishermen two days of fishing they'll fish for two days.

Area 3 is not the same. A very large Seattle fleet fishes Area 3 with large longliners, and that fishery catches the most fish. They have a lot of expenses--fuel and crew costs, and so forth--and we'd like to give them a reasonable length of time to catch enough fish to meet those expenses, so they have a 15-day first period. We know they won't exceed their catch limit of one million pounds in the first 15 days. In fact, we think that they may very well get two full 15-day fishing periods. Area 3 is not such a problem this year. There won't be an international problem if they exceed their catch limit since Area 3 is now strictly a U.S. fishery. Last year we exceeded the quota a bit in the part of Area 3 out in the tip of the Aleutians, but this year we've changed the boundaries and that is part of Area 4. Where we have the problem now is Area 2 because the quota is split internationally, but we're going to creep up on the catch limit in both countries and just hope for the best.

Question: Doesn't setting a shorter and shorter season discourage capitalization in the halibut industry?

Reply: I don't think we can say any longer that there is strictly a halibut fishery. With the smaller catches and increases in effort, the halibut fishery is a part-time fishery. Longliners are now fishing halibut during halibut season, black cod during black cod season, and will eventually fish for Pacific cod and rockfish at other times. There will be a regular progression of species in the catches of longliners. Halibut will be one part of that.

There is some research going on now by a working group set up by the Northern Pacific Fishery Management Council (NPFMC) to look into a limited entry halibut

fishery in the U.S. It's just in the very preliminary stages. The first thing they are going to decide is whether limited entry is needed in the halibut fishery. There's a lot of opposition from fishermen, and that will be taken into consideration. But if it is deemed necessary to have a limited entry fishery, then the next point will be to try to devise the best of all possible limited entry systems. We don't know what that is. I have come to the conclusion that I know little about limited entry fisheries. It's a very complex business. There are social and economic considerations; and as fisheries change, the whole set of conditions changes, so I can't tell you whether limited entry would be a good idea or not. It would allow us to keep accurate records on every licensed boat and to compute catch-per-unit-of-effort by boat. It would be very easy for us to know what level of effort is going on for the whole fleet. From a selfish point of view in terms of fisheries management, limited entry would be very nice. From fishermen and industry points of view, I don't know if it's good or not. It does bother me that it's really not free enterprise. I rather like the free enterprise system. A person should be allowed the opportunity to fail at something if he wishes.

Question: Is it illegal, according to the FCMA, to limit entry?

Reply: That is a problem right now that is being researched by the attorneys for the NMFS. There's another problem. Inside a three-mile-wide area offshore, fishing is controlled by the coastal state, for example, the State of Alaska. Any type of limited entry program would have to be consistent with Alaska's management program as well as with the management in the FCZ. Yes, limited entry is legal in this country. However, there are a lot of legal problems between federal and state jurisdiction.

There are real problems with some limited entry programs. If you want to see some bad limited entry programs, look to British Columbia. People there who have been involved will agree that they have had problems. Limited entry has been instituted there in every fishery, species by species, over the years. In some cases they gave the license to the boat; in others they gave it to the individual. What they really should have done was to develop a complete system from the beginning. There are herring fishermen in British Columbia right now who lease their herring license for $50,000 a year. That's the going price. They never fish themselves--they just lease out their license and reap the profits.

Question: How do you manage a fishery with a fish that lives 25 or 30 years? Do you have in mind any methods for restricting the catch to an optimal size, say eight- or ten-year-old fish?

Reply: First you compute an optimal size limit, then you determine what age group of fish are recruited into the fishery. Optimal size limits usually come from a yield model like the Beverton-Holt yield-per-recruit. You can optimize the yield from that kind of analysis, but it is fraught with difficulties and risky assumptions. But that's where the size limit of halibut came from. One tries to optimize the catch from each cohort. Then, based on the available information on age-class structure of the catch, all the necessary information is generated to use population dynamics modeling to estimate a set of optimal conditions under which to fish.

Question: Not quite. You gave an example of two fishing areas that did quite well. How do you know this wasn't caused by substantial migration of 20-year-olds, for example?

Reply: Our tagging information this year indicated no changes in migration patterns. What we think happened is that the fish became more available. We believe temperatures were higher than usual, feeding rates probably increased, oceanographic conditions were quite different, and the halibut came in closer to shore and were more available to the fishery.

Purchasing, Processing, & Marketing Seafoods Domestically and Internationally

Mark S. Sandvik, Vice-President
Icicle Seafoods Incorporated

I hope to give you some insight into the fish processing industry's approach to purchasing, processing, and marketing of seafoods, both domestically and internationally. Much of what I will talk about today will concern the actual operations of the company I work for, Icicle Seafoods, so I feel it is best to start with a brief description of the company itself.

Icicle Seafoods is a fairly typical Pacific Northwest and Alaska fishing company. It was started in 1965 in Petersburg, Alaska with the purchase of a small cannery. This purchase was privately financed by several individuals who are still involved as the top management of the company, along with a group of fishermen. The situation seemed very attractive since it gave the company a captive source of production, while giving the fishermen a guaranteed market along with an opportunity to share in any profits.

This concept has proven to be very successful; and from one small cannery in 1965, Icicle Seafoods has expanded to include five complete, shore-based processing facilities and three floating processing vessels. Gross sales went from $5 million in 1970, to $25 million in 1975, to $75 million in 1978, and hopefully, this year, we expect to go over the $100 million mark. We buy the raw product directly from independent fishermen, process it in our own plants, and market this product throughout the world. Approximately 85 percent of our production is frozen and 15

percent is canned. Half of our total production is marketed domestically and half is marketed internationally.

Historically we've been involved in the high-value seafood products in the north Pacific: the five species of salmon, halibut, shrimp, king crab, tanner crab, Dungeness crab, sablefish, and herring. By far the greatest opportunity for the future is in the bottomfish industry. The potential for the bottomfish industry was defined somewhat by the Fishery Conservation and Management Act of 1976 (FMCA), which I will discuss in some detail a little later. One way in which we differ from other American companies is that we have remained a privately held U.S. corporation. Many of our competitors are 50 to 99.7 percent owned by Japanese conglomerates with unlimited resources.

We feel there are three critical relationships necessary to make a seafood company successful: its relationship with 1) fishermen, 2) its employees, and 3) its customers.

Generally speaking these three relationships link directly to the three topics of today's discussion: purchasing, processing, and marketing of seafoods. Each of these three areas must support and complement the other. A seafood company can have the best processing plant, employees and customers in the world, but if no fishermen are willing to deliver products, that company will not survive. Conversely, a company that purchases enormous quantities of products from the fishermen but has no established market will also fail.

If I had been asked to discuss these subjects five years ago my approach would have been much more straightforward. Your course syllabus reflects this; it recognizes the difference between utilized and underutilized species. Utilized species are generally the high-valued ones I have already mentioned; and underutilized species are the vast resources of pollock, hake, cod, flounder, and sole from the north Pacific and Bering Sea. Of course, these species are only underutilized as far as American industry is concerned; they are very well utilized by the vast foreign fleets fishing our waters.

There are reasons why the U.S. industry has concentrated on a few species and neglected others, all related to the lack of economic opportunity. Currently these underutilized species just cannot be purchased from the fisherman at a price he can live with, and if they were, they could not be processed through U.S. fish plants and marketed at a competitive price on the world market.

The FCMA was essentially designed to make all seafood resources located within the U.S. 200-mile economic zone available to the American fishing industry, that is, U.S. fishermen and processors. However, a ticklish situation is developing concerning the proper interpretation of the FCMA.

This law is vague and unclear in its actual intent. There are several misconceptions. The main one is that the American fishing fleet is enjoying much less competition now that the foreign fishing fleets are out of its hair. That couldn't be farther from the truth. In reality, foreign fishing fleets are still fishing very actively in U.S. waters under quotas and restrictions which aren't too far below their historical catch levels.

American fishermen feel that the law intended these seafood resources to be harvested by them, while American processors feel that the law was really designed to enable them to process the resource, hopefully caught by the American fishermen. Processors contribute to local economies, pay substantial amounts of taxes, and eventually will contribute to a decline in our national trade deficit. We feel strongly that the emphasis should be on industrial production rather than on fishing effort, although these will hopefully coincide with each other.

The fishermen feel that if the U.S. processors cannot match prices offered by foreign processors, then the fishermen should have the right to sell to the foreign processors. However, U.S. seafood companies are forced to compete on the world market with subsidized foreign processors who are not encumbered by our state and federal regulations and taxation. The foreign companies contribute nothing to the U.S. economy other than the initial purchase price to the fishermen.

In many cases the only viable markets for the underutilized species are in the same countries that are now fishing in our 200-mile limit. Many of these countries have imposed restrictions or barriers preventing the importation of these species from the U.S. They also realize that as U.S. industry develops their quotas in U.S. waters will be decreased, so they are not too anxious to help us out. Icicle

Seafoods' current production, as is the case with most other companies, is probably 95 percent utilized species and 5 percent underutilized species.

> *"We try to develop a team concept in which we work with fishermen . . ."*

Since most of our experience has been with the utilized species, we are more comfortable purchasing these from the fishermen. To develop an effective purchasing situation you must have a consistent or captive source. Few companies still own their own vessels; Icicle Seafoods does not. We maintain a so-called captive source by striving to pay the fishermen the top price for a quality product and to guarantee them a viable market.

Developing a top price is an inexact science requiring active input from marketing, accompanied by as accurate a forecast of catch levels as possible. In some cases this must encompass not only U.S. catch levels but also the entire world catch levels. Sometimes we tend to forget that we are not the world's only harvesters of certain species. It is true that there are times when we are able to "back-to-back" purchase; to buy and sell in the same time frame, but this is not always possible. As the company's volume increases it grows impossible to liquidate inventories in short periods of time. We must begin to carry an inventory on a year-round basis. That is fine on a firmer, rising market, but in a falling market it can be brutal. The market is volatile and subject to many factors beyond our immediate control, and it is very frustrating. When we commit ourselves to buy a product in a certain geographical area, we are committed to buy whatever volume we can physically handle. This is part of the service we provide.

Catch limits for most species of seafoods are governed by quotas or structured seasons or both, with specific management tools being implemented as seasons progress. Salmon for instance are governed by closely monitored seasons accompanied by escapement targets of spawning fish. Allowable herring catches are generally set by an assessment of the stock with, in some cases, a 10-percent allowable catch of whatever the stock's level is determined to be. Crab are governed by quotas and seasons accompanied by catch per unit of effort data, that is, the number of legal crabs landed for each pot hauled.

Purchasing seafood is a straightforward process of building a viable relationship between the fisherman and our company. This includes an open line of effective communication. We try to develop a team concept in which we work with the fishermen to catch, process, and market the highest quality product available. We meet with the fishermen to discuss better ways to handle and hold the fish. The end product is only as good as the raw material we receive, and the better the quality we receive, the higher market price it will command.

There really is no distinction between utilized and underutilized species when it comes to the mechanics of purchasing seafood. The difference is simply that for underutilized species we have no track record to fall back on and no viable market situations at present. We don't know what we can sell these species for. A workable selling price starts at whatever price is paid to the fisherman, plus state and federal taxes, plus recovery losses, plus processing costs, plus plant overhead, plus transportation to the market place, plus hopefully, some sort of profit margin. With the emerging bottomfish industry which consists in part of underutilized species, we have too many gaps in this sequence to proceed at full speed.

Icicle Seafoods' approach is to develop the bottomfish industry on an incremental basis. In other words, if we can reasonably expect at least a break-even situation while paying the fisherman a price he can live with, then we will all proceed in a controlled manner. We are presently purchasing flounder, pollock, and cod at plants in Alaska with, we feel, a fair chance of success. These operations require sacrifices from both the fishermen and the processor. We have to be very open with each other. The fisherman must agree to fish for very low prices close to his break-even point, and we must work with an essentially break-even philosophy on profits.

> *"These operations require sacrifices from both the fishermen and the processors. We have to be very open with each other."*

Question: What are you doing to expand the market for underutilized species?

Reply: When I travel to Europe or Japan or wherever I go, I'm actively selling utilized species: salmon, halibut, crab. When I get a captive customer, I try to sell him anything I can think of, or explore the potential for selling him anything I can think of. We're continually pushing to open up markets for species we may not actually be processing. Sometimes you approach a problem on a tangent: you start from the production end and just work for the best sales or marketing you can do. In other cases you can work backwards from a viable market price back to the price you can pay the fishermen so that you can realize some kind of a profit.

Question: What effect does the U.S. quota for the foreign fishing fleet have on settling prices?

Reply: Most of the species being restricted are low in value. One of these is sablefish. The quota on sablefish has been cut back very sharply for Japanese fishing in U.S. waters. Originally, they wouldn't buy our product. They said we were too high. But now that they are cut back to a level where their own needs aren't met, they are a buyer.

"If there's economic incentive, the rest will take care of itself."

I think you'll see the same thing happen with all bottomfish, but we have to develop some mechanism to phase foreigners out. The way it's set up now we tell our government that we can utilize so many million pounds of a particular species, then the government allocates the rest to the foreign fleet. I think we should cut foreigners back somewhat first to allow us the opportunity to develop the ability to use these species. I believe strongly that if the foreign fleet were not in Alaskan and U.S. waters, within 5 to 10 years American industry, without too many problems, would be able to completely utilize the vast resources of bottomfish that are within our 200-mile limit. I'm in marketing so I'm telling you my version; maybe a production person might approach it in a different way. From my standpoint, it's a very basic situation. If there's economic incentive the rest will take care of itself.

Question: How do you choose fishermen from whom you will buy?

Reply: It's a mutual situation that develops over a period of time. Today with sockeye we're faced with tremendous production and limited processing facilities, so it is important for fishermen to ensure themselves a market for their fish. In times of short production it is important for us to ensure a large fleet to fish for us. In other words, it's a two-way street. There are times when we are very important to the fishermen and times when they are very important to us.

We try to be consistent, regardless of the situation. We, of course, will work more closely with the fishermen who over the years have cooperated with us.

There has to be cooperation in order for us to develop the bottomfish market. We need a more open relationship with fishermen than ever before. We can't expect enormous profits in a very marginal situation like this. If we find markets which will ensure us clear profits or if we become more efficient at handling the product, then we can pay the fisherman a higher price. Or, conversely, if the fishermen can easily catch large quantities of the product in short periods of time, then maybe they can accept a reduction in price. But it's going to take mutual cooperation to develop this fully.

I noticed in your course syllabus that you will include the area of aquaculture. I am not actively involved in aquaculture but I would like to make a few comments about it. This is an exciting, innovative field, and one of extreme interest to Icicle Seafoods. Contrary to what some of you feel, we do not feel threatened by aquaculture programs as long as we're aware of them. Populations are growing and people are eating more fish. Severe shortages are not healthy. They create very high and unrealistic markets. I have visited the fish farms in Norway where the smolts are released into circular pens in fjords, in some cases at the heads of fjords which have been completely blocked off from the ocean. I have watched several thousand pounds of fish being butchered and learned that farmed salmon are just as inconsistnet in quality and size as wild salmon. Possibly they will be able to control size genetically in the future. There are problems in developing diets for these penned fish. The fish lack the natural exercise necessary to create the proper body tone. Along with increased produc-

tion, the strong point of farmed salmon is that it can be marketed fresh on almost a year-round basis. Large processing and freezing facilities are not necessary and the fish derive top market price.

Weyerhaeuser has developed a concept called ocean ranching which is much more exciting. The smolt are raised just as they are in fish farms, but instead of being released into pens, they are released into the ocean. These fish live and grow with the wild salmon. The problem, of course, is the loss to natural predators and to fishermen. Now I'd like to discuss some trends in the processing area of the seafood industry which is more straightforward than the purchasing and marketing areas.

Years ago most seafood was salted or canned. These were the only methods of preserving seafood products.

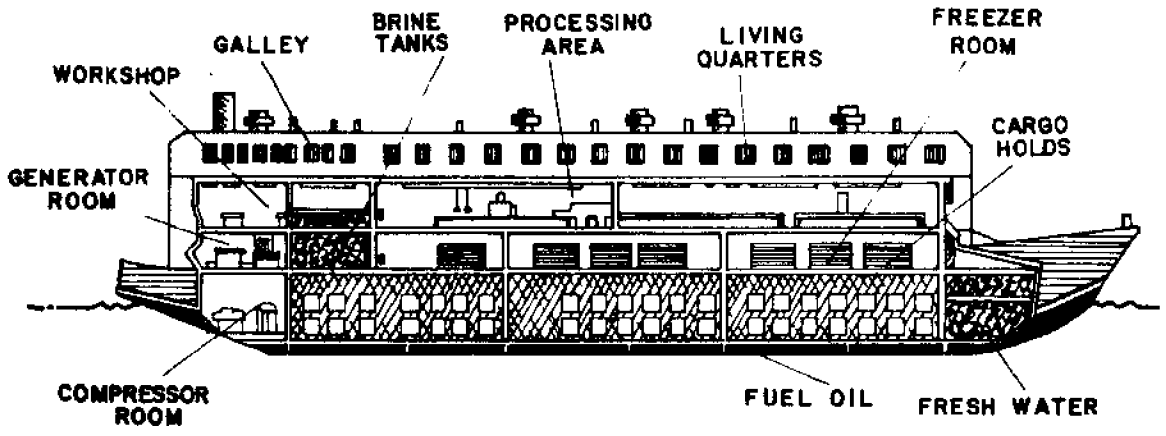
Freezing wasn't heard of, and fishing effort was generally limited to the area close to the canneries. There was, of course, a viable market for all fresh products, again, within a certain distance of a processing plant. This was also limited by time constraints and available modes of transportation. Freezing capabilities slowly began to develop and as the demand for frozen products grew along with the selling price, processors made major commitments toward expanding their available frozen products. They built freezers and cold storage side by side with their canneries. This trend has nowhere been more apparent than in the Bristol Bay sockeye fishery. Historically 100 percent of the sockeye production was canned, but now as much as possible is frozen. Canning is still an integral part of the seafood business, but the dollar return from canned products is generally much lower than from frozen ones. As more and more seafood companies with freezing capabilities compete for the raw product, the price of the raw product becomes higher and, in some cases, forces companies with only canning capabilities out of the market.

The philosophy of effective seafood processing is very basic. The more expeditiously seafood products can be taken from the sea and processed into one form or another the less deterioration they will suffer. Once the product has been landed the clock starts. There are various methods to protect the seafood quality prior to delivery to the plant: fishing close to the plants; semi-processing the product quickly and using some sort of refrigeration; and delivering the product live to the plant in tanks as with crab. There are many other techniques but none substitute for a quick delivery of the product directly from the fishermen to the processing plant. This is one of the reasons that Icicle Seafoods has made a major commitment to processing barges which can be towed to wherever the production dictates. These floating sea plants are completely self-sufficient. They have their own power supply, processing capabilities, and work force. We're very excited about this particular effort. These sea plants are located right in the fishing grounds in an optimum situation. Other processors must, in some cases, fly salmon all the way from Bristol Bay to Seattle where it is finally processed.

Icicle Seafood's production, as I mentioned, is 85 percent frozen and 15 percent canned. There will always be a market and a need for the canning aspect of the seafood operation. When we buy raw products from the fishermen we are buying straight run or ocean run. Fish are no different from human beings: some are young, some are old, some long, some short, some thin, and some fat. Only very good quality fish are frozen. To be frozen a fish must, above all, be firm with no severe external blemishes. If you've ever observed salmon in a natural state you'll see fish that you don't think should be alive, fish with half their backs chewed away swimming along with all the other fish. If we buy from the fishermen we have to buy everything, which isn't a problem as long as the product is graded and properly frozen.

The traditional method of preserving frozen products is by immersing the frozen product in a water solution and creating a protective layer of ice or water glaze around the product. This is an effective method of preventing oxidation and dehydration. However, a proper glaze is effective for not much more than a year. Hopefully, the product is marketed within a year but that is not always the case. With time the product will dehydrate.

In our largest plant at Petersburg, Alaska, we have made a major commitment to vacuum packaging the product when it is fresh--before freezing. The product is packaged fresh into a durable plastic bag and almost a 100 percent vacuum is drawn. The product is then frozen exactly as before, with complete protection from freezing process and from any further oxidation or dehydration. No further handling is



FLOATING FISH PROCESSOR

required and the quality of the product is guaranteed for extended periods of time. We're very impressed with the process although it's more expensive than conventional handling. We feel it's the way to go and most other companies are going to be forced to package in this manner in the future.

Question: What do you find is the optimum size for your fish-processing barges?

Reply: Large European fishing companies which own many fish-processing vessels feel the optimum size, if I remember correctly, is 150 feet. There are foreign vessels up to 200 feet that really aren't more effective than a vessel of 150 feet but consume a lot more energy. Energy is a factor, but in our situation it hasn't become too large a factor.

Question: How are your fish-processing barges designed?

Reply: What we call our sea plants started out as basic barges. We put refrigerating facilities or holding facilities in the hull. The hull is essentially a giant cold storage unit. We built a three-story superstructure above the deck: the main floor is freezing facilities; the second floor is processing facilities; and the third floor is living accommodations (see Figure 1). It's a very functional situation with some space limitations. We can freeze roughly 300,000 pounds of product per day in a barge. Storage is the limiting factor; a barge's capacity is about 3 million pounds. Of course, if you're processing 300,000 pounds a day, in 10 days you have to have some means of offloading the product. We use the same vessel that tows the barge as a support ship.

Question: What do you do with fish that are not of freezing quality?

Reply: In some cases we have canning-quality product. We have to semi-dress it, freeze it, stow it, and ship it to one of our shore plants for canning at a later date.

Question: What are living conditions like on the barges?

Reply: These barges have anywhere from 100-150 people living in very close quarters. Sometimes they work two shifts a day. We try to provide comfortable accommodations and entertainment, although there are not too many forms of entertainment you can provide. We have a video television system and a sound system. There is also time for a lot of reading. If you sign on with us, it's generally for a four-month period.

Getting back to the packaging: as I mentioned, after the product is vacuum packed, it's frozen exactly as it used to be. The vacuum-packed product will keep well over three years, which should cover any possible situations.

The fresh market for many types of seafood is mushrooming as effective modes of transportation and innovative methods of

handling have become available. Although shipping costs can be much higher with a fresh product, the market return is also higher, and processing and handling costs are decreased. As people become more receptive to seafood, they tend to prefer a fresh product over a frozen, even at considerably higher prices. If this trend continues, more product will be marketed fresh than has been in the past.

One new method of handling fresh products over longer time periods and distances is the controlled atmosphere container. With this system the product is semi-processed fairly close to the source of production and then packed in ice in a refrigerated container from which the atmosphere has been partly removed and replaced by carbon monoxide or nitrogen. This retards oxidation. The product is then shipped by land, with a reasonable shelflife guaranteed upon arrival. Costly air freight charges have been circumvented. In some cases this procedure is used to ensure a first-quality product even when that product has been frozen at a distant site.

In most instances seafood companies package their products in what we term a "bulk pack," meaning semi-processed in large cartons of 100 pounds or more. There are several reasons for this. First of all, most of our product is landed in very large volumes within a very short period of time. We just do not have the opportunity or the personnel to process it into speciality packs. This would require expensive labor. The high cost of labor in Alaska is a limiting factor in this regard. Ultimately the marketplace dictates the method and style of handling and packaging.

We're willing and capable of packing the product in any imaginable form if a company agrees to buy it at a price which will enable us to cover our cost. In some cases we have to anticipate our customers' needs or desires because tremendous quantities are purchased in very short periods of time and decisions must be made at that time as to which method of handling and processing to use. These decisions are made from past experience and certain current marketplace situations. Slightly different packs and products are required by the international market than by our domestic market, so the situation can become very complex.

The third and final step in the movement of the product from the ocean to the consumer is marketing. I'm sure you've sensed a certain influence from the marketing place as I have discussed the purchasing and processing of seafoods. There are essentially three viable markets for U.S. seafood products: United States and Canadian markets which I will lump together as the domestic market; the Western European markets; and the Far Eastern or Japanese markets. In addition, there are minor markets throughout the rest of the world.

At Icicle Seafoods we view the entire world as our marketplace. We have no conscious constraints as to our potential customers. But we do feel an obligation to protect our established business before taking on new commitments. We currently sell 50 percent of our product domestically throughout the United States and Canada and 50 percent through the international markets. Of the latter half, we sell approximately 50 percent to the Far East, primarily Japan, and 50 percent collectively throughout western Europe. I might mention that even though a considerable amount of seafood product is shipped to Korea, it is in most cases simply being reprocessed for a Japanese company which is taking advantage of the very cheap labor costs in Korea.

Recently I've heard people talking about the large volumes being shipped to China; and, of course, this is very interesting to us because if we can sell a billion people anything we would have a pretty good situation. Our information, however, is that the Chinese are interested in exporting seafood products; they're importing technology not food. But people are right; there is seafood product being shipped to China. This is because Chinese labor is now cheaper than Korean labor. Five years ago Korean labor was 30¢ a day. Now it's roughly $3 a day, and Japanese companies are using China as a shipping site instead.

Question: Do you see a potential for a market in Russia?

Reply: I had the opportunity to spend one day in Leningrad two years ago and I don't think that there's any potential market with Russia. A lot of our European customers have done business with Russia, but it's difficult. They still have a barter system in Russia; their currency is not traded in the world market so they can't buy and sell. One customer was telling me he sold some seafood to Russia and had to take a shipment of ice cream back! That sounds very strange, but apparently the Russians make really good

ice cream. He made money when he sold the fish, and he sold the ice cream in Italy at a profit, too. I think it would be very difficult for us to deal with Russians in the short term, however. They produce tremendous amounts of seafood items that we produce and export.

We sell products sporadically in areas of the world such as Australia, South America, and the Caribbean. There is tremendous potential in the Middle East (with their oil money), and in Egypt, the rest of North Africa, and Nigeria. We try to be patient; you wouldn't believe the number of calls I get from people that want 10,000 tons a week of this or 10,000 tons of that for some market in Nigeria or Egypt or someplace else. We can't be too negative about it because one of these days they may really need us. But most of these people are opportunists; they're in the exporting business. They may make a contact in Saudi Arabia who says, "We really need some fish, what can you give me?" Then they'll call us, knowing nothing about seafood, but just figuring if they get a quote from some company they can sell it. One of these days something will click and it'll work. One never knows when a change such as a shift in currency rates will enable a previously unworkable situation to become very attractive. At the same time we work hard to protect our market distribution, although from year to year one market may become more attractive than another. Our philosophy is to maintain our presence in each market.

Our domestic programs differ slightly from our export program. Approximately 75 percent of our domestic product is sold to wholesale distributors who ultimately sell our product to what we call institutional buyers such as schools, hospitals, and restaurants. The remaining 25 percent is sold to large supermarket chains and fast food restaurant chains.

Almost 100 percent of our international business is to large importing companies or very large wholesale distributors who are providing essentially the same source in their countries as we provide to the domestic market. When we market our products we do not dwell strictly on the specific product and the price. We sell not only the product but Icicle Seafoods' entire operation. This starts with the raw product from the fishermen and continues as the product is carefully handled and processed in the manner the customer desires, and then is marketed, not sold, within a consistent, continuous, and realistic program. We strive to work very closely with our customers, just as we do with our fishermen and employees.

"We believe in having the industry police itself, but there are problems inherent in this policy."

Question: What kind of federal regulations are there on quality?

Reply: Our government has no really strict quality codes which would govern the seafood business. Our personal feeling is that to be a successful company we have to produce a quality product. We believe in having the industry police itself, but there are problems inherent in this policy. A good case in point would be sockeye. We probably freeze as much sockeye in Bristol Bay as anyone. Let's say there are 50 companies processing it. If a few companies process an inferior product which develops a bad name in the marketplace it reflects on all of us. We feel personally it's something industry should try to control; and the better we handle our quality, the better we'll succeed in the world market.

One country where the government does get more involved in quality is Canada, and I think they have done a good job. I know that my counterparts in the Canadian companies don't like it; but as far as the international market, the Canadians have a better reputation than the Americans because of it. Maybe that is a good point to consider.

Today's market situation is very complex. Everyone is aware of the awesome marketing problems and the tremendous quantity of underutilized species which someday will be harvested by American fishermen. The maximum sustainable yield for all seafood resources in the world is estimated to be 100 million tons. Five percent of this is located within Alaska's 200-mile limit alone, and three-quarters of that five percent is comprised of bottomfish. Foreign fishing fleets, by the way, are currently harvesting 99.5 percent of the total bottomfish production in Alaska. The short-term outlook for marketing large volumes of American-processed bottomfish is not too bright. The U.S. domestic market is pretty well saturated, in many cases by imported products caught within our own fishing zone by foreign fishermen.

The Canadians also are exporting large quantities of processed bottomfish. This is sold by fishing companies which are subsidized by the Canadian government and which are buying the raw product more cheaply than their U.S. counterparts. Western Europe could be receptive to U.S. products, but until they are cut back from fishing in U.S. waters they will be able to supply most of their own needs plus enough to sell considerable quantities to the U.S. Freight rates, and in some cases local trade restrictions, also make U.S. products less competitive than the European product on the European market. On the other hand, low production in the North Sea has temporarily forced Europeans to look for cod and herring from the U.S., but again, margins are very thin because of the freight situation. Since Japan is the world's largest market for fish products it holds by far the most potential for marketing of U.S. bottomfish. The Japanese have imposed severe import quotas and freight restrictions on a number of products, however. Freight rates have a limiting effect with Japan also.

I think some people feel that the reason we aren't selling our underutilized species is that we don't have a market for them. There is a market but it's just not a viable one at this time. We know the customers that could buy our bottom fish. Right now we're just not competitive on the world marketplace.

On the other side of the coin, with the utilized species we have exactly the same market to contend with, but it is a completely different picture. There are viable markets for most of our utilized species, the same three world markets I've been discussing. That is why these species are utilized. There is economic opportunity involved with their purchasing, processing, and marketing.

Everyone is predicting gloom at the prospect of the 1980 Alaska sockeye season, but we feel if we buy at the proper price when it is realistic from a marketing standpoint as well as being fair to the fishermen, we will generate much more interest with our customers throughout the world. We will go on to successfully process and market everything we can physically handle.

Actually there are several good reasons to be very optimistic about the prospect of the seafood industry. Everyone is aware of the dietary and health benefits of seafoods, and as this becomes a more health-conscious nation, many people are jumping on the seafood bandwagon. As people feel more positive about a product, they're willing to pay higher prices for it. People no longer feel they are compromising themselves when they order seafood. Our per-capita consumption in the United States has increased about 20 percent in the last 10 years, from about 11 pounds per person to 13 pounds. And our population is growing at approximately four percent per year. Of course, we have a way to go to match the pounds per capita consumption of seafood in Japan. It is also forecasted that the world population will double by the year 2000. The protein to feed this tremendous population will have to come from somewhere, and it might as well come from the sea.

> ***"Right now, we're just not competitive in the world market."***

In closing, if I had to select one key word to denote a successful seafood operation I would choose the word "quality". A quality product will always sell, which is not necessarily the case with mishandled products. In the past American seafood processors have been guilty of sacrificing quality for quantity and have gotten by with it. But as the overall production of seafood expands and the business becomes more competitive, the quality seafood processors will prevail. Quality control is particularly crucial with bottomfish production.

One of the largest seafood buyers in the country was discussing Icelandic cod fillets and he was asked for his opinion concerning bone content. His reply was that since they never found any bones in their Icelandic cod fillets it was not an issue.

This is our competition and they have set the standards we must strive for.

Developing & Implementing the Fishery Conservation & Management Act

James P. Walsh, Deputy Administrator
National Oceanic and
Atmospheric Administration

When I first came to the U.S. Senate in a staff capacity in 1972 questions were being raised about the adequacy of the U.S. fishery policy. Foreign fishing off U.S. shores had been on the increase for several years, expanding from about 1 million metric tons in 1963 to about 3.6 million metric tons in 1971. This increase in the foreign fishing effort came at a time when U.S. fish catches were declining. During that period several fish stocks began to succumb to overfishing. The limit of our exclusive fishery management jurisdiction was then 12 miles.

> *"The predominant political power in U.S. fishery policy was the tuna industry."*

In 1972, despite this condition in our coastal fisheries, not a lot of sentiment existed in the Congress favoring a law to create a 200-mile limit. That concept was viewed as a protectionist measure--a measure that might solve political problems for a number of coastal congressmen and senators--but that might also create serious foreign policy problems for the country as a whole.

The predominate political power in U.S. fishery policy issues was the tuna industry. That industry was the best organized and the only sector of the fishing industry with the money to finance a substantial political effort in the Congress. Dependent on catches off other nation's shores, the tuna industry strongly opposed a 200-mile limit. Large processing companies were quite a powerful component of this group. Distant-water shrimp fishermen also opposed the 200-mile limit since this group was quite successful in fishing for shrimp off Brazil and Mexico.

Another powerful influence in fishery legislation was the Third Law of the Sea Conference. Preparations had begun for this conference in 1967 and it had convened in 1974. The extent of a coastal nation's authority to regulate fishing was one of the more important subjects under consideration. Thus, in 1972, there was some sentiment in Congress for dealing with the fact that foreign fishing fleets--many subsidized by their own governments--were catching increasing amounts of fish off U.S. shores and that U.S. coastal fishermen were being harmed economically as a result.

"I was told to draft a bill that (would) kick the foreigners out of our 200-mile zone."

Genesis of the 200-Mile Limit Bill

In the summer of 1973, however, Senator Magnuson of Washington State, changed his mind about the question. Elections were coming up and the senator felt something had to be done about foreign fishing off the State of Washington. He also had a visit from Senator Ted Kennedy who said that the fishermen were giving him a bad time about foreign fishing off the coast of New England.

I was called in shortly after the meeting between Senator Kennedy and Senator Magnuson and was asked to draft a bill. "What do we want to do in this bill?", I asked. I was told to draft a bill that kicked the foreigners out of our 200-mile zone. So I had a very short bill drafted by the Senate Legislative Counsel that really did nothing more than declare a 200-mile limit and direct all foreign fishermen to stay outside of it. Two hours before the bill was to be heard in the Senate I received a call saying that Kennedy had decided not to co-sponsor the bill. Of course, I was shocked. My boss, Senator Magnuson, had been very reluctant to embrace the 200-mile limit in the past because certain Washington State salmon fishermen and processors were opposed to the concept. They feared that a 200-mile limit law would jeopardize the salmon agreement that the U.S. had with Japan, which kept Japanese fishermen west of 175° W longitude. But by then, despite Senator Kennedy's last minute change of heart, the bill was introduced.

The Senate Commerce Committee, which Senator Magnuson chaired sponsored hearings across the country in 1974. Throughout the hearings the Nixon administration expressed strong opposition to the legislation. In addition, the tuna industry was able to influence the House Merchant Marine and Fisheries Committee and kept the bill from moving in the House during the 93rd Congress, which ended in 1974. However, Senate Bill 1988, Senator Magnuson's original bill, did pass in the Senate in December 1974 without much opposition and without much debate.

As I mentioned, when it was first introduced the bill was aimed at expelling and then keeping foreigners out of an expanded U.S. fishing zone. However, it was obvious that if we kicked them out, all of the available harvest would not be taken by U.S. fishermen. There wasn't enough domestic interest in the high-volume, low-value fisheries on which the foreign fleets concentrated such as Alaskan pollock. For the most part U.S. fishermen pursued the low-volume, high-value fisheries such as salmon and crab. In addition, I believe that the nations of the world would not accept our 200-mile limit, nor would such a claim withstand a challenge in the International Court of Justice unless we demonstrated our intent to manage fish stocks within that zone once we asserted exclusive jurisdiction.

To gain world acceptance and sustain a possible legal challenge, the legislation should, I argued, only reduce the amount of foreign fishing to the amount U.S. fishermen did not want and which was consistent with good conservation. We had to demonstrate our intention to conserve the fish and to share them fairly with other nations. This, however, was not accepted by many of the fishermen who were involved in this early phase of the legislative process.

At the time the principal proponents were the New England fishermen. One very active

fisherman for whom I have a great deal of respect is Jake Dykstra of the Point Judith Fisheries Cooperative which is located in Rhode Island. He is a knowledgeable fisherman, a highly successful businessman, and a shrewd politician. He was aware of my advice to the Senate committee and was quite concerned. One day he took me to lunch and asked what he could do to help the bill pass. And then he said, "By the way, we're not going to have anything in this bill about management." I told him I didn't think a bill could be successfully defended without management provisions. Later, I got a call from Senator John Pastore of Rhode Island, one of the co-sponsors of Magnuson's original bill and a senior member of the Senate Commerce Committee. Senator Pastore is what is commonly referred to in the U.S. Senate as a "whale," a very strong legislator. He was also probably the Senate's best debator; I have never seen anyone successfully stand up to Senator Pastore. He told me he didn't want management in the 200-mile limit bill. Needless to say, there were no strong management provisions in Senate Bill 1988.

Argument For and Against the Bill

During the 94th Congress momentum began to gather behind the legislation. The fact that the foreigners were contributing heavily to overfishing of stocks off U.S. shores, although they weren't the only ones overfishing, was a central reason for the bill's growing support--that and the slowness of the Law of the Sea Conference. According to U.S. biologists fish were being taken in excess of the maximum sustainable yield in most fisheries off U.S. shores in which foreign fishermen participated. The Third Law of the Sea Conference continued to drag in its attempt to develop a comprehensive treaty governing all uses of the sea. An earlier conference in 1960 had failed to develop a treaty that gained acceptance by the large fishing countries, nor had the limits of the national fishery management zone been settled at the second conference. During the 1960's the customary practice of nations, not a treaty, had tentatively set the limit at 12 miles.

"We had to demonstrate our intention of conserving the fish and to share them fairly with other nations."

U.S. negotiators at the Law of the Sea Conference were using the 200-mile limit as a trade-off tool for provisions that would further national security interests such as a free passage through straits. The U.S., of course, as one of the world's naval powers, requires the ability to be mobile throughout the world's oceans (with the concomitant need to use coastal waters and straits) and, therefore, we must be concerned about having rules of international law that facilitate naval flexibility. Most coastal nations, however, were pressing for a 200-mile economic resource zone. It was our negotiators' desire that we not accept the 200-mile limit until we had been assured that our basic national security objectives were protected in a new Law of the Sea treaty. Thus, the executive branch did not want to see a unilateral declaration by Congress take away this negotiating tool.

During 1975 Senator Magnuson held no hearings on his bill and said he would not consider the bill until the House of Representatives asked. Pressure began to build and opposition and support for the bill began to mobilize to a higher degree than had been the case in 1974. Serious opposition was organized by the State and Defense Departments.

Let me briefly tell you what the Administration's position was and the reasons why the Administration was opposed to the bill. Looking back I often ask myself how the bill passed, given the lobbying forces arrayed against it.

First of all the Defense Department was strongly opposed for the reasons that I have just explained. That is, if the U.S. acceded to the 200-mile zone, then we might not get a fair trade-off for transit rights through straits and the like. The State Department tends to be the spokesman for other countries--it's part of its job. Therefore, it was very much concerned about the impact the bill would have on Japan, the Soviet Union, and the several other nations which operated fishing fleets off our shores. However, the best organized lobby in town was the tuna fishermen. They maintained not only full-time representation but their people were extremely effective at knowing what needed to be done at the right time in order to hold up a bill or defeat it.

The tuna fishermen were joined in their opposition by the distant-water shrimp fleet who felt that the 200-mile limit would cut them out of places like Brazil

and Mexico. Arrayed against this strong group were a rag-tag group of coastal fishermen like Jake Dykstra who were very independent, who didn't know how to organize very well in the political sense, and who, as a group, didn't have a lot of money. To send people to Washington costs about $50 a day for room, $25 for food, and more for expenses. A good full-time advocate charges $100-125 an hour. Independent coastal fishermen were at a decided disadvantage, at least according to traditional Washington power theory, in a head-to-head political battle with the opponents of the 200-mile limit bill.

But they had one thing in their favor which I believe destroyed the Administration's arguments--U.S. coastal fish stocks were in fact declining and were being overfished. The principal source of pressure on the stocks was the foreign fleet. No matter how much the Administration argued that the Law of the Sea Conference would solve the problem, more and more people became convinced that something else had to be done soon.

Let me just read you the Administration's basic arguments as presented in their lobbying papers. During the Congressional debate representatives of the Administration would appear on Capitol Hill and talk to every congressman and staff person they could, using a list of talking points--a list of their main arguments.

Their arguments were these:

1. The only effective solution to our fishery and other ocean problems was a comprehensive treaty on law of the sea. It was forecasted that by 1975 a Law of the Sea Treaty would be completed. Unilateral action by the U.S., it was asserted, would destroy the Law of the Sea Conference. Unilateral action by the U.S. was certain to trigger more extensive unilateral claims by other nations.

2. A unilateral extension of fisheries jurisdiction would be inconsistent with U.S. international legal obligations, citing a recent International Court of Justice opinion that Iceland's 15-mile extended fishery zone violated the United Kingdom's rights in that zone.

3. Finally, the Executive Branch was said to be taking concrete steps to relieve the fishery problems of the U.S. coastal fisherman. The positions began to polarize. Senator Magnuson and others tried to refute the Administration's position. The debate began to focus on the steps the Executive Branch was taking to relieve the coastal fishing problem:

   a. They were negotiating agreements with other countries to reduce the level of foreign fishing.

   b. They said that if we got a Law of the Sea Treaty there would be provisional application, which means that if we signed the treaty its provisions could go into effect before it was finally ratified.

   c. They were getting tough with regard to continental shelf fisheries resources which under international law were strictly within our own purview.

The basic counters to these arguments were the converse of all these things and what made the debates even more interesting was the editorials that appeared in newspapers. Senator Magnuson and Senator Stevens wrote the editor of the Washington Post arguing against the Administration's position and in favor of the 200-mile limit, and the New York Times editorialized against the proposed legislation.

> *"The only effective solution to our fishery. . . . problems was a comprehensive treaty on the Law of the Sea."*

The Washington Post did something similar--their editorial writers were in contact with the State Department. I talked to the editorial staff member concerned with the bill and gave him some arguments, but he used none of them because he was the "international" editorial writer. To rebut Senator Magnuson and Senator Stevens wrote a letter to the editor of the Post. The Post's editorial had pointed out that the U.S. had strengthened certain treaties and agreements to protect our fish stocks, in particular with the Japanese, and to reduce foreign fishing. In Senator Magnuson's response it was pointed out that every one of the agreements to which the Post editorialist had alluded allowed fishing by foreign countries in excess of the maximum sustainable yield for the stock it covered. The following species were listed as being overfished: yellowfin sole, Alaskan pollock, Pacific Ocean perch, Pacific halibut, Atlantic halibut, Bering Sea herring, Bering Sea shrimp, haddock,

yellowtail flounder, California mackerel, Alaska sea scallop, Northwest Atlantic shrimp, and Atlantic bluefin tuna. All these were not being overfished by foreigners but most significant fish were.

The basic points were these: on the question of whether the fish stocks were in trouble, yes; on the question of whether international agreements were preventing overfishing and bringing fish stocks back to a healthy condition, no. This was our most effective argument.

The forum of the debate then moved to the Senate floor. At this point a very interesting thing occurred. The original sponsor of the bill, Senator Mike Gravel of Alaska, turned state's witness. No one understands why this occurred because since he was from Alaska everyone assumed he would fight hard for the 200-mile limit. Although a sponsor of Magnuson's original bill, S 1988, (in the new Congress, the bill was known as S 961), Senator Gravel became the principal spokesman for the Administration in opposition to the bill.

Before I start discussing the Senate floor action let me briefly go to the management issue. Remember Jake Dykstra didn't like management. But leaving the management provisions in the bill obviously strengthened its acceptibility. The legislation was redrafted to include provisions for management. The House passed its version of the bill. Obviously, the debate in the Senate would be critical because the Senate was specially concerned with foreign policy and most of the objectives of the bill were based on foreign policy considerations.

On the one side we faced effective lobbyists fighting hard to kill the bill. Senator Gravel was their champion. Then, near the end of the floor debate Senator Alan Cranston of California came out strongly against the bill. (He is a senior senator, considered to be quite effective.) The tuna interests had gained his attention and his involvement made it more difficult for us at the final vote.

By this time, however, we had a very strong array of senators in favor of the bill. Senator Kennedy was back. Senator Pastore had accepted the concept of management and was ready to fight. Senators Magnuson, Stevens, and Russell Long, (some of the "whales" I mentioned earlier) were also able floor fighters. It came down to a single critical vote on what was referred to as a "perfecting" amendment.

Senator Cranston had an amendment which he called an amendment to strengthen or perfect the bill. In a crunch of a floor vote the characterization of an amendment can be critical to its success. Cranston's amendment was really an amendment that gutted the bill by requiring long negotiations before a 200-mile limit could be adopted. We huddled on the floor and Senator Ed Muskie suggested that we offer a "perfecting" amendment to Senator Cranston's amendment that would strengthen the fishery act. We won the vote on the Muskie amendment 64-23, Senator Cranston conceded defeat, and the bill passed.

Because of the differences between the House and Senate bills the next step was a Committee of Conference between the two bodies. Legislation is perfected quite simply. Each house of Congress passes its own bill and then they settle the differences in a Committee of Conference.

The key problem in the committee was to draft a bill less objectionable to the Administration. President Ford faced a very difficult political campaign in 1976 and the New Hampshire primary was coming up. We needed to draft a bill that would be hard for President Ford to veto. A delay in the bill's effective date had been added in the Senate which helped. In other respects we tried to be consistent with the U.S. position on the Law of the Sea Treaty. We then completely rewrote the bill. Most people believe that legislation is developed in committees or on the floor of the Senate or the House. But the Committee of Conference is one of the most powerful mechanisms in our legislative branch. If everyone agrees, and the original bills are broad enough, you can literally redraft the entire bill in a Committee of Conference.

We took a considerable period of time to write up the new statute which is admittedly rather complex. Most of the debate up to that time had been focused on whether or not the bill ought to pass. Very little had been done on the actual management provisions and so forth. In order to get Senator Pastore's support we had agreed to a very complicated management scheme which depended on regional fishery management councils, unique institutions within the government. We took several weeks drafting it and the conference report was approved by Congress without too much difficulty.

After three years we finally managed to convince Congress that the 200-mile zone was in our best interest and that the bill

as drafted would not be the disaster predicted by the State Department and others.

> *"After three years we finally managed to convince Congress that the 200-mile zone was in our best interest."*

Reassessing the Arguments

Let me go back over those points made in opposition that I listed before and reassess them from today's perspective. First of all, with regard to the Law of the Sea Conference, it has not finished its work to this day. At the time we enacted this bill the 200-mile fishing management limit was the basic concensus of the Law of the Sea Conference. The U.S. had publicly stated its support for this limit. It was other issues, notably those concerning exploitation of the deep seabed, that prevented conclusion of the treaty. (The present text of the Law of the Sea Conference gives more power to the coastal state than our legislation, incidentally.)

As for the danger of unilateral action by other nations in areas other than fisheries, there has been no bold stampede in that direction. It has been interesting to see how other countries behaved. After the U.S. took the lead in declaring a 200-mile limit, Mexico and Canada did the same. They wanted us out in front taking all the heat. In my opinion, the 200-mile limit is now the customary rule of law around the world. "Fish wars" are now a thing of the past. By and large our law set a high standard for management, and as the Law of the Sea draft treaty text does, promotes maximum or full utilization of fish stocks. That means that if a fish stock produces X amount, but U.S. fishermen can only take Y amount, then the difference between X and Y is made available to foreign fishermen. Most nations followed our lead, except in connection with tuna. Other more broad claims of jurisdiction simply did not materialize.

The next point was the danger of confrontation with the Soviet Union and Japan. That also has not occurred. Every major fishing nation fishing off our shores has accepted our law. Nations now negotiate quietly over fishing privileges without resorting to gunboat diplomacy. I have always found it astounding that so many eminent jurists preferred continuing a rule of law which stimulated fish wars rather than developing one which fostered negotiations and peaceful settlements of dispute.

Next, regarding consistency with U.S. legal obligations, one could make various legal arguments about international law at the time we were debating the statute. Clearly, at that time the 12-mile limit was no longer the customary rule around the world. A significant number of countries had adopted the 200-mile limit for fisheries and others had promulgated fishing laws covering other distances greater than 12 miles. Without a rule of law fixed by universal treaty customary practice determines a rule of law. Our argument was that the rule of law was in a state of flux and was changing in the direction of expanded fishing jurisdiciton. Therefore, U.S. unilateral action setting a 200-mile limit was not inconsistent with international law. We did not act suddenly; there was a period of delay, and the new law specifically provided for a transition period. Looking back, no one challenged our action or sought to have the new law reviewed in the International Court of Justice.

The impact of the 200-mile limit on distant-water shrimp and tuna fishermen has obviously been negative. U.S. shrimpers have been foreclosed from the waters off Brazil and Mexico. The U.S. flag tuna industry is in a life-and-death struggle with Mexico, Costa Rica, and other Latin American countries. Our law did not assert jurisdiction over fishing for tuna. Since tuna are highly migratory we felt management of these resources was best handled by international or regional bodies and not solely by coastal nations.

Despite this exemption the tuna industry still feared the bill's impact and fought it hard. Consequently, they obtained provisions in the bill to protect our juridical position--embargo provisions against any nation that asserted exclusive authority over tuna. Our strongest leverage for protecting U.S. fishermen is use of the U.S. marketplace. If another country claimed jurisdiction over tuna the U.S. law makes mandatory the imposition of a trade embargo against tuna from that country. This device has permitted fairly effective bargaining in tuna negotiations, if it hasn't changed the world's view on tuna. I think it's fair to say that in the final analysis the 200-mile limit certainly did not strengthen the position of the U.S. tuna fishermen around the world.

"Prior to the 200-mile law most banks in New England would not make loans to fishermen."

Finally, the last argument made by those opposed to the bill was that the State Department was pursuing agreements to protect our U.S. fishery resources and such agreements would be threatened by unilateral declaration of a 200-mile zone. It became clear, however, after a year of these special negotiations, that we had no leverage to control foreign countries' fishing efforts. As long as the resource was considered to be an international resource, even if it was within 200 miles of our shore, we had no strong bargaining position. Therefore, the agreements were weak and would not deter the forces that led to the 200-mile limit law.

President Ford signed the bill into law even though the State and Defense Departments recommended that he veto it. Since enactment, in my opinion, the law has revolutionized fishery management in the U.S. and in the world. We now have a fairly sophisticated process for managing our fish stocks. Whether or not fishermen are better off under the new law is the subject of much debate. I think they are. Foreign catches have been cut from 3.5 million metric tons in 1971 to less than 1 million metric tons in 1979, and U.S. catches are up moderately. As our fishermen develop the interest and the capacity to take more of the resources off our coasts the preferential policy in the law will allow them to do so.

What it did for domestic fishermen can be summarized in three points. The Law

1) reduced foreign fishing pressure on stocks that were being fully used by U.S. fishermen or were in trouble biologically;

2) gave domestic fishermen preferential rights to all the fish stocks; and

3) established a system of management which, in theory, provided stability and more security for the investor.

Prior to the 200-mile limit most banks in New England would not make business loans to fishermen. Now that has changed. Not only are the fishermen assured the fish will go first to Americans but the law requires conservation limits so the fish stocks will improve on a long-term basis. These, I think, were the major benefits of the legislation.

Of course, since that time fishery policy has evolved further. It is now focusing on other considerations such as trade and economic development.

Management Plans

Let me briefly talk about domestic fishery management programs that are now being implemented. First of all, prior to the new law, fishery management in the U.S. was predominately an activity of state governments. The coastal state governments still maintain their historical management authority over fish stocks within their territorial waters, generally within 3 miles. What the 200-mile limit did was to establish an entirely new domestic management program in the area from 3 to 200 miles. The goal of the program is to achieve conservation as well as to fully utilize as many fish as possible for both commercial and recreational fisherman. The management process that was set up is critical to this goal.

Fishery management plans are initiated by regional fishery management councils. These councils are assigned specific geographic portions of the 200-mile zone to manage. The eight councils are New England, Mid-Atlantic, South Atlantic, Caribbean, Gulf of Mexico, Pacific, North Pacific, and Western Pacific. These councils are semi-independent administrative bodies made up of state, federal, industry, and public representatives that initiate the management process and recommend fishery management plans to the federal government.

". . . the law requires conservation limits so the fish stocks will improve on a long-term basis."

The work of the councils is coordinated by the National Marine Fisheries Service. The job of these councils is to determine which fisheries need management and the manner of management. The Act does not require that all fisheries be managed, although it does require a conservation plan for stocks that are being overfished. Councils operate publicly by holding hearings. They have small staffs of their own. NMFS provides

biological assessments and other data needed for drafting and implementing the plan. It is also NMFS's job, once a council recommends a plan, to determine whether the plan is consistent with the national standards, other provisions of the Act, and other applicable law. The plan is then either approved or disapproved.

The NMFS policy is to approve a plan unless it is clearly contrary to the intent and letter of the law. We try to allow as much independence as possible to the councils since they know best about the problems of their region. Currently there are 25 fishery management plans in effect. This includes plans to regulate both domestic and foreign fishing. The most controversial plans have been the ones regulating the New England groundfish fishery and the Pacific salmon fishery.

Obviously, as with any new system, problems remain. Moreover, controversy is inherent in fishery management. And most fishermen do not like to be constrained by any government institution. But I personally feel that it is a sound management system, built on democratic principles, and it is flexible. It was also a tremendous experience for me to have been in on the legislative process from start to finish.

Pacific Salmon Interception

Kenneth A. Henry, Fisheries Research Biologist
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In the early 1900's one of the major fisheries in northern Puget Sound and British Columbia was for Fraser River sockeye salmon. In peak years this fishery yielded 30 million sockeye (Figure 1), about 75 percent of which was caught by American fishermen in American waters. Then in about 1913 a rock slide in the Hell's Gate Canyon blocked the upriver migration and just about destroyed the runs. A severe decline in stocks ensued and as a result the U.S. and Canada started talking about forming some kind of an international commission to manage and distribute the remaining fish as well as to rebuild the runs. In 1937, after years of preliminary talks, a treaty was signed and the International Pacific Salmon Fisheries Commission (IPSFC) was formed.

"U.S. fishermen can catch over a quarter of a million (sockeye) in a single day . . ."

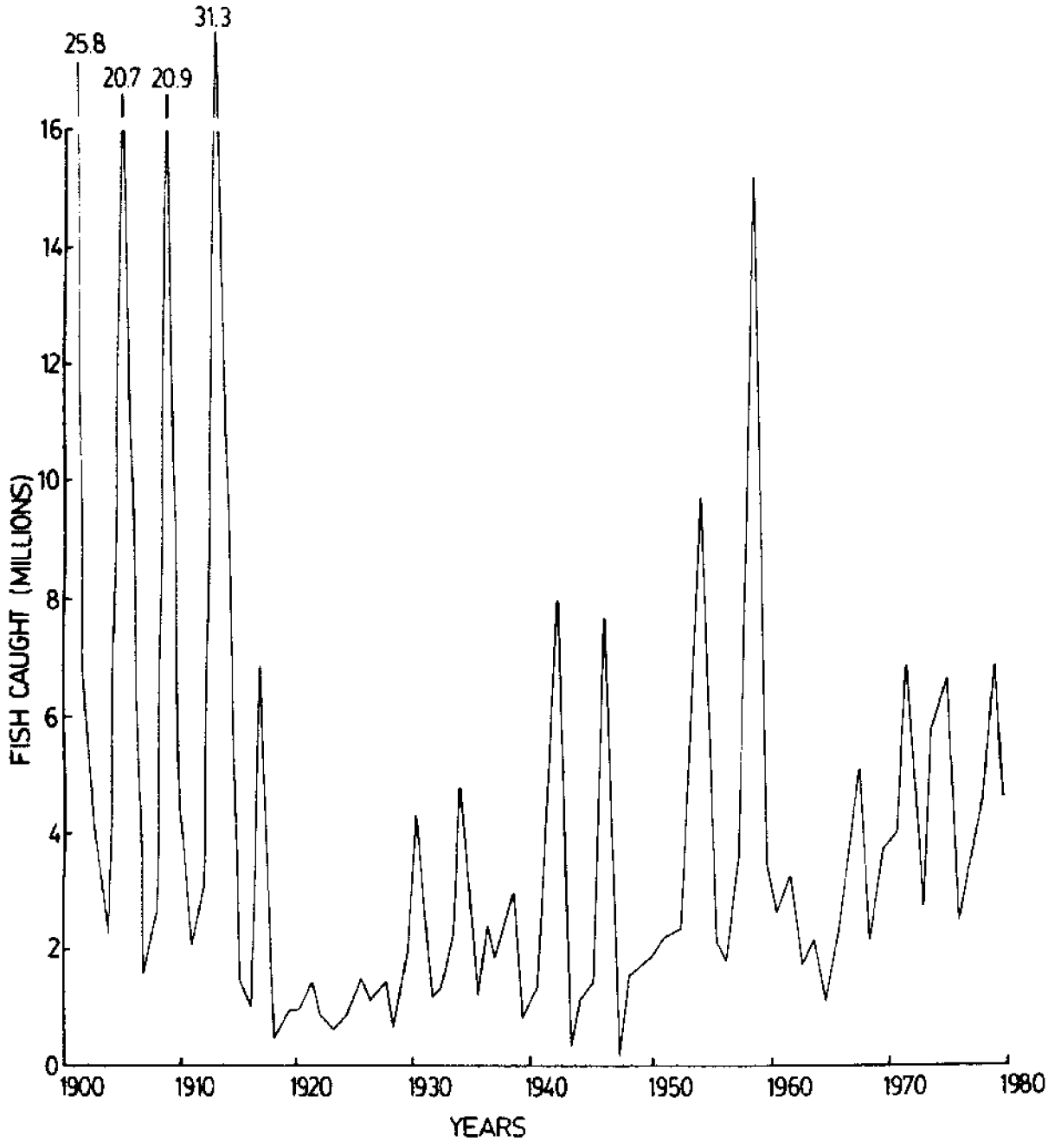

Figure 1. Catch of Fraser River Sockeye in Puget Sound & Gulf of Georgia 1901-1951. Catch of Fraser River Sockeye, 1952-1980.

About the mid-1950's Canada began to develop a major salmon troll fishery off the west coast of Vancouver Island. The majority of its catch was of U.S. origin. This was a serious international interception of U.S. fish by foreign fishermen--in this case, Canadians. (The Japanese also intercept U.S. salmon in the northeastern Pacific Ocean.) In 1957 Canada and the U.S. agreed to ban ocean netting of salmon along the entire Pacific Coast.

The extension of fishing rights evolved into a major political issue during the

late 1950's and early 1960's. In 1964 Canada adopted a 12-mile territorial boundary on its coastal waters; in 1966 the U.S. did likewise. This caused severe problems because both countries had already established fisheries up to 3 miles off each other's coasts. As a result of these conflicts the two governments signed a 2-year reciprocal fishing agreement in 1970. That agreement covered more than salmon, but all we're concerned with here are the salmon aspects. Basically the original agreement restored the fisheries that were threatened by the 12-mile territorial limit; it allowed the U.S. to fish to 3 miles from the Canadian coast, that's within the 12-mile limit off the west coast of Vancouver Island, and it allowed the Canadians to fish up to 3 miles off the coast of Washington.

The agreement was renewed in 1972 for one year. Then in 1973 representatives of the two countries met again in Ottawa to deliberate under quite a bit of political pressure that had built up concerning the reciprocal agreement. The Americans thought the Canadians had an unfair advantage and the Canadians thought the opposite. The drastically revised treaty that emerged from this meeting allowed U.S. fishermen access to only a small triangular area inside the 12-mile Canadian territorial sea near the entrance to Juan de Fuca Strait and reduced the area of U.S. territorial waters in which Canadian fishermen were allowed by moving the southern boundary northward. Canadians were barred from fishing inside the 12-mile limit south of Carrol Island. The result of the agreement revisions was a reduction of reciprocal fishing area for both countries.

In 1977 both Canada and the U.S. implemented a 200-mile fishing limit. These acts generally provided that between 3 miles and 200 miles from the coastline each country would regulate the fisheries. Part of the U.S. law, the Fishery Conservation and Management Act (FCMA), stated also that any international agreements or treaties which were in conflict with provisions of the act had to be renegotiated. This again put the reciprocal fisheries agreement up for review; a new agreement was designed in 1978. A part of the new agreement that applied to salmon was worded "fishing shall continue in accordance with existing patterns."

The new Pacific Fishery Management Council (PFMC) established under the FCMA had begun managing within the 200-mile zone for the first time in 1977. It began by imposing regulations on U.S. troll salmon fishermen. Canadians fishing off our coast had to obey these new U.S. regulations. Their government protested that the council regulations were not in accordance with existing patterns. In 1978 the Pacific Council's troll management plan was even more restrictive. That year the U.S. imposed a 28-inch minimum size limit on chinook, increased from 26 inches. The Canadians fishing in our waters were really unhappy then. The U.S. part of the new reciprocal agreement allowed Canadians to fish all the way down to Gray's Harbor. In a way this was compensation for the additional troll restrictions. However, another part of the agreement stipulated that Canadian fishermen would be prohibited from waters off the State of Washington if U.S. biologists believed Canadian Area 21 should be closed because of a high incidence of shakers and if Canada did not prohibit its fishermen from fishing there. (A shaker is any fish that has to be thrown back because it's either too small or out of season. Shakers have a high mortality rate.) When the season started, however, the Canadians refused to shut down the area when requested to do so by the U.S.

Actually the fishing effort in that area is not very great, and if you look at absolute numbers, the harm done to various stocks through shaker mortality is not serious. But it's the principle of the thing. It does cause an unnecessary, avoidable waste of the resource. I couldn't believe it when they said we resist it, we don't think it's important. So the U.S., under the circumstances, told the Canadians they could not fish off the U.S. coast. (This is somewhat simplifying the actual diplomatic exchanges.)

As a result the two countries never had an agreement for 1978; neither country passed one. Since June 1978 there has been no reciprocal fisheries agreement between the two countries for salmon.

In 1970, when we signed our first west coast reciprocal fishing agreement with Canada concerning salmon, there was a provision for the two countries to get together and discuss salmon problems of mutual concern. This was the formal start of our present-day interception talks. A predominant, pressing issue in these talks has been a difference over the right to Fraser River salmon. Strangely enough, at least to me, the Canadians look at our catch of Fraser River fish as salmon interceptions. I don't see it the same way

as the Canadian troll fishery catching U.S. salmon off the west coast of Vancouver Island. Sure we catch Canadian fish but we do it under a treaty. However, Canada wants to revise that treaty. They want to reduce U.S. interceptions of their fish from the Fraser and elsewhere. On the other side, our people, primarily from the State of Washington, but also from Oregon, want to put a lid on Canadian interceptions of U.S.-spawned fish caught off the west coast of Vancouver Island because this conflicts with our large enhancement programs. It's hard to sell a state legislature on pouring a lot of money into a new hatchery and spawning channel if you have to say that 70 to 80 percent of the resulting fish are going to be caught by the Canadians. Actually, for the Puget Sound stocks, more than half the catch of chinook and coho is taken by Canadians.

One of the first actions by the two countries after the interception talks began was to ask their scientists to develop estimates of interception. The scientists were charged with identifying fisheries in which interception occurred and coming up with the best estimate of the proportion of the catch that belonged to the other country. This really highlighted the areas for which there was complete lack of knowledge about the stocks. For some areas, particularly northern Puget Sound, the west coast of Vancouver Island, and farther to the south, there had been extensive tagging and marking studies to determine where the fish were going and what proportions were bound for each country's waterways. Off Alaska there was quite a different picture. I think there were 206 separate categories for which estimates were made on the percentage each country caught. There was pretty good agreement for southern regions but in certain northern regions there was wide disparity.

To help us get a handle on these U.S./Canadian interceptions scientists have developed five major interception areas (Figure 2). During 10 years of interception talks participants have come to know what we mean when we refer to category A, B, C, D, or E. The areas are defined by problems or are commonly perceived as a unit.

Category A fisheries compromise Alaskan interceptions of Canadian fish. The area in which this takes place is in southeastern Alaska. These are mainly fish that are returning to British Columbia through the Queen Charlottes and around Vancouver Island.

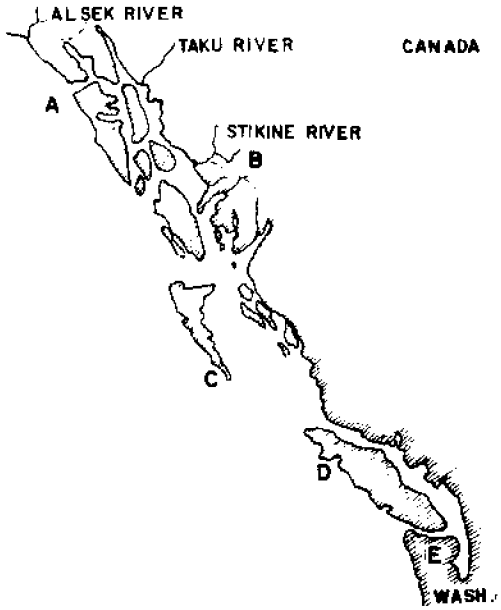

Figure 2. Major U.S. and Canadian Salmon Interception Areas

Category B is comprised of fish called panhandle fish. We started out calling them panhandle fish because they primarily spawn in rivers that flow through the Alaskan panhandle. (There are certain exceptions such as the Yukon River.) However, all the fish in this category spawn in Canada and the young migrants go downstream into U.S. waters where they are fished by U.S. fishermen. This is a unique situation. We don't quite recognize them as Canadian fish, although they spawn in Canada; we believe there is U.S. entitlement to them because they pass through U.S. territory and feed in our waters. For purposes of negotiation we have said they should be entirely at the disposal of the U.S., while Canada has claimed they're entirely Canadian.

An easy solution might be to divide them 50-50. If the Canadians didn't protect those spawning grounds there wouldn't be any fish. Therefore, it's really in the U.S. interest to have Canada maintain its fishing rights. On the other hand the U.S. could fish them out or build a dam to prevent the fish from returning upstream. From this standpoint the U.S. has complete control over how many return to Canadian streams to spawn. Of course, it would be very counterproductive for either country not to enter into joint attempts to keep those runs at maximum production.

Category C is Canadian interceptions of Alaskan fish. It's the counterpart of Category A. These are fish that are returning through Canadian waters to enter Alaskan streams to spawn.

In the south we have just two categories. Category D comprises fish from the south intercepted by Canadians. These fish originate mainly in Washington, but also in Oregon and even California and Idaho. Some of the upper Columbia River fish that spawn in Idaho are intercepted by Canada. The final category, E, comprises fish of Canadian origin intercepted by fishermen from Washington, Oregon, or California. The California fishermen primarily intercept pink salmon in the odd years.

Let us consider the findings of the scientists of the two countries for the D category, U.S.-spawned fish caught in Canadian waters, in one of the interception reports. Category D fisheries are both net and troll. It covers a physical area from Alaska south through Canadian Areas 1, 2, 3, 4, and so on. Along with the actual numbers and pounds landed according to the Canadian catch statistics we have estimates by each country of the percentage of the other country's fish in the total for each species or fishery. There are 206 different estimates like this and they're not all based on comparably sized areas. For example, there is one set of estimates for Area 3, which is a relatively small fishing area, and one set for Area 21 and 24, which is the entire south west coast of Vancouver Island. In any case, the point is the difference in the two countries' estimates. It makes you a little concerned about what scientists can do with data. If you go through an annual interception report, you will see there are biases in it. If a Canadian fishery is being analyzed you'll find almost without exception that the U.S. estimates of American fish are higher than the Canadian estimates. For U.S. fisheries you'll find the reverse: Canadian estimates of the percentage of Canadian fish are higher than U.S. estimates. These are estimates based on basically the same data.

There are several ways this bias may occur. It may result from the way data are grouped. Some tags may be thrown out for various reasons or disregarded on the basis that the information is too old to be trustworthy. Certain data were collected 50 to 60 miles off the Alaska coast and estimates simply interpolated from this to get a picture of what was happening just offshore. Others said this technique was not acceptable. The problem is that the differences are consistent.

Comparing U.S. estimates to Canadian estimates of catches in a Canadian fishery, it is clear that what I have described has occurred. It's disturbing to see scientists do this.

In looking at estimates in this report for chinook salmon in 1976, notice the size of the catch for Areas 21-24, off the west coast of Vancouver Island: 555,000 fish caught that year by Canadian fishermen. The total of Canadian landings along the whole west coast of Vancouver Island was about 650,000 chinook. Even Canada said that 80 percent of these were U.S.-spawned fish; we said 83 percent. This has a significant impact on U.S. stocks.

It's interesting where the 83 percent came from. Originally the U.S. said it was 85 percent and Canada said 80 percent. At a meeting of the scientists a compromise was agreed upon to narrow the gap. We changed our number to 83 percent, but somewhere Canada forgot to make the transfer and it never was changed from 80 percent. It's really not that important what the percentage is. It becomes important later, but as of right now it doesn't really matter.

Question: How do you account for the difference between 5 and 55 percent shown for Area 3?

Reply: This, again, is based on interpretation. The U.S. has grouped these areas. We don't believe we have enough information to separate them into individual areas. Canada has a separate estimate for each.

Question: Is it possible to use this data to derive procedures that you can use for management control?

Reply: Well, in this case, not really. We based our estimates on whatever data we could find. Some of these tagging studies were done in the 1920's. For pink salmon, for example, the only salmon that were tagged anywhere in this region for which the data were usable were tagged in 1957 and 1958. There's been very little work done off Alaska. Canada has taken some tagging that was done by the International North Pacific Fisheries Commission (INPFC) and extrapolated landward on some of their estimates. Alaska doesn't accept this. They think there is a major change in the stocks between where the measurements were

taken and where they were applied. So it's very difficult to say what data you can use and what you can't. We're talking about going to some type of technical settlement session, having an impartial third party, possibly from FAO, resolve some of these differences. We should reach that stage before final negotiations come about.

To reverse the procedure, consider the Point Roberts fishery in northern Puget Sound. We primarily intercept chinook salmon that are returning to the Fraser River. The U.S. estimate of its interception is based on a grouping of the whole area: Point Roberts, San Juan Island, and West Beach. This estimate is 80 percent. Canada's estimate is 85 percent.

Question: Is there a limit on these interception catches?

Reply: There's no limit on catch. It's limited only by the season. A catch limit is one of our goals, and I'll get to the details of that later.

Three or four years ago there was a very bad drought in California, and we're expecting the chinook run in 1980 to be very depressed as a result. We're looking at more stringent restrictions on the troll fishery this year for California stocks. Hopefully, if the stocks are better next year more fishing can be allowed.

Returning to the interpretation of data in estimating interception, I'd like to add that scientists are not trying to cheat or misrepresent anything but there are several ways to interpret the data. I think we should interpret it in our best interest as long as it is honestly and professionally done. It seems that our best interest would be to try to get the number of our fish caught by Canadians as high as possible. Then we can say, look, you're catching a lot more of our fish than we're catching of yours. This was part of the rationale behind these figures. If they are catching thousands of ours and we're only catching hundreds of theirs, then obviously they should compensate us in some way for this difference. But it turns out differently: to have a high percentage of the other country's fish is actually to your advantage, while a low percentage is a disadvantage. That's just the reverse of what the scientists assumed.

The numbers we've come up with are not as important as how we are approaching this problem to get some basis for negotiations to resolve these differences over interception. Another approach we've taken is to apply values to these fish. In one case we've used Canadian prices, in the other we've used U.S. prices. So we have for each category four separate estimates: the Canadian estimates using Canadian and U.S. prices, and the U.S. estimates using Canadian and U.S. prices.

A summary of the estimates for 1976 show that in 1976 Canada said the U.S. caught 859,000 fish more than Canada caught, while the U.S. said that it had caught 293,000 more. Because of the varying percentages among the categories there is a difference of half a million fish between the two estimates. The values of the two estimates are $570,000 in favor of Canada and $1.2 million in favor of the U.S. Remember this was 1976, which was an even year, and the Fraser River pink salmon only come back in the odd years. If you were to look at an odd year it changes drastically. A glance at 1977 figures shows about $14 million in the U.S.'s favor because of those pink salmon and because prices were going up on the sockeye. Again, this really isn't fair but how do you get a balance? From the U.S. standpoint we don't think a balance sheet like this is really fair, but Canada says an intercepted fish is an intercepted fish.

Question: Is that $1.2 million a very significant part of the total value of the fishery?

Reply: No. For example, this interception of the Canadian fish by U.S. fishermen off Alaska which we see as $3 or $4 million is probably no more than 5 percent of the total Alaskan catch of salmon. This is why Alaska is so upset about this because a little bit of the tail is wagging the whole Alaskan dog. They've probably spent more than $1 million on interception talks.

Question: Can you comment a little more on the kinds of samples scientists are taking--tagging, marking, scale samples, or blood samples--and why they are coming out with such different estimates?

Reply: The main reason is that these estimates were developed using whatever data we could get. In part, this involved going back to studies that were done in the 1920's: surveys done by Kirkness of Columbia River chinook off southeastern Alaska. Since they were first developed in 1970, these estimates haven't changed. Recently Oregon, Washington, Alaska, California, and Canada have put out a tremendous number of coded-wire-tagged

fish. Any given year class may have up to 10 million tagged fish in the ocean. We're going to get new sample data based on recoveries of these fish, and then we should be able to come up with much better estimates. The old data were almost entirely based on tagging or marking of smolts. At that time they were marked by fin cutting, which we now know may influence results. Now we use a coded-wire tag.

Question: *On how many recoveries are the data you used based?*

Reply: In some instances probably less than 100. For salmon off northern British Columbia recoveries from 1957 and 1958 are now being used for developing the percentages. I can't remember exactly how many were tagged--perhaps 200 or 300, of which we might have had 30 or 40 recoveries. These were recovered on spawning grounds and in fisheries, and the estimates of the percentages were made accordingly. We're having indications now that those were atypical years, and that could well be. Of course, if you only tag one year it's an atypical year. However, I'm sure there have been some stock changes since the 1920's. Columbia River stocks no longer contribute to southeastern Alaskan fisheries like they formerly did. All the runs from above Grand Coulee Dam on the upper Columbia River are gone. Obviously, conditions have changed quite drastically, but again, the old material was the only information available at the time we had to make our estimates.

Question: *Even if you could determine very accurately where the fish spawn, they still pass back and forth across international boundaries. How can you allocate them fairly, based on the random shifts in their movement?*

Reply: You can only do this in a general way on an average. Eventually we're going to have enough detailed information so we can say that during March, on the average, 50 percent of the fish in a given area are U.S. fish, while in April U.S. fish start to leave that area and may only constitute 40 percent. Our ultimate goal is to develop an interception limitation scheme--1971-1974 is our base period. We'd like to be able to say to Canada, you caught an average of 800,000 American salmon a year during that base period off the west coast of Vancouver Island. That's your limit; you can't catch any more than that. On the basis of very reliable tag information, 50, 70, or 80 percent of the fish in particular areas are U.S. fish on an average. Next year when you go there and fish those percentages will be applied to your catch and when you come to 800,000 you will have reached your limit.

That will permit the U.S. to catch more fish from enhancement without having to compete with the Canadians. We foresee the percentage being valid as an average of 4 years, unless there is a major change in stock composition. In the meantime, we'll continue to mark our stocks and develop new estimates of the population composition off the coast. This tagging information we're working on now is going to give good estimates of the proportions of the U.S. and Canadian stocks in these major fisheries. The numbers involved are so significant that the information will be reliable. The difference in estimates we're seeing now is going to disappear.

Question: *You are discussing a management regime based solely on a biological basis. When you have more reliable information on which to make decisions, do you envision a management scheme based on social and economic criteria as well?*

Reply: Yes I do.

Question: *Looking over the data, do you see any trends? Are the Canadians catching more?*

Reply: I'm convinced that the Canadian proportion of the catch off Vancouver Island is probably greater now than when that information I gave you was gathered. We're saying 83 percent and Canada is saying 80 percent. I'm convinced that the enhancement program that the U.S. has had is working. The U.S. proportion of the fishery could go above 85 percent but on the other hand, I'm sure it hasn't decreased. We haven't changed the old estimates. Right now the 1977 sampling by the Canadians is the latest information we have. We just got that and it's being analyzed right now.

Question: *I believe you stated that one of the goals of the program, to get improved estimates, is to make it politically more palatable for the U.S. to finance enhancement programs. I understand the Canadians have a massive enhancement program underway. How do you feel about the program?*

Reply: It's extremely important to them, also. In fact, it's one of the reasons that we're having negotiations. Up in

northern B.C. they have a major sockeye run into the Babine Lake. This is intercepted in southeastern Alaska. The Canadians plan to enhance these sockeye runs and they don't want the Alaskans to catch them all. While this is a minor fishery to the Alaskans it is a major fishery to the Canadians. We have tried repeatedly in the talks to separate the south from the north because there are much better data for the southern areas but the northern area is too important to the Canadians. They've got to get a lid on interceptions in the north to protect their stocks.

Question: It seems to me that the people of the State of Washington are not going to want to invest in hatcheries if southeastern Alaskans are taking the fish, either. Do you have any information on the Alaskan catch of continental U.S.-spawned fish?

Reply: We don't think of those as interceptions in the same sense, but this is a very serious problem for the States of Washington and Oregon. In fact, the Pacific Council endorsed a minority report letter written by the Director of the Washington State Department of Fisheries protesting the North Pacific Council's actions on a troll salmon plan. They don't think it's adequate; they don't think it protects the stocks from the south. Even the Canadians, in the meeting we had with them last month, said we're going to have to have coastwide management on chinook salmon. It can't be done piecemeal. A management plan is not as important to Alaskans as it is to Americans farther south because most of these fish don't originate in Alaska. (They do have a very serious Alaska coho problem, however.) These problems are being addressed by the council and in the salmon negotiations.

Another major reason we're participating in the talks is because of the International Pacific Salmon Fisheries Commission. One of the bases for getting into these talks was that Canada wanted to revoke the Salmon Commission treaty. I want to go back just a little into the history of this.

The Commission was created to manage Fraser River stocks. In 1913 the Fraser River catch was 31 million sockeye (Figure 1). The railroad was being constructed along the Fraser and a large amount of rock slid into the river in Hell's Gate Canyon, creating a blockage that wiped those fish out. The fish couldn't get back upstream to spawn and a real disaster hit the salmon industry. From catches of over 30 million every fourth year, the level declined to 200,000 for a 10-year period, and the two countries decided the situation had to be studied.

On the return to the spawning grounds some of the fish come down through Johnstone Straits, but most of them come in through the Straits of Juan de Fuca, go through U.S. waters to the San Juan Islands, and into the Fraser River. There's a major Canadian fishery right now at the mouth of Juan de Fuca, a major U.S. fishery in Puget Sound, and another major Canadian fishery in the Fraser River. After the disaster at Hell's Gate the two countries started talking about the International Pacific Salmon Fisheries Commission. Five different treaties were proposed before one was finally agreed upon in 1937. That established the Salmon Commission. But one of the details of that treaty was that there would be no fishery regulation for eight years, only study. Dr. W. F. Thompson was hired to begin studying the problem in 1937. He found that the major block was at Hell's Gate and the Hell's Gate fishway was built to correct it. Since then there have been other blocks and other fishways and spawning channels recommended and constructed, and it's been quite a successful program. The Fraser River runs have increased (Figure 1). We had a peak in 1958 of almost 16 million fish caught from the Adams River run. I happened to be on the Fraser at the time; the run was tremendous, the river was red with bright red spawning fish. There were probably three million more fish than it was believed the Adams River spawning grounds could hold. To relieve the overcrowding the Director of the Salmon Commission put an electric fence at the mouth of the Adams River. Now, biologically, I think this was a sound decision, and believe me, it took more intestinal fortitude than most people have to do this. Three million fish had to be kept out in the lake. His idea was that too many fish would destroy the spawning ground, and I think his logic was fine. Unfortunately, something else destroyed the resulting run. It was a disaster. Although I believe that the fence was not the cause, he's never lived that fence down.

Under the Fraser River treaty--the treaty that set up the Salmon Commission--an area was set up which is called Convention Waters. That's the area over which the Salmon Commission has regulatory authority. Major Canadian fishing grounds are

adjacent, making it a very complicated management problem. The terms of the treaty are that the two countries would share the sockeye catch in Convention Waters 50-50: half to the Americans, half to the Canadians. In 1957 pink salmon also came under the treaty and were managed the same way--50-50 in Convention Waters.

A graph that I developed for the 1975 run will show the problems of trying to manage these fisheries (Figure 3). First of all there are many races of salmon migrating at various times, each with different spawning requirements. A whole variety of races come in throughout the fishing season and the commissioners manage these on a racial basis. During early July they manage the Stuart River run. As July progresses they primarily manage the Chilco run, which was the dominant run at that time during some cycles. The early runs are the upper river runs; those later on are lower river runs. The problem the commission faces is that when the fish approach Area 20 there is a big block of almost unfished fish that are impacted by a major Canadian fishery. It's about a 3-day migration from there to the major U.S. fisheries. The proposed regulations for 1975 basically would have allowed those fish to be wiped out. The Area 20 fishery would not have completely wiped out the run since obviously 100 percent of what's there won't be caught but it would have been impacted very severely. There was a U.S. fishery at San Juan Island proposed under this particular pattern. It is another day's migration up to Point Roberts where there was another U.S. fishery. The lower Fraser River Canadian fishery also impacted the run and finally,

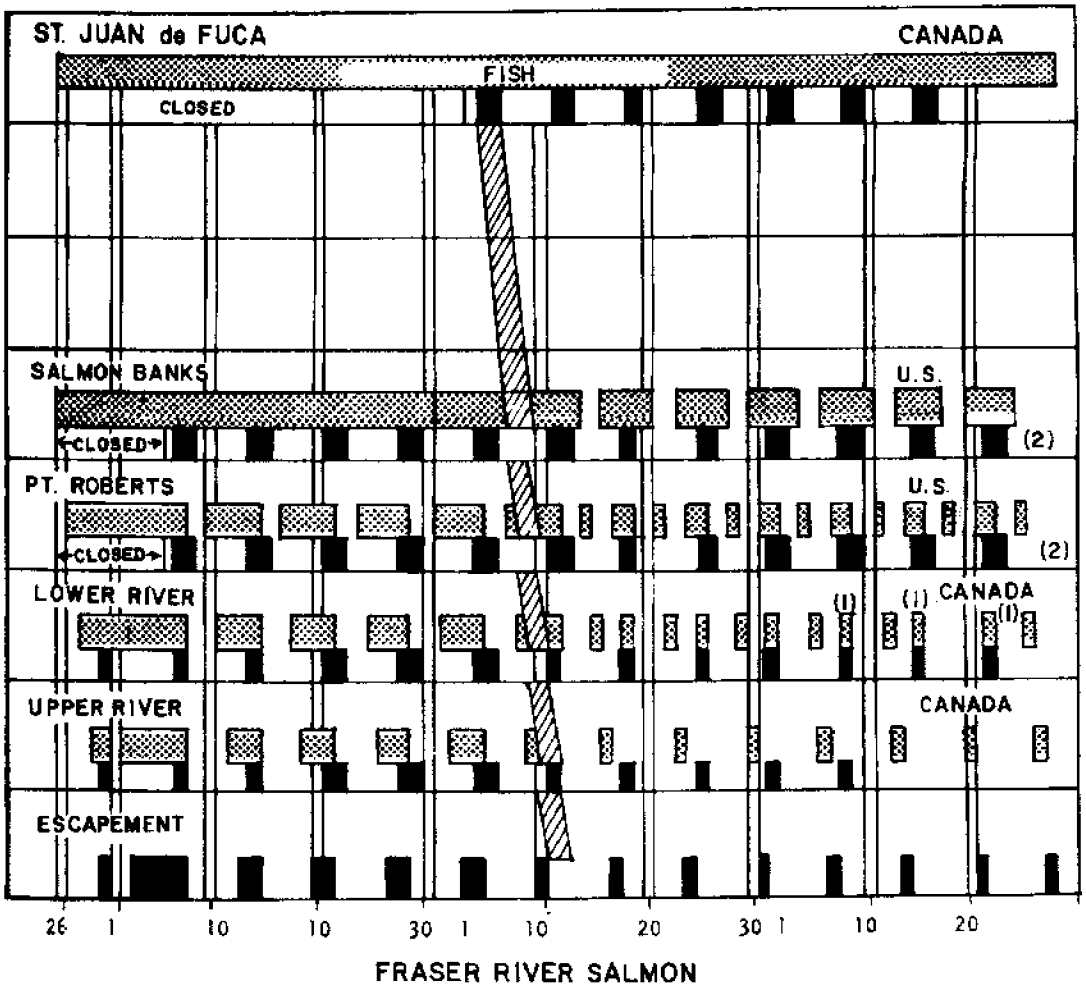

Figure 3. Effects of 1975 Purse Seine-Gillnet Regulations on Fish Stocks

there was an upper river fishery. Obviously the upper river fishery got very few fish.

The commission has to attempt to get through the season with a balanced escapement pattern for all the different races, allowing fish from each stock to get through. During the season whenever a race comes in that needs a lot of protection, for example the early Stuart run, usually in early July, the regular fishing seasons have to be specially arranged around that period. The commission patterns the season to get these blocks of escapement.

The Fraser River sockeye runs occur on a 4-year cycle so that each year there's a separate almost distinct run of sockeye salmon returning. These are identified as the 1901 cycle, the 1902 cycle, etc., (Figure 4). It looks like the 1902 cycle is becoming the dominant cycle in recent years. It was the cycle that generated that big 1958 Adams River run that I mentioned.

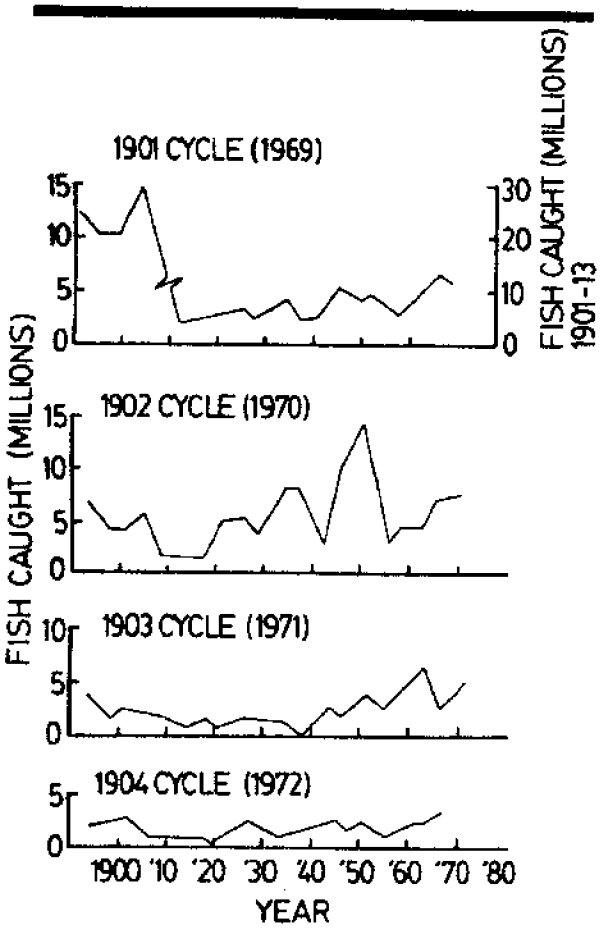

Figure 4. Catch of Fraser River Sockeye by Cycle Years

I think the improving trend in all four of these cycles speaks well for the Salmon Commission. Even after the electric fence episode when the run went down the 1902 cycle has been increasing during the last four cycles. Overall it looks like a good pattern of management; more fish are returning and the catches are increasing.

I said one of the points of the treaty was that the catch was to be divided 50-50. I have a chart here that shows the catch inside and outside Convention Waters (Figure 5). In the part describing the catch inside Convention Waters the black bar is the U.S. catch and the white bar is the Canadian catch. In most cases it is divided 50-50. A problem has arisen in that fisheries have developed outside the treaty area. Also, in the last 8 to 10 years the Fraser River Indian fishery has increased significantly. In addition, troll fisheries off the west coast of Vancouver Island and also a net fishery in Johnstone Strait catch more of the Fraser River salmon. So, while the U.S. is getting 50 percent of the fish in the Convention Waters, Canada is getting 100 percent of those increased, outside fisheries. From our standpoint that doesn't look too good. We've got to keep this in mind when we go for a new treaty to avoid being trapped into a similar situation again.

Question: Isn't there a U.S. troll fishery?

Reply: Yes, but its catch of sockeye is minor. Not a great many sockeye go south of the U.S.-Canada border. Looking at the proportion of the catches outside Convention Waters since the 1950's you can see that 50 percent of the treaty area catch is a smaller and smaller part of the whole catch each year. The two big years when the U.S. percentage went up were years that Canadian fishermen were on strike. In general, in recent years, we're getting less and less of the fish. The Convention Waters catch just isn't that good a deal anymore.

In 1957 pink salmon were included in the international agreement, and while we didn't know it at the time, pink salmon management has an additional problem. The commission has adopted the policy of allowing a greater and greater percentage of the run to enter the spawning grounds (Figure 6). Although there is an agreement permitting us 50 percent of the catch, we can't fish many of them. Ten years from now when those runs come back we'll be out

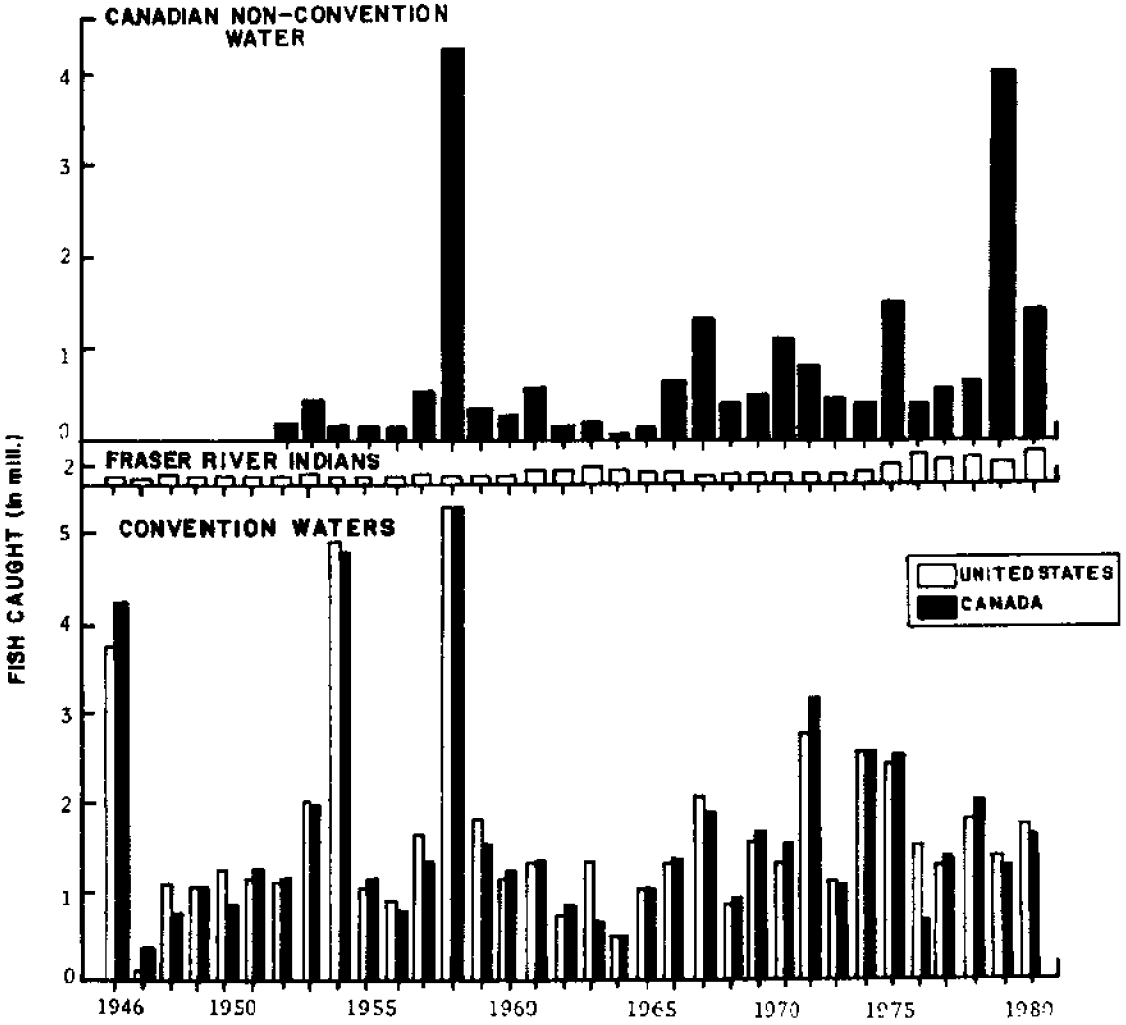

Figure 5. Catch of Fraser River Sockeye by U.S. and Canadian Convention Waters Fisheries, Fraser River Indians, and Canadian Non-convention Waters Fisheries

of the agreement and the present increasing escapements will not benefit us. Hopefully we'll reach a point where there will be so many fish, the runs will be so big, that they will not want any increased escapement. At present, out of an 8-million-fish run, nearly 30 percent are allowed onto the spawning grounds. In earlier years, with a 10-million-fish run only 19 percent of them were put up for escapement.

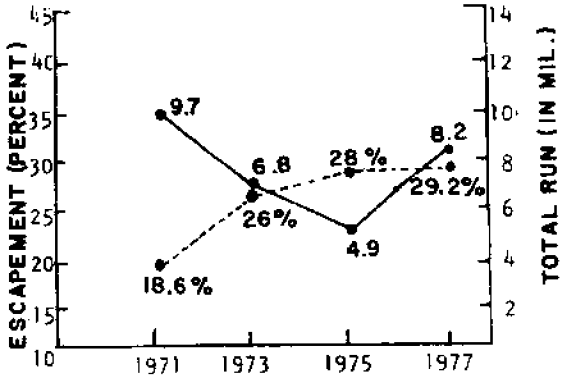

Figure 6. Fraser River Pink Salmon--Total Run Size & Percent of Total Run Going to Escapement

Question: How would you make the allocation if not on a percentage basis?

Reply: I think we're going to have to take either a percentage of the catch, wherever it's made, or a percentage of the total run, whichever is bigger. The total catch includes all the Fraser River fish. Basing the allocation on that eliminates the problem of outside catch. It won't eliminate the problem of a certain fraction of the run going into escapement. That would be solved by an agreement allowing a percentage of the total run not of just the catch.

Question: Is there a biological reason for these large escapements?

Reply: They are based on a somewhat different philosophy than the Salmon Commission presently has. The Canadians think that the Salmon Commission isn't putting enough fish on the spawning grounds, and looking at the last cycle, I have to agree with them. The commission has been responding to the immediate concerns of the industry in holding down the numbers. The Canadian reply is that if they put more in they would get the benefits back and industry would have a bigger return.

I don't know which approach is best. Under the proposed new agreement, the management, the actual setting of escapement goals, would become Canada's responsibility. The U.S. would have no involvement in Canadian territory. Canada would develop escapement goals and submit general management plans to whomever is responsible for day-to-day management.

Question: Can you explain what you mean by cycle dominance?

Reply: I spoke of cycle dominance on sockeye. There are four separate cycles of sockeye. It's been the history of the Fraser River fishery that one cycle was dominant. Historically it's been the Adams River run and Figure 1 shows a big run every 4 years. That went up to 30 million fish, but only every 4 years. Two of the runs are very low, a third run is sort of sub-dominant. The same thing occurs in Alaska on a 5-year cycle. There have been many studies to determine the cause of this. They've tried to relate it to the conditions in the lake, the predation between different species, and the zooplankton cropping off the plankton in the lake which takes about 4 years to build back up. There have been all kinds of studies. The fact is every 4 years there is a big run.

Question: Has the Boldt decision impacted the talks?

Reply: I spent all summer in court because of the Boldt decision. It's one of the problems that we're having in the U.S./Canadian talks. We have this court decision that says the Indians are entitled to the opportunity to catch up to 50 percent of the catch in certain areas. That is, they're entitled to 50 percent of the U.S. catch of Fraser River sockeye and pink salmon. Until this came along they were catching maybe 3 percent of the sockeye and less than 1 percent of the pink taken by U.S. fisheries. Now they're taking close to 30 percent of the U.S. sockeye catch.

The only way we've been able to achieve this is by setting a more restrictive season for non-Indians. The joint U.S./Canadian commissioners of the Salmon Commission set their sockeye season and the U.S. approves it. I gave an example for what it was for 1975. However, the only way the Indians are going to catch 50 percent of this amount, or anywhere near it, is if they fish two or three times as long as the other U.S. fisheries. For the past 4 or 5 years the U.S. has approved the regulations as proposed except as they apply to the U.S. Indians. The Departments of Commerce and the Interior then have set up separate Indian regulations independent of the Salmon Commission regulations which give the Indians more fishing time; for example, 5 days a week when the rest of the U.S. fishermen are fishing 2 days a week. This made Canada madder than a wet hen, and it made the commissioners from both the U.S. and Canada mad because they were just sort of bypassed. The only way we see of getting these treaty rights to which the courts have said the Indians are entitled is through separate regulations. Canada now feels that the sockeye and pinks are regulated internationally and does not want to worry about U.S. domestic problems. There's going to be specific language in the new treaty that will take care of the Indians for these and other species. At the present time the Salmon Commission is to look at sockeye and pinks and ignore the chinook and other fish the Indians are fishing.

Question: Is it really valid to look at Indian rights as a domestic problem?

Reply: It's domestic from the international standpoint. It's a domestic problem that the U.S. has to resolve. It's none of Canada's business. The Canadians don't want to set seasons for our Indians because that would generate problems with their Indians for similar consideration.

Question: How do Canadians manage their Indian fisheries?

Reply: There is an historic Indian fishery on the Fraser River and the Canadians recognize it. The commission recognizes it too and takes it into account. When the commission sets the regulations for the Fraser River itself it allows so many fish to enter the mouth of the river, so many for the Fraser River fisheries, so many for the Fraser River Indian fisheries, and the remainder for escapement.

Question: Could you explain how the Fraser runs are managed under the commission and the role the commission plays in day-to-day operations during the peak of the season? What kind of data do you use and where do you get them?

Reply: Let's use 1975 for an example to see how the commission operates. In December 1974 the staff of the commission developed a proposal considering all the races, estimating the status of stocks and the number to allow for escapement. A season was proposed in terms of days of fishing in each of the fishing areas. This was based on estimated numbers of units of gear in the U.S. waters and out in the Canadian strait fisheries, and the projected intensity of the river fishery. Early in the spring the staff formulated the final season regulations after the advisors and the industry gave their input. Usually there isn't much change. In recent years the U.S. has accepted the regulations with a stipulation exempting U.S. Indians. The season usually starts in early July. In 1975 everything was closed in U.S. waters until about the 10th of July when the season opened for 2 days. On the night of the first day of fishing the commission biologists took scale samples. These were of fish the purse seines or gillnets began bringing in early in the evening and throughout the next morning. The scale samples were sent to the commission and studied. By the first thing the next morning the races were identified by their scales and estimates prepared on the proportions of the major races present in the sample. In this case it was pretty simple because they were almost pure Early Stuart. By the amount of gear, generally catch per unit effort data, an idea of the abundance of the fish was obtained.

The staff samples and reads the scales every day for every fishery in operation. If it's not a critical period the commissioners only meet twice a week to decide whether to allow additional fishing or to require additional closures. Generally one meeting is on Friday so they can decide on the basis of what occurred that week whether to go ahead with the original proposal for the next week or to make changes. During the early part of the season most Canadian fish are caught in the river. In 1975 there wasn't any fishery out in the straits until early August. In the middle of the season it gets critical; this is when they are trying to ensure the proper catch division.

Historically the commission has found that by the time the season has progressed this far the U.S. is probably ahead. The catch division may be 70-30. That is normal. If the U.S. for some reason has not gotten the anticipated gear in the water--say they stayed up in Alaska because of big runs--and its proportion of the catch is down, and if the stocks can stand it, the commission might decide to allow an extra day or two of fishing in U.S. waters. The time allotted gets critical if there is a lot of gear in use. U.S. fishermen can catch over a quarter of a million fish in a single day of fishing in U.S. waters.

That's how the commission works during the season. It will meet at least twice a week, usually in Bellingham because it's an in-between place, and the members and staff confer every other day by telephone. The basic procedure is collecting scale samples from the fishery and getting catch information. One member of the staff does nothing else in the morning except contact the buyers and get an estimate of the previous night's catch. Early in the morning the commission already has very reliable estimates of how many fish were caught the day before, the racial composition of the catch, and if the results confirm the proposed season plan. On the basis of this information the staff will report to the commissioners: everything is going as predicted, do nothing; the catch division is out of balance because the Americans haven't got enough gear out, so give them more fishing time; or the run's not nearly as large as we projected and additional closures are

needed. This goes on for a 3-month period from July through September during which time the commissioners meet two to three times a week and every day in some weeks.

In addition, there is the problem of the division between the Indians and non-Indians in U.S. waters. If the commission decides to make a change in the allowed U.S. catch then the U.S. has to decide how this will affect the Indian's part of the catch. It happens that one of the U.S. commissioners is the Regional Director of the National Marine Fisheries Service and also is involved in the Indian problems as a domestic responsibility. He puts on his regional director's hat when an Indian problem comes up. It's a tremendously complicated and very tiring job for those 3 months. You almost have to live through it to understand.

Question: How many scales do you look at on a day-to-day basis?

Reply: The technique is so refined tremendous sample numbers are not needed--only a relatively good sample of the fishery. In 1958, when the big Adams run came back, for some reason there was a large diversion through Johnstone Strait and tremendous catches of salmon were made in that area and along the northern coast of Vancouver Island. The immediate question was, are those Fraser sockeye? I left Vancouver in the morning on a float plane and stopped at every port along the west coast of Vancouver Island and took scale samples. That afternoon those scales were read and we knew the racial composition of the fish from each port and established that these were indeed Fraser River fish and clearly there was going to be a large diversion from the more usual route. We could estimate the proportion of Adams River fish passing along the west side of the island.

Question: What's the total magnitude of that whole fishery in an average year?

Reply: The U.S. catch probably averages around 2 million sockeye. The prices are going up so much the value may be $10 a sockeye. That's $20 million. You have a similar-sized run of pinks every other year, so on alternate years the U.S. value is $40 million. It's one of the major salmon fisheries other than Alaska. This year in Bristol Bay the conservative U.S. prediction is for a 56 million sockeye run; the Japanese are estimating 80 million. Obviously salmon prices will be depressed this year.

Question: Can you predict what route the various races of a run are likely to take?

Reply: No you can't. It varies so much depending on oceanographic conditions. In 1958 we had a warm-water intrusion quite far north, that sort of shoved all the fish up north. That year there was a major diversion through Johnstone Straits. They also had a major diversion about two years ago. The route is more dependent on conditions in the ocean than on the genetics of the fish, although in most years their routes are fairly similar.