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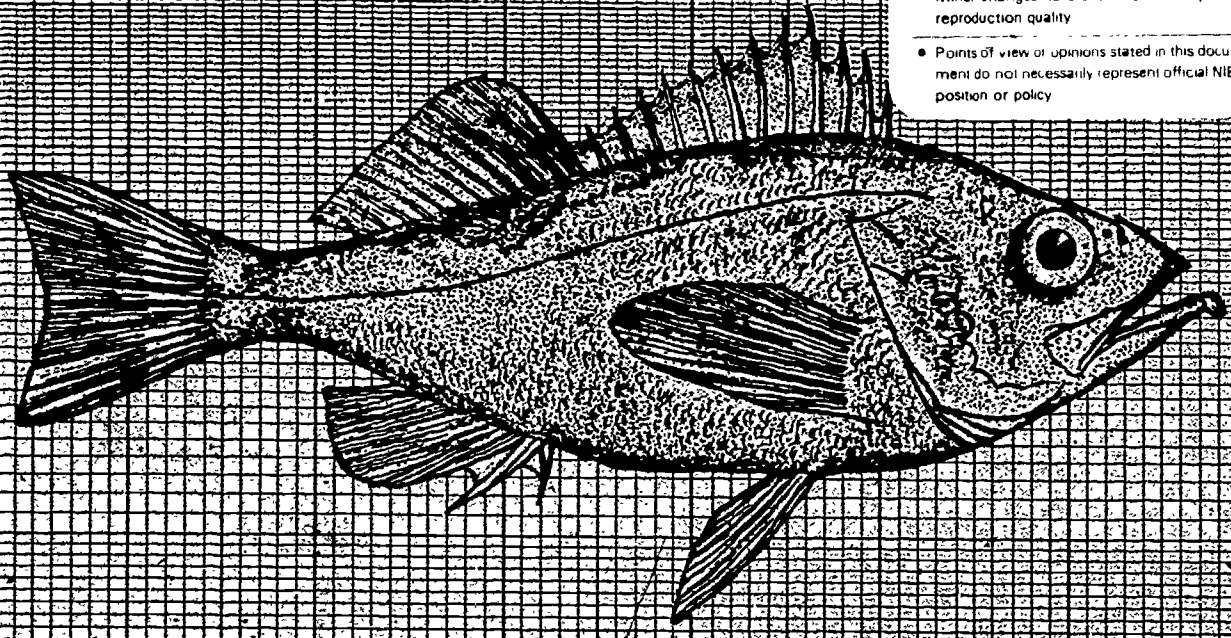
ABSTRACT

This conference was an attempt to have the fishing industry join the state of Alaska in building fisheries education programs. Topics addressed in papers presented at the conference include: (1) fisheries as a part of life in Alaska, addressing participation of Alaska natives in commercial fisheries and national efforts; (2) the international perspective, discussing fisheries education system in Japan, Newfoundland fisheries, fisheries education in Denmark, and fisheries research and training programs of the Whitefish Authority (Hull, England); (3) technology of the fishing industry, including community college, university, and college programs; (4) fish as food, considering the educational needs of the seafood processing industry/workers and educational needs in food science and technology; (5) marine resource management, discussing aquaculture systems, constraints and outlook for fisheries and aquaculture, and education for marine resource management; and (6) the business of fishing, focusing on education for the business of fishing, educating fishermen and others to appreciate the importance of fishing as a business, and government involvement in United States fisheries development. Summaries of workshops considering fisheries and marine education needs in Alaskan elementary and secondary schools, planning for vocational/technical education, and university level programs (providing a survey of educational needs of fisheries/ecologists) are included. (JN)



Conference Report

FISHERY EDUCATION IN ALASKA

December 1980

University of Alaska - Juneau
Sea Grant Report 82-4

University of Alaska, Juneau
11120 Glacier Highway
Juneau, Alaska

FISHERIES EDUCATION IN ALASKA:

CREATING A PROGRAM OF EXCELLENCE

December 8-12, 1980

Anchorage, Alaska

Proceedings of the Conference

Sponsored by

University of Alaska, Juneau

Office of Governor Jay S. Hammond
Division of Policy Development and Planning

Alaska Department of Education

Alaska Department of Commerce and Economic Development
Office of Commercial Fisheries Development

William W. Smoker, Editor

December 1981

Alaska Sea Grant Report 82-4

PREFACE

Planning for this conference was begun in early 1980 by Jim Edenso, then Bottomfish Coordinator in the Office of the Governor. With primary funding from that office, which later transferred to the Department of Commerce and Economic Development, the conference was sponsored by the University of Alaska, Juneau (UAJ), the Department of Education (DOE), and the Division of Policy Development and Planning in the Office of the Governor (DPDP).

The steering committee for the conference consisted of William W. Smoker and Richard S. Lee from UAJ, Terry A. Whitbeck from DOE, and David Allison from DPDP. Mr. Allison ably served the conference as Master of Ceremonies on a moment's notice.

The conference was visited by some tough travelling weather. Some participants were late or didn't attend, some arrangements were makeshift. In particular we regret that remarks made by Jay Barton, president of the University of Alaska, and Serge Doroshov, aquaculturist from the University of California, Davis, were not recorded because of equipment failure.

We regret that we could not reproduce all of the visual materials that were presented, but feel that the speakers' meaning is adequately clear without them.

For their help we thank Community Enterprise Development Corporation, the Alaska Native Foundation, the Bering Sea Fishermen's Association, Kawerak, Inc., and the Sheraton Anchorage Hotel.

Catherine W. Mecklenburg redacted the transcripts of the presentations and workshop materials, producing the material contained herein.

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INTRODUCTION:
CREATING A PROGRAM OF EXCELLENCE*

Probably the first of its kind in the nation, the conference entitled "Fisheries Education in Alaska: Creating a Program of Excellence" was an attempt to have the fishing industry join the State of Alaska in building fisheries education programs.

In his introductory address, Dr. Jay Barton, President of the University of Alaska, pointed out that advanced fisheries education at the technical and university level is needed if Alaska is to keep up with a rapidly changing and highly technological offshore development of the fisheries.

Rod Moore, assistant to U.S. Representative Don Young, challenged Alaska to develop its own expertise in resource management, harvesting techniques, processing, and marketing. Our geography, population distribution and potential, and political situation are unique, Moore said. We must "be imaginative, be cooperative."

Others making presentations at the conference were personnel from the University of California, the College of Fisheries at St. John's, Newfoundland, Clatsop Community College in Astoria, Oregon, the Jutland Technological Institute of Denmark, the Massachusetts Maritime Academy, and Oregon State University in Corvallis; the American Embassy in Tokyo; Nunam Kitlutsisti, which is the environmental arm of the Association of Village Council Presidents; the Alaska Food Company, Icicle Seafoods in Petersburg, and Peter Pan Seafoods; Groton Bio Industries in Massachusetts and Oregon Aqua-Foods, which are involved in aquaculture; the Alaska Department of Fish and Game; the National Federation of Fishermen; and the Alaska Fisheries Development Foundation.

In a short three days those people attending the conference tackled the monumental task of identifying educational needs in terms specific enough for program development. From the many examples of programs in other places, they sought to conceive of appropriately scaled and designed programs that could be implemented here in Alaska.

The programs of the Whitefish Authority at Hull, England, represented by Dr. Dennis Lodge, now with Clatsop Community College in Astoria, Oregon, illustrated that science and technology often go hand in hand in fisheries education. Lodge's example of such a partnership was the hydraulic flume tank used by the Whitefish Authority both to assist engineers in net design

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*Adapted from an article by Terry A. Whitbeck, Fisheries Education Supervisor, Alaska Department of Education, and Hank Pennington, Marine Advisory Program, University of Alaska, that appeared in Alaska Seas and Coasts, Volume 9, Number 1 (February-March 1981).

and to help fishermen learn to use these nets to increase their harvest. Actual vessel and sea conditions are duplicated in the tank. Lodge feels the United States, particularly the west coast, needs to have a tank to increase the competitiveness of the U.S. fishermen. He asked, "Why not in Alaska?"

Following their presentations, the individual speakers conducted workshops with educators from around the state to discuss education and training needs and methods specific for their area of expertise.

In these individual sessions it quickly became apparent that, due to the diversity of the communities in Alaska, the "best" education program and the "most important" needs often had little in common from one region to the next. Should one general overall program be designed so that it might fit all communities? Or should individual regions design programs that meet their specialized needs?

It was not possible in the short time allowed to come up with the solutions to such mechanical problems, but it was possible to identify some of the most important fields where educational programs of one form or another are seriously needed today, or will be needed in the near future.

The list was long and comprehensive. It included resource management, harvesting techniques, processing techniques, marketing, aquaculture, gear design and manufacture, electronics, vocational and on-the-job training, entry-level training, quality control, engineering, operations and personnel management, communications, law, and politics.

Some of the programs needed can be designed and implemented without too much trouble. In others, however, the real educational needs can be obscured as we try to fit them into the traditional divisions of elementary school, high school, vocational school, community college, and university programs.

Consider resource management, for example. Obviously that would be a college degree program designed to produce managers for the regulatory agencies. But could not fishermen use a background in fisheries management for those times when they must stand in front of the Board of Fisheries or the North Pacific Fishery Management Council and defend their opinions about the management of the fisheries? If they could, then we must consider a basic fisheries management program for the high schools, for the community colleges, and for short courses designed for fishermen who are no longer in school.

As we look at many of these fields, and the diverse educational needs, it becomes fairly obvious that we may be looking at some new approaches to education, and even the forging of some new partnerships in education. None of these programs are going to be worth the time it took to develop them if they are not influenced strongly by the industry and the agencies. It is also apparent that there will have to be continuity and coordination between the fisheries education programs developed for elementary schools, high schools, junior colleges, colleges, vocational schools, and on-the-job training. Such continuity and coordination imply the overcoming of some fairly strong bureaucratic and institutional barriers.

Finally, we must consider time constraints on the efforts to develop fisheries education programs that work for Alaska. We have to sort the problems and the programs into immediate and long term groups and build our programs accordingly. Some of the needs facing the industry and the agencies are immediate. They cannot wait 10 years for a solution. In other cases, there are problems that will come up once we are well on our way to developing new fisheries.

PART I: PLENARY SESSIONS

(MONDAY-WEDNESDAY, DECEMBER 8-10, 1980)

FISHERIES AS A PART OF LIFE IN ALASKA
(MORNING SESSION, DECEMBER 8, 1980)

PARTICIPATION OF ALASKA NATIVES IN COMMERCIAL FISHERIES

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In my comments today I do not presume to represent all Alaska Natives. My perspective will be basically from that of my work. For the last 4 years I have been working with Nunam Kitlutsisti, which is the environmental arm of the Association of Village Council Presidents which encompasses one-fourth of all the villages in the State of Alaska.

Participation of Alaska Natives in the commercial fisheries is very new. Ours is basically a subsistence life-style in rural Alaska, and for the most part our fishery is a subsistence fishery, but a lot of native people have been getting into commercial fishing. This is especially true in Bristol Bay, and presumably it is also true in the Aleutian Chain, Kodiak, Southeast Alaska, and Prince William Sound. If you were to go to the meetings of the North Pacific Fishery Management Council and the Alaska Board of Fisheries which are also being held this week, you would learn of the involvement of Alaska Natives in the regulatory mechanism set out by both of those groups.

Individually and collectively we have very definite needs from the State of Alaska in terms of managing and conserving the fishery resources, and we have very definite needs in terms of fisheries education.

At times we also have individual and differing views on the existing fisheries. I, for one, have specific ideas on what can only be called "wasteful fisheries." A prime example is fishing herring for sac roe. This is very wasteful. The carcasses are discarded. When you come from a lifetime of using pretty much the whole of a fish or any other resource, this type of fishery seems really strange.

However, we find ourselves becoming more and more involved in the wasteful fisheries because we do need the money. It has been a drastic change from the traditional way, of catching the fish when it is there, using it when it is fresh, or preserving it by drying it or smoking it, and, within the last 100 years, salting it. But, for the most part, the saltery has come in as an introduction by outsiders. The introduction of canneries also led to our participation in the commercial fisheries.

The fisheries of the Yukon and Kuskokwim rivers are very limited compared to, say, the fisheries of the high seas or Bristol Bay. The kind of fishery

is very different, and the price of the fish is very different. Last summer we were getting from 5 to 15 cents a pound for chum salmon.

We have individual problems that need to be addressed by the state, by the University of Alaska, by research. Biologists have very little information about a lot of the different kinds of fish that we use in our region. The Alaska Department of Fish and Game studies resources that produce cash income, so there are a lot of studies on salmon and herring. At this point I think they are inadequate, but at least studies are being done. Few or no studies are being done on whitefish, blackfish, great northern pike, trout, needlefish, lampreys, sheefish or inconnu, and burbot, to list but a few.

We need information about such species for several reasons. Big industry in the form of oil exploration and development is coming, and it will jeopardize a lot of things. It will jeopardize the fish and wildlife resources that surround us, and also the water supplies. Alaska is basically very dry. Yes, we do have 3 million lakes, but the annual precipitation is very low. So we do have potential water problems. We have to be really careful about these resources. We need more information on them.

Another problem is the complexity of the regulatory system we have to understand and work within. First we have the State of Alaska's local Fish and Game Advisory Committee. Then we have the state's Board of Fisheries, which revises its regulations twice a year. As you know, the State of Alaska has jurisdiction of all fisheries in the waters within 3 miles of the coast. For fishing beyond that limit, we also have to deal with the North Pacific Fishery Management Council, and if you think the Board of Fisheries is complicated, you should look at the council. We also deal somewhat with the International North Pacific Fisheries Commission, which deals with protocol concerning the salmon and herring fisheries of the high seas.

You have to remember that when we look at all this, most of us have to look at it from the perspective of the person in the village, where people don't speak English. Everything has to be explained in our language. That is one of the best things about our area. We use our native language for almost all everyday business. It takes a lot of bending and twisting and borrowing of words from English and other languages, but it works. I would like to see the State of Alaska, the University of Alaska system, try to work that out because I think it is important.

Nunam Kitlutsisti's goal has been to involve as many fishermen as possible, so it is involving people who have little knowledge about multi-national corporations that ship fish all over the world. I think it is government's responsibility to look at the really small fisherman. In our area we have fishermen with 18-foot skiffs who fish in the river for two 6-hour periods a week, and for the most part that is the source of their income for the rest of the year. It is a very small fishery. We have to deal with things like fish quality. Can we get a good enough product out of the Yukon-Kuskokwim drainage? Can we sell it?

The state and federal governments should both make commitments to looking at the small fisheries. It is difficult for us on several levels. The herring fleets, for example, can start out from San Francisco, complete with their

processors, and go up the coast following the fish as they migrate. They are better equipped, they have money backing them up, and they have a history of fishing commercially for herring. It is a different kind of fishery in a place like Goodnews Bay where most of the people do not speak English and most of the fishermen have only small skiffs. They are not prepared to fish herring on the same level. What kinds of protection are the state and federal governments going to give those citizens for fishing?

Even though it is so complicated, we have a lot of fishermen who are willing to look at the whole process and get into commercial fishing on a larger scale. It is a long, complicated process and I think we will need the help of big industry to get into it.

NATIONAL EFFORTS

Rod Moore,
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We all recognize and agree, or we wouldn't be here, that commercial fishing is an important part of the Alaska life-style. We have two of the top three ports in the nation in terms of value landed, we have 35 percent of the nation's shoreline and 75 percent of the continental shelf, and all of the major fishing allocations occur within the 200-mile fisheries conservation zone off the coast of Alaska. Most of those allocations are still going to foreign nations, but we hope that is changing. The fishing industry is an important employer in this state. If you look at the fishing communities, the coastal communities like Petersburg or Kodiak, you see that it is the employer.

What are we going to do about it? Do we let the fishing industry continue going on as it has been, relying primarily on traditional species, doing a little bit of experimentation here and there with the so-called underutilized species--pollock, black cod, and so forth? Or do we make a major thrust at getting into some of these new fisheries? That is something the fishing community and you, as educators, are going to have to decide. I say, "you," because you have to supply the support for the efforts of fishermen and processors in Alaska as they get into these developing fisheries.

Regarding national efforts, I think one of the things that we have to learn to recognize is that Alaska has to compete in the world market--even though Alaska is a good distance away from the rest of the United States, even though we all sometimes think we are not getting equal treatment or we deserve special treatment, which is true in many cases, and even though people in other areas do not understand many aspects of life in Alaska. Alaska has to compete in the world market, and that market includes the rest of the nation. If we are going to compete, we had better start gearing up to learn exactly how to do it.

Look at fisheries development in Alaska now. Look at the boats, like the Arctic Trawler, or some of the new boats fishing for the joint ventures in the waters off Alaska, and you will find that a lot of these boats are coming out of Seattle. Why can't they come out of Alaska? There are some Alaskan boats participating, but for the most part they are sticking with the traditional fisheries. If we keep up with that approach, we are going to go right back to where we were before statehood, with everything being controlled out of Seattle. I do not think anybody wants that.

It is time to start using our imaginations a little bit. Tony Vaska was talking earlier about how folks in the bush, especially in Western Alaska, have relied on fishing for many years, primarily as a source of subsistence with some small-scale commercial fishing. I used to work in the lower Yukon area, so I am familiar with the fisheries there. In that area, essentially the same kind of fishing has been going on for years and years. With the exception of perhaps better boats, more powerful motors, and some nets that are put together a little bit better, not much has changed.

Recently we have noticed that some people are starting to look at changes. For example, Calista Corporation and Cook Inlet Region Incorporated are looking at a joint venture operation to see if they can develop some of the underutilized fisheries using small boats in their particular geographic area.

The need for imagination extends to the educational system. I graduated from the natural resource management program at the University of Alaska in Fairbanks, but the reason I did was that the fisheries program up there did not have the course work I needed to fulfill my interest, which was resource management with an emphasis on fisheries. The fisheries program up there was structured for traditional fisheries biologists. You learn everything you have to know about water pollution, ichthyology, zoology, anatomy, and so forth. This is fine if you need to deal only with fish, but you will also be dealing with fishermen, and with the environmental factors that affect them such as the economy and sociopolitical structures. Therefore, the fisheries education system you develop needs flexibility.

What type of fisheries education system should be developed: a traditional 4-year program in which the first couple of years are spent on English and chemistry, and so forth, and the next 2 years on a major subject; a community college program of 2 years spent in specialized courses; or short courses and workshops, where a fisherman can spend his limited amount of time in port gaining additional knowledge about his field? Whatever is decided, we must be flexible and innovative. We should not echo all of the ideas that are being pursued elsewhere, in other programs.

The first step in developing a fisheries education program is to identify your goals. Next, identify the problems that are preventing you from reaching those goals. Then organize in order to work at solving those problems and reaching those goals. Take, for example, the Bering Sea Fisherman's Association, which organized a year or so ago. The people in Western Alaska realized that if they were going to be able to compete in fisheries management in Alaska, they would have to organize. And that is what you must do, whether you are an educator looking for funding for education programs; or a fisherman who is worried about the price of fish or about new management regulations coming down from the National Marine Fisheries Service or the State of Alaska; or a processor who is worried that individual processors are being singled out and sucked under. You have to organize and do things together because this is the only way you are going to solve any problems. Once you organize you will find a lot of people are willing to help.

Congressman Young is very interested in the development of the fisheries in Alaska. He wants to see fishing continue as a major industry in Alaska, but

it is difficult to focus on specific problems. If we get fisherman A from Kodiak saying one thing, fisherman B from Petersburg saying something else, fisherman C from Wrangell saying a third thing, and fisherman D from Bethel saying yet a fourth thing, it would be the same situation as educators from the community college system or from the University of Alaska, say from Kodiak, Kuskokwim, and Prince William Sound community colleges, all identifying different problems. This is why you must organize and decide exactly what you want, and then we can work together to try to get it.

That is pretty much the focus of any national effort that is going to occur. We need to use our imaginations and be willing to use innovative approaches, whether it be in fishing, processing, or support systems such as education. We must learn to work together. This conference, which has gathered people from all over the United States and all over Alaska so they can sit down and identify these problems, is a tremendous start. If you take advantage of this opportunity, if everyone works together at goal identification and problem solving, both during and outside of the various workshops, it will be helpful for the future of the fishing industry in Alaska.

THE INTERNATIONAL PERSPECTIVE
(AFTERNOON SESSION, DECEMBER 8, 1980)

FISHERIES EDUCATION SYSTEM IN JAPAN

Yoshio Nasaka,
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American Embassy
Tokyo, Japan

Zenko Suzuki. Perhaps some of you have heard this name. He is the current Prime Minister of Japan. The reason I mention the Japanese prime minister is that he is a graduate of a Japanese fisheries high school and a fisheries university. This fact alone will give you some idea of the Japanese fisheries education system, as I believe there has been no other president or prime minister in the world who was a graduate of a fisheries university.

The Japanese educational system as a whole starts with elementary school with six grades, and junior high school with three grades. Everybody must go to these schools. They are compulsory education in Japan. After graduating from junior high school, then you have a choice of going to either of the following four types of high schools, each with three grades: ordinary high school, fisheries high school, agriculture high school, and commerce high school. The academic year is from April to March, which is the same as the Japanese fiscal year.

With regard to fisheries education, there are 52 fisheries high schools and 18 fisheries universities in Japan at present. The fisheries high schools give exclusive fisheries education together with an English language curriculum, and they are run by prefectural governments. In other words, the Juneau Fisheries High School of the State of Alaska, if there was such a school, would be equivalent to one in Japan. About 18,000 students are enrolled in the Japanese fisheries high schools.

When I said that there are 52 fisheries high schools in Japan, this means some prefectures have more than one fisheries high school. This is because there are 48 prefectures or states in Japan, including Tokyo. For example, Japan's Hokkaido Prefecture has six fisheries high schools. So you will recognize the importance being attached to fisheries education by the prefectural governments out of taxpayers' money.

These high schools have their own training vessels so the students can learn how to catch fish. Sometimes these vessels are used in joint governmental research programs such as the United States-Japan Joint Salmon Research Project which has American scientists on board.

Above the high schools, there are 18 fisheries universities, each with four grades. Two of them are exclusive fisheries universities run by the

Japanese Government. One of these is located in Tokyo and the other in Shimonoseki, the southern part of Honshu. The remaining 16 universities, which are either governmental or private, have a fisheries department or faculty together with other departments. This resembles the University of Alaska system. The total number of students majoring in fisheries in Japan is about 6,000. The universities also have their own research or training vessels, each 200 to 300 gross tons. Right now, we can find many people who are graduates of the fisheries universities among leaders of the Japanese fishing industry.

The history of fisheries education in Japan goes back 100 years. In fact, Prime Minister Suzuki is a graduate of Japan's second oldest fisheries high school which was established in 1895. He is also a graduate of Japan's first national and exclusive fisheries university which was established in 1897, and which is now called the Tokyo University of Fisheries.

As an example of the fisheries curriculum at the university level in Japan, let us take the Tokyo University of Fisheries. It has the following seven faculties. Under the Faculties of Fisheries Science and Technology and Fisheries Science and Engineering, you learn fishing methods, fishing gear, navigation, oceanography, and population dynamics. Under the Faculties of Food Science and Technology and Food Technology and Engineering, you learn microbiology, biochemistry, food preservation, food processing, and refrigeration. Under the Faculties of Mariculture and Aquaculture, you learn fisheries biology, ichthyology, pathology, and fish culture. Finally, there is the Faculty of Marine Environmental Science and Technology. In addition, there is a course in Fisheries Management where you learn international relations in fisheries, fisheries policy and administration, and fisheries economics.

After 4 years of university studies, you can get the Bachelor (Gakushi) of Fisheries degree, although the definition of "Bachelor" may be slightly different from that of the United States or other countries. Further, there is a graduate school for the Master (Shushi) of Fisheries degree, which takes 2 years, and the Doctor of Fisheries degree, which takes 3 years.

Apart from a sister school arrangement between universities of the United States and Japan, there is a Japanese scholarship available to foreign students as long as they are under 35 years old. This is granted by the Japanese Ministry of Education to foreign students wishing to pursue the master's degree in Japan. However, even if you are a recipient of this scholarship, you are automatically enrolled in the Japanese Language Course of another university during the first 6 months or so, unless your knowledge of the Japanese language is considered to be sufficient for pursuing your studies at your desired fisheries university. For more details about this scholarship, the Japanese Consulate Office will be of assistance to you.

One more scholarship is available to foreign researchers who have a doctor's degree, and this is granted by the Japan Society for Promotion of Science under a government subsidy.

In the field of fisheries research, the Japan Fisheries Agency, which is equivalent to the National Marine Fisheries Service of the United States,

has a total of 9 research institutions and 12 research vessels. There are six Regional Fisheries Research Laboratories, plus the Far Seas Fisheries Research Institute, the National Research Institute of Fisheries Engineering, and the National Research Institute of Aquaculture.

In addition, the Japan Fisheries Agency has salmon hatcheries in Hokkaido and the Inland Sea Fish Farming Centers. The total number of employees including scientists working at these governmental research institutions is 800 and the budget totals $24 million (5,000 million yen), or 1.6 percent of the total agency budget of $1,457 million (306,000 million yen) for Japanese fiscal year 1980.

The prefectural governments also have their own fisheries experimental stations. There are 157 experimental stations, including branch stations, and these have 145 boats, 3,100 employees including scientists, and a combined budget of about $86 million (18,000 million yen).

Dissemination of knowledge and research findings to fishermen and others in the industry is important. The governmental and prefectural research institutions, as well as university scientists, are playing an important role in this regard. Their activities include basic research on stock assessment for improving conservation and management, fish diseases, new types of gear, vessels that will consume less fuel, aquaculture, fish processing, fish preservation, and other studies.

Furthermore, there is a fisheries extension service in Japan. This service may be similar to those being carried out by the University of Alaska or by other universities in the United States. The difference may be that there are 450 fisheries extension workers in Japan and that they are civil service employees of prefectural governments. They are scattered among 147 area offices throughout the country. Fisheries extension workers make their own knowledge of the fisheries, along with the scientists' research findings, available to coastal fishermen for the purpose of increasing productivity and improving management of the resource.

I would like to take this opportunity to express my appreciation to the University of Alaska, the Alaska Department of Education, the Office of the Governor, and those who assisted me in making travel arrangements, including the Alaska Asian Office in Tokyo.

THE NEWFOUNDLAND FISHERIES

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Similarities between Newfoundland and Alaska that have resulted in similarities in the fisheries include weather, isolation, and oil. The formation of pack ice in northern areas and generally inclement conditions in ice-free regions constrain the nearshore and inshore fisheries to a seasonal basis. Communities are geographically isolated in both Newfoundland and Alaska, and this affects the fisheries. Oil and gas development is accelerating off both coasts, and wherever fishermen and oilmen exist together the "cod-crude syndrome," with all its associated environmental and social factors, will arise. There are other similarities, but these should suffice to create a backdrop for a general outline of the Newfoundland fisheries.

According to Canadian Federal Government figures recently obtained, there are 74,017 licensed commercial fishermen throughout Canada. This total breaks down as follows:

West Coast (B.C.)		15,500
Maritime Region		18,000
Quebec:	Fresh water	588
	Salt water	4,929
Newfoundland Region		35,000

Nearly half of the commercial fishermen of Canada working in the Newfoundland region? Well, not exactly, because these figures could be somewhat misleading. Fishermen are bona fide, according to the Newfoundland fisherman's union, if they fish throughout the full season, derive the majority of their income from fishing, or both. As I mentioned, the inshore fishery of Newfoundland is seasonal, and many fishermen may only work in the industry on a part-time basis. Non bona fide, part-time fishermen account for perhaps 40 percent of the personal licenses issued.

It would be wrong to suggest that these part-timers always detract from the livelihood of the bona fide fishermen. In many cases they complement one another within the industry.

What this figure of 35,000 licenses really indicates is the interest of Newfoundlanders in the fisheries. Most Newfoundlanders have some contact, direct or indirect, with the fishing industry.

Newfoundland's offshore fishing fleet consists of 90 "wetfish trawlers." Most of these are modern stern trawlers, about 150 feet long. These vessels

are operated by three major fishing and processing companies, who also purchase from the midshore, nearshore, and inshore fleets. Quotas permitting, the stern trawlers operate on a year-round basis.

The nearshore and midshore fleet is made up of approximately 1,200 vessels of the 35- to 65-foot longliner type.

There are 17,682 registered fishing vessels under 35 feet in length. In my estimation some 7,000 to 10,000 of these are operated by full-time, or bona fide, inshore fishermen.

The 1979 landed catch for Newfoundland was 569,108 tons, with a landed value slightly over $156 million. Seventy percent of this landed catch was handled or processed by the three major fish companies. Little or no primary processing, other than gutting and icing, is carried out on board Newfoundland vessels.

The Alaskan herring roe fishery, with all its wastefulness, brings to mind another similarity. In Newfoundland the words "cod" and "fish" are synonymous. Until comparatively recently other species were often discarded. Mackerel, squid, and herring, for example, have all traditionally been used only for bait.

Because of world market demands, however, the traditional codfish of Newfoundland is only one of many species harvested. Squid, for example, is now exported to Japan in reasonable quantities. The 1979 landed value of squid was $19 million. Strict allowable catch quotas for cod stocks in areas within the 200-mile fisheries conservation zone have widened the scope of species being harvested and processed by the offshore sector. These now include redfish, turbot, flounder, plaice, and many other species.

The expanding longliner fleet is involved in a very diversified fishery, including both pelagic and demersal species. This is an area which many young, well-educated fishermen are seeking to enter.

The inshore fleet is still largely traditional. Despite predictions made in the early 1970's that the static gear (cod trap) fishery would decline, current indications are that it is still providing a living for many fishermen. Diversification of species harvested and advances in small vessel technology have ensured the survival of the inshore fleet.

Some of the problems that will have to be considered when developing a fisheries education program include the following:

1) The attitude of young people towards the fishing industry. The need for good high school, industrial arts, and prevocational programs.

2) Training for isolated communities. Computer links may be the way to accomplish this in the future.

3) Financial considerations, particularly the interruption of earning for learning. Training programs must be geared to the fisherman's requirements to improve his earnings as well as his learning.

However, the existence of these problems, and many others, should not prevent or detract from the development of fisheries education and training for the future.

Commercial fishermen are a pragmatic breed who through their own practicality are quite capable of learning and innovating within and without the scope of their profession.

The main roles of fisheries education and training can be: (1) to help new entrants to the industry, (2) to provide basic training in new areas of fishing technology, and (3) to provide upgrading and updating for practicing fishermen, particularly in the fields of gear technology and detection electronics.

FISHERIES EDUCATION IN DENMARK

Ehlhart Hauptmann
Jutland Technological Institute
Aarhus, Denmark

First of all, I would like to give you some background figures. Our total population in Denmark is about 5 million. The number of people in the productive years between 50 and 74 is 3,725,000. Of these, 2,675,000 are economically active people. Only 9,300, or 0.4 percent, of the active population are fishermen. For comparison, 6.4 percent work in agriculture, and 24.6 percent in manufacturing.

The total catch of saltwater fish in 1978, which is the most recent figure I could find, was 1.666 million metric tons. This is a low figure. Normally the catch is about 2 million metric tons but it is decreasing because of the common market regulations. You know that each country in the common market has a certain fishing quota for each species. Only about 300,000 metric tons of the total catch are for human consumption. The rest of it is waste fish used for industrial purposes.

There are 7,340 vessels with engines; 3,700 are below 5 register tons and 1,362 are 25 to 1,000 register tons (1977 data).

The Danish educational system (Figures 1 and 2) begins with elementary school, which is usually completed by 16 or 17 years of age. We have what we call the "unity school." The old division between primary and secondary schools no longer exists. All children have to go to school 10 years.

By 18 years of age all students have left primary or elementary school. About half go on to high school, which is the admission ticket to university education; vocational education; or secondary alternative schools. The other half leave the educational system by age 18. The vocational educational system in the old days was an apprentice system, but now it is based on technical college. Secondary alternative schools are something very specific for children who get tired of school after 9 years. They can go to the secondary alternative schools where things are much more interesting. For example, the curriculum includes 2 months of work in Morroco. We also have business schools.

Fish processing industry workers are trained in short courses which are open to students 17 or 18 or older. There is no fee, and you get 90 percent of the normal fishing industry wage while you attend.

The first course is a 2-week basic course for workers in fish processing. After that, the students specialize. They can take hand filleting of roundfish and flatfish (3 weeks); boning, trimming, and portioning of filleted fish (2 weeks); weighing and packing of fish fillets (1 week);

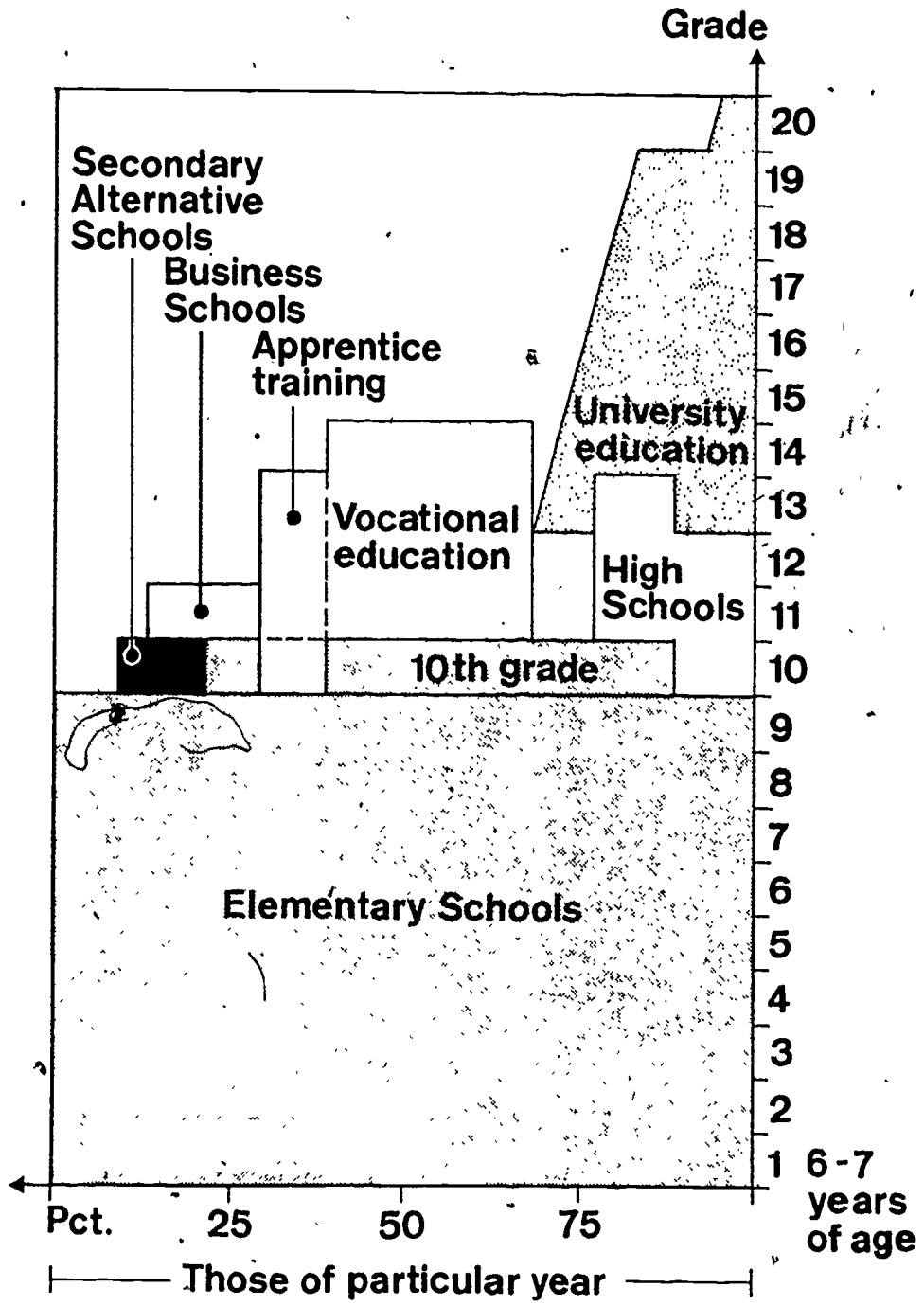

Figure 1.--Educational system in Denmark 1.

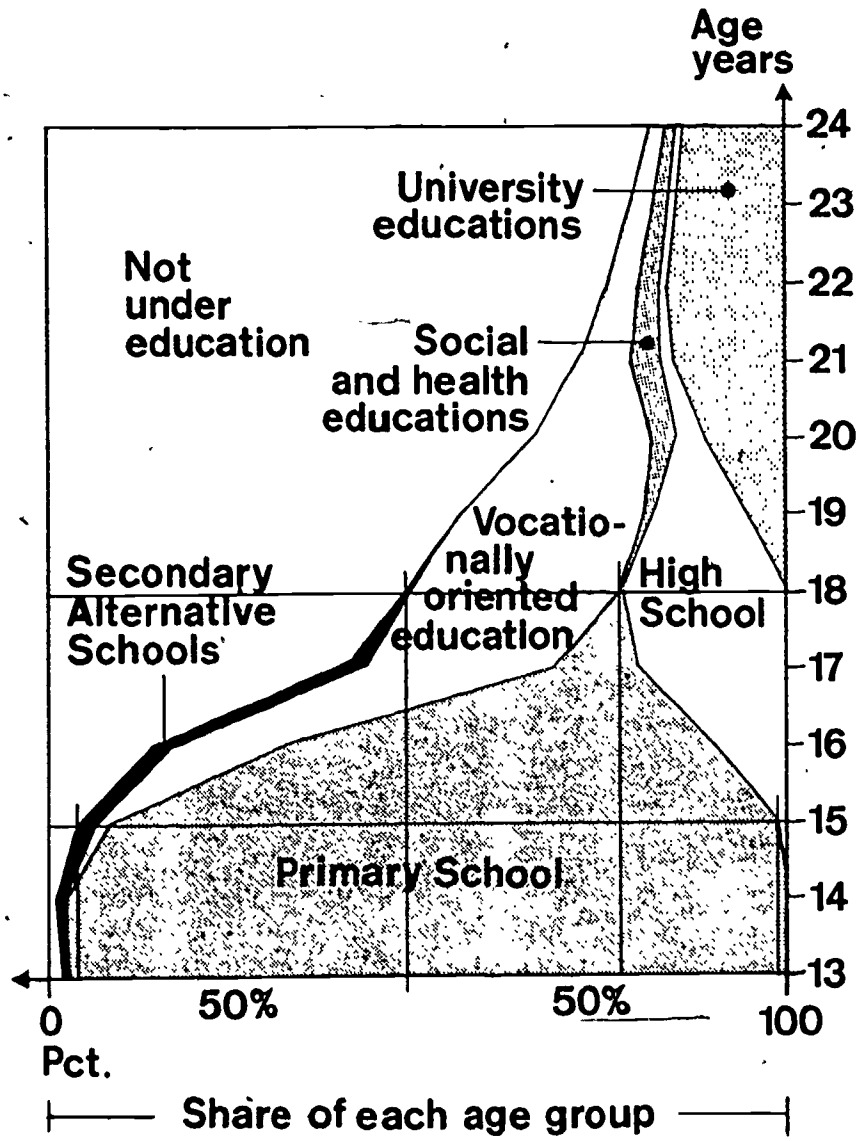

Figure 2.--Educational system in Denmark-2.

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treatment of crayfish (2 weeks); and weighing and sorting of fish for auction (2 weeks).

Eighty percent of all participants take the hand filleting course and the boning and trimming course. The other courses are not held very often. Some of the courses are taught several times each year, resulting in about 60 to 70 courses a year and 600 to 700 participants.

Now let's look at the curricula for these short processing courses. Here is the breakdown on the basic course:

Basic Course for Workers in the Fish Processing Industry

Processing of fish products to consumption	6 hours
Trade in fish products	1 hour
Treatment of fish	2 hours
Hygeine and bacteriology	6 hours
Labor relations	10 hours
Factory visits	8 hours
Trainee period (practice)	4 hours
Program information	3 hours
Total program	40 hours

After only 40 hours, however, you have not learned much about how to handle fish, so the course will be extended to 80 hours in 1981 and there will be more practical training. Each participant will have 20 to 40 kilos of whitefish to exercise on. You cannot do this at a technical school, because what would you do with the fish when you have treated it? So these courses are run out in industry, and fish which is not wasted or soiled during the exercises can be used.

The course on hand filleting of roundfish and flatfish contains the following elements:

Hand Filleting of Roundfish and Flatfish

Raw product, final product	6 hours
Tools	2 hours
Arithmetic	8 hours
Labor relations	4 hours
Output and production control	2 hours
First aid	2 hours
Ergonomics	2 hours
Storage of final product	2 hours
Safety	2 hours
Trainee period (practice)	90 hours
Total program	120 hours

After this the participants are able to hand fillet round- and flatfish, but expertise comes later, with experience in the processing industry. In some programs we combine this course with a later period of on-the-job training. At the beginning of on-the-job training, the government pays half of the wage and the processing industry pays the other half. Then, as long as production increases, the subsidy goes down. After about 3 weeks they are considered experienced workers and the industry pays the entire wage.

Here is the curriculum for boning, trimming, and portioning of filleted fish:

Boning, Trimming, and Portioning of Filleted Fish

Raw product, final product	3 hours
Tools	1 hour
Arithmetic	8 hours
Labor relations	2 hours
Output and production control	1 hour
First aid	2 hours
Ergonomics	2 hours
Safety	2 hours
Trainee period (practice)	59 hours
Total program	80 hours

In these courses, training goes on for 8 hours each day because industry does not want people to be school-minded. This is not a school where students come at 8:00 in the morning and leave at 2:00 in the afternoon.

Now let's look at the programs for fishermen. There are two: one for what we call the "best man," or leading fisherman; and the other for ordinary fishermen. As is the case with the processing courses, everyone 17 or 18 or older is eligible.

Ordinary fisherman training is a 3-week program:

Ordinary Fisherman Training Program

Mending of yarns and nets	24 hours
Treatment of fish	20 hours
Steering and navigation	34 hours
Vessel knowledge, engine care, and maintenance of winches	14 hours
First aid	6 hours
Fire protection	4 hours
Safety on board	4 hours
Ropes and wires	2 hours
Emergency calls	2 hours
Splicing	6 hours
Program information	4 hours
Total program	120 hours

To this is added 80 hours of practice on board a training vessel. Then one can go into the leading fisherman's program:

Leading Fisherman Training Program

Mending, ropes, and wires	52 hours
Treatment of fish	16 hours
Engine care and fire protection	30 hours
Steering and navigation	76 hours
First aid	12 hours
Safety on board	4 hours
Ergonomics	2 hours
Emergency calls	2 hours
Helicopter rescue	2 hours
Program information	4 hours
Total program	200 hours

After completing these courses, a person has to work on board a vessel as an ordinary fisherman for at least a year before he can become a leading fisherman.

Every vessel which is larger than 20 register tons should have both a skipper and a leading fisherman on board. The leading fisherman, as you saw from the course breakdown, has some of the same training a skipper has, like steering and navigation, so he can take over from the skipper when necessary. The skipper has the certificate which allows him to navigate and steer a fishing vessel.

Any youngster may attend the skipper's program, which starts with a basic course of 1 to 5 months (Figure 3). There is no charge, but participants do not get a wage. Next is duty on board a fishing vessel for 19 to 23 months, after which a certificate of proficiency is awarded. From there, a person can go on to be a leading fisherman or first mate, but I don't know what the quality is when the title is achieved through this route. Or you can go on to the 5-month skipper school which culminates in skipper examination III. If you pass it, you are allowed to navigate a fishing vessel in certain waters of the North Sea. If you attend skipper school for another 6 months and pass skipper examination II, you can also fish in the Atlantic Ocean up to the Faroe Islands. If you pass examination I, you can fish anywhere in the world.

Here is the training which leads to each skipper level:

Skipper I	Skipper II	Skipper III
Navigation	Navigation	Navigation
Ship handling	Ship handling	Ship handling
Sea law	Sea law	Sea law
Health care	Health care	Health care
English, Danish	Danish, English	Instruments
Fish biology and oceanography	Fish biology and oceanography	Fish hunting
	Meteorology	Fish treatment
	Signalling	Meteorology
	Fishing methods	Engine knowledge
		Fire precautions
		Administration
		Fishing legislation
		Safety at sea

Denmark also offers some academic education in fisheries, like fish biology, but we do not have any universities which concentrate on fish. People with academic educations in fish biology are not very popular with the fishermen. The two groups argue over how much fish should be caught.

I will finish by explaining how the Jutland Technological Institute produces training programs to suit specific industries (Figure 4). We start by determining what the industry will produce, how it is organized, the job structure, and the technical knowledge required. The other input is manpower: what is available and how people are recruited and selected for the specific industry. Then we make a list of tasks to be done. Some of these tasks are uncomplicated and require no special training. Others have to be analyzed. We prepare training modules for selected tasks, set up training programs, and then begin training.

Many people have asked me what a technological institute is. I don't think you have any in this part of the world. The main task is to supply industry with technological services in all kinds of fields. If you have some problem with a method or machinery, for example, you can ask how to approach it or treat it. You can also ask to have specialized training, tailored to the specific needs of an industry or company.

I have designed a five-step approach to training in fish processing which could be used to attack your training problems in Alaska:

1) Build or select a model whitefish processing plant suitable for combined production and training.

2) Recruit and select supervisors and key workers with sufficient professional and intellectual capability for training of others. They should be supervisors in the processing industry but they should also have the capability of training people.

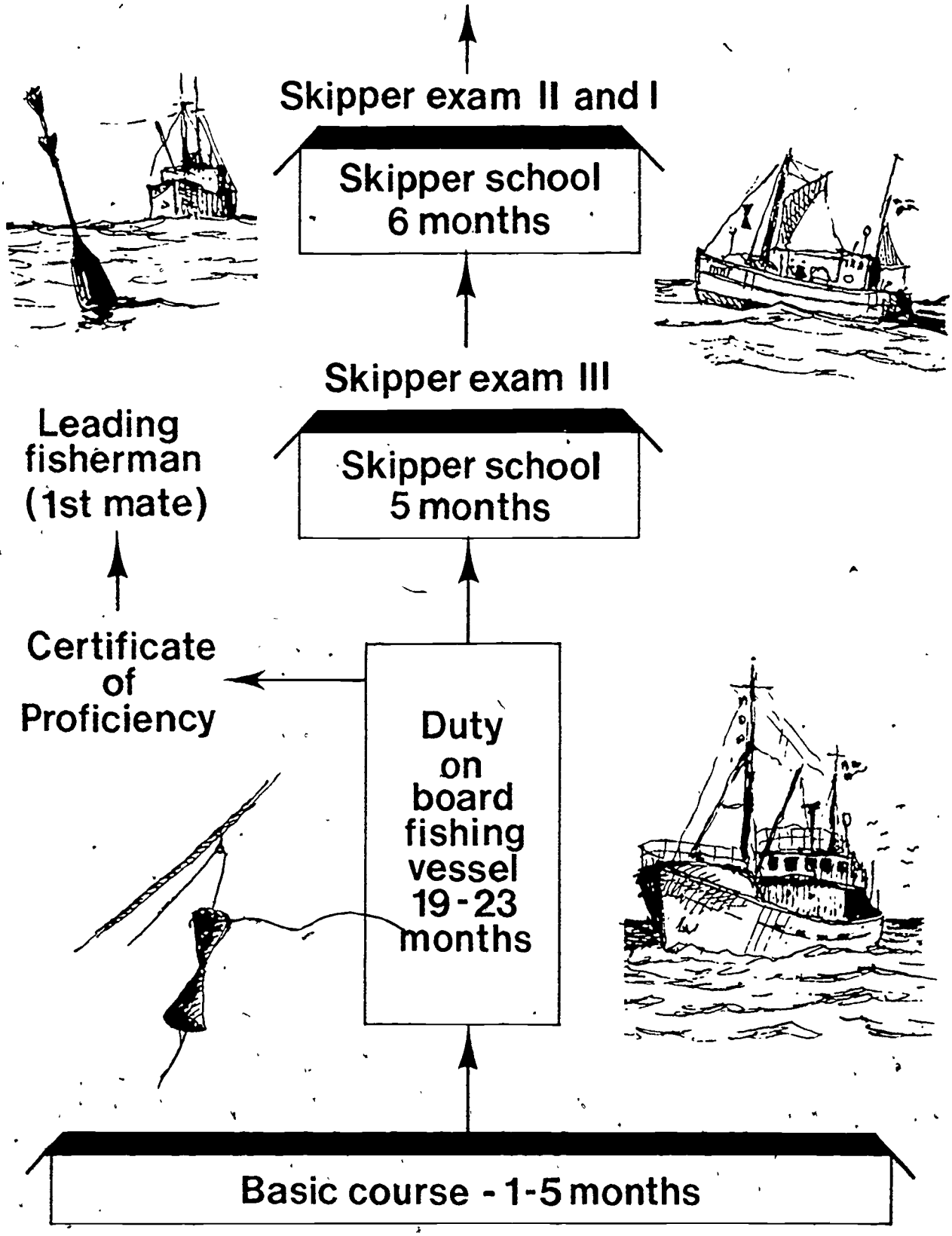

Figure 3.--Danish skipper school program.

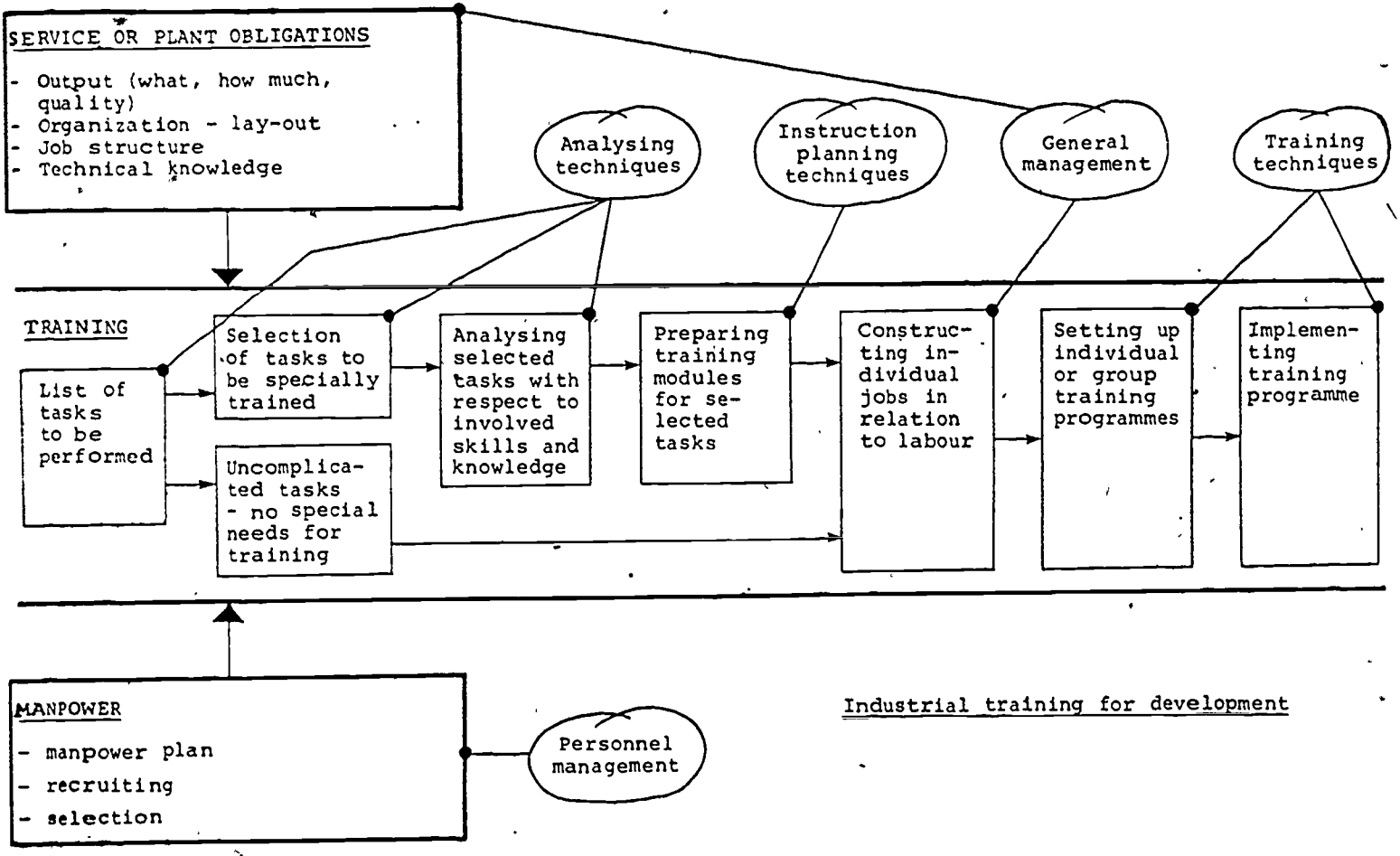

Figure 4.--Production of training programs to suit specific industries by the Jutland Technological Institute.

3) Start production to determine methods, quality, and output for each job. This is what I call the "experienced worker's standards"--not the acrobatic worker who is able to work at a rate of 150 or 170. He is not the experienced worker. The experienced worker is the one who is able to work with the working rate of 100.

4) Analyze each worker's job and develop training programs.

5) Train supervisors and key workers as trainers and instructors.

The processing plant might also be a technological service unit, where the supervisors and the management give advice to other processing plants. This way you would obtain a snowball effect.

FISHERIES RESEARCH AND TRAINING PROGRAMS OF THE WHITEFISH AUTHORITY, HULL, ENGLAND

Dennis Lodge,
Director
Fisherman's Training Program
Clatsop Community College
Astoria, Oregon 97103

We have the word "excellence" in the name of this program we are trying to develop, which implies that we have some excellent knowledge to impart to the students. However, this is one problem we have with fisheries training. It is very difficult to get hold of excellent knowledge in fisheries, particularly advanced knowledge. Where are we going to get this knowledge? Are we going to get it from the highline captains? Very difficult. Which captain is going to tell you the secrets of his trade? It is like a gold miner telling you where the mother lode is.

I was fortunate enough to spend the last 17 years working for the industrial development unit of the Whitefish Authority in England. The overall brief of the Whitefish Authority, which was set up about 20 years ago, was to look at the industry and its many facets to determine where efficiency could be improved. So in its early days the Authority carried out numerous vessel trials. A team of about 15 engineers put in about 80 man years of sea time on various-sized fishing vessels collecting complex data on everything from navigational systems to fish processing, diesel engine development, and deck gear development. We disseminated this vast amount of information to the industry, which at the time was branching out into the new techniques of midwater trawling. For example, we published pamphlets on such subjects as vessel design, maneuvers of pelagic trawls, hauling nets by netdrum, and installing tension meters on stern trawlers.

The situation of the Whitefish Authority at that time was very similar to the Sea Grant Marine Advisory Program in the United States, which gives out similar kinds of information to fishermen. But the Whitefish Authority was also unique. It had no research vessel, and that is unusual. It did not have a vessel because research was to be carried out on vessels chartered for the purpose of working alongside commercial fishermen.

The Whitefish Authority was funded 50 percent by the industry and 50 percent by the government. We had to prove to the industry that we were producing results, because they were putting in the dollars. As a consequence, we built up a very good rapport with industry. This makes the Authority unique because other fishery development projects in Great Britain, Europe, and other parts of the world often have difficulty in reaching the level of the working fishermen, and often take a lot of derogatory comments from them.

However, we realized that the information we were collecting and disseminating was not getting through to the fishermen as well as it could, and we

concluded that education was not our business. In Great Britain there are six major fisheries colleges scattered around the coast and fisheries education is their business. We decided to give the colleges the information so they could spread it out to commercial fishermen, which would allow us to carry on with research and development.

We contacted the colleges, but very quickly realized that the instructors lacked the expertise to put forward these new techniques. The industry is developing so fast! Microcomputer techniques, for example, are now used in navigational systems, fish detection systems, net sounding systems, and more. Many of the computer techniques developed for the Apollo spaceships are now used on board fishing vessels. The technology is so complex that the average nautical college instructor cannot handle the information. The nautical college instructor does not have the time to spend at sea, or the necessary direct contact with manufacturers of equipment. New equipment is constantly coming out from Japan and Europe. At every fishing exhibition you go to, you see a frightening amount of new, complex equipment which is coming out to the market. To give that kind of equipment to a captain with a grade-school education is like putting a child at the controls of a spaceship, or in charge of a 747 jetliner.

The actual seagoing part of fishing is becoming relatively unimportant in the overall scheme of things. All European captains need what I sometimes like to think of as a license to get to the fishing grounds. British fishermen go through a qualifying program that is very similar to the one Dr. Hauptmann described for Danish fishermen. The resulting certification allows the fisherman to get to the fishing grounds, but the real complexity occurs when he gets there. There is satellite navigation, for example, to pinpoint a spot in the ocean, and complex hydraulics systems for handling the net. The net has to be spread correctly, because the vessel is going to be pulling it full of 50 to 100 tons of fish. The American No. 1, which came out of Seattle and is fishing off Alaska, is the most advanced fishing vessel on the west coast. It cost $7 million to build. In the wheelhouse the captain, a former student of mine, has a Norwegian Simrad fish detection system which cost a quarter of a million dollars, and he has literally dozens of other pieces of electronics.

This highly technological field does not bear much relation to the subsistence fishing which the earlier speakers talked about. But if we are going to catch vast quantities of fish and be super-efficient, I am afraid that high technology is the only way to go. It has already happened in Europe, Japan, and Russia. Most people working in the industry in Europe reckon that Alaska is about 10 years behind the times. If we really want to compete in the international groundfish fisheries, that's how much catching up we have to do.

An introduction to fisheries electronics would be one of the most important courses in any fisheries education program. It takes training to get the best out of the equipment. Many captains will spend $10,000 to $20,000 on a fish-finding sonar or echometer and not really understand its capability. I have known of many cases where an incorrect setting of the controls has hidden fish from the fisherman which he actually would have seen with a

simpler machine. The electronics have gotten so complex that if they are not set correctly, they can lose fish for you.

The Whitefish Authority was rather unique in its development and carrying out of 1-week advanced courses which attracted fishermen from all over the world: about 60 from the United States, but mostly from Great Britain, Australia, South Africa, and Mexico. Over the last 8 years, about 4,000 fishermen, all captains or alternate captains, have passed through these 1-week courses. Each course cost $400, but that is chicken feed compared to the overall cost. Participants from Seattle and Alaska were paying about $4,000 if you take into account hotel bills, air fares, and lost fishing time. Fortunately, none of them asked for their money back and most thought it was well worth the $4,000.

Probably the most dramatic part of the Whitefish Authority training program revolves around a net-testing tank, in this case a flume tank, which is 100 feet long, 15 feet wide, and 15 feet deep, and filled with 700 tons of water. The water is moved around this trough at speeds of up to 10 miles an hour by 600-horsepower impellers. A net is hung in the moving water to see the effects on different net shapes. The nets are about one-tenth the size of a full-sized net, and are very fine meshed.

It takes about 200 hours of intensely complex work to make a scale model of a full-sized net. On occasion, the model maker has dropped a stitch or a mesh and had to start over. That is the kind of exactness you must have when the world's captains are looking through the glass windows of the tank at your model. If there is one mistake in it you can bet your life that some clever person will notice it and point it out.

About 80 models of the major trawl nets used throughout the world are now demonstrated in this flume tank. The tank can also be chartered for about $3,000 a day for net development purposes, and net manufacturers, as well as fishermen, from all over the world have used it.

The tank is not completely unique because others exist, in Japan and France, but they are smaller. A larger one is being built in Denmark, but at this time the largest net-testing facility is at the Whitefish Authority. A film of the system has been made by a British net company. [At this point, the film was shown.] You can see how useful a facility like that would be in a fisheries training program.

Handbooks are now prepared for each 1-week training course at the Whitefish Authority, so that the captains attending do not have to take a lot of notes. We have had a lot of feedback from the participants over the years, on what kinds of courses the average captain needs, for example, and we can tailor courses to fit, again for example, a certain fishing ground or type of vessel.

Barney Perkins brought up the problem Newfoundland has of getting information to remote areas, which is the same kind of problem you would have in Alaska. To get over that problem in Britain, we built a mobile classroom which consisted of a 30-foot-long bus containing a classroom and a movie screen, and a 30-foot-long trailer which contained a lot of electronics,

hydraulic equipment, and engine maintenance equipment. At various ports throughout the United Kingdom, over 3,500 fishermen passed through that bus. Recently the Whitefish Authority invested in a new mobile training unit which cost $80,000. This one is a custom-built unit with a tractor and a 50-foot-long trailer containing the same equipment as the old unit. So that is one answer to your problems of getting information to the outports: put it on wheels.

In any training system you will have the problem of finding instructors with the right kind of knowledge, with the right seafaring background. The Whitefish Authority policy was to delve into engineering research. Most of the problems in the industry, the inefficiencies, were engineering problems dealing with engine power, winch power, propellers, deck layouts, and so on. As a result, hardly any of the staff on the Authority are biologists. In fact, the leader of the unit, Bob Bennett, is an ex-helicopter designer. That is the main reason the Whitefish Authority has had such a good rapport with fishermen and has been so successful.

Other government departments in Great Britain carry out fisheries research. The Ministry of Agriculture and Fisheries, for instance, has research departments, but they tend to be staffed almost entirely by biologists, and they do not have that rapport. A fisherman once expressed the problem very succinctly to me. He said, "The job of a biologist is to conserve the stocks and my job is to wipe them out."

CONCLUDING REMARKS ON THE INTERNATIONAL PERSPECTIVE SESSION

Captain Geoff Motte,
Dean
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145 Oakdale Road
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Most of your problems seem to have been solved by the preceding speakers, so I will just fill in the gaps. I have been involved in fisheries education for about 16 years, and if there is a mistake to be made, I've made it. I originally occupied Barney Perkins' position at the College of Fisheries in Newfoundland, from the time it was founded in 1964 through to 1967, and you can learn a lot from the mistakes we made there, because they were made in the same sort of environmental conditions as you have in Alaska. After that I was involved in the founding of the University of Rhode Island's fisheries education program.

We can learn a lot from some of the pitfalls that existed in Newfoundland, and still do exist there. At the College of Fisheries a particular tack was taken by the government which I believe was misdirected. A more technical level of education would have been far better than a low-level vocational education directly linked to a government handout program, and I objected to it at the time. I still believe I was right, but Barney can update you on that in his next presentation.

Dr. Hauptmann solved the problems in the processing area, but if you were to transpose those factors directly over to the catching area, it would be an absolute disaster.

The reason I think a number of fisheries education programs in this country have gone down the tubes, which they have in Florida, Maine, and quite a few other states, is the order of priorities was wrong. The knowledge of the people who were establishing those programs was deficient. It is very difficult for a person who has not been immediately involved in commercial fisheries to assess the job that is being done by the instructors working for him. He can believe that these people are doing a wonderful job but he doesn't really know. The time he knows is when the program folds.

The schedule for this conference mentioned that we should discuss the levels at which fisheries education is required. It is necessary at all levels: from elementary school to graduate school and extension courses. Why should this industry be different from any other industry? The United States has 253,000 registered commercial fishermen, 16,000 vessels over 5 tons, and about 4,000 marketers or processing companies. We export and import many tons of fish, a huge amount of money changes hands, and many external jobs are generated. This is a huge nationwide industry, but look at the educational backing for it. It is nonexistent or it is absolutely atrocious.

When I was chairman of the Department of Fisheries at the University of Rhode Island, across the hallway from my office was a department which was turning out turf management people for golf courses--golf course superintendents. They had a wonderful program, at both the undergraduate and graduate levels, with loads of money coming in. That wasn't the only one. There were similar programs at maybe 10 or 15 other universities, but programs for commercial fishermen, forget it!

You know how many marine biologists and oceanographers are let loose in this country. They have had the benefits of wonderful training and they can move pretty well whichever way they like, should the jobs be there, of course. In commercial fishing, the jobs are there but there aren't enough people with the expertise and confidence that a good technical program can provide. They say that education is expensive. Only one thing is more expensive, and that is ignorance. Basically that is the problem we are facing.

Four factors bear on the success of a fisheries education program. The first and most important is the instructors. No matter how much money they have, every program seems to look at the instructors last. First they look for academic credentials. That is bilge water. You have to take a man and look at him for his expertise, his experience, and his knowledge. You have to break all the rules and hire at least a couple of fishermen who have sufficient experience at sea, sufficient liking for the profession, and a real feeling that it is a good thing for somebody to be involved with, that it is a viable sort of profession. I had several instructors when I was chairman of that department, and the most valuable instructor was the least qualified academically. I don't think he even graduated from high school. He is now an assistant professor with tenure at the University of Rhode Island.

The second factor is political strength. I think you have it in Alaska. Enough people are concerned about it here to make it work. You have to have that for the funding. And you need the funding to provide for those illustrious instructors you are going to hire.

The third factor is highly motivated students, and you cannot get or keep them unless you have the first two factors. You cannot fool the students. Don't bring some amateur in to teach who has learned about the technical aspects of commercial fishing from some manuscripts or third-person contacts and expect him to indoctrinate the students at a professional level. The students can detect this in 2 or 3 weeks.

The fourth factor is a strong acceptance by the industry, which you won't get right off. It does not come easy. In the long run, it is the students who win the acceptance of the program. In the short run, it is your well-qualified instructors. Product is what you are judged on. The fishing industry is a hard-nosed industry. If one bad student goes out, you have to put six good ones out to make up for it.

A fisheries program at the university level does work. I know it works in this country because it has worked at the University of Rhode Island, and I will be telling you about that program tomorrow.

TECHNOLOGY OF THE FISHING INDUSTRY
(MORNING SESSION, DECEMBER 9, 1980)

COMMUNITY COLLEGE-LEVEL PROGRAMS: CLATSOP COMMUNITY COLLEGE, ASTORIA, OREGON

Dennis Lodge,
Director
Fisherman's Training Program
Clatsop Community College
Astoria, Oregon 97103

This morning I would like to tell you just what we are doing down in Oregon in the way of fisherman's training. Clatsop Community College in Astoria has been running basic fisherman's courses for 12 years or so. The program is similar to many of the community college programs in its basic form. Classes are given in net mending, making crab pots, navigation, welding--all the normal craft courses which are associated with fishing. It is a 2-year associate degree program to prepare for entrance into the industry, and is based on the Whitefish Authority program.

The latest advances in the fishing industry have been mainly in the fields of electronics, hydraulics, and fishing gear, so our advanced courses concentrate on those particular fields. The college has a fairly modern 50-foot-long vessel with facilities for some limited development work and classroom space equipped with the electronic instruments required for an advanced program. Originally, $100,000 was made available through Sea Grant to purchase our electronic equipment. We are also extremely fortunate to have $200,000 worth of equipment which was donated to the college by various manufacturers: Furuno U.S.A., Epsco Marine, Atlas Electronics, Simrad, and Morrow Electronics. They are the main manufacturers of fish-finding equipment in the United States, and most vessels over about 40 feet carry various examples of their makes of equipment. So we have a wide variety which we can demonstrate to the students. Some of it is driven by tapes which have been prerecorded at sea.

In order to get across a vast amount of information in a short time, we cannot use normal teaching techniques. I make great use of color slides of different fishing situations, vessel layouts, sonar and echometer charts, graphs, and more. The color slides form the major part of the instruction. I use a technique of reinforced teaching whereby each major point is made about three times, so by the time a person has heard it the third time, it has really sunk in.

Why is it so important for the students to get these facts? Well, the problem is that in a developing fishery where education in the new techniques is very limited, it is very easy for captains, for example, to be conned by high pressure sales techniques into buying equipment which is not

really suited for their kind of fishery. Sonar sets and echometers cost anywhere from $20,000 to $250,000, just for one machine. And it is a very complex machine. If you get one with the right specifications, it will pay for itself quickly, but it is very easy to have wrong specifications--for example, in transmission frequency, pulse length, and beam width. A person can buy the wrong equipment simply because he doesn't know enough about it. Once the right equipment is obtained, then the fisherman has to know how to use it. Operation of this very complex machinery requires a basic training program.

The most modern equipment is being used on vessels out of Newport (Oregon), Seattle, and San Francisco because they generally have larger vessels down there which are bottom fishing. You don't have many in Alaska, but the way that the industry is developing up here, it won't be long before you are going to branch out into those larger vessels and newer techniques.

One interesting thing about this program in Astoria is that it is entirely self supporting, and in fact makes a profit because we charge the students $300 a week. That seems like quite an expense compared to normal college programs, but the courses are almost all completely filled before the classes start, and paid for in advance.

Our success at Clatsop Community College is due mainly to the reputation of the Whitefish Authority. The reason the equipment was donated verifies this. When the electronics company managers who had attended the courses in Great Britain heard that courses were starting in the United States, they donated all this equipment because they could see the advertising potential and the value of having captains who could operate the equipment satisfactorily rather than waste its potential.

This year we have 120 places available for captains and alternate captains. We are limiting it to captains because we think that is where you can make the greatest economic impact. We may eventually get around to teaching advanced techniques to deckhands too. I have run three courses and am starting the next one next Monday. The feedback from captains has been very encouraging.

[Slide.] This is part of the electronic equipment I have set up at Clatsop Community College. It is important to have that equipment for demonstration but not absolutely essential. You can get away with just photographs and lectures.

[Slide.] By using simple cartoons, you can demonstrate many of the complex techniques of beam angle, fish positioning, and boat positioning, and how these various factors affect the readouts on charts.

[Slide.] One of the big problems with echo sounding is the fact that when fish are close to the seabed, like pollock or flounder might be in Alaska, they become very difficult to see due to the curvature of the beam at the bottom. These machines will frequently hide fish from you simply because of the inbuilt physics of the systems, which are generally unknown to commercial fishermen until they are taught. Then they find they can explain

many of the phenomena they had noticed at sea but at the time were unable to explain.

[Slide.] On occasions like this, for example, the captain will not see the two fish down around the edges of that pinnacle. He would only see the ones around the top because of a strong echo from the top of the mountain which masks out the fish lower down. Fish in a gully like this we won't see either.

[Slide.] When we get to actual charts, there are several pointers which we can give to fishermen to help them draw out more valuable information. For example, here you have the same seabed at the left as at the right of the picture. It looks a lot more jagged and rough at the right, not because it really is, but because the movement of the graph paper through the machine is slower and compresses more information into a smaller space.

[Slide.] The technique of white-lining is used a lot these days. It enables us to see groundfish on the seabed. The brown lumps at the bottom are clumps of groundfish. Without the white-line technique, which separates the fish from the seabed, those clumps of fish would merge in with the seabed and we would lose sight of them. The brown clouds near the top of the paper represent a small midwater fish, probably herring, with bigger Oregon rockfish down on the seabed.

[Slide.] Shows of herring will look something like this on an echometer. The brown cloud to the left of the center represents a school of herring.

[Slide.] The latest development is to move away from paper graph machines like the ones we have just seen, to fish-finders that use a color television display like this Chromascope from Japan, which is marketed in the United States by Epsco Marine. This is an entirely different kind of readout, so new knowledge is needed. This brings out the point that a college program has to keep up to date with these advancements. The Whitefish Authority, by having a team of engineers constantly at sea feeding back information, was able to keep the courses up to date. One difficulty we are having in Oregon is getting in enough sea time each year and visiting enough manufacturers to keep up to date on the latest techniques. Color fish-finders would be very valuable in Alaska for exploiting midwater schools of pollock because the readout enables you to immediately determine the exact depth to put the fish net.

[Slide.] This picture shows the versatility of these machines by displaying two pictures of the same ground at different transmission frequencies. Using the high frequency transmission we can see a gravel bank, but not at the low frequency. These different effects are very important to a fisherman who is going to buy a particular type of machine. If he buys one with the wrong transmission frequency, he can easily end up missing an object he is searching for, whether it is a certain type of ground, a coral reef, or a certain species of fish.

[Slide.] Another machine used by most of the vessels out of Seattle and Newport, and all vessels in Europe, is a fish scope which gives an oscilloscope view of fish marks. The very bright, wide patch at the bottom of this

slide represents a single cod about 3 feet above the seabed in 80 fathoms of water. The advantage of the oscilloscope technique is that we can draw much more information out of the scope than we can out of any other device which we have, whether it is a color screen display or a paper display. The fisherman who knows the secrets of reading one of these oscilloscope readouts can see flatfish, for example, sitting down on the sand in a way which he cannot possibly see with any other device. But he has to know what to look for, and one reason for our course is to show him. You can actually measure the size of the fish shown from the amount of horizontal spread, if allowance is made for the depth.

[Slide.] In the next two slides we can easily see the difference between schools of fish. This is what a dense school of pollock would look like, with each of the jagged horizontal bars representing a single fish in the school.

[Slide.] But when we move to a small bait fish like smelt, anchovies, or sardines, we get an entirely different picture: more of a rounded-off shape with a weaker signal. After seeing 50 or so different examples, the fishermen soon learn how to read these machines. They usually have one of these on board but have never realized its potential even though they may have paid $8,000 to $9,000 for it.

[Slide.] Sonar is a big help, particularly in a midwater fishery or to avoid snagging nets in a groundfish fishery. It enables you to see the rocks ahead of the boat for about half a mile ahead. Using an echometer, you get an entirely different picture. The picture at the top of the slide represents the echo from two sandbanks. When we look at the same banks on a sonar set, instead of being represented by a contoured shape they are represented by vertical lines sloping up the paper. It is the same area of the seabed, but a different way of looking at it. This is confusing to fishermen until they understand how the pictures are generated and built up. We spend a full day talking about these different build-up techniques.

[Slide.] Here is a chart from a sonar set showing 50 tons of mackerel as they approach a midwater net. The captain picked the fish up on the sonar from three-quarters of a mile away. He managed to run them straight into the net by using more electronics, such as a net sounder which shows the fish actually going into the net.

[Slide.] One thing that sonar will not do is find groundfish. The problem is that the beam will hit the first fish and give a little echo back but a fraction of a second later, we smack into the strong ground mark and that masks out the fish farther across to the right. So there are limits to what sonar can do, and these are the points we bring out in lectures.

[Slide.] Many of the controls on sonar sets appear complex, but once they are explained a fisherman can easily get the best out of the machine. We often walk around fish docks in various parts of the world and, by looking through the wheelhouse windows, can often see the mistakes captains are making which are costing them a lot of money. Millions of dollars are lost every year throughout the world simply because a control is a little bit too high or a little bit too low.

[Slide.] This shows a captain catching almost 1 million pounds of herring in a purse seine. This is more than he can carry, and he shared the catch with other boats in the vicinity.

[Slide.] The latest thing to hit the west coast is midwater dragging, or midwater or pelagic trawling. The net is flown off the seabed to catch fish at any depth, from about 20 fathoms down to 300 fathoms, so the fish have even less of a chance with this advanced technology. The breakthrough in this technique came with the invention of the electronic systems which make it possible to measure where the net is at any instant in time. The nets are very expensive--$30,000 to $40,000 for a big one. If you hit the seabed with the net you can lose it quite easily because it is relatively fragile. You have to know exactly where it is in relation to the seabed and to the fish you are going to catch. The only way to do this is with an electronic measuring system sitting on top of the net. The first net sounders used a cable down to the net, but the newer types are acoustic-link net sounders which use an acoustic beam to transmit information. The information transmitted tells the captain the mouth opening of the net, shows him fish going into the net so he can estimate when the net is full, and tells him the distance of the net from the surface and from the seabed. This is a marvelous way of fishing because, if it is done correctly, there is very little net damage. The only damage comes when you catch too much. You can easily catch hundreds of tons of fish in the net and split it wide open. In some fisheries the net should only be pulled through a school for 2 or 3 minutes. If you tow it for 4 minutes, you are going to split it.

[Slide.] Here is the type of readout this type of machine produces. This ship is catching pollock in the Bering Sea. The boat is actually from Oregon, and as someone was mentioning yesterday, most of the fish in Alaska are being exploited by out-of-state boats simply because they are bigger and have the capability. The top horizontal bar represents the headrope of the net, the next line down represents the footrope, and the bottom jagged line is the seabed. Fish going into the net occupy this space. With experience, the captain can even determine the type of seabed. This is a rocky patch with the long black stripes underneath indicating hard ground, whereas this is softer ground.

[Slide.] Here the captain can see from the machine that the rigging of the net is fouled. As well as getting an echo from the footrope, he is also picking up the transducer which is probably slanting and hitting the side and bottom of the net, so he is getting two echoes.

[Slide.] This slide shows the readout from a battery-powered acoustic-link system. Note the surface echo at the top, the headrope of the net represented by the double bar in the center, the mouth of the net, the rockfish going into the net represented by the brown marks in the gap, and the seabed by the mark at the bottom. In order to understand some of the more unusual things which can happen with these graphs, some kind of instruction is needed. You can get the information on a simple, straightforward graph from the handbook supplied by the manufacturer. But the funny thing is, on many occasions the manufacturers do not know how their equipment is being used. Fishermen get hold of a piece of equipment and make it do things the manufacturer never intended, but which are very useful.

That takes in 1 week of my program. The other week concerns fishery technology. Looking at nets, the big development in ground trawls has been to move to four-panel nets and different rigging arrangements to get wider mouth openings in order to catch more fish with less fuel.

[Slide.] This shows a four-panel ground trawl net designed in Aberdeen, Scotland. Various modifications of this idea are now finding their way onto both the east coast and the west coast. The net has a box-shaped opening rather than the oval opening of a conventional trawl net.

[Slide.] Here is a similar net from another manufacturer. It is called a box net because of the box-shaped mouth opening. This shape of opening is also common in midwater trawl nets.

[Slide.] This is a German-designed trawl net which is very popular in Europe for catching midwater fishes. It was designed almost 20 years ago and has caught literally millions of tons of fish. This is the type which will come to Alaska. In order to perform with it a person needs to know more about net technology than he does with the simple ground trawl nets. In other words, training is needed.

[Slide.] When I discuss rigging of trawl doors, I have one-tenth-scale models for passing around the classroom. Proper rigging can be shown with models like this. The trawl door opens the mouth of the net, and if the captain rigs the door incorrectly he can burn a lot of fuel and get nothing for it. A door like this will normally trawl through the water at about a 40- to 45-degree angle of attack. If it opens up to 50 degrees, which is quite common, on a small boat you can easily burn another $5,000 worth of fuel a year. Three-bridle rigs, as shown here, are the coming thing in net development. Many nets now use three wires to allow the mouth of the net to spread quite wide, as much as 30 to 40 feet in some ground trawl nets.

[Slide.] The captain also needs to know how much power is needed to pull the rig. We provide graphs like this which are obtained from personal experience, from FAO catalogues, and gear research programs like the Whitefish Authority program. This puts the captain on the right track as to what size of equipment to buy. High pressure sales techniques can cause a person to buy the wrong net and trawl door combination.

[Slide.] We need to go a little bit into hydrodynamics to explain trawl door performance. This type of graph lets us explain without using a lot of mathematics. Often the students are not versed in mathematics. Many of the effects can be described using diagrams and models.

Another field we discuss in our 1-week technology course is fish behavior. One of the major fisheries institutes in the world, the Aberdeen Marine Laboratory, spends millions of dollars each year on fish behavior research using such techniques as underwater television. To design a net, you have to know how the fish react. How fast can they swim? Are they likely to dive or to lift when they are scared? How long can you chase them before they are fatigued? The biologists at the Aberdeen Marine Laboratory have fed a lot of such information to the industry, enabling these nets to be developed and to be very efficient. This is one instance where the

fishermen appreciate the biologists' contribution to the industry. The biologists have given us a lot of useful facts which make new net designs possible.

Biologists in Alaska are also doing useful things for the industry. Richard Lee, of the University of Alaska, has recently written a book which shows fishermen how to identify groundfish. National Marine Fisheries Service biologists supply charts showing the catch rates of different species of groundfish on different areas of the continental shelf off Alaska. These catch rates are based on data obtained by U.S. observers on the foreign vessels. Okay, it is history and the fish are not going to be there when the fisherman gets there, but at least it gives him the right area to look for a certain kind of fish.

Our program at Clatsop Community College is doing very well. We are pulling in students from all over the United States and from other parts of the world. Last week a captain from Taiwan attended. It is obvious to me when we pull people in from so far away that there is a need for this kind of course. I think more of these courses would be valuable in different parts of the United States.

DISCUSSION

QUESTION: Can you comment on the effectiveness of satellite detection?

LODGE: I have read something on that. As far as I can determine, the value of earth resources satellites is not in the detection of fish but in the detection of upwelling areas where there are different water temperatures which can be detected by infrared detectors. Upwelling areas are often associated with high concentrations of plankton and good fishing grounds. So earth resources satellites may be an answer for spotting potential fishing areas. As for detection of fish, however, a fish has the same temperature as the surrounding water, so you are not going to detect fish. You might detect marine mammals, but fish would be difficult to detect with any resource satellite system.

COMMENT: Detection of the oil that is released from a menhaden shoal, for instance, has been recorded.

LODGE: Now that's interesting. One way of detecting fish, of course, is by aircraft. Aircraft have been used for spotting fish in Peru, Iceland, and various other parts of the world for the last 50 years or so.

QUESTION: At the Whitefish Authority I presume that your teaching was done in the presence of a rather large-scale research facility, which meant that you were always current. Did you ever run into difficulty teaching in the absence of a large-scale research facility?

LODGE: Some difficulty, but I have sufficient funding to be able to visit institutes and exhibitions in various parts of the world in order to keep up to date. For example, Epsco Marine funded my visit to Fish Expo 80, which was held in Boston in October. I am also in contact by

mail with people working in various fields in Japan and Europe, so I will be able to keep in touch. As you say, however, it is a problem keeping in the forefront of this advancing technology. Each year big changes take place. In a year's time, these color television-type displays will be old hat. Maybe the next system will use lasers. That has been examined.

QUESTION: Do you see a future in pair trawling with small vessels?

LODGE: Yes. Pair trawling has long been popular in Europe and has become popular in New England. It was started originally by the Danes. Pair trawling is a very efficient system. You don't have to contend with the drag generated by trawl doors. By getting rid of the doors, you immediately have 25 percent less drag, so you can pull proportionally bigger nets. The only problem is getting two captains to agree. It is a problem of human nature. It is okay with a father and son relationship, but when you get two highline captains they both want to be boss. That is why pair trawling has not caught on as well as it could.

QUESTION: At what point do you feel the limitation of your efforts . . . [indiscernible] . . . ?

LODGE: At the moment, this training system I am running down in Oregon is fairly unique. The University of Rhode Island is trying to run a similar program, but on a reduced basis. They don't have the input of equipment from the manufacturers which I have been able to obtain. So far I am fortunately in virgin territory and I do not know how long it will be before enough information is gathered. It is very difficult in the normal university atmosphere to collect information to spread out directly to the industry. Universities tend to concentrate on longer courses and it would generally be against the policy of a university to run 1-week upgrading courses, although Geoff Motte tells me that the Massachusetts Maritime Academy is looking toward developing similar 1-week courses. So I think there is a future for the short, sharp, high-interest course for people already in the industry, for existing captains. What was your question again? What would the overlap be? How long would it be before the other universities start coming in?

QUESTION: At what point do you feel . . . [indiscernible] . . . ?

LODGE: No, I don't think it will. At the moment there is no duplication, apart from the little bit at the University of Rhode Island. I hope to be able to shortcut the long training time and trial and error period which occurred in Europe when the new techniques were introduced. The lessons have been learned over there, but in many cases at great cost. I am hoping to shorten that period by bringing the information directly from Europe to the states.

QUESTION: [Indiscernible] . . . educational efforts were able to keep up with innovations . . . ?

LODGE: No, at the Whitefish Authority we were not involved with training. We were a research unit. As soon as we realized training was needed,

we looked to the nautical colleges and the universities to pull some courses together. We quickly realized they did not have the expertise to do the job, so we had to set up our own training unit to get over this problem, to directly feed research into training. Universities usually work on a more limited budget than we had. Ours ran into millions of dollars a year. The Whitefish Authority is one of the very few institutions in the world which combines research directly with training. You cannot do this in a normal university situation. When experiments are carried out by universities, it is usually 2 or 3 years before the results are published, and the industry is advancing so fast that in 2 or 3 years your information is obsolete. You need to get it into print within 3 to 6 months.

QUESTION: Your perspective is looking down at the fish, and as a fisherman. Has anybody looked up, as though you are a fish, to see what your gadgets are doing and to gain some better understanding of fish behavior and their responses to effects caused by detection devices?

LODGE: Yes. In the early days of fish-finding, 30 years ago, many captains would not use a sonar or echo sounding system because they thought it scared the fish. The experiments carried out by marine laboratories by biologists have shown that cod, for example, and gadoid fishes, can normally only hear sound frequencies up to 4 kilohertz, on the outside, which is quite a low pitch. Because the sounding systems work at very high frequencies, they have no effect on the fish whatsoever. In fact, it would be a great thing if we could scare the fish with the sounding systems, because then we could shepherd them around. Experiments are being carried out in Norway with powerful sonar sets to try to do this, but with no success, so we are pretty sure that sounding systems will not scare fish.

UNIVERSITY-LEVEL PROGRAMS: UNIVERSITY OF RHODE ISLAND

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I have been to a lot of fisheries seminars and conferences all over the world and I think that, particularly in this country, there is absolutely no important function performed by any negative feed into fisheries education. There is absolutely no room for it. As it is, you are starting off with a zero. Look at any high-technology industry, and you can see what a tremendous job is involved in building up a compatible educational structure.

In the United States about 250,000 people are involved in catching, processing, and selling fish. There are about 16,000 vessels above 5 tons, and 4,000 processing and wholesaling establishments. We import about 1 million metric tons of fish every year, with a value of about $2.5 billion. About 24 percent of that is shrimp. We export about 150,000 metric tons of fish with a value of about $0.5 billion. Our fleet, including the Gulf, Pacific, and Atlantic fisheries, lands about 2.5 million metric tons. Estimates of our capability within the 200-mile fisheries conservation zone range between 9 and 18 million metric tons. This means our fisheries can easily stand a three-fold increase, and shows that fisheries education, at all levels, is needed now and will be needed even more in the future.

Some of this country's fisheries are well developed. Some set an example for fisheries all over the world. Our tuna fleet is generally accepted as being the innovator for tuna catching. The purse seine was invented in the United States, but it is only in recent times that our trawl fisheries have been developed to the point they are comparable with the trawl fisheries of some of the nations that depend more on their fisheries than do we. For instance, Scotland and Norway. Most of the key developments in the trawl fisheries that are relevant to our requirements in this country have been refined in Scotland or Norway, such as two-boat midwater trawling.

As important as the new developments in the fishing industry is the fact that now, with the 200-mile zone, commercial fishing is being viewed as a much more viable and feasible investment area by the people who hold the purse strings. The average cost of a 72- to 75-foot trawler is in excess of $0.5 million, and it doesn't have to be much bigger to cost considerably more than $1 million. Some New Bedford scallopers are running an investment of $2-3 million, with a non-owner skipper earning well over $100,000 a year.

High technology is involved, and the sort of information that is needed at the university level is available only at a few institutions. Here again, there is no need for any negative feed. Why should the fishing industry be

different from any other industry? People who are leaders in other industries have had to suffer through a university education, so why shouldn't people in the fishing industry? More importantly, it is a great advantage to a person struggling to gain information in a certain technology to have it delivered by instructors who are recognized experts in the field, in a college setting.

We tend to concentrate too much on what is required here and now. We want people who are well conversed with the high technology of the situation at this immediate moment. However, in the long run, the fishing industry can benefit to a much greater extent by people who realize how important the fisheries are and just what the lot of the fisherman is all about. That is the only way fishing will get the respect it deserves. In Britain, on the Cornish coast where I come from, a master mariner is something akin to royalty. The profession carries a great deal of weight in that area. When I first arrived on the east coast of the United States, having heard of the Boston clipper ship era and so forth I expected the same treatment. I did not get it, but I have gotten used to that now. I am a much humbler individual as a result of it.

An unpublished estimate by the National Marine Fisheries Service suggests that with the 200-mile zone, a total investment of $3.8 to $4.0 billion will result in an annual increase of $3.6 to $3.9 billion to fisheries business. The number of jobs in fishing and the support industries would increase by 75-80,000. These potential increases point to the need for both vocational and technical education.

The only university program in commercial fisheries in this country is the one at the University of Rhode Island, which was started in 1967. Six or seven other attempts to start university-level fisheries programs have been made. About half a dozen community college fisheries programs are managing to hold their own, and they would be thriving if it were not for a lack of funding. Three or four students are enrolled in each of those programs. A similar number of students are enrolled in general fisheries programs at the vocational high school level, but they are not necessarily directed immediately toward fisheries and might be more appropriately described as marine resource programs. It is not entirely appropriate to contrast this with Japan where around 60,000 people are enrolled in high school fisheries courses. In the United States in 1977, 67,700 students were enrolled in oceanography-type courses in public secondary schools, but in fisheries maybe a couple of hundred. I figure this is Jacques Cousteau's fault. But you can hardly compare the job market and the opportunities in oceanography with those existing in the commercial fisheries.

The university program in commercial fisheries at the University of Rhode Island was initially funded by the Department of Health, Education, and Welfare, and they funded 11 separate technical programs. Three were fisheries programs and the rest were in agricultural technology and other areas. One of the other two fisheries programs was a marine science program and the other was a fisheries program. At the end of 5 years HEW evaluated the 11 they had funded. The other two fisheries programs had collapsed. Because the University of Rhode Island was easily the most productive and the most stable, HEW offered a similar amount of funding to put an additional

component on the program, to produce oceanographic technologists. I didn't know quite what that was, so I went to some of the leading commercial institutions in this country and found that they just laughed. They said they did not need people like that, because there are already several institutions churning out many thousands of these people and we cannot use them all. So I had to turn down the offer.

Prior to the establishment of the University of Rhode Island's fisheries program, the only one in North America was the College of Fisheries in St. John's, Newfoundland. I learned quite a bit from the mistakes that were made in establishing that program. The initial mistake was that they beat a big drum and said what a wonderful job they were doing when they had only been in existence for 3 or 4 months, and fishermen don't like to listen to things like that. We had to overcome that and create a sort of philosophy and an image that was acceptable to commercial fishermen.

You don't have to worry too much about these things if you get the correct type of person to run the program. This can present a big problem. Often the people who establish these programs truly believe they have that correct type of person, but they may not be in a position to be able to make that evaluation. This is often the reason fisheries programs fall down.

When people set up a fisheries program, they want the boat or the buildings first. In Vancouver they built the buildings first and they wonder why they don't have a fisheries program. The first thing is the instructor. If you have an instructor who knows his business, you can almost not worry about the curriculum because he will develop it.

When our program started at the University of Rhode Island, many people said it was not going to work, that you cannot put people through a degree program and expect them to be fishermen. I remember one highline skipper who told me it wouldn't work, who I bumped into again 9 years after the program had been under way. It turned out that every single person on his boat was a graduate of our program.

The standard program at the University of Rhode Island is a 2-year associate degree program. If a person wants to get the full Bachelor of Science program, he goes another 2 years, during which he does very little additional technical work. The university imposes so many course requirements for the bachelor's degree that we only have space for about 20 credits of additional technical courses. That doesn't matter too much because the associate degree is sufficient for the level that the graduate will occupy in the industry.

The university should also have a graduate program in commercial fisheries, a Master of Science in commercial fisheries, but right now the funding is not available. Enrollments have been decreasing at most institutions of higher learning.

We found that, in order to deliver the technical material in the 2-year program at the level the instructors thought was necessary, the students needed to be able to read and write at a reasonable level; to be able to investigate and research material on their own; and, because any technical program

is based on math and physics, to have a reasonable level of competency in number manipulation skills. So in the first year composition, speech, math, and physics are required. Math is taught in an applied rather than a pure sense in order to retain student interest.

Five different areas of training have to be included in a fisheries education program. One is the academic course work, like composition and math. Another is fishing gear, from net work through gear design and construction. Third is engineering, including basic trouble shooting and principles of operation of diesels, and construction and design of fishing vessels. The fourth area includes seamanship and navigation, but not taught in the way they have always been taught at merchant marine institutes. Navigation has to be taught differently. In deep water, navigation is two-dimensional. You assume you are going to stay on the surface. In fishing, navigation is three-dimensional because the seabed has to be taken into consideration. Seamanship has to be taught differently because, starting with knots, work on a fishing vessel is vastly different from that required on a merchant vessel. The fifth area of training is the shipboard components. To be realistic, get the smallest training vessel you can get away with, because it will cost a lot less to maintain, haul out, fuel, and so forth, than a large vessel.

Most people would want to locate a fisheries school right in the middle of the fishing fleet, and I think that is wrong. It would be best to pick the most attractive spot available on the coast, to help attract students and instructors. Also, if you are in an area where the weather tends to be bad in the winter and you are situated right in the middle of the fleet, you get all sorts of drunken people staggering through the labs in the middle of the afternoon advising you on what they think you should be doing.

It is important to locate where you can have the boat right alongside the labs, and that you have waterfront facilities. You cannot spend too much time steaming to and from the fishing grounds. Where we are, we can fish within 10 minutes. A net loft is necessary and should be large enough to spread out a complete trawl rig, with sufficient height to work. We have a diesel workshop with 15-20 diesel engines, a navigation lab, a seamanship lab, a hydraulics setup, and a small electronic aids lab. The electronics lab is small because the boat is the main electronics lab.

In order to evaluate this program, after the first 7 years we sent a questionnaire to all of the 108 people who had been through the program. The 71 people who responded had been out of the program, on the average, for about 2.5 years. About one-fourth reported they were captains, about one-fourth were mates, one-fourth were deck captains (boatswains, or leading seamen, or engineers), and about one-fourth were deckhands. Some people prefer to stay ordinary deckhands, to leave the worrying to the skipper. Of course, that survey was some time ago. Now about 40 of those graduates are skippers or skipper-owners. So there is no doubt that this sort of program can work. Most of the respondents believed that the training provided them a 3- to 5-year advantage over others who had started in the industry from scratch.

I served on the U.S. Senate advisory panel to investigate the need for a national commercial fisheries college, and we recommended that there be two:

a Pacific and an Atlantic. The project got buried, probably because we also recommended $50-70 million for first-year funding. But that would actually have been bare-bones funding. At the Massachusetts Maritime Academy, where I am now, we just spent $5 million to refurbish our training ship. I just signed a contract for a radar simulator for $600,000--one training aid. But we set up the fisheries program at the University of Rhode Island with considerably less than $600,000, and it had to last 5 years.

In this country we do not have a high-class merchant marine, yet we have a national merchant marine academy at Kingspoint, New York, where there are about 1,100 cadets, and six state academies that are heavily subsidized by the Maritime Administration. The Massachusetts Maritime Academy is the largest, with about 1,000 students, and the oldest. It has been operating since 1891. The students go through a Bachelor of Science program in either marine engineering or marine transportation.

I have some recommendations that you should consider. One is that you have to establish a fisheries education council, or whatever you wish to call it. The council will have to include technical educators, but particular ones. You do not want types who are going to foul up the deal. You want top fishermen who understand education, and that is a difficult beast to get. You will also want processors and marketers, and people who know where to get funding. The obligation of the council would be to analyze and consider things, and to recommend specific programs that they view as required over a period of, say, 3 years.

The second recommendation is to pursue the traveling school concept. We introduced traveling fisheries schools in Newfoundland about 15 years ago, and they have worked reasonably well. Again, the instructor is the key. Often fishermen go into maritime technical education after they decide not to go back to sea because of a family situation or an injury. They make the best instructors because you know they are not going back. I do not know Alaska well enough to be able to advise you on the best method for a traveling school, but I suppose either a boat or an airplane would do.

My third recommendation is to produce movies that could be shown on television. They could feature top fishing personalities of the west coast like Barry Fisher, who has sort of a Clark Gable style. Do this with different types of vessels, and explain to people just what a fisherman's life is. People have weird ideas about what a fisherman really does.

Whatever you do, do not link fisheries education with the social welfare system, because it does not work. Fishing is a business of maximum effort and successful people in fishing are maximum-effort, determined people. Concerning their academic misfits, the high schools tend to think, "These students are not very good academically, so what is the best thing to do with them? Make them fishermen or farmers or something like that." I do not agree. There is a place for such persons, but they would benefit more by a general approach to training, where you talk about marine resources and the whole scope of different job opportunities. We have a couple of high schools that have commercial fisheries programs but we have managed to convince them they should be more general in their approach. They should not expect to turn out a twine man or a person who can navigate with any degree

of proficiency. You walk a fine line between what is best for the industry and what is best for the individual. I always look at what is best for the individual because in the long run that is how industry is going to benefit.

DISCUSSION

QUESTION: [Indiscernible.]

MOTTE: Each of our instructors acts as an advisor to the school board in his area. We also put the high school instructors through our workshops. Dennis Lodge mentioned that it is difficult for universities to get into a workshop situation, but it really is not. Last year at Massachusetts Maritime Academy we had 16 workshops, with a total of 729 fishermen attending. These are mainly inshore fishermen. The University of Rhode Island concentrates on the offshore fishermen. Most of the high school instructors who attended the workshops were biologists or otherwise loosely linked with fisheries, but none were commercial fishermen and so most of them were delighted to attend the workshops, like the diesel workshops. Most of them also took some of the navigation courses that we offer at night. That way they understand a little bit more about what is required.

QUESTION: How much of this high technology is applicable to our small-boat fishermen? Where do they fit into this new industry you have described?

MOTTE: There are different degrees of that category of fisherman, and I think that in modern times a lot has been done with small-boat fishing, like two-boat fishing. You can fish a two-boat rig with low-powered vessels nowadays, and in these waters it could be done very easily.

QUESTION: Are you training for that?

MOTTE: No, not in the regular program. We do offer short courses, like diesel engineering which they find very helpful because their boats often have diesel engines, but most of them are pot fishermen. A 4-week program would probably be right up their alley.

COLLEGE-LEVEL PROGRAMS: COLLEGE OF FISHERIES, NAVIGATION, MARINE ENGINEERING, AND ELECTRONICS, ST. JOHN'S, NEWFOUNDLAND

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Yesterday I gave you a brief outline of the Newfoundland fishing industry and now I will describe how we serve that industry by way of training and education.

The College of Fisheries, Navigation, Marine Engineering, and Electronics was set up in 1964 and came from a situation similar to what you have in Alaska. A need was identified. The decision to institute a fisheries education program was sort of a political decision with possibly industry input, and the fishermen were not involved in the early development stages as much as they should have been. Something along the lines of this conference would have been useful in the setting up of the college, but we didn't hold any conferences at the time. We consulted with other establishments around the world and received a lot of help from Japan and Great Britain, but there was no real structured thought about the educational program before it came into being.

The College of Fisheries was mandated by a legal act. You need an act or some sort of political move, and the role of the college at that time was fairly well defined in legal terms. I will read you a brief extract from the act. The mandate of the college is "to furnish technical, vocational training and to conduct research in fisheries, navigation, marine engineering, electronics, and any other science or art relating to all principal aspects of the marine and fishing industries including naval architecture, shipbuilding, and fuel technology."

The college has a large academic department which has two major functions. One is the upgrading of high school students. If they haven't graduated they can be taken up to a high school graduation level. That side of the academic department is called Basic Training for Skill Development, and the original idea was that after the students were academically upgraded they would move into one of the technical areas within the college. In fact, only about 5 percent of the upgraded students stay. Most go elsewhere, but the program still serves that very useful function. The academic department also includes all the other departments within the college. Each department operates various programs, from a 3-year diploma program down to 1-week and 1- or 2-day seminars. Each department was initially supposed to be related just to the fisheries, but because of demands from other areas in the marine industry they have expanded.

My department, Nautical Science, is involved with marine safety training, including survival at sea, lifeboat work, and fire fighting. It is also involved in government training, because in Canada we have strict government requirements for all seafarers. Anyone in charge of a vessel of over 5 tons is required to have government certification, or licensing as you would refer to it here. That forms quite a large part of our work. I am not sure of the American situation, but I believe that for smaller vessels the government does not yet require certification. When you get enough of them plowing into one another, then it will come. Studies in our department include gear technology, the use, repair, and maintenance of gear, and net-making. The twine work, as it is called, seems to be dying out. We are fortunate to have as one of our instructors a former Grand Banks schooner fisherman. Seamanship, navigation, cooking, and sewarding also come under the Nautical Science Department.

Our Marine Engineering Department was originally set up to produce engineers for trawlers, but has expanded into the whole scale of training for merchant marines, producing people for the offshore oil industry and so on.

The Marine Electronics Department deals with navigation, including radar, echo sounders, and sonar, and their maintenance and repair. This department was one of the first at the college to go into the mobile training setup. Dennis Lodge described a bus operation. Much has been said about the difficulty of traveling in Alaska, and I sympathize with you because we are in the same situation in Newfoundland. We used to have a large trailer that I think went out once or twice. It is still there, in the parking lot outside the college. It is too big for roads. We do have roads in Newfoundland but they are not the best. The trailer is now used as a classroom, but it is stuck on the spot.

The Naval Architecture Department gets involved in all sorts of things in addition to shipbuilding and ship design, like the current project dealing with the transportation of liquefied natural gas. The students are involved from that scale right down to the actual construction of fishing boats, and they will go out and help a fisherman build his 30-foot trap skiff, or long-liner, or whatever. They have been involved in all sorts of projects over the years.

The Department of Food Technology is very large. The college originally focused on the nautical science side of the industry, where seamanship and navigation formed the center of the operation and everything sort of plugged into that. Now processing plant management and operation is probably the largest department we have. They deal with fish from harvesting through to marketing.

One of the most important departments is Extension Services. Initially they were just a traveling school setup. A gentleman with boxes of equipment would head off into the wilderness. From time to time they got frozen in at various places, and you wouldn't see them until the spring thaw. That has changed. The Extension Services Department is just one man who identifies the need for courses. If he sees a need for a navigation course for fishermen at Pigeon Inlet, or wherever, he comes to me and my department will organize the course. It is much more than just traveling schools. It is

also involved in public relations, and publicizing of the college and its programs.

We have had the most success with our short programs: the 1- or 2-day or 1-week seminars. They are very good and I think we are working in areas where the fishermen or people from the marine industry can see a need. The short courses are similar to those Dennis Lodge is operating at Clatsop Community College in Oregon.

However, we run into all sorts of problems with the 3-year program. One is that if you bring a person in for 3 years of training in fishing technology, even though he is going out in the summer for industrial training, at the end of the 3-year period, unless you are very careful, he is 3 years out of date as far as the industry is concerned. I could probably count on one hand the number of people who have graduated from the 3-year technology program and then gone into the fishing industry. One is on my staff. He was a trawler skipper for awhile and then came into the teaching business.

One of my mandates when I was brought in as head of the department was to get this 3-year program going, so I went into the field to see what needed to be done. I came back with very severe doubts about whether there was any need for a 3-year program, and I still wonder about it even now. There is a need, of course. I hate to think where I would be without the staff member I just mentioned. There is certainly a need in the industry, but I wonder if it is very important for fishermen.

A lot has been said at this conference about the importance of the staff when setting up a marine training establishment. We have great difficulties attracting instructors. Salaries in teaching are not comparable to those in marine industry. My staff member from the fishing industry, the one who graduated from our technology program, was earning over $80,000 a year as a trawler skipper and we had to bring him on at a salary in the low or mid $20,000's. He can afford to teach for us only because he had already bought his house, car, and everything else. He can afford to sort of semi-retire. But this business of getting the right staff when you start off is very, very important.

The need for an establishment like the College of Fisheries or your proposed Marine Training Institute to keep up to date on developments in the industry has been expressed by Dennis Lodge, and I would like to endorse that. If fishermen coming into the college see a piece of equipment which is a year or two out of date, they are not interested. They don't want to have anything to do with it. Sometimes we really are a year or two behind them. It all comes back to money. We are strapped for funds now. In the early days when Geoff Motte was there, you could have what you wanted. Now we operate on about $5 million a year and we find it pretty tight. If you get into a situation where you are constrained by the budget, then your training very rapidly falls off, at least in the fisheries field.

As far as the College of Fisheries is concerned, there is a light at the end of the tunnel. We are now moving back into an era where it seems that money will be forthcoming. We are going to have a new marine training institute, not a college of fisheries. The building has been planned, the site has

been picked, and we hope to be setting up our new establishment about the same time the one here gets going.

Involvement at the high school level is important. It should be at the prevocational or vocational industrial arts level rather than being specific training. That is very, very important. High schools should be involved in all marine training, including fishery and merchant marine training, but not specific training. It should be general interest, prevocational training.

One of the things we have been concerned about acquiring for our new establishment is a flume tank. This is perhaps almost as important as getting the right staff. The flume tank would be used about 80 percent of the time for training and about 20 percent for industry or company use. There isn't a flume tank anywhere in North America. In the past we have sent our staff to the one in England, at the Whitefish Authority. It is a big draw, and anything that brings people from the fishing industry around the world is very useful to any training establishment.

If you had a flume tank in Alaska it could service the whole west coast of the United States and Canada, and if it proved cheaper to send people here than to England, you would also be servicing the east coast until they get one. Several establishments on the east coast are working toward the acquisition of a flume tank. A lot of political maneuvering goes on, because we know that if somebody gets one in Halifax, for example, we won't get one in St. John's. I would certainly like to see one at our new establishment. We once sent fishermen from Newfoundland to the Whitefish Authority and they came back very enthusiastic. It was the first time they had been able to see gear in operation underneath the sea surface, so to speak.

You have an obvious need for a marine training program in Alaska. It is very similar to our situation in Newfoundland. You educators will have to be careful when approaching this. You can say there is a need and you can identify that need as increasing safety, productivity, or whatever, and you can then set up programs, but if you carry on in an isolated way then these programs are doomed to failure. You have to consult with fishermen, and with potential fishermen at the high school level. You have to interest people at that level. You also have to consult with industry and with the government. There have been a lot of failures and a few moderate successes. The College of Fisheries, just because it has lasted, has been a success. You people here have a tremendous opportunity to create something--a real program of excellence.

DISCUSSION

QUESTION: Would you comment on the importance of fish quality?

PERKINS: I think it is vitally important. We have just come to realize that in Newfoundland. I think quality control goes far beyond the basic quality of the fish. Reputation is very important and Canadian fish, particularly east coast Canadian fish, has probably in the past had a somewhat poor reputation in the European and Japanese markets as far as quality is concerned. We are just moving away from the stage of

having the fisherman heave the fish up on the wharf and letting it lie in the sun for half an hour or so, or letting it rot in his gillnets for 2 or 3 days. We are becoming greatly involved in quality control and are trying to establish all sorts of training programs. The Food Technology Department holds 1- and 2-day seminars for the fishermen, and longer, more intensive courses on quality for the processing side of the industry. One of the most important aspects of deckhand training is the proper understanding of, for example, what an icer's job is, why he does it, and how to do it properly. Traditionally, the fish market has been a sort of salt fish export around the world, and cod block to the Boston market--this sort of thing. Now we are breaking into the European market, and we are selling fish to the Japanese. If anybody knows anything about quality, it is the Japanese, and we are having to improve our quality control programs.

QUESTION: Are you maintaining that . . . [indiscernible] . . . ?

PERKINS: It is probably a social difference, and an economic one. We found that if someone wants to go fishing, he spends 2 or 3 months doing math and physics and maybe gets a look now and then at a trawling model or a trip out on a training vessel, and he says, "To heck with this, I want to go fishing." If we get him through the first year of studies, we put him into the industry during the summer vacation. There is no wage scale on the deck of a trawler--no learner level. You go right in at the top wage. So a young fellow goes out during his first summer break and earns a salary which may range from $20,000 a year upwards, and then we ask him to come back to college to continue on no salary and he doesn't want to do it. We are trying to design shorter courses to help this type of person and are moving away from the 3-year diploma or degree-level courses. As I said, the program has been in operation for 16 years, yet we have produced only five or six graduates. The 3-year program has failed.

QUESTION: Are you saying that your program might be shifting towards . . . [indiscernible] . . . ?

PERKINS: No, because we are involved in that sort of thing already. We are already doing government-required training for certification. We are doing workshop training as well. We are looking at ways of maintaining an academic level of technical training but making it relate more to something that can work. I tried to establish the need and the way that this program can be set up. In Newfoundland you cannot do anything new in the fisheries, because it has all been done. I have just set up a study that is being conducted by a market survey firm. Nobody knows that the college is doing the study, because if we go out to the fishermen or the industry and ask how we can improve our programs, they will say we are doing just fine and to carry on. We are trying to elicit some honest, unbiased comments, to find out what people <u>really</u> think of us.

QUESTION: [Indiscernible.]

PERKINS: At that stage you cannot get into specifics. We do a lot of work with the high schools. We spend a lot of time visiting schools and talking to potential students, and we make our training vessel available to high schools. You can do some pretty quick screening just by taking people to sea for half an hour or so on a nice North Atlantic day. You take 15 to 20 high school students out and by the time they get back at least half of them won't want to go to sea or have anything more to do with it. The production of films, like Geoff Motte suggested, is a good idea. General interest training films using your key fish harvesting and processing people, and getting them to talk about their jobs and how they do them, is something you could produce in Alaska. Once again, I do not think that high schools should become involved in specific marine training, but a general introduction to the fishery and marine training should definitely be provided.

QUESTION: [Indiscernible.]

PERKINS: Yes. We have moved away from the traditional idea of setting up a program and giving it to the fishermen. We wait for them to approach us. We have just done some very interesting work with fishermen from an inland area in Labrador which has been flooded due to the construction of dams. The Inuit Indians fishing there asked us how to find trees under water. They had a real problem because the area had been forested and they were losing nets and gear in the trees. We do a lot of field work. We have a lot of problems associated with reaching people. They do not want to travel into St. John's, so we go out to them. But we try not to offer formal training. First we ask them how we can help them, then we send the people out. If they want courses in navigation, marine engineering, and small boat maintenance we send out three people for 3 weeks each, or whatever is necessary, to conduct the courses.

FISH AS FOOD
(AFTERNOON SESSION, DECEMBER 9, 1980)

EDUCATIONAL NEEDS OF THE SEAFOOD PROCESSING INDUSTRY

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My comments today will pertain mostly to the middle management people in seafood processing, the plant managers. We depend on them to keep the processing lines running. I am not going to spend much time talking about top management or executive officers.

Since the 200-mile fisheries conservation zone was established by Congress in 1976, the Federal Government, the State of Alaska, and the fishing industry have been deeply involved in trying to start a bottomfish industry in Alaska. We have consulted the fishing and processing experts in government and industry, in this country and in other nations. Management has traveled to the Orient and Europe to observe fishing vessels, fishing techniques, processing plants, and processing methods. The experts have volunteered all kinds of ideas on how to develop the bottomfish industry in Alaska, which is estimated to be 5 billion pounds. They tell us it will take $1 billion in fishing vessels, including new vessels, conversion of older vessels, and vessels already built; $1 billion to build processing plants on shore for the underutilized species; and 20-30,000 people to process the fish. This is all going to happen within 5 to 20 years, depending on which expert makes the prediction.

Today, after a few minor efforts by the industry to catch and process fish, we are no further ahead than we were 4 years ago. In fact, today there is no operating bottomfish plant in Alaska. Four years ago the fishing industry experts visualized and planned a certain direction that would take place in the development of the bottomfish industry in Alaska, but it has not materialized. Much of the reason for this dilemma is economic: the high cost of money, high production costs, and the high cost of fuel. Another is that the processing industry hasn't become mobile enough. The production of high-quality raw material dictates that much of the fish caught offshore will be pre-processed at sea. The entire success or failure of industry's expansion to take advantage of the 200-mile limit depends on the processing sector being wherever the fish is handled.

We have already shown that some American fishermen, with current vessels and gear, are able to catch fish within the 200-mile zone as efficiently as the foreigners. Some vessels already have the most sophisticated electronic fish-finding equipment made in the world. We heard this morning from one of the speakers that this is a problem, that we are going to have to teach

fishermen to use this equipment. But some of them are already using it. I firmly believe the fish processing sector, not the fisherman, is the entire problem behind not getting this bottom fishery off the ground.

During the 35 years I have been the manager of various seafood processing plants in Alaska, I have been an educator. I have been training people on the lines in the cold storages, in the canneries, in crab and shrimp operations, and in specialty operations like making lutefisk and other ethnic products. A manager in the processing industry in Alaska is continually training people. Every plant manager becomes involved in seeing that his work force is qualified to do an efficient job and produce a good product, or the best. Managers need to spend a considerable amount of time on the production line observing and instructing. They must also keep up with the latest developments in processing technology, and pass the information on to the technicians. Managers also have to deal with the staggering burden of legislation from all levels of government.

A rough survey I recently made of chief executive officers and top managers in the seafood industry shows that most of them have started in the lower ranks of the labor force and progressed to the top as a result of drive and the continuing learning process. About 40 percent of the top management personnel have come from financial or business management education backgrounds, 20 percent have engineering or technical training backgrounds, and 20 percent have scientific and research experience. The remainder are from a variety of fields of experience: military, legal, education, and some without any formal education whatsoever.

The problem today is, where do you get qualified workers in the seafood industry? Certainly Alaska has no system of providing laborers--a local or central information source. The State of Alaska employment centers do a good job of providing a source of unskilled workers to fit into the seasonal programs. The industry recruits most of its expertise from outside the state, or through individual company training programs. I don't think this is the most successful method of recruiting qualified personnel.

Production training of workers often falls short of what is needed to prepare them for tomorrow's jobs. Clearly government programs are not adequate. Graduates are prepared for jobs that no longer exist, or the jobs they are supposed to have been trained for are actually above their abilities and level of training. These failures have been inevitable, since the goals of these programs have often been to solve social problems and not to train workers. At the same time, we have glorified education and offer college degrees to most of the population. Some cases we guarantee. We have developed an anti-intelligence mood. Expertness has been downgraded.

We in industry have found that technicians are almost as good as engineers in many respects, and that you don't have to have a degree to be a manager or an engineer. The most critical area in the labor force of the fishing industry at the present, and certainly to be considered in the developing fisheries, is the technical staff of any seafood production line. This staff includes production foremen, or middle echelon managers; machinists knowledgeable in power plants, including diesels and diesel generators; steam and refrigeration engineers; mechanics; electricians; and quality

control staff. The production staff must be trained and qualified, not only to operate the equipment, but to maintain or repair all of the components of a production line. This is particularly true in Alaska where production lines are hours or days away from the parts suppliers and repair shops.

I do not believe it is practical to attempt to train a large group of workers for the seafood processing industry. Almost 90 percent of the workers in this industry do unskilled labor that requires very little training, and with only a few hours of instruction on a job may become proficient in their work. The need for training is in the technical field. The skilled workers need a good training program. Experience is the criterion for a constant, successful, and efficient labor force.

We at Icicle, rather than going to the public school system at any level, chose to concentrate on in-plant or on-the-job training to develop basic skills, and to encourage workers to continue the learning process by taking advantage of the special training sessions and workshops offered by industry, vocational schools, and extension service courses. In some cases we have sent employees to special schools to increase their knowledge in their particular field, such as refrigeration, electronics, or quality control.

Development of new techniques in the processing of fish and fish products has accelerated more rapidly than any other segment of the fishing industry. This is probably due to the demands of the consuming public more than to anything else, but it is also due to the need to reduce cost in order to be competitive with other food items in the marketplace.

The United States has been slower than other nations to progress in this phase of the industry because it is not a fish-eating nation. We have not needed the protein from the sea as have other nations. But since 1976, we have rapidly become involved in harvesting and processing fish from both the Atlantic and the Pacific. Our bottomfish industry has a lot of catching up to do in order to be competitive in both the domestic and overseas markets. We have had to learn a new set of rules and entire new processing systems, largely from other countries.

The State of Alaska should have a food science and technology research department to deal with the problems of handling, processing, distributing, and storing of fish. The staff of this facility could advise firms in the fishing industry, and conduct seminars on the latest developments for people engaged in handling and processing fish. There is no doubt this would help those engaged in the many day-to-day operations in the fish industry to do a better job, and also help prepare the way for development and expansion into the bottomfish industry.

A fisheries education program should accommodate the needs of the older workers. Industry is finding that older workers, those eligible for retirement, are easier to manage and fit into the system better. They are less mobile and are not concerned about self all the time, so you sacrifice a certain amount of drive and enthusiasm. But they are good workers and are totally honest and completely loyal. Because of the current rate of inflation and the problems of living on a fixed income, the current trend of early retirement is being reversed. People are living a lot longer after

retirement and they can't keep up with inflation. A weekly paycheck looks much better than a promise of social security or a pension payoff.

The shore-based seafood processors are more concerned than ever before with trying to develop and become part of the bottomfish industry and to be competitive with other modes of fish handling, such as joint ventures with the foreign countries that process at sea. But regardless of the systems we will use to expand into the bottom fisheries, we will need highly trained and expert people to operate the facilities.

Another consideration in a fisheries education program that is of particular interest to the processing sector, because we own and charter and operate the fishing vessels and support vessels, is the need for qualified fishermen and seamen to man these vessels. This need could be filled by a strong educational program, starting at the high school level and located in the coastal communities, that teaches basic seamanship to prepare the student for summer jobs on the vessels and in the shore plants and floating processors; and then going on to more technical training programs, if the student desires to remain in the industry. The only program I know of that has been of any help in the last 35 years is the Boy Scouts of America; at least the Scouts learn to tie knots!

To satisfy the needs of the seafood processing industry in Alaska, a fisheries education system should include a technical program for training and retraining processing personnel of all ages. The program should emphasize these critical areas: machinists, mechanics, electronics, refrigeration, quality control, communication, and, last but not least, seafood handling and processing methods. Without a viable and profitable processing sector in Alaska, without highly skilled workers producing products that are competitive on the world markets, the development of a low-value species would be a slow and painful process and might not occur unless subsidized by huge amounts of public funds.

DISCUSSION

QUESTION: You mentioned the problem of quality control in the processing plants. Would you comment on the relationship of the quality of the catch when you get it off the boat to the quality of the product when it gets through your plant?

ENGE: Take pollock, which is a highly perishable fish. We have limited the time that the fisherman can be on the fishing grounds, and we like to keep the fish on the boats not over 36 hours. Sometimes it runs a bit long, but then we have provisions on board or on the dock so that we can either slush-ice or chill the fish. The timing is very important. Highly perishable fish need to be gotten into the plants as quickly as possible. I doubt that we are going to see much development of shore plants for pollock in Alaska. A lot of the effort is going to be on the high seas, either processor-trawlers or mother ships, because the timing is so important. It is not that bacteria build up in the fish, it is just a breakdown of the enzymes in the flesh of the pollock; and the same applies to the yellowfin sole in the Bering Sea. The Russians

had a joint venture with Marine Resources, Inc. this last year which was highly successful. The only reason it was successful is that the fish was aboard the processor within about 2 hours. That type of fish has to be processed almost immediately.

QUESTION: To what extent do you think processors will cooperate with educational institutions in the educational process that you have outlined? You have talked about some new programs. Where are you willing to put up in the process of educating people?

ENGE: No problem. We have become involved with the high schools. We have students come in and work in the plant and if they work out and become skilled in their particular field, why, we could find a job for them.

QUESTION: How do you train your management people in labor relations?

ENGE: In Petersburg we have one man who deals with the contracts and labor relations. We haven't had too much of a problem. We just get along with people. We get along with fishermen and we get along with the workers and I think we do a good job. I am not going to get involved with union problems because we have just certified most of our plants. I think we are doing a good job in labor relations.

QUESTION: Is there a mechanism for assembling the harvest of a large number of small fishermen, or does your processing depend on having access to the catch of a major vessel?

ENGE: I am glad you asked that. Yesterday Tony Vaska was mentioning the small boat operators in Western Alaska. I don't see much hope for them because in the summer they are involved in salmon fishing, and they are too small for winter fishing. We are going to have to go to the bigger boats for the bottomfish industry. I think a 58-foot limit is a good size for fishing in Southeast Alaska. When you are on the outside waters, then you need the larger boats. When you get out in the middle of the Bering Sea that's another problem. But for small boats to get involved in the bottom fishery, I think that is a long way off.

QUESTION: What about the use of the smaller vessels for longlining for cod, for example--for specialty products like salt cod? Several operations like that are being discussed for the Aleutian Chain right now.

ENGE: That is a possibility. There are plants out in the Chain, of course. The salt cod market is a special market. I do not think we are ever going to sell any salt cod in the United States because the American Medical Association tells us that salt is no good for us. The same thing is happening in Japan. So that is a problem. It is also going to be a problem for small boats because it is a volume fishery and I cannot see it developing very fast. It is going to be a slow process.

QUESTION: Was Icicle's reason for getting out of the bottomfish business economics?

ENGE: Yes.

QUESTION: Does Icicle plan to continue that program at all?

ENGE: I don't think so. We found that the bottomfish species in Southeast Alaska, especially pollock and flounder, are concentrated on rocky, rough bottom in small areas. It is easy to wipe them out or get the catch down to where the sizes are too small to process economically, and that is what we are running into besides economics.

QUESTION: Do you think there is some shortcoming in being innovative on the market again?

ENGE: Well, there could be. I think we have as good a marketing staff as anybody in the business. There certainly is a field open for different products, and that is why I would like to see Alaska become involved in a research and development department where you can go with your problems on some of your specialty products. We are busy selling canned salmon and frozen salmon and halibut and are pretty well involved in that. But it is true, we could be involved in selling other products. It takes a lot of research and money.

EDUCATIONAL NEEDS OF SEAFOOD PROCESSING WORKERS

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You can catch as many fish as you want, but you have to market them and you have to market quality and quantity. That is the total picture.

In many ways Alaska is unique. How many people realize how big Alaska is and how many different resources the state has? Earlier in this conference Tony Vaska was talking to us about the fisheries in Western Alaska and about total utilization, and he used the herring roe fishery as an example. There is a market for herring roe, but is there a market for herring as a food fish? There is one developing in the United States, but out in Western Alaska could you take the herring and cook it; add water, salt, and oil to flavor it like tuna fish; can it; ship it; and market it; and afford to sell it for 49 to 60 cents for a half-pound can? There is your competition from Peru right now. So you have to keep that in mind.

You have to train the processing line workers in how much skin can be left on the fish after hand- or machine-filleting and still have a product that can compete in the marketplace. You have to teach them how much blood can be left on the backbone of a salmon. What will the consumer accept? You also have to teach the line workers a little bit about basic plant sanitation and personal hygiene. A lot of this should be learned in basic schooling, from kindergarten through high school.

If an employee repeatedly does not do his task, you dismiss him, but you then have another problem. How many people on the outside realize what it takes to fly people around Alaska? You also have to house and feed the employees. If you fire one, you have to get and train a replacement. Then you take a look at your season. Are you dealing with a high-margin product and a short season, or a low-margin product such as whitefish over a long season? You have to take a look at all of these costs.

Right now we are in a situation where a machinist, for example, takes home $20,000 to $30,000 for working 3 to 5 months. Maybe he lives on Maui the rest of the year. You have to hire machinists for the whole season to stand right there to work with the machines. Suppose you are out in the middle of no place, and a machine shows up which you have to install, and you find you have to make parts for it. There has to be a little bit of imagination out there. It requires some training past high school.

Another basis of the whole problem is investment. If you are going to have to take your dollar and invest it, what kind of return do you expect? Zero, as the industry is putting out now? Or 1-2 percent if you are very lucky? Do you want 10 percent? You have to take that into consideration for the

future. I can see why the bottomfish industry is on the back burner. We have to get this canned and frozen salmon thing cleaned up so we can turn around and take these profits, and the profits are nothing, but you build for the future, and put them to work. Until you get to that point, I don't see any hope for growth in this area.

Where does quality assurance start on the marketplace? If you go out and buy something and like it, you buy it again, maybe even if the price goes up. What is the consumer looking for? Open a can of salmon, for instance. What color is it? How much oil is there? Is it a solid chunk of meat, or does it have holes in it? Does it fill the can? When you dump it out, does the meat come out freely or does some stick in the can? Success here is a product of education.

Look at the marketplace. Back in the 1930's we ate one can of salmon to three cans of tuna. Now it is more like one can of salmon to 20, 30, or even 40 cans of tuna. With these and other changes in the world marketplace, salmon is going to have a harder time. We have to get out there and sell that product.

In marketing, we strike for repeated sales. We have to keep the consumer. Peter Pan, Icicle, all the brands have their markets and they market certain qualities of fish in certain areas. Whether it be salmon, bottom fish, or whatever, you have to establish specifications that will meet the marketplace, no better and no worse. If it is a new product, you might be forced to sell high quality in order to establish yourself on the market. Let's say Peter Pan is competing with Icicle on a market and they are trying to get a bigger piece of that market. Peter Pan would probably have to put in a slightly better product for awhile, then wean the consumer down to an average quality.

But consistency is generally what you are after. For instance, take the french fries sold in fast-food chains. Don't you always get pretty much the same color, same texture, same mouth feel, and the same taste? This is going to be very difficult to do with bottom fish. It will depend on how the fisherman handles it, how fast you process it, how you grade it, what your specifications say, and what defect limits you will allow. You have to train people to do these things.

Some of the specifications you set can be handled by the people on the line. They can grab samples every so often and record their observations. An example would be to compare the weight of a raw fish and the fillets you get from it, to get a yield record. This doesn't have to be a special quality control person. Management should not have to visit the plant and perform these duties to see what they are getting per pound.

Let's say we take the bottom fish one step further and we bread it. Most of us prefer a light breading, but maybe a business administration person says that with light breading the profit margin is going all to pieces. So you put more flour on, and then you lose your market.

On the other hand, you will run into the marketing manager who claims he can sell anything. There are plenty of products that stay on the shelf or in the freezer and don't even sell as bait, because you cannot sell garbage.

Let's go back to this plant, where we have established some quality attributes and defect limits for a product. Management knows what they are and they do not lose sight of them, but what about the labor pool? Suppose, for instance, somebody turns a freezer off too soon. Basic education in the handling of fish is needed, although some of the problem is attitude. Many people do not understand the system we deal in. We have to make a profit. We cannot keep on going with a deficit.

A lot of high school students have had family living courses which discuss finances, but how many of them get even a smattering of business economics? How many in college get business economics?

I would like to suggest an educational program. Processing plant workers need to know how to measure production efficiency, from input through yields and equipment efficiency.

They will also need to know all aspects of sanitation. And don't tell them to use 4 ounces of soap. Tell them to use a cup or whatever measurement they can understand. How many of you have been in a salmon cannery? It is a lot easier to use a fire hose, isn't it? That is the mentality we are dealing with.

One of the biggest problems is that, as a result of long, hard working hours, you get pretty tired and a lot of things just kind of walk on by and don't even get looked at. Does a cannery really run itself? Or does management run it? These are questions a lot of people have to ask.

Other educational needs include inspection of raw materials and finished products, warehousing, shipping, and subsequent storage controls including temperature and inventory controls. You cannot ship a product in a van that will only maintain a temperature of 5 degrees if the product has to be kept at a lower temperature. Your quality would be gone before it even gets to the marketplace.

Processing plant workers also have to know something about the scheduling of operations and how to satisfy local, federal, and foreign regulations. Take the European common market, for example. They have different weight laws than we have in the United States.

Waste disposal control is also important. Nothing is worse than having the village elders come and complain that you are not taking care of the dump or that you have garbage all over the beach. Peter Pan and every other processor in Alaska feel that they are here as permanent residents, and that they have to keep the place clean as part of their job.

Top management has to have input from the plant foreman concerning inventory policy, budget policy, pricing policy, and evaluation of individual employee performance. There has to be training for this. The foreman might have something to say to the manager which would affect the price of the product.

All of us have gained common sense, as well as school sense, covering the responsibility that we have on our jobs. But take these people you bring into the plant. I have had some very intelligent people who come in and do the job, and as soon as they are off head for the bunkhouse like a bunch of idiots. They just cannot handle themselves. They think it is a completely different kind of society at King Cove or False Pass, out in the middle of nowhere, and that they don't have to answer to the same social constraints as they do in Anchorage, Seattle, or Corvallis.

We need to stress all aspects of sanitation. Tell them why and how we clean up, about personal hygiene, and about sanitation on the boat, in the plant, and in transportation facilities. We have to have a fresh product from the sea which is free from decomposition and other quality defects.

In October 1977 the Institute of Food Technology, which is a group of food technologists from throughout the United States, published its minimum standards for an undergraduate curriculum in food science. Then, in 1980, the food industry came out with a quality assurance program called a controlled option in food science. In this curriculum they spelled out majors in food science and management and food engineering. There is a 2-year course at Mt. Hood Community College on food science. They prepare people mostly to go into a quality control technician role, then into management--foreman, lead person, and on up to plant manager.

The industry developed a course in the Seattle area on quality control in the salmon industry. This course included a smattering of microbiology and a little bit about catch methods, then went step by step through the processing of salmon. The course was basically for summer industry employees. Topics covered included freezing, grading, temperature, sanitation, water supplies, chlorination, canning operations, seam examinations, why we retort a product, the use of heat to kill botulism bacteria, why we take samples, a little bit of statistics to explain sampling methods, a little bit about the canned salmon control plan of the industry and the Food and Drug Administration, and employee and employer relationships.

These people are the nucleus, or the brains, of a cannery during the summer. They can help you out, or, if you are not careful, they can cause a lot of problems. Summer employees make enough money to keep them going through college. They make $5,000 to $7,000 in our plants, which are run longer than the other plants. Properly trained, these people are the nucleus to go into middle management because they understand quality. Teach them a little about quantity too, because you need the quantity to stay in business.

We are having a problem with the course in salmon quality control, probably because the industry people are getting tired of teaching it after 7 years. We have tried to turn it over to somebody else in the Seattle area, but here again is the problem of quality in the instructor.

Processing plant workers also have to be taught how to handle frustrations they will meet on the job. They have to have the ability to step back, take a hard look at what they are doing, and go back to it and understand it, but they have to understand the whole system to do this. Less than 10 percent of the people coming out of high school can do it.

Somebody asked me yesterday how long it would take to get a program rolling. Once you get started, maybe 10 to 20 years from now we will have something going that all of us will profit by.

DISCUSSION

QUESTION: In your company, say on a given production plan, where does the quality control person fit in? Who does he report to?

SCHNERINGER: We have a director of quality assurance and he reports to the president. I have kind of a dual responsibility. I report straight to the president if I want him, and I work directly with the vice president of Peninsula Operations. If there is a product out there I think should be held up because it doesn't meet our standards, I just write a hold on it. I work closely with marketing so that they understand the various qualities we have and will know what they are selling. I have a full-time employee in King Cove. Each summer I employ 21 people in five plants. Quality control functions also handle some inventory work. I make a recruiting trip to Oregon State University, and I sit down there for 4 to 8 hours interviewing people for summer jobs. I paint the worst picture in the world. I tell them how lousy it is, that they are going to have to work from 7:00 a.m. to 2:00 a.m., and some days they are going to have to work when other people have the day off. In most of the canneries, the people who handle the inventory work and canned product and frozen product also work for me. I can recruit people, and through some of the union regulations, I can fire them. I have fired some. I explain the problem to them the first time, give it to them in writing the second time, then that's it, ship them off. I think that is hard, but fair.

QUESTION: In your plants, how complex are your test facilities? Can you do chemical tests--for paralytic shellfish poisoning and that kind of thing? Just how are you testing for quality?

SCHNERINGER: The quality tests are basic, quite rudimentary, although in one of our plants we do have a complete bacteriology laboratory which used to be provisionally approved by the State of Alaska for water analysis. It was on our first floor. A person was breaking windows one day and the local police arrested him and chained him to a water pipe upstairs. He proceeded to break the pipe, and flooded the lab. We have since rebuilt it and are slowly working toward regaining the status of an approved laboratory. This time I have broken it into some rooms so that when and if we do get into the clam business--since a lot of surf clams are out there off Point Moller--that I will be able to have a mouse room and do some paralytic shellfish poisoning tests. So we don't get that complex. If we have problems, the National Food Processors Laboratory in Seattle can handle just about anything. If I have something really off the wall, I can get samples air-lifted into Washington, D.C., or Berkeley, California, or even use some of the college laboratories.

QUESTION: A lot of the requirements of Europe and Japan, for example, are quite strict, aren't they? Can your lab perform the tests necessary to meet these standards?

SCHNERINGER: Yes. A lot of it is visual, and many of the standards are what the consumers set. It is just like apples in Washington. My wife swears that the apples she buys in Seattle are garbage compared to what is shipped around the rest of the United States. They sell their top quality outside of Washington. Well, the same thing holds for canned salmon. The prime canned salmon--and I am not talking about decomposition, odor, or taste, but about workmanship: how it looks when you open the can; the color, amount of oil, and so on--is sold in Europe, Australia, and some in South Africa, because that is where the market is at this time.

QUESTION: The skill of energy engineering or energy efficiency--is that something you look at as an in-plant capability, or do you always go outside the plant for things like that?

SCHNERINGER: Well, as far as energy efficiency, we try to work in some programs. Again, this costs money and it changes. You find when you come to Alaska that when something gets installed, it is generally going to stay that way until it becomes outmoded or burns down. The King Cove plant uses heat exchangers on the generators and they recycle some retort water. There is still lots to be done, but you take our False Pass plants. We are losing money like you wouldn't believe, just because of the steam that goes out the retort.

QUESTION: Could you pinpoint any of the problem areas with quality control at the fishing end, like handling and cooling?

SCHNERINGER: It starts from the time you catch the fish. Some fishermen tell me that you can't pull a fish out of a gillnet by its head, that you just grab it by the tail and you pop it up. That busts the backbone, and then it bleeds all through the meat. You sell that fish in Europe or Japan and they fillet it out and try to smoke it, but it's full of blood and they can't sell it. But it goes on down in the plant too. Suppose you are at the height of your season and you are packing like mad. You are receiving pinks, chums, and silvers, and maybe a few hundred pounds of reds; and the reds are on ice and somehow you forget about them. They are decomposed by the time you get to them, so you have to throw them away. Anything can happen. You name it and it's happened.

EDUCATIONAL NEEDS IN FOOD SCIENCE AND TECHNOLOGY: PROGRAM AT OREGON STATE UNIVERSITY

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The objective that was given to me was to discuss the kinds of education in the area of food science and technology that ought to be provided in Alaska in order to enhance the development of the fishing industries in Alaska. It was tempting to respond by simply reviewing in great detail the courses that are part of our food science curriculum at Oregon State University. You will be happy to know I resisted that temptation.

I was pleased to hear Barney Perkins mention food technology this morning. Up until that point, I had been here a day and a half and I wasn't sure that any of you were aware that the fish you catch is really intended to be food, and I think that is an important point.

I want to set a background for the things I have to say by reviewing some items I looked up in connection with the fish industry, particularly the use of fish as food. Some of this is very informal, and some of it comes under the heading of being nonscientific, but it is necessary background information if you are going to understand why we need educational programs in food science and technology.

The first item I have is the fact that Alaska is the number one state for pounds of fish landed. The catch makes up a little over 14 percent of the U.S. total, and the dollar value is over 26 percent. Now, to set that in perspective, in Oregon where we think we have a pretty good fishing industry, we land 2 percent of the U.S. total poundage and it has 3 percent of the dollar value.

Oregon has four fisheries education programs: the one at Clatsop Community College; ours at Oregon State University, with our campus at Corvallis and our seafood laboratory at Astoria; a program at the Marine Science Center which uses the funding and skills of the Extension Service and the Marine Advisory Program; and a program which I hesitate to mention after hearing the remarks about biologists made during this conference, a program in fisheries and wildlife which uses biologists.

The annual consumption of fish and shellfish in the United States went from 10.3 pounds per capita in 1960 to 13.3 pounds in 1979, which is a 22 percent increase. That sounds pretty nice until you look at the consumption of poultry in the same period of time, which has gone from 28 to 48 pounds, a 42 percent increase; and the consumption of hard cheese (the mozzarella used on pizza), which has gone up 50 percent.

Where do people in the United States eat their fish? Almost 69 percent of the fish consumed in the United States is consumed in public eating places, 26 percent goes through retail stores, presumably for in-home consumption, and another 4.5 percent goes to institutions. In 1979, Americans spent a little over $9.00 a week on food eaten away from home, and three-fourths of that money went to lunches and dinner or supper. So, looking at fish as food, you are not getting a fair share of it one way or another.

Here is another type of observation. Although Corvallis is only 50 miles from the Pacific Ocean, there is only one restaurant that specializes in seafood, and the seafood item that they sell, and which is good, is frozen Icelandic cod. It is not anything that comes from the Pacific Coast. Just so you won't think we don't eat out in Corvallis, in Corvallis there are five restaurants specializing in Chinese-type menus, four first-class steak houses, and three real good Mexican restaurants. But there is only one fish restaurant, and it doesn't use any fish that ever swam the Pacific Ocean. There is not what I consider to be a good seafood restaurant within a reasonable driving distance of Corvallis.

I surveyed some people who I knew were knowledgeable about fish, and I asked them just two questions. The first was, "What is good about fish?" Right away I got the response, "It's nutritious." These people all agreed that fish provided good-quality protein, and that properly cooked it is low in fat, low in cholesterol. They also agreed that good fish--and they underlined, and I want to underline, that term "good"--that good fish is really a delight to eat.

All of them stopped at that point, so I asked my second question, "What is wrong with fish?" I have quite a list of responses. Understand that even though these comments are criticisms, the real point of talking about them is to make you understand why we have to have some educational programs in food science and technology.

Concerning fresh fish, the comments went like this: poor quality of fish available at retail; poor packaging and display at the retail market; lack of freshness; strong fish smell; variability of quality as a result of the type of handling; the thawing of frozen fish at retail and selling it to the consumer as fresh; selling so-called fresh fish long after the season has closed; and the smell of non-fresh fish when it is cooking, which can drive customers away permanently. What these comments boil down to is the lack of an effective effort to provide the consumer with a consistent level of quality in a fresh product. That is what we are talking about: a consistent level of quality.

Dan Schneringer stole some of my thunder on frozen products. Few quality products are available, and what is being used for packages does not maintain what little quality there is. In my survey I also got the comment that Dan referred to, excess breading on frozen products. When the customer goes to buy a fish product, he really wants a fish product. He is not interested in buying a cereal product. I even got a comment that fish sticks may reach a specific market but they do not do much to enhance the overall image of fish products.

Then there was a raft of comments I put under the heading of general comments. One I think you need to fix in your mind. The consumer is not as stupid as he or she is sometimes portrayed. The processor, wholesaler, and retailer should quit trying to fool the consumer, and you should quit trying to educate the consumer on how to buy and cook fish. This is a waste of time right now because the consumer cannot go out and buy a quality product to cook. You'd better concentrate on developing and supplying a quality product. Compared to consumer confidence in beef, pork, or chicken, consumer confidence in fish and fish products is lacking. The consumer has no confidence that he or she can go into the supermarket and buy a decent piece of fish and feel confident about serving it to a guest. Most of them won't even consider cooking fish when they have guests because they don't want to smell up the house.

What does all this suggest? The statistics tell us without any doubt that we have the capability of catching and processing a lot of fish. But we have to start thinking of that fish as food, and not as some kind of commodity that we can just push into one end of a plant and out the other and the consumer is automatically going to take it off our hands.

I will follow up on the comments that were made by my predecessors here. The quality of the fish has to be maintained by the fisherman. No amount or method of processing will improve quality. You cannot process quality into a product if it is not there to begin with, so you have to start out with good raw material. Then you can make a processed product which is acceptable, but some thought needs to be given to marketing, to the wants of the consumer. When I look at the frozen food cabinet in a grocery store, I get the impression that a lot more time has been spent on developing the picture on the package of frozen fish than has been spent on developing the product inside. Packaging needs to preserve and protect the quality of the fish product. When we begin to produce quality products, we need to educate the wholesalers and retailers to the fact that they are handling a food product which is perishable.

The whole objective is to build consumer confidence, and this is going to require developing products that meet consumer needs. It is going to require providing quality products on a consistent basis. Keep in mind that if a consumer gets a bad fish product, he will probably be turned off on fish for months. That does not happen with beef, pork, or poultry. The consumer will go back and buy beef again the next day.

With those points covered, I can address educational needs. The basic need is training in the fundamentals of food science and food technology. Our approach at Oregon State has been to train people to apply scientific principles to the handling, processing, and preservation of seafood.

One of the definitions of food science gives you an indication of the kind of job we are working on: the application of science and engineering to the production, processing, packaging, distribution, and utilization of food. In other words, we need to train people to work in the seafood processing industry in several major categories of jobs. We need people for quality control and assurance, and John Enge has mentioned the need for people who can work in processing. We also need to tie the whole thing together so

that we can produce products which will attract the consumer and which will restore and maintain consumer confidence in seafoods. This is where food science and technology comes in.

Our program at Oregon State actually exceeds the recommendations of the Institute of Food Technologists. Alaska's goal should be to have a program that is certified by the Institute of Food Technologists.

Under our university's quarter system, it takes 192 credits for graduation in the area of food science and technology. The curriculum includes courses in food processing, food chemistry, food analysis, food engineering, quality control methods and practices, and an introductory course in food laws and regulations. All told, the students take 56 credits in food science and technology, which is about 30 percent of the 192 total credits. They take related science courses including general chemistry, quantitative analysis, and biochemistry; and microbiology courses, including food microbiology. The students also take courses in math and statistics, and the university has some requirements in communications and humanities.

In addition, each student is encouraged to select from a group of options, or minor fields of concentration. One is the business option, in which students may take up to 37 credits. They get a pretty good background in business administration, personnel management, and supervisory-type programs. Many of the students look forward to being a supervisor or manager, and they take business as their option.

Another option is industrial engineering, which provides students interested primarily in processing and production work with training in the general area of production planning, material handling, and data processing. This option is not designed to train the students as engineers, but to help them understand and communicate with engineers in a processing plant situation.

We also offer a science option. Many of our students come into food science because they have a higher than average interest in science. Courses under this option include additional chemistry and microbiology courses.

Of course, a college education cannot teach a student what really goes on in industry, so we encourage our students to spend their summers working in the food industry. Virtually every one of our students does this. Some of them come up to Alaska to work. This exposure is a real eye-opening experience for many of them. You can see quite a change in the students' attitude when they come back. The big advantage, from our standpoint as educators, is that when the students get into the industry in the summer, they can see processing and quality control in action on a scale and with an intensity that we cannot possibly duplicate in the classroom, in the laboratory, or in a pilot plant. There is just no comparison.

Our recognition of the value of practical experience caused us a few years ago to restructure our curriculum so that all of the junior- and senior-level food science courses are offered only in the winter and spring terms. This way, the students can work for 6 months and then come back to school for 6 months. This program, called the "6-Pac" program by faculty and students alike, gives the students extra work experience, a chance to earn some

money, and, because they are available to industry for a longer period of time than most summer workers, some of the students secure truly responsible jobs. Under the 6-Pac program it takes an extra calendar year to finish the requirements for a Bachelor of Science degree, but this does not seem to discourage students. Students who participate in the program for one 6-month employment period are the ones who are hired first when they graduate, and often they are hired back by the companies they previously worked for.

Just recently we made the 6-Pac program even more attractive by enabling a student to earn internship credit by sending us reports. These entail the student's cooperation with the employer and a faculty member, and lets us know if the student is actually thinking about what he or she is doing.

The most important contribution that industry can, and does, make to our fisheries education program is its willingness to provide summer and 6-month employment opportunities for our students. The benefit obvious to students is, of course, dollars, but the other benefit is that students begin to see that there is more to industry than they had thought. Industry, in turn, has an opportunity to sell a student on the company and the industry. This is important because there is an awful trend in this country for young people to automatically equate industry with the bad guy. The newspapers, the television, everything they are exposed to tells them this. When they get out and work in industry, they find it isn't so.

Industry also contributes to our educational program by providing our students with tuition scholarships on a competitive basis. Industry provides 10 scholarships annually to our students. The scholarships not only help the students financially, they provide a tangible evidence to the student of industry's interest and commitment.

Another aspect of education that a food science program should provide is continuing education: education for people after they finish their college program. We accomplish this through a variety of short courses, including a microbiological methods update course, a course in sanitation and health for managers, a can seaming school, and a better process control school (which you may know as the retort operators school or the low-acid school) which provides the necessary Food and Drug Administration certification. Depending on the topic, these courses run from 1 day to 1 week.

In closing, I will read you two particularly pertinent passages from a 1957 publication entitled "Fish Marketing and Consumption in the Pacific Coast States." It was published by, as it was then called, Oregon State College. The first passage is,

> In recent years the fisheries industry of the west coast and other sections of the United States has been faced with unsatisfactory prices for many of its products. This situation has resulted mainly from increased operating costs, and increased competition from imports and other food products. Over-investment in boats and gear has added to the problem. Also, problems of maintaining quality have pyramided as fishermen have been going farther from port and

remaining at sea longer to insure a maximum catch under restrictive fishing regulations.

The other quote is the last of 10 action recommendations, which says,

> Greater stress should be placed on fish quality. Better in-plant methods for determining quality should be established, more rigid sanitary regulations should be enforced, and fishermen should be taught the importance of proper handling.

This sounds similar to what we have been hearing at this conference.

Let's face it. With very few exceptions, we are not doing a good job of processing and retailing fish--either fresh or frozen. Because of this, consumers lack confidence in the quality of seafood products. If we are going to sell all the fish that you people are going to catch with all those fancy devices Dennis Lodge described yesterday, we are going to have to gain the consumer's confidence and keep it. We have to do it by improving our skills at processing and quality control, and this can be done through an educational program in food science and technology. I have used the Oregon State University program as an example because it is a good program. I can tell you that because that is what industry tells us. We will be happy to work with you in any way that we can to get a food science program going in Alaska, because in the long run a good program up here is going to benefit us down in Oregon.

DISCUSSION

QUESTION: How many of your bachelor-degree students are specifically interested in fish?

KIFER: You really catch me short. I don't know. They are not a majority, for one reason: when our students graduate they are willing to go anywhere in the food industry providing it is in the Willamette Valley. But they do stray up here. It is not because of a lack of interest in seafoods, it is because they do not want to leave Oregon.

QUESTION: Do you perceive a need from the industry's point of view for an associate degree in food technology, as well as your 4-year program?

KIFER: There is an associate degree program at Mt. Hood Community College. I don't know how many of their students go into the seafood industry. They have a 20- or 30-student program. To train technicians, to put some trained people into the business in a hurry, that could be a way to go. It hurt when Dan Schneringer said 20 years. I hope we are going to get something done before 20 years, but to get something done in the next reasonable period of time, 5 to 10 years, it is going to take some people with a full background in food science.

QUESTION: Do you see any very large future in industries like, say, beef jerky, or other specialty items that have hit it big? Is there room for looking into some of those kinds of things instead of depending on traditional ways of processing and selling fish?

KIFER: Well, that is the area of product development, and I guess if there is any one industry that has not really been too innovative in product development, it is the seafood industry. You know, you send it out the door fresh or frozen or you stuff it in a can if you can't get rid of it any other way, and that's been the amount of innovation. But there is no reason you can't make anything in the world out of it. The possibility is there.

MARINE RESOURCE MANAGEMENT
(MORNING SESSION, DECEMBER 10, 1980)

AQUACULTURE SYSTEMS

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Much of our concern at Groton Bio Industries in recent years has been with social and economic development in the Third World. This has taken us into the tropics more than to your higher latitudes but, except for the temperature, some of the problems are very similar and we hope to be able to draw from that experience some guidance as to alternative ways to deal with the resources here.

Aquatic animal husbandry is an ancient practice in some parts of the world and has supported very high population densities, as it is now doing in Asia. China produces between 2.2 million and 17.5 million tons of food from aquaculture a year. These are two separate estimates of the productivity of mainland China's aquaculture efforts. The lower number is a 1975 FAO (Food and Agriculture Organization of the United Nations) estimate, and the larger was made by an associate who did some calculations based on productivity per unit of area. Probably it is somewhere in between, but it is a significant quantity of human food, mostly in the form of freshwater, warm-water fishes grown in polyculture systems. Each system supports three to five species. Currently these are primarily carps. The species do not compete because each species occupies a different ecological niche in the system. I won't go into the details because polyculture systems are not appropriate or applicable directly to ecosystem management at these latitudes, but it is an encouraging indicator that properly understood and managed aquatic resources can produce a considerable volume of human food.

Of the 70-72 million metric tons that are extracted yearly from the ocean by the capture fisheries, probably some 40 million metric tons are directly consumed by humans. The remainder goes into feeds to support terrestrial animal husbandry, for the most part poultry. Food from aquaculture is all consumed directly by humans. If the numbers I gave for China are added to the rest of the world's aquaculture production, which is by FAO estimates about 6 million metric tons, or by other estimates 10 million metric tons, you can see that it adds significantly to the 40 million metric tons that are a consequence of the capture efforts. Saying it the other way around, the contribution of aquaculture to human food is around 20 percent. It may be even higher, and if that is the case, then we are indeed making some progress with what has been considered to be an insignificant contribution to world food production efforts.

There are two different kinds of aquaculture. There is the small-scale subsistence farming which goes on in Southeast Asia and the Mediterranean, in the Adriatic, and a few places in the Western Hemisphere. These are small family or village farms, which are relatively unsophisticated and low in productivity compared to the large-scale, corporation-managed, centrally controlled, vertically integrated industries which are maturing in various parts of the world as significant food- and wealth-generating businesses.

Just for reference, in Ecuador where we are growing shrimps, artisanal aquaculture will be productive only to 300 or 400 kilos per hectare. This is based on natural recruitment of larvae or juveniles in an intertidal pond; confinement of some sort, usually in an earthen pond; and no additional subsidy in the form of feed. Therefore, this 300 or 400 kilos per hectare represents the natural carrying capacity of that ecosystem in Ecuador.

However, in that part of the world technology, capital, and management have been introduced which can increase the productivity of the system by an order of magnitude to 4,000 kilos per hectare. Such production is common when instead of depending on natural recruitment, there is an addition of seed from a hatchery, and when instead of depending on natural productivity, feed is added in the form of a formulated ration which supports the higher density population. In addition, there may be other management practices which result in a healthier environment, like better water quality by virtue of aerating the water and monitoring and removing toxic waste products, and controlling competitors and predators, which the natural system does not consider.

Still another stage has been achieved, in which the environment is under total management and generally in a constant state of movement. The water is constantly being moved in a raceway system. Other contributions to the enhancement of productivity in this level of aquaculture include increasing the carbon dioxide content of the atmosphere, which increases the efficiency of photosynthesis. This level of aquaculture can add yet another order of magnitude, increasing production to 50,000 kilos per hectare, which is a very significant food-generating system. Now that requires capital, very sophisticated technology, and a kind of science which we are just beginning to understand. It also requires the use of strains which are genetically improved to make more efficient use of feed, to tolerate greater environmental stress, and to withstand disease. These improved strains are beginning to appear in some culture systems. The Israelis are making real progress in this. We are very optimistic about what can be done with some crustaceans.

How we can make all of this work in Alaska is the question. Aquaculture can contribute to economic development by creating rural employment and providing a cash crop that will allow the purchase of more than subsistence foods. It can generate wealth to reinvest in infrastructure: providing power, fixing roads, building schools and hospitals, and making life richer and more fulfilling. Maybe we could bring this about in Alaska by trying a system which, again, has been around for a long time but hasn't been applied much to aquaculture: an affiliated growers program. With this type of program, the advantages of sophisticated technology, capital-intensive investments, and management skills can be realized at the same time that operation of subsistence-sized farms is made available to the individual owner or family

farmer with all the advantages that the large corporate effort has provided for itself.

The advantages of an affiliated growers program would include a hatchery which generates the seed. The hatchery is a technical management problem requiring various degrees of sophistication, in some instances not readily accomplished by people who are not well educated, well motivated, and well supported by the necessary tools and management.

A hatchery is an essential component of an affiliated growers program. To predicate a large program or significant effort on recruitment of seed or juveniles from the wild is unwise because this source is unreliable.

A feed source also has to be provided. To efficiently generate formulated ration, you would probably need an 80- to 100-ton-a-day production facility. Obviously, a small farmer does not get involved in that except maybe as a shareholder. This again requires a level of sophistication that is ordinarily not available to the farmer.

The components of an affiliated growers program can be developed by coordinated effort. They can be made available either through the private sector, as a corporate profit center, or through the public sector as a good investment in society. They can be made available, from a central source, through grants or sales to small farmers.

This kind of program is not unlike the large poultry operations where day-old chicks are provided by a central source, or some agricultural operations where seed and fertilizer are provided from some central source to dispersed producers. They may be in a cooperative structure, but not necessarily. The corporate or the central control system is the recipient of the product that the small farmer produces. He is not locked into the corporate entity in any other way. This way we can preserve the culture, the farmer's way of doing things, and, most of all, his pride and his identity and separateness. He doesn't have to be locked into a large, organized controller, whether it be state or private.

An affiliated growers program isn't going to happen overnight. It is going to require a better understanding of the cultural requirements, the sociological needs, and the nature of the people to whom you are going to bring these ideas. It is going to take a lot of organizing. I don't even know the best crop for Alaska. I am really proposing a methodology for implementing an aquaculture which is yet to be developed. It could be scallops, or some of the fin fishes.

It could be the whitefishes. Almost inevitably, a decade or more from now there will be a need for the whitefishes. The United States imports about a billion pounds of whitefish blocks a year. About 98 percent of what we consume, we import. The price of cod, haddock, hake, and the others that go into these frozen blocks keeps mounting year by year, not only because of inflation but also as a consequence of a decreased or decreasing catch. The known stocks of cod are pretty well exploited and may be at a sustainable yield or they may be overfished. I am not sure.

But I am sure of one thing: the oceans in which the cods and hakes grow are being polluted. There is DDT on the coast of Ireland which evidently came from Iowa, down the Mississippi River, into the Gulf Stream, and then via the great gyre to Ireland. It really limits the production of the crops that we were interested in there.

Whatever the reason, the yields of some of these wild populations are going to go down. And the cost of getting them is going to go up. With rising costs of fuel, vessels, gear, and labor, the capture fishery is getting to be a more and more expensive fishery.

DISCUSSION

QUESTION: [Indiscernible.]

WEBBER: Yes. Cod has been cultured in Norway for a long time. Since the turn of the century a Norwegian gentleman and his son have been culturing cod and releasing them into the Oslo Fjord to enhance the natural capture fishery, and evidentally it is doing so although there is some controversy as to how many of them survive. The natural fluctuation of the population has kind of masked the effect. I also understand that cod is being studied for culturing in Russia, and we hear reports that the Norwegians are expanding their effort. It is probably technically feasible, but we don't know if it is economically sound. At the current price of cod, which on our coast is 60 cents a pound ex vessel, it is beginning to look very attractive indeed. We are making a lot of money growing catfish for a lower price.

QUESTION: [Indiscernible.]

WEBBER: The question relates to the marketing mechanisms that might be available. The central source of seed, feed, and technical assistance would also perform the function of processing and marketing. We see this as an essential part of the total system and the demand for fish is almost inevitably going to continue to increase as it has during the last decade. Consumption went from around 10 pounds per capita for about 30 or 40 years to the current 13.4 pounds, and it seems to still be going up. So the demand for fish seems to be secure, but the mechanisms for getting the product out into the marketplace can be improved a great deal. We see a lot of this happening now. I think that a small-scale artisanal aquaculture system has to be dependent on some centrally managed marketing mechanism which could be the company that supplies the seed and feed. There may be other ways to do it. I like the idea of a cooperative, but that is part of what I was alluding to when I said you have to know the culture and the attitudes of the people. Some people fall into cooperatives and work out fine, and some people make cooperatives a very difficult mechanism to operate, so I am not sure about Alaska Natives or Alaskan people. I don't think it is limited to Native populations. I hope it would include all Alaskans.

CONSTRAINTS AND OUTLOOK FOR FISHERIES AND AQUACULTURE

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In 1969, following two decades of unprecedented growth, the world harvest of fish and shellfish approached 70 million metric tons. The more conservative analysts were then predicting that the world harvest of aquatic foods would continue to grow for at least another decade. The record shows, however, that this anticipated growth has not occurred. The combined harvest from traditional fisheries (hunting) and aquaculture has remained near 70 million metric tons. In recent years the harvest from hunting has declined, whereas production from aquaculture has approximately quadrupled (Figure 5).

HOW MUCH FOOD FROM AQUATIC SOURCES?

While some analysts have expressed optimism about the capacity of aquatic environments to produce food, others have expressed pessimism. Regardless of the level of optimism or pessimism, perceptions that the "oceans" will solve world food shortages are no longer in vogue.

Plant life is the foundation of food production in terrestrial and aquatic environments. However, the dynamics of food production on land and in water differ considerably. Annual production is much more concentrated in space and time on land than in water. Plant crops grown on land usually have an annual cycle and can conveniently be harvested directly by man or converted into animal tissue by feeding them to herbivores.

In aquatic environments, on the other hand, plant production is scattered throughout the photic zone which typically extends to depths of 200 meters in marine waters. Furthermore, the production cycle of aquatic plant life can often be measured in days or weeks rather than months or years. Thus, several crops can grow to maturity and be recycled through an aquatic ecosystem in 1 year, which greatly reduces the concentration of plant biomass at any given time. Minor exceptions are plants which attach to substrates in shallow waters. These attached forms represent a small fraction of the total biomass of aquatic plants, most of which consists of phytoplankton.

The amount of energy required for man to harvest phytoplankton directly would be prohibitive. The only practical alternative is to have higher trophic level animals graze on plankton and convert it to a form which can be harvested more conveniently. Unfortunately, the conversion process is inefficient. Nearly 90 percent of the food value of plant life is lost through catabolic processes by converting it to herbivorous animals. Low efficiency is further compounded in aquatic food chains by the fact that most herbivores are also very small and not useful for human food. There are a few exceptions, such as oysters and clams, but most large food fish

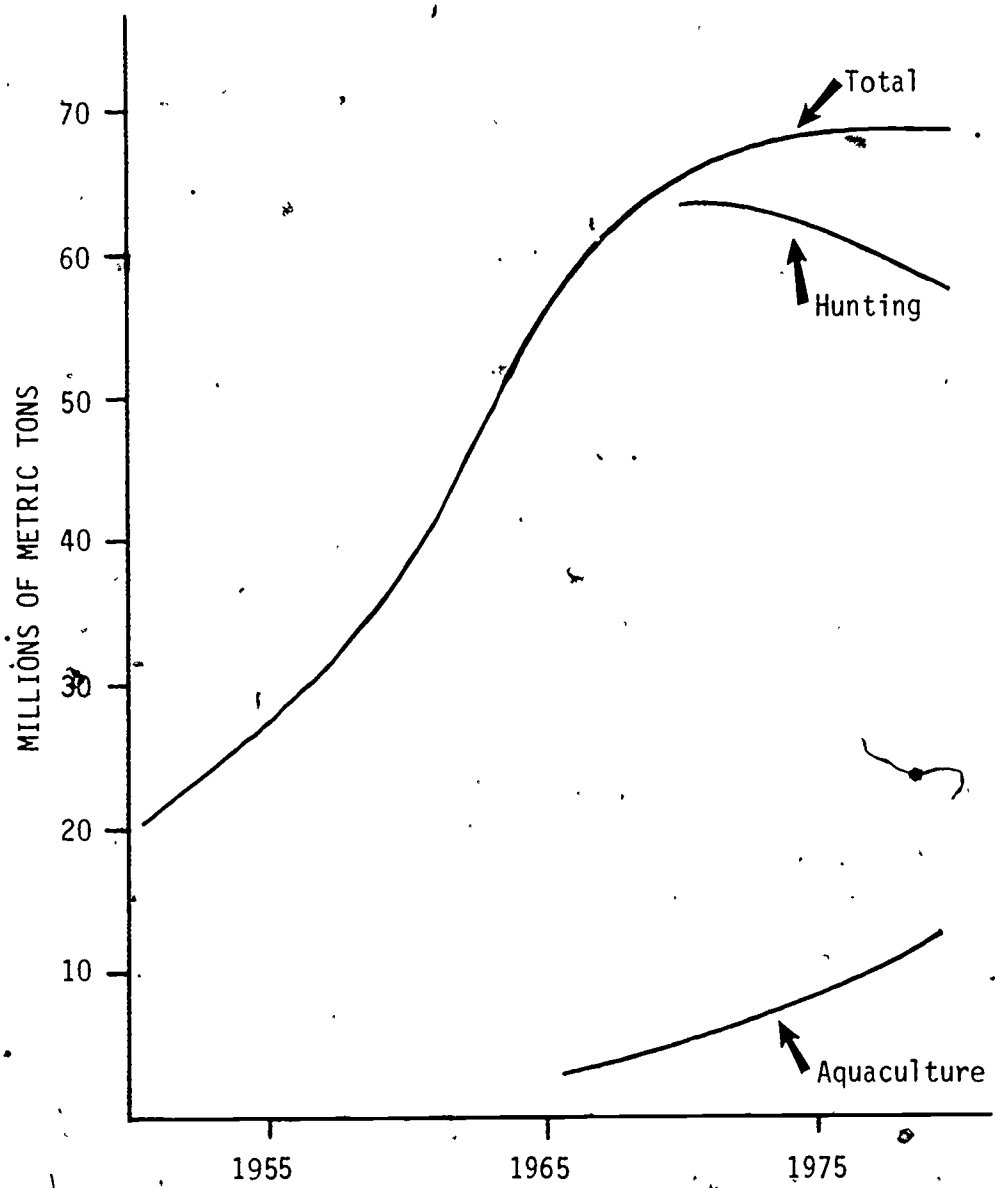

Figure 5.--World fisheries harvest.

and shellfish are carnivores. This means that the food value of plant life must be cycled at least twice within the food chain. In most cases the resulting conversion to a harvestable form is less than 1 percent of the original food value of aquatic plant life.

A simple model will help illustrate why, although 70 percent of the earth is covered by water, aquatic environments provide a relatively small reservoir from which man can extract food. We will make two assumptions:

1) The average primary productivity (plant production) per unit of surface area is the same for land and water. This implies that 70 percent of the annual biomass of plant production occurs in aquatic environments and 30 percent in terrestrial environments.

2) The average efficiency of food conversion between each of the three main trophic levels (plant, herbivore, and carnivore) is 10 percent. This implies that the efficiency of conversion from plant to carnivore averages only 1 percent.

The relative biomass of plants, herbivores, and carnivores in aquatic and terrestrial food chains based on these two assumptions is illustrated in Figure 6. Because most food organisms harvested from aquatic food chains are carnivores, aquatic environments provide a relatively small reservoir from which food may be extracted by man. The opposite is true for terrestrial food chains, which provide a large reservoir of plants and herbivores for harvest. One conclusion to be derived from Figure 6 is that less than 1 percent of the total reservoir of biomass from which food can effectively be harvested by man is to be found in aquatic environments. This estimate of the relative potential contribution of aquatic food organisms may be conservative, but the contribution of food from aquatic environments is destined to remain quite small in relation to terrestrial environments.

WHAT ARE THE LIMITS TO HUNTING?

Excluding aquaculture, the world commercial harvest of fishery products grew from 20 million metric tons in 1950 to 68 million metric tons in 1970. The catch has remained at or below 68 million metric tons since 1970. Does this leveling and reduction of catch mean that man has reached the limit in the harvesting of food from aquatic environments by hunting?

The model of relative biomass in the aquatic and terrestrial environments (Figure 6) shows the very limited production of food organisms from aquatic environments. It is interesting to compare total world aquatic food production, which is about 70 million metric tons, with world grain production, which is about 1,200 million metric tons. A portion of the world grain production is fed to cattle and other herbivores before being used as human food, but there is a compensating large contribution of non-grain crops to the terrestrial food-producing system. Much of the non-grain contribution to human food, such as grasses and legumes, is also converted into animal tissue by herbivores. I do not have estimates of the total contribution of terrestrial food sources, but the general relationships shown in Figure 6 appear to be substantiated by experience.

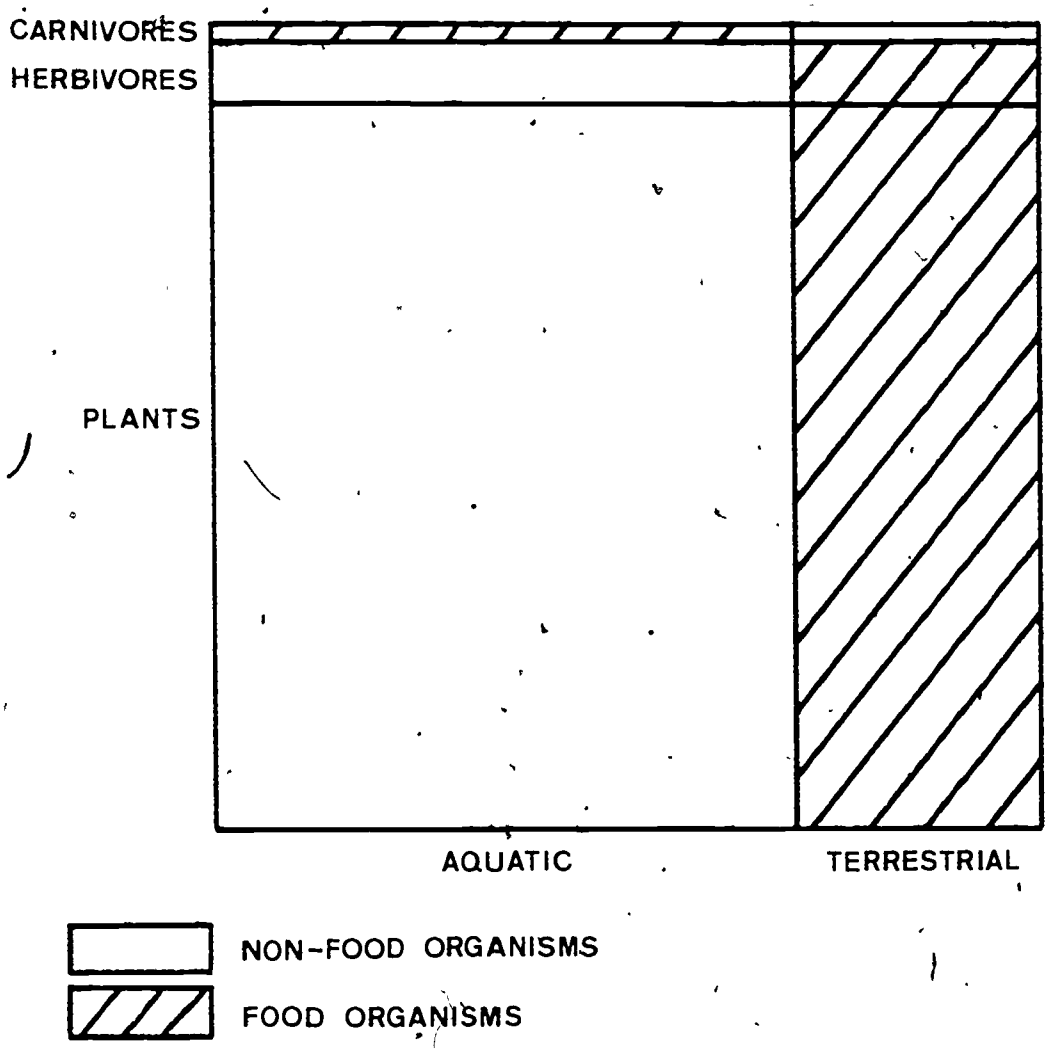

Figure 6.--Relative biomass of principal trophic levels in aquatic and terrestrial food chains.

Statistical evidence for the capacity of aquatic environments to produce food is still incomplete, even though there is a suggestion from Figure 5 that the practical limit may be somewhat less than 70 million metric tons a year by traditional hunting techniques. Analysts who have made predictions about the potential of aquatic environments to produce food have usually given larger estimates. Ryther (1969), for example, based his estimate of 240 million metric tons on measurements of primary productivity and ecological efficiency. Of course, all of this estimated production would not be available for harvest by man because of competition with other predators, such as marine birds and mammals, and the lack of effective harvesting techniques. Ryther believed that, nevertheless, man should be able to obtain more than 100 million metric tons of food from aquatic environments through the hunting of wild stocks. He did not address the potential for increasing production through aquaculture.

WILL REALLOCATION OF HUNTING RIGHTS HELP?

Catch statistics suggest a strong possibility that the harvest of aquatic food organisms by traditional hunting has approached a practical limit. Because evidence is mounting that the resource base is very limited, major reallocation of hunting rights on world oceans is now occurring. In the 1950's, coastal states typically claimed jurisdiction over fishery resources only in the territorial sea, which extends seaward about 5 kilometers from headlands. A trend emerged in the 1960's to establish exclusive fisheries zones beyond the territorial sea--frequently extending 20 kilometers seaward from headlands. By the 1970's, major coastal states had established fisheries conservation zones extending an additional 300 kilometers beyond the exclusive fisheries zone. The United States has even declared jurisdiction over anadromous fishes, notably salmon, on the high seas.

Extension of jurisdiction by coastal states is causing major shifts in the allocation of harvest rights among nations. Distant-water fishing fleets of countries such as Japan, the Republic of Korea, and the U.S.S.R. are being replaced on many fishing grounds by domestic fleets. Conservation is usually given as the reason for adopting extended jurisdiction laws. However, it remains to be determined if the productivity of wild stocks will increase significantly.

IS THERE EVIDENCE OF TRANSITION FROM HUNTING TO FARMING?

The supply of aquatic foods is limited, but the demand continues to grow in response to increasing population and living standards. Economic incentives exist, therefore, for expansion of aquaculture.

Since the early 1960's the contribution of aquaculture has grown from about 2 to 10 percent of the total world supply of aquatic foods. Production by aquaculture has recently been doubling in about 5 years, but this rapid rate of growth is likely to moderate as production increases. The National Academy of Sciences (1978) has pointed out that world aquaculture production may reach 50 million metric tons by the year 2000. The implication is that food production from aquaculture could approach that from hunting in just two decades.

Malnutrition caused primarily by a chronic shortage of animal protein is a serious problem in the world today. Because aquatic foods consist primarily of high-quality animal protein, the nutritional importance of aquatic foods is much more important than the statistics on the relatively small volumes produced might indicate. Thus, there are compelling reasons to increase the supply of aquatic foods through aquaculture.

Catch statistics suggest that the harvest of aquatic foods from hunting is likely to increase modestly at best. Aquaculture shows promise of adding to the supply of animal protein, but the likelihood of doubling the production of aquatic foods through aquaculture, to 140 million metric tons, appears doubtful to me. I agree with Ryther (1969) that a reasonable expectation for the harvest of aquatic foods is somewhere above 100 million metric tons. By the year 2000, I expect aquaculture to contribute somewhat less than half of the yet-to-be determined practical limit to aquatic food production.

WHAT TYPES OF AQUACULTURE OFFER THE GREATEST PROMISE?

There are numerous applications of technology in aquaculture. Some involve feeding artificial foods in totally artificial environments, while others involve the use of natural foods in natural environments. Frequently both strategies are utilized in combination for different life stages. It is my belief that applications which make use of natural foods offer the greatest potential for production of animal protein through aquaculture.

There are three applications of aquaculture which I believe show the most promise for expanding the production of aquatic foods:

1) the culturing of crustaceans and fishes in ponds and lagoons,
2) the culturing of molluscs in coastal waters, and
3) ocean ranching, particularly with anadromous fishes.

The culturing of crustaceans and fishes in ponds and lagoons is expanding rapidly in tropical and subtropical areas. A variety of both freshwater and saltwater species has been successfully cultured, including shrimp, prawns, crayfish, milkfish, tillapia, carp, and catfish. A typical operation involves the diking and flooding of lowlands, and stocking the shallow water with naturally or artificially produced larval or juvenile forms. Natural foods, usually aquatic vegetation and zooplankton, can be supplemented with various artificial foods.

Because bivalve molluscs are herbivores, culturing them is perhaps the most efficient method of producing animal protein from aquatic environments. The phytoplankton they feed on is carried to them by the natural water currents, so oysters, mussels, and scallops can be stocked at very high densities in coastal waters.

Anadromous fishes are the best candidates for ocean ranching because they exhibit a self-herding behavior during migrations to freshwater spawning areas. Some anadromous forms, such as salmon, feed predominantly in pelagic waters where they accumulate sources of protein which would otherwise be unavailable to man due to high energy costs for harvest.

Salmon ranching is developing rapidly in Alaska and elsewhere around the North Pacific rim. It has become an important industry in Japan and in the U.S.S.R. These two countries combined released approximately 2 billion juvenile Pacific salmon from hatcheries in 1976. This represents a fourfold increase in the number of juvenile salmon released over the last 20 years and a potential harvest of about 40 million adult salmon in 1980.

By combining the three applications of aquaculture I have described, a relatively efficient system for extracting food from aquatic environments should be possible (Figure 7). Hatcheries for the production of larval or juvenile forms to stock ponds and coastal waters and for ocean ranching can sometimes take advantage of wasted heat and nutrients from industry.

WHAT ARE SOME BARRIERS TO AQUACULTURE?

The scientific and technical issues faced by aquaculture have many similarities to the issues previously faced by agriculture and forestry. Because aquatic food production is of relatively low priority to the United States in comparison to terrestrial food and fiber production, the scientific and educational community has paid relatively little attention to aquaculture. Management of natural stocks has received priority over aquaculture in state and federal agencies for the relatively limited funds allocated to research and development on living aquatic resources.

Aquaculture also faces a complex of institutional barriers which vary among political jurisdictions. In a few countries, such as Japan, aquaculture has become an important economic activity supported by public policy and by institutions created to support aquaculture. In the United States, the development of aquaculture has been impeded by the lack of supporting public policy and institutions. Special interests are frequently opposed to aquaculture because they fear economic competition and the allocation of funds and property rights to aquaculture. The sociopolitical barriers to aquaculture are in many instances more difficult to overcome that the biotechnical barriers.

WILL AQUACULTURE BECOME IMPORTANT TO THE UNITED STATES?

The development of aquaculture in the United States is well behind world trends. Less than 3 percent of the aquatic food production in the United States is from aquaculture, whereas world aquaculture currently provides at least 10 percent of aquatic foods. Furthermore, world aquaculture production has been doubling in about 5-year intervals over the last decade, while catches from the fisheries have declined.

The United States has not placed much emphasis on food production by its fisheries, even though about 20 percent of the world biomass of harvestable seafoods is believed to occur in our continental shelf waters. There are signs, however, that public policy towards fish production is becoming more favorable in response to our deteriorating position in world trade and the escalating world demand for aquatic foods. Our fisheries are rapidly expanding in response to the recent establishment of a fisheries conservation zone which encompasses most of the continental shelf waters surrounding the United States. However, it is not known if aquaculture will benefit from

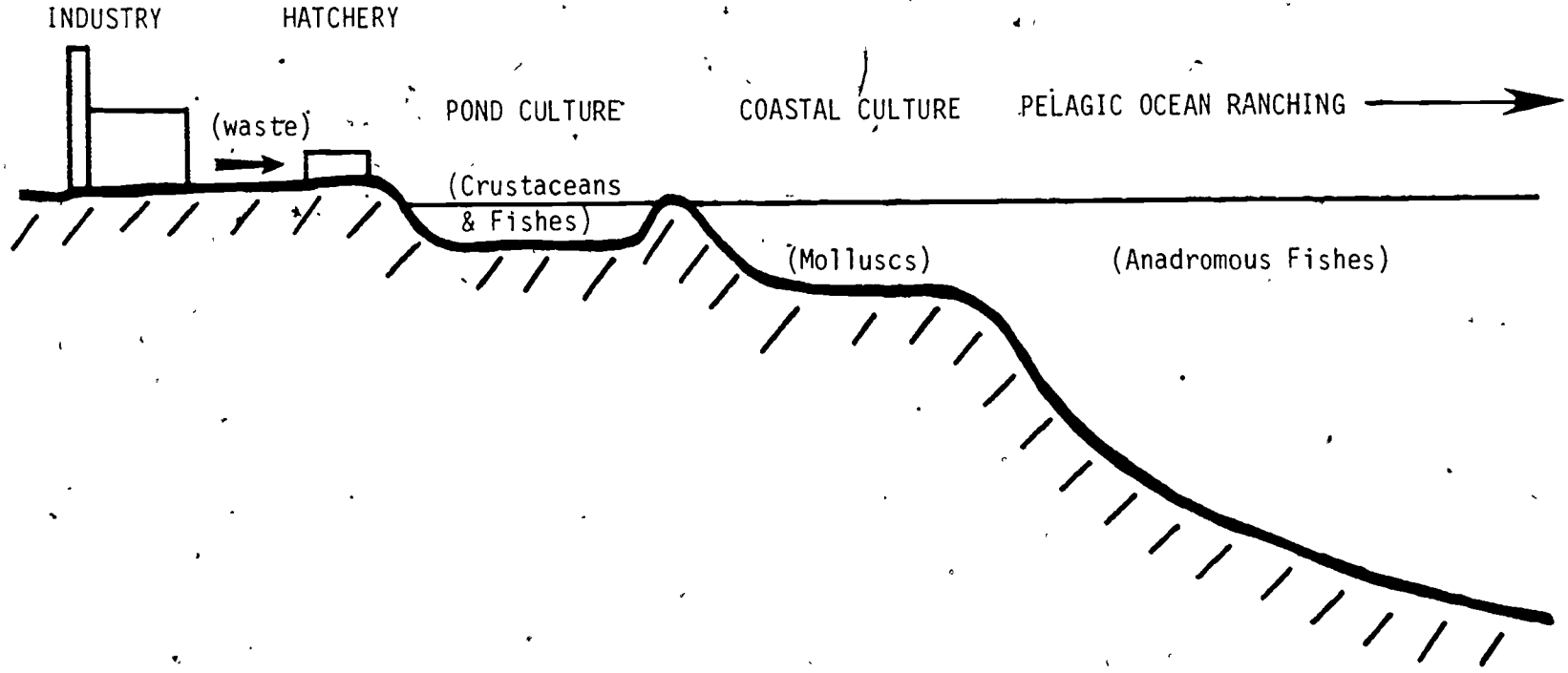

Figure 7.--Aquaculture systems.

policy changes which favor the development of the domestic fisheries through reallocation of wild stocks from foreign to American fishermen.

A national aquaculture bill was passed by the Congress in 1980 and signed into law by President Carter. This legislation provides a necessary foundation for public policy decisions which will favor the future development of aquaculture in the United States. The responsibility for aquaculture is shared by the Departments of Commerce, Agriculture, and the Interior.

State laws and administrative rules vary considerably in their treatment of aquaculture, but most tend to be restrictive. Although state fisheries agencies typically have the major role in managing aquaculture, they are frequently reluctant to support aquaculture projects.

The educational community has generally been supportive of aquaculture, even though funding for aquaculture programs is very limited. Positive responses to aquaculture have also come from the media, the business community, and the general public.

I am optimistic that aquaculture will demonstrate steady but modest growth in the United States. The aquaculture industry will probably continue to face opposition from established commercial fishing interests, recreational interests, government bureaucracies, and environmentalists, but I believe that this opposition is a natural resistance to change as man strives to develop methods to increase food production from aquatic environments. Economic necessity will gradually allow aquaculture to assume a logical role in the production of food along with aquatic hunting.

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EDUCATION FOR MARINE RESOURCE MANAGEMENT

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Development of a fisheries education program will entail asking what must be done to ensure development and sound stewardship of Alaska's most important renewable resource. I have a list of considerations which, unless accounted for, could lead to the development of programs and plans that will not be appropriate to marine resource management:

1) An underlying attitude among Alaska Natives, especially in the rural communities, that the resources in the state belong to them. This attitude influences their actions, their relationships with persons outside of their communities, and their attitude toward use and protection of the resources. This attitude has survived the Russian exploration, Seward's Folly, statehood, and the Alaska Native Claims Settlement Act, and will probably continue for generations to come. The reason for stating this particular condition today is not to create or debate an issue, but rather to set a stage for understanding why the Alaska Native communities react in certain ways, demand certain concessions, and have certain concerns.

2) The Tongass National Forest land management plan. The current plan to cut 450 million board feet a year for the next 10 years will have a significant impact on salmon runs, especially where they are going to write off 90 percent of an island group, like Prince of Wales.

3) The U.S. Borax project at Quartz Hill which includes one of the largest deposits of molybdenum in the world. The fjords, including Boca de Quadra, Wilson Arm, and Smeaton Bay, which have salmon runs important to the fishermen in Ketchikan, must be protected from potentially damaging mining and smelting activities, including disposal of tailings.

4) Offshore oil drilling. We have heard a lot about potential oil spills and what they can mean to marine life, especially in an area that is fragile or in hazardous areas where existing oil extraction technology may not be adequate.

5) The State of Alaska's land disposal plan, which entails disposing of 100,000 acres of land each year until the usable supply is exhausted. The concerns here are for the large river drainages: the effects of sewage, sediment, and other pollutants associated with industry, and, of course, the resulting loss of fish and wildlife habitat in a state that may appear to have a lot but in some cases does not have that much.

6) Our lack of knowledge about many of our harvestable marine resources: their ability to reproduce and survive under the stress of larger human populations, loss of food sources, pollutants, extreme harvesting conditions, and changing habitat.

7) The socioeconomic impacts of these activities are as yet unknown. The impacts will be staggering in certain parts of Alaska. The way of life practiced in parts of Alaska today will become a thing of the past. These impacts will affect the entire coast of Alaska, and they will affect not only our marine resources, but also our wildlife and human populations.

8) The ever-increasing demands of the United States and the rest of the world on our natural resources will affect our ability to deal in an orderly and rational manner. You know that good management includes protection of the resources for future generations to use and enjoy. If we are going to do this effectively, we must take a comprehensive look at the communities of the world, especially those we deal with directly.

These conditions point out the need to expand the students' concerns, horizons, and skills. Students will have to learn skills that enable them to deal with and understand the influences of heretofore unrelated concerns: influences critical to their ability to conduct research, plan for the future, and manage now.

The overall goal of the fisheries management program of the Alaska Department of Fish and Game is

> to protect, maintain, rehabilitate, enhance, and develop the fishery resources of the state and adjacent marine waters in order to maximize the benefits realized by the citizens of Alaska from these fishery resources by providing for their sustained optimal utilization.

Obviously, without a resource you would not need management. Also, the greater the human population, the greater the demand, so the less each person is allowed to harvest.

In Klawock, when I was a kid, every spring I used to go to the river for sockeye salmon. I went by myself and fished a very short time, and brought home enough fish to last a large family all winter. Late in the summer I would go out for pink salmon, and again quickly catch enough to last all winter. I can remember miles and miles of milky white water in March as millions of herring cruised through the harbors spawning, and in later years the excitement of harvesting eggs commercially, seeing boats take deckload after deckload of herring to parts unknown. Today, if I go back to Klawock in March I will be lucky to see one or two small patches of herring spawning. What happened to the salmon, and what happened to the herring? What happened to the tremendous runs in Bristol Bay and the Bering Sea which are now in a decline? Have we learned anything? Do we care?

Let's look at some of the facets of the department's goals that fishery management needs to understand. Some of the educational requirements necessary to carry out these responsibilities or objectives are

1) an understanding of the need for long-term preservation of a marine habitat capable of supporting desired fish populations;

2) the ability to collect information on and gain sufficient knowledge of the life history of each species, or to build a biological data base, to protect, maintain, rehabilitate, and enhance the population;

3) the ability to assess the population of each utilized species for an annual harvestable supply beyond that needed to sustain reproduction;

4) the knowledge and understanding that will enable them to maintain the biological requirements of large populations of selected species used by Alaskans;

5) the technology to be able to assist in the sound development of underutilized fishery resources;

6) the ability to relate to the public needs and desires, to be able to provide sufficient information to the public so that the objectives and management programs of the state have an opportunity for informed pressure; at least; and

7) an appreciation and understanding of the economic, social, and cultural problems created by our decisions.

And then, of course, we always have to look at management theory, management skills, and, among the most important requirements, knowing how to work with people. These many facets of the overall goal of the Department of Fish and Game are what the managers of each of the three fisheries divisions are required to understand in order to carry out their assignments.

In closing, I would like to pose three questions for all of us to think about. First, does the educational program in existence in Alaska today meet the needs of rural marine resource managers? Probably not. Second, does it provide the industry with an understanding of the true economic values; the habitat concerns, stock status, and how and why the stocks are being maintained? Probably not. Finally, does it provide the users, the various segments of the Alaska public--the angler, the subsistence user, the commercial fisherman, and other users of the resource, including those who prefer to just watch for aesthetic reasons--with sufficient information to make knowledgeable decisions about what to use and what to protect? Probably not. If that is true, then I believe we should ask ourselves where we want to go and how we should get there as we develop new industries and programs. We must at the same time ensure that we care for our resources, that they are maintained so that we have a stable supply and so that our children and grandchildren will have the opportunity to enjoy the benefits as we have enjoyed them and in some cases still enjoy them.

My great grandfather built and operated a cannery in Klawock before I was born. His sons helped him operate it and later ran it themselves. Their sons, my father and uncles, worked in the plant or fished commercially for it. Interestingly enough, I had an opportunity to participate in this operation for four generations after it was built. I consider this a record for the State of Alaska and I would like to see this record continue for several more generations. So let's do our job right.

DISCUSSION

QUESTION (WEBBER): Part of this question I would like to put on the board: large-scale, company-owned fisheries versus small-scale, artisanal fisheries. Around 450,000 fishermen are employed in the large-scale fisheries, and over 8 million in the small-scale fisheries. For each $1 million invested in fishing vessels, large-scale company-owned fisheries employ 10 to 100 fishermen, and the artisanal fisheries employ 1,000 to 2,000 fishermen. The amount of fish caught for human consumption is just about equal: 24 million tons annually by large-scale fisheries and 20 million by small-scale fisheries. The capital cost of each job is $10,000 to $100,000 for large-scale fisheries, and $100 to $1,000 for artisanal fisheries. Fuel consumption by the large-scale, company-owned fisheries is very high: 10 to 14 tons annually, versus 1 to 2 million tons by artisanal fisheries. There is a big difference in fish caught per ton of fuel consumed: 2 to 5 tons for commercial, and 10 to 20 tons for artisanal. This comparison says half of the fish that we consume comes from our small fishermen, and the small fishermen are now being threatened by the large fishermen who are coming in close to shore. This is going to require a difficult decision. Where should the state be putting its effort?

DEMMERT: I have some philosophical problems with the way we operate big industry. There is a tremendous amount of waste connected with the large-scale fisheries. Just look at the herring losses and the fact that we are now starting to have a declining resource. Look at the king crab losses in the Aleutians and Kodiak over the past few years, and the tremendous losses that occurred in Southeast Alaska when we started moving to the large-scale operations. One thing you did not include in your list is the relationship of waste to one style or the other and what that might offset. The other, of course, is that the large industry will go to different parts of the world, over-harvest, and leave a dead or declining resource. This has been the pattern in the past, and I am not sure they are ready to change that pattern. The small-scale fisheries have a large number of people and very little waste. They can feed virtually as many people. It could well be that some adjustments will have to be made that allow us to catch fish differently so we don't have the waste, if that is possible.

COMMENT (LODGE): Looking at the graph from a different point of view, we might say that the artisanal fishery looks as though it is super-efficient, Looking at it from another point of view, you could say that most of these small vessels will only be able to operate within 5 miles of the coast, so how do you harvest the stocks which are 100 miles out?

You are forced to move to the apparently less efficient system of a larger vessel, or you leave the stocks completely unexploited. Another way of looking at it is, either you capture them or you don't. If you want to capture them, you have to be relatively less efficient.

DEMMERT: Let's take a specific example: the inshore herring fishery. The fish move in, and they move out. The large, very efficient seine boats can go out and harvest their quota in a very short time. The small or inefficient gillnetter working along the coast takes a much longer time to harvest the quota, but allows the resource to remain healthy. We can look at it from a little different perspective and say that, at least in the past, the large effort has killed off the stocks, but the small effort has not.

COMMENT (WEBBER): I will respond to that by saying that I put this out not to shoot down the large, but to protect the small. Obviously, we need the large-scale fishery, but we ought to cherish the artisanal fishery and preserve it, and one way to do it is to keep those large vessels out where they belong. Keep them from coming in close to shore where they are competing with the artisans.

COMMENT (LODGE): Thoughts like this can easily be biased and you can easily get the wrong impression from a simple graph like that. You need to get the complete picture, and look at the environment and the areas involved. Quite often it is not possible to exploit a stock with an apparently simple system. Graphs can be very deceptive, is what I am saying.

DEMMERT: It is especially hard to replace a stock that does not come to shore, that stays way out, and maybe that needs to be considered as we discuss and decide who ought to fish, and where, and for what.

COMMENT (LODGE): Another complication is that in the small-scale artisanal fisheries, no fish preservation is involved, and the fish is probably consumed within a few miles of the ports. The company-owned vessels are probably freezer vessels which can export fish for thousands of miles, so it is the distribution problems as well, which further complicate the picture.

DEMMERT: On the other side of the coin you have the economic problems that develop when you bring large numbers of people in to a community from the outside and then take the money out completely.

COMMENT (ALLISON): I would like to comment on Harold Webber's question concerning where the state should put its money in the fisheries, given the information that was put on the board. It is partially answered by the policies that have been established for the state's fisheries development programs. Those policies clearly set forth the interest the state has in maintaining and protecting the small-boat fisheries and encouraging shoreside processing. Although I'm sure Dennis Lodge did not intend it, his comment regarding the fact that the fish caught by the artisanal fisheries are consumed close to the coast could imply that there is a premium placed on feeding the people in the urban

industrial centers as compared to the rural coastal areas. Surely this is not so. I believe there are some reasonable answers, and I think they were touched on in terms of the high-efficiency vessels. Those high-efficiency vessels, the offshore trawlers, are becoming more and more expensive to operate. No longer does it work, in many cases, for those vessels to target only, for example, on pollock or on yellowfin sole. Sometimes those vessels must, in order to justify themselves economically, come in close to shore and target, for example, on the sablefish stocks that have traditionally been a longline fishery. One of the things the state is looking at now, and for which we hope to have educational programs, is development of alternative fisheries for traditional salmon fishermen who find that the efficiency of gear, management, or both, requires that they look elsewhere to make their mortgage payments. Our policy is to help develop those fisheries and to encourage the utilization of underutilized domestic fish stocks. I only mention these things because throughout the conference we have heard much regarding efficiency, and I fear too frequently efficiency is used as a code word for expediency. Frequently we find a constituency building for making boat payments, as opposed to the constituency which supports maintenance of the harvestable surplus. Fishermen at Sand Point and out in the Chain have expressed to me the concern that many of the programs, including educational programs, are designed for the trawlers that are increasingly coming under the ownership of vertically integrated, multi-national corporations who can, when the fish are gone, shift to fish ranching or aquaculture. There are valid needs for educational provisions for the high-efficiency trawl fisheries.

THE BUSINESS OF FISHING
(AFTERNOON SESSION, DECEMBER 10, 1980)

EDUCATION FOR THE BUSINESS OF FISHING

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A fisheries education program in Alaska should have two main objectives: to give Alaskans more opportunities, and to make Alaska very competitive in world fisheries. I can't emphasize enough the word, "competitive," because we are in deadly competition with practically every other fishing nation in the world. Alaska is right on the edge of one of the biggest fishery resources in the world, but it is going to take very competitive performance to take advantage of it. Those two objectives provide the rationale for quite a broad program of education. It doesn't have to be a big program in the beginning, but it has to be fairly broad. These objectives provide the rationale for creating a core of efficient harvesters which can participate competitively in the whitefisheries as well as in the traditional fisheries.

Let's look at the profit and loss statement (P&L) of an Alaskan trawler (Figure 8). This is typical of many trawlers which will harvest fish year round for plants in Alaska. The boat is 90 to 100 feet long. It brings in about 150,000 pounds of fish a trip. The plants will not be able to take the catches from larger boats for awhile. If someone brings in 300,000 pounds, for example, it would swamp just about any plant we can devise for several years. So this size of boat is okay for our present state of development.

The P&L for a longliner would be similar to the P&L for the trawler, except the crew's share would be greater because there are more hands on a longliner. The crew's share on the trawler is about $380,000, and if it was a longliner the share would be over $400,000. The gross stock would be about the same but the price of the fish per pound would be much higher. This trawler P&L is based on 16.5 cents per pound as an average price for the catch, and that includes a lot of cod and some herring, which are relatively high-priced fish. To make a go of it, a trawler has to fish for high-priced species as well as low, to bring up the price of the catch. Longliners fish mainly for high-priced species like halibut and black cod.

The biggest single item in the P&L is the gross stock, which is how much the vessel sells. For this size of trawler it has to be over $1 million a year. The main problem the fisherman has is generating a big enough gross stock. He has to catch enough, be able to target on sufficiently valuable species, and take good care of the fish so it sells at a reasonably good price.

Gross Stock (Sales) (7,280,000 lb @ $0.165/lb)		$1,200,000
Fuel and Lube (165,000 gallons)		$ 280,000
Net Gross Stock		$ 920,000
Owner's Share 60%		$ 552,000
Less:		
Insurance	$ 75,000	
Depreciation	$105,000	
Interest Expense	$157,000	
Fishing Gear Replacement	$ 70,000	
Maintenance, Hull and Machinery	$ 75,000	
Technical Service	$ 10,000	
Moorage Licenses	$ 10,000	
Amortization Pre-operating Expense	$ 29,000	$ 531,000
Owner's Pre-tax Profit		$ 21,000
Crew's Share 40%		$ 373,029
Groceries		$ 23,328
Net Crew Share		$ 349,701

Figure 8.--Profit and loss statement (P&L) of an Alaskan trawler.

The next largest item in the P&L is the crew's share. This pays for about eight people, with six of them on the boat at a time. Two men have to be ashore on vacation at any given time because this boat has to work all year, except during an annual maintenance period of 6 weeks or so. The boat also has to fish all day and at night. If it fishes roundfish during the day, it has to go up on the flats and fish flounders at night. So crew members have to take about every fourth voyage off. People that run boats like this are going to have to be very good in the management of people.

The next largest cost on the P&L is the fuel, which for this trawler is $280,000. That sounds as if trawling is awfully expensive, but when you divide by the pounds of fish caught and by the dollars of catch, you find the fuel cost is not so bad. You will catch more pounds of fish per gallon of diesel fuel and per dollar of cost trawling than just about any other method. The several billion pounds of bottom fish that we will have to catch to make a go of it in Alaska will have to be caught by trawling.

Fuel can be saved in trawling by carefully engineering the trawl doors. They can be designed to give greater spreading force per ton of pull. Boat

hulls can be redesigned to go through the water more readily. Nets can be improved so that they have the same catching power but exert a lot less pull on the trawler. Mesh size can be increased. A great many innovations will come along in net design so that the same amount of fish can be caught using less fuel. Certainly that should be an important element in any fisheries education program.

The next largest item is over $500,000 of expenses, consisting of interest on money, and depreciation and maintenance of fishing gear and hauling machinery. Success depends a lot on what interest rate you can get on boat financing. A fisheries education program should include a course in vessel management in which, among other things, boat financing, insurance, and accounting are covered. There is a great deal of business management in managing a boat.

Any fisherman owning a trawler should hire a certified public accountant to keep his books and to lead him through the intricacies of the Capital Construction Fund. The boat must be in the Capital Construction Fund, which is administered by the National Marine Fisheries Service, to make a decent return on your capital. If the boat is run properly for 10 years, you will come out with a very large net worth at the end, but not without the tax shelter. You have to take every bit of cash flow, all the cash flow representing your earned depreciation, for example, invest it in good securities, and keep reinvesting the tax-free income.

It might not be possible to succeed in American fishing today, particularly in the whitefishes and related trawl-caught species, without a tax shelter. Because of the intense foreign competition, the price of the fishing products isn't high enough. For the last 5 years or so, the Korean-made Alaska pollock block has come into this country at about 70 cents a pound. The price is not going up. It went down to 65 cents a pound for a few months, and then back up to 70 cents. An American would lose money at that price, and I doubt if the Koreans are making any money. Individual fillets also come into the United States at very low prices: between 80 and 90 cents a pound. The wholesale price has been under $1.00 a pound for 3 years. That is the biggest single concern in this business of trying to get started in bottom fish. Alaskan fishermen can achieve a very high state of efficiency, but unless there are better markets and prices, it is going to be tough.

I have worked on the arithmetic of a large freezer trawler processing its catch at sea. A freezer trawler of 6-7,000 horsepower could catch over 200,000 pounds a day. The West German trawler fishing out there now catches that much just about every day, but even at that production rate and reducing all of the catch to fillet blocks and fillets, it's hard to make money.

The University of Alaska should take a look at the fishing programs of various countries. There is a need for fisheries intelligence. The National Marine Fisheries Service used to do a lot of foreign fisheries intelligence, but their appropriation has been cut. We need to know what we are competing against. For example, Newfoundland and Nova Scotia took a major hand in building up the whitefishery of Eastern Canada. These provinces made very low interest loans to companies to build huge processing plants, and those plants are the foundation of the major fishing companies of Eastern Canada.

They are major competitors of Alaska. They will harvest up to 2 million metric tons of fish in the future, and a lot of it will be shipped into the United States. Our biggest competitors are Eastern Canada and Asia and we have to know the policies of their governments.

Most foreign governments put up major capital for both fish catching and fish processing. Argentina obtained many millions of dollars from other countries for building processing plants, in return for letting those countries into Argentina's fisheries. The whiting blocks those plants produce will come into the United States duty free and compete with Alaska pollock. Some has been coming in, and if the quality is decent it sells for 80 cents a pound. The Alaska pollock is inherently a better fish, yet it does not fetch as high a price.

There is something wrong with the pricing and the marketing. Alaska pollock is a dead ringer for Atlantic haddock, which is being landed in the fresh fish markets on the east coast at about 80 cents a pound. If a fisherman in Kodiak landed pollock right this minute, he would get only 7 or 8 cents a pound. This is because Kodiak is like Newfoundland. It is far from the market, so the fish has to go into the frozen market instead of the fresh market. The frozen market price is consistently lower, so you cannot pay the fisherman as much and the processor cannot get as much fish.

More than half of the fish eaten by Americans comes in virtually duty free. It comes in in block form, and there is no duty on frozen blocks. The highest duty on frozen fillets is only about 2.7 cents a pound, and countries enjoying "most favored nation" status can ship fish in here at half that duty.

So these are the kinds of things we are up against and why we need foreign fisheries intelligence. We can put all our efforts into developing the industry, but if the world market situation or the economic environment is wrong, we are going to fail.

In Alaska the two principal groups of people whose needs would have to be met in a fisheries education program are the young people coming out of high school and the older people who are already fishing and want to increase their skills or knowledge. The high school graduates need a 2-year fisheries course. Although there is certainly enough subject matter to keep them going for 4 to 6 years, I don't think they could sit still long enough. The university needs to run a program of extension courses for the people who are already fishing.

The first year of a 2-year fisheries program should include basic courses in mathematics, physical sciences, and marine biology. Mathematics is needed for navigation, and physical sciences in order to understand how engines, electrical systems, and fish-finding electronics work and to do an intelligent job of maintenance and repair.

The second semester of the first year should include courses in the fishing environment: the ocean and the atmosphere. The student ought to learn enough about the ocean to understand the currents and the differences in the

temperatures of water masses. This has a great bearing on one's ability to catch fish.

The school would need a 100- to 130-foot-long ship, which could accommodate 10 to 20 students or more plus captains and instructors. Seamanship, basic safety, and piloting should be taught with the aid of a school ship. By piloting, I mean how you steer a vessel through channels and use channel markers and radar. Basic things about the behavior of a hull and how to do dead reckoning should be covered. Sometimes all your electronics fail, but if you can read charts and can do arithmetic, you can do dead reckoning.

Probably about 30 percent of the time in the first year should be spent on how to catch fish: courses in fish behavior, fishing methods, and fishing gear. The students will have to learn to mend web until it's second nature. This is a necessary skill and it saves a lot of money. A course in fish preservation at sea is also necessary, to learn about bleeding and gutting, as is a course in welding.

The second year should include courses in power technology and mechanics; repair and maintenance of diesel engines; electricity and electronics, coordinated with sonar technology; hydraulics; vessel stability; and, using the school ship, courses in navigation and advanced fishing gear. A course in fishing vessel management, covering the business end of running a vessel, would also be necessary.

The school could be located anywhere on the coast if it has access to good fishing grounds. It would certainly be stimulating to the students if the school was located at a major fishing port.

As for general policies, Alaska residents should get a tuition break, the school should be open to people of other states and other countries, and exchanges with other fisheries schools should be considered.

We have to be careful, though, that we don't train a lot of people to become excellent fishermen when the market is not adequate for the catch. In this state, the development of the processing and marketing sectors is way behind the harvesting sector. One of the biggest problems facing Alaska is getting this industry in a position where it can pay the fisherman for the catch.

EDUCATING FISHERMEN, AND EDUCATING OTHERS TO APPRECIATE THE IMPORTANCE OF FISHING AS A BUSINESS

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Fishing is a business, but it has been considered by too many people to be a romantic cottage industry. There has been no real understanding of the fact that it is a business, although perhaps this is less the case since the passage of the "200-mile law" or Fishery Conservation and Management Act. It is a business of producing food, and there are problems related to trying to change the perception of the legislators and policymakers in Washington, D.C., and elsewhere as to what that business means to the United States.

The question of educating fishermen is one point we are addressing here. The question of educating educators and others to appreciate the importance of the fishing industry as an industry for food production is another question. I will address those separately. However, I would stress at the outset that there is a difference in what theoretically would be desirable in dealing with fishermen and with educators.

As far as educating fishermen goes, the State of Alaska has done a great deal of considering and talking with fishermen about what fishermen need. Pete Harris just outlined a curriculum that would make a lot of sense in light of everything that fishermen both in Alaska and elsewhere have said. There were a couple of things, however, that Pete left out which I would like to see included.

I know what I would like to see so that I could get from fishermen what I need to do the job I am supposed to be doing for them. When I told one fisherman I was coming up here and that fisheries education was the subject of discussion, he said, "Well, now let's see. He needs some marine biology with an emphasis on ichthyology, physical oceanography, chemistry, physics, some courses in civics, a course in the Fishery Conservation and Management Act, and some courses in international law." And he said, "That's just for your run-of-the-mill fisherman."

That is part of the problem. All of the things Pete Harris talked about are important but one of the things that people who get into the business of fishing have to understand is that this is the last quarter of the twentieth century, and in the last quarter of the twentieth century you don't do business in this country without spending a certain amount of time and money on the bureaucrats who are trying to mess up your business.

As a result, in addition to the technical things Pete has outlined, you need an understanding of the environment in which you do business. That environment is no longer just the ocean, but includes things like the regional Fishery Management Council, the laws passed down by Congress, and the policy decisions that the National Marine Fisheries Service and the Department of State make. These are part of the business of fishing.

I would like fishermen to have a much better understanding of the physical environment--the ocean, the fish, and so on--in which they operate. But I would also like them to understand that I have to have the information--information they take for granted and think everybody knows--to try to get the point across to the legislators and policymakers who have these marvelous ideas about what fisheries management is that frequently bear little, if any, relation to what is actually going on in the fishing industry, in the business of catching fish and selling it for food.

Regarding the need for a fisheries education program, one fisherman said to me, "A fisheries education program to train new fishermen in the state that pioneered limited entry?" That is an oversimplification, but it is one of the problems we have. Decisions about the future of the fishing industry, and this often the fault of the fishermen, are being made by people who have an imperfect understanding of the industry. Fishermen should be aware of the technical things Pete Harris talked about, but also of the framework in which they have hired me to operate. This is because frequently decisions are being made by people whose paychecks are not affected by the quality of the decisions they make, whether they are reasonable or unreasonable.

Every time I come up to Alaska, I enjoy reading the local newspapers because there is a greater awareness here than in many other places. There are a few exceptions. Oregon is one. Rhode Island is another. But for the most part, there is a much greater awareness in Alaska of the importance of the fishing industry than there is in many of the other states where the fishing industry is important.

Frequently in Washington when we try to do something for the fishermen, we run into a problem where the people at the Office of Management and Budget say, "Well, gee, Lucy, your people are less than 2 percent of the gross national product." Well, that completely overlooks the fact that we are a food producing industry. It is a strategic resource. We are the second largest part of the balance of trade deficit at $2.7 billion and we are often the backbone economically of the communities in which our people live and work. These are all points that the theoreticians in Washington are inclined to dismiss by saying, "Your people are only 2 percent of the gross national product." A very important thing that educators from all levels could do for the fishing industry is to make people all over Alaska and all over the country aware of the importance of the fishing industry from those points of view.

Yesterday John Enge said that the processing industry was not a profitable and viable business on its own, that it may not evolve, and that government may have to come in and subsidize it with great amounts of money. Well, essentially my job is to keep the government out of business. The first rule of dealing with the government is, "He who has gold makes the rules."

If people in the fishing industry take government money directly, they play by government rules.

In the development of the American Fisheries Promotion Act, Alaskan fishermen were among those most strongly opposed to a federal bailout program for the Gulf of Mexico shrimp industry. They were opposed because it was a government program with government rules about who would get the money for bailout and it called for, as the government press releases said, restructuring the fishing industry for long-term efficiency. All well and good, but the problem with the bailout program was that each fisherman who read this press release that said there would be $12.2 million available and looked at the part that said there would be this bailout program thought, "Whoopee! I am going to be saved." But the fact is that a certain percentage of fishermen will not be saved by either the $12.2 million or the bailout program, and those who will be saved will be told the terms on which they will be saved, probably when they can fish, what kind of vessel they can use, and what kind of gear they can use. It will be even more restrictive than the present fisheries management plans because it will be designed to cut down the size of the fisheries.

We have tried to say that we want from the government (1) a greater understanding of the importance of our business, and (2) an environment in which to do business. When we argue for tariffs or countervailing duties on fish products coming into this country that compete directly with our products, we are told this is not possible, that this is a free trade nation. That makes me angry. Our fishermen pay up to 50 percent more for their nets and roughly 20 percent more on electronics because of the tariffs.

Pete Harris talked about the world picture. It must be taken into consideration in development of the Alaska fisheries. We are competing in a world market. Fishermen and others in the industry must understand that modifying the way we have always done things by changing this a little and changing that a little is not going to work. We have to look at what we have done before as the basis from which to depart.

There are only two constants in the equation we are working with now, in the new importance that the fishing industry should have: here are the fish, and there are the markets. How do we get the fish to market? The kind of expertise that people who are not in the fishing business can give us includes what we need to know to do that effectively and quickly. But to do that effectively and quickly, the economists and biologists are going to have to understand that we are not a romantic cottage industry. We are a food business.

That orientation is probably the basic one that has to change in the outside perception. One of the reasons I was very happy for this opportunity to talk with you is that fishermen are very slow to understand that. The people who are trying to get this point across in the fishing industry are tremendously dedicated, but they are a very small percentage of the fishing industry. The fishing industry as a national resource needs help from other people. Educators can help improve the environment in which we do business by helping more people understand how vitally important our business is.

GOVERNMENT INVOLVEMENT IN FISHERIES DEVELOPMENT IN THE UNITED STATES

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The question I was asked to address is, basically, "Should government become involved in the development of the fisheries in the United States?" I work with the Alaska Fisheries Development Foundation (AFDF), so of course my answer is yes. And government should be involved not only in fisheries development, but also in fisheries management.

However, my answer is a qualified yes. There are times and places for government involvement, as when we move into a new area with a lot of problems and industry wants and needs government involvement. On the other hand, once development is progressing, most people in the industry would probably like things to go their own way and let business take care of business.

The most important thing is that there should be communication back and forth. There are people sitting in Washington, D.C. who very much want to help, who want to be involved, and who want to do the right thing, but they just do not have all of the necessary information. There isn't anything that makes anybody shudder more than a fishcrat, as we fondly refer to them, taking off and deciding that this is the way it is going to be and that's it. A classic example is a call I made to D.C. when I was working for the National Oceanic and Atmospheric Administration on the halibut fishery. I had been trying to understand a memo that had come across my desk. I read it and I reread it, and I just could not figure it out. So I called the guy, who was with the U.S. Department of State. As it turned out, he didn't even know what a halibut looked like. He had just finished putting some deal together for shoes, and had just taken that form in his haste, in his need to get on with the job, and used it for halibut.

So there are things like that which bring one up short very quickly and make you realize that while the industry wants government involved, the industry has a responsibility, too, and that is communication. Communication, of course, means that we must listen as well as put out the words. Anyone who has been in a position involving handling of government monies, monitoring programs, realizes that the responsibility is cut both ways.

In trying to define what the role of government should be, I have come up with a list of functions that I see as the most important, and have split them into long term and short term. The short-term functions are the most important to the industry. They are the ones that really bring home the groceries.

Before I list those, however, I should say that the Federal Government has shown an interest in and has become involved with helping the development of the fishing industry. There are those who say, "High time. It is about time they started working with us instead of against us." Others are less positive about it.

The Department of State has a change in policy which is going to greatly affect the development of the fisheries in Alaska. It is called "Fish and Chips Diplomacy." The Alaska Fisheries Development Foundation is going to work closely with the Department of State and foreign governments to develop a program which is really going to benefit our industry. The Saltonstall-Kennedy program has money for research and development. Alaska got most of their money last year. Many people support the fact that Alaska is where it is for fisheries development in the United States. We have, of course, legislation--the Breaux Bill, Fishery Conservation and Management Act, and other pieces of federal legislation--supporting development and management, and management is the key issue. It is a key role for government involvement. The executive branch came out in May 1979 with a policy supporting fisheries development which has made a significant difference in what we are going to get and see from the Federal Government versus what we saw from the last administration. We will see what happens in the next round.

These changes in the federal policy concerning fisheries development are responses to the world situation: the food stresses and the pressure on our stocks from foreign fleets. But I think another reason for the changes is that the industry is getting its act together. This is partly because of the foundations, of which AFDF is but one of six, that have memberships made up of processors and fishermen, and which work to unite the voice of the fishing industry. The industry has a responsibility to not only voice its opinions and its needs, but to come forth with a single voice.

The State of Alaska has certainly indicated its commitment to supporting the development of the fishing industry. For the most part we have not had much state money in our program. We have operated mostly with federal money, although I received a check for $18,000 from the state just the other day.

In the future we will probably see some changes in government support of the fishing industry. The support and involvement of the Federal Government are going to be more legislative and regulatory, more management-oriented, and less dollar financing. Alaskans will have to look more to the state for their dollars, if that is what they want for their fishing industry. As the industry develops and becomes stronger, it is going to need less financial support from the public sector. But the need will never go away. There will always be programs that must be funded from the public entity, because it does not pay when you are running a business to build a lighthouse for everybody else to use.

In this function of government, in financing, Alaska has a big lead over many other states. You can get both dollars and management consulting from the Alaska Renewable Resources Corporation, the Commercial Fishing and Agriculture Bank, and the state loan program. On the federal level, you have the Fishing Vessel Obligation Guarantee and the Capital Construction Fund. Those are controversial programs which will probably be short lived because

they draw criticism from the farming industry and other industries around the country, and from the fishing industry too. Fishermen are very quick to appreciate overcapitalization of a fishery, to see how it hurts them.

Right now AFDF gets more requests for help to develop processing and marketing programs than we do anything else. The risk is high, and if it is so high the private sector cannot afford it, there is the role for government; structuring a program so it does not last forever, so that it is not a subsidy. Saltonstall-Kennedy monies, for example, come from revenues generated on imports and will disappear when we have a strong industry. So the S-K program is a self-destruct program.

We need research and development. Only large companies have enough money to get involved in research and development, and the information they generate never reaches the public, never reaches the little guy. He needs that information. We receive many requests for grants from individuals, but in return for those grants, we get all the information that results and we hand it out to industry. That is the purpose of the expenditure of that federal dollar.

Another key function of government with respect to fisheries development is management. We have a huge responsibility. We do not want stocks 15 years from now that have been depleted through overfishing or indiscriminant fishing. Enough information is available, enough technology is available, and enough people have been through these problems before, that we can be smart about it. At AFDF we have an opportunity to work closely with the North Pacific Fisheries Management Council. The council is developing management plans for the same fisheries AFDF and the industry seek to develop, and we are hoping these things happen at about the same time.

We want government concern, and we want to make sure that management legislation happens, that it is responsive, and that it is gotten rid of when it no longer serves its purpose. If the Jones Act is not appropriate, let's do something about it. There is a big fight over the Jones Act, and nobody is very optimistic about it, but it is an example. It's the same way with the Capital Construction Fund and the Obligation Guarantee.

Some people feel government should not be involved in fisheries management. The North Pacific Fishery Management Council is a fabulous example of how a group of people who have been involved in the fishing industry are making decisions which really do help the industry rather than hurt it.

Government will spend the most money and have the greatest impact on support systems: the physical support systems, including harbors, docks, utilities, schools, housing, roads, and airports; and less obvious support systems such as the educational system, the communications system, and quality assurance.

Another government responsibility is improving the public attitude toward fish as good food, and the image of the fishing industry and the fishermen. It may come across in the schools, in an elementary program, or it might come across in some kind of media program that is put out for the industry.

What kind of educational system does the industry need? The industry has to determine what it needs. We need trained educators in Alaska.

When I was in Norway recently I learned that that country had not had a large fisheries education system for very long. The Norwegians have not totally resolved what they need. Their government just transferred its fisheries division from the commercial fishing department to the education department. Some people are concerned about what that is going to mean to Norway's fisheries education programs, many of which are now practically oriented. Their courses are scheduled in the villages at the times when not much fishing is going on. They are task-specific courses, like running a filleting machine, or packing fillets, or improving one's ability to trim fillets. In addition to that practical orientation, they have a fisheries university comprising a series of courses and programs in different places throughout the country. They do not have a deliberate fisheries education program at the elementary level. That is something that could be quickly placed in the Alaskan school system.

One of the things I noticed in my tour of Europe is that the government and the industry do not assume they have all the answers. This fall, at a conference in Norway, researchers and educators from that country, Finland, Sweden, Denmark, and the Faroe Islands discussed how they could share information on research and fisheries education programs, so they are working together as a team.

Our position at AFDF on fisheries education is that formal education is not an area an organization such as ours should be involved in. We do not have the funds to address this problem; and we see it as a function of the public sector. We are available to advise, comment, and suggest. If an educational program would benefit from having space available in the plants or on the boats, any of the projects we have will be flexible enough to accommodate it. We would be eager to be involved. However, our projects are focused on the commercial aspects. If we have a boat and it is out fishing, we want that boat to fish and we want it to fish as a commercial venture. We do not want to turn it into a laboratory or a training center totally, so that any training or what have you that would go on in one of those projects would go on with the understanding that it will not interfere with the commercial liability of the operation, which is our key role. Aside from that, we are eager to participate in developing a fisheries education program for Alaska.

PART II: CURRICULUM DEVELOPMENT WORKSHOPS

(THURSDAY AND FRIDAY, DECEMBER 11 and 12, 1980)

FISHERIES AND MARINE EDUCATION NEEDS IN ALASKAN ELEMENTARY AND SECONDARY SCHOOLS

Belle Mickelson,
Education Specialist
Alaska Sea Grant College Program
and
Workshop Participants

Fisheries as a food resource and a renewable resource will be more and more important to Alaskans in the coming years. Students, our future decision makers, need to be aware of the economic, social, biological, political, and cultural impacts of Alaska's vast coastal resources. Decisions made today concerning natural resources in the Interior--in Nulato and Fairbanks, Ft. Yukon and Rampart--affect the whole western coast of Alaska as the Yukon River flows to the sea. Likewise, the affects of coastal decisions, such as those dealing with the oil and gas potential of the Outer Continental Shelf, reach to the Interior.

By learning about the marine and fisheries resources right at their doorsteps, students are motivated to continue in our educational programs. Motivation comes as the students see the importance of mathematics, reading, and writing in fisheries and marine careers; as they learn nagivation, read the fishing regulations, figure taxes and keep records; and learn about the complexities of food chains. Many parents and students, particularly in coastal communities, are concerned. They feel the need to understand and appreciate their local marine environment and to be prepared for hometown jobs and the intricacies of coastal decisions.

At this conference, we heard that if the fisheries of Alaska were developed according to their potential, Alaska would rank as the ninth fish producing nation in the world. Alaskan students will have difficulty entering the traditional commercial fisheries due to limited entry and the high cost of gear, so programs are needed to investigate alternative fish-oriented occupations in home towns and villages.

To meet the needs of young Alaskans statewide, we recommend a program of school administrative support, teacher training, curriculum development, funding, and community involvement.

ADMINISTRATIVE SUPPORT

We recommend that a letter be sent to school superintendents and principals around the state stressing the importance of marine and fisheries education, acquainting them with the outcome of this conference, and thanking those districts who sent teachers to the conference. Short presentations on fisheries and marine education should be made to superintendents and principals at their yearly meetings. State-level support through the Department of

Education will filter down to the school districts and assist local interest in marine and fisheries education.

TEACHER TRAINING

More courses and inservices are needed to train teachers in the marine and fisheries education field. The University of Alaska and various community colleges are urged to develop innovative courses and methods of delivery to meet the needs of both rural and urban teachers. Processors and fishermen, government agencies, biologists, and other local resource people can assist with inservice programs for teachers. The Department of Education's Talent Bank can be used to assist in training and information exchanges.

The Northwest Association of Marine Educators can assist with professional teacher development through journal articles and conferences. A conference planned for June 14-17, 1981 in Sitka will include credit classes for teachers. The Alaska Sea Grant College Program has an Alaska Marine Educators Newsletter which keeps teachers in contact with one another and aware of new teaching materials. The Department of Education publishes the Yellow Pad which communicates with all disciplines, plus the Alaska Education News. Tundra Times and other state newspapers can be encouraged to carry articles in the fisheries and marine education field.

Two marine education one-credit courses are planned at the NEA Conference March 5-7, 1981, one for elementary teachers in Seward on the Alaska Sea Week Curriculum Series, and another for secondary teachers in Homer on Project Oceanology materials from Connecticut as applied to Alaska.

CURRICULUM DEVELOPMENT

Teachers need curriculum materials, audio-visual supplies, and resources geared to local needs. We hope all schools--private, BIA, and public--will be involved in these marine and fisheries programs. We urge the preparation of a resource directory which includes reference materials for teachers, materials for use with students, names of resource people available to both students and teachers, and an annotated bibliography. The Department of Education has volunteered their computer system to store teaching activities and resources for teacher assistance. The Alaska Native Foundation has already begun to compile annotated bibliographies of available resource material, which can be plugged into the Department of Education system. The Arctic Environmental Information and Data Center has a regional library and other state and local libraries have marine and fisheries materials.

The Alaska Sea Grant College Program is working on a suggested list of books for library purchase. Schools are urged to buy or build saltwater aquariums and binocular microscopes so that marine organisms can be studied more thoroughly.

We encourage the development of more Alaska slide shows and films on fisheries resources. Pieces of film already exist in agency files that could be coordinated into films or videotapes to address current Alaskan issues such as subsistence, oil development, marine animals, fisheries regulation, and coastal zone management. We hope the state telecommunications systems will

immediately begin broadcasting existing fisheries- and marine-oriented programs, and that they will develop new programming, including teacher guides.

At the elementary school level, the Alaska Sea Grant College Program has the Alaska Sea Week Curriculum Series which was developed in Juneau at the urging of parents there. Alaska Sea Week is being revised for statewide use and is available to local districts to test and evaluate. The Southeast Regional Resource Center is available to assist schools in their region with Sea Week.

Alaska Sea Week is a chance for students to integrate the sea into their regular classes for a week each spring or fall. The seven curriculum guides are Discovery, Sea Animals, Shells, Legends and Traditions of the Sea, Birds and Estuaries, Fish, and Man's Influence on the Sea. Several school districts are already piloting the Sea Week Program.

The Education and Resources Group, Inc. is assisting with a program for kindergarten through twelfth grade in Akhiok teaching basic science, introductory economics, and decision-making skills through a scallop culturing project involving the school and the entire community. Topics important to cover in elementary schools, through focusing on local, observable species, are food chains, biology of fishes including their life cycles and the various species, exploitation of fisheries, ecosystem interrelationships, and interdependence of life cycles.

At the statewide level, no secondary curriculum materials exist, although Ketchikan, Kodiak, and Sand Point all have vocational programs covering marine fisheries, biology, aquaculture, and seamanship. The Lower Kuskokwim School District has contracted with the Alaska Native Foundation to research source materials. The Kodiak Area Native Association is working with Kodiak Schools on secondary materials implementation. Kodiak Community College is developing navigation and fisheries law enforcement modules with plans for more modules in the future. Many schools have marine biology programs, including those in Wrangell, Kenai, Seldovia, Cordova, Craig, and Anchorage. Cordova, in fact, is planning a secondary Sea Week Program this spring.

But statewide materials are needed. We recommend a summer workshop for teachers to write curriculum with the assistance of resource people from the fishing industry, university, and native corporations. Many curriculum materials from other states can be used to assist in this effort. Topics should be integrated into English, math, science, and social studies classes as students study oceanography and marine biology, general fisheries, and aquatic ecology in their science classes; seafood preparation, cooking, and quality assurance in home economics; and subsistence food preparation and nutrition and safety. Social studies classes can tackle coastal issues. Math classes can cover the rudiments of navigation and utilize problems in figuring nautical miles and seafaring distances. All students should know about boat safety and handling, swimming, radio use, and other survival skills. The Department of Education and school districts already involved in fisheries and marine education should be consulted in developing course outlines. There are communities working as de facto pilot communities. There is a need for many more.

Vocational topics in secondary schools should include marine electronics, hydraulics, fuel systems, refrigeration, diesel mechanics, welding, fishing gear technology, marine power systems, and propulsion systems. Many of these topics are greatly facilitated by having access to boats. In Ketchikan their boat, the Sea-Ed, is used for not only vocational classes, but by many other classes involved in marine studies. Districts need to pick up insurance so that students can actually experience the ocean, and complement their studies by real life experience. A vocational marine technical center would greatly assist rural schools. The Kuspuk School District is anxious to begin a facility in Aniak. Perhaps the Seward Skill Center can also assist in this program. Anchorage and Fairbanks have career centers which can possibly assist in training. Western area schools particularly need courses in outboard marine engine repair, net technology, boat repair (both fiberglass and aluminum), fish quality control, fisheries economics, fisheries law and politics, fishing boat safety, and seamanship.

Kuskokwim Community College is working on short, intensive courses in boat-building, navigation, welding, small engine repair, net mending, net handling, first aid, survival skills, purchasing, and record keeping. Elementary schools should contain some exposure to marine careers. Students should be trained as cooks, scuba divers, mechanics, and net menders as entry level positions in the fishing industry. Quality control is important to emphasize as students learn about and experience fish processing.

The community colleges, school districts, the regional resource centers, private consultants, processors, and fishermen can all contribute to the development of a comprehensive vocational curriculum through another conference, after the presently proposed curriculum is developed and piloted.

FUNDING

We urge legislative support through the Bottomfish Coordinator's Office and the new fisheries and marine education supervisor at the Department of Education level. Various grants, processors, fishermen, the university, school districts, and native corporations are all sources of potential funding. The Department of Education needs to search out funding possibilities.

COMMUNITY INVOLVEMENT

Community involvement is particularly important for program success. Students can make community presentations about their learning experiences. Parents can be involved in assisting with field trips and inservices and being on advisory boards. Advisory boards representing various sectors of the community will insure that fisheries and marine programs meet local needs. Community fairs and festivals can encourage fishing related skills such as the survival suit races in Kodiak's Crab Festival and net mending contests at Ketchikan's Festival of the Sea. Community swimming pools can contribute to swimming and scuba diving competency.

SUMMARY

By developing a statewide comprehensive fisheries and marine education program, students will be better prepared for the complexities of coastal

decisions whose results will affect all of us for many years to come. The fisheries and marine program will require efforts by all of us--fishermen, processors, teachers, administrators, parents, native corporations, government agencies, students--as we train teachers and administrators and develop curriculum, funding sources, and community support. But the result will be Alaskans ready for the future: ready for aquaculture; commercial, sport, and subsistence fisheries; recreation; and, perhaps most important, resource management so that generations to come will enjoy the bounty of the sea.

Addendum

Dick Clark,
Curriculum Director
Lower Kuskokwim School District

If you view the December 1980 fisheries conference as a starting point for the development of a concerted effort to introduce a program of awareness at the elementary level, academic and vocational preparation at the secondary level, and professional preparation at the university level, much has been accomplished by bringing people from diverse fields together to support each other in a common effort.

Three groups worked separately on the program from the perspectives of kindergarten through twelfth grade development, vocational and technical concerns, and university programs. This process involved introducing position papers about their individual concerns and reporting to the total group. Time and format did not permit a work-study group made up of representatives of the three groups.

It appears that the next step in the process is to bring the groups together to write a skeletal outline identifying the specific components that would represent an exemplary program that individual school districts could use as a base for the development of programs unique to their own areas.

The sequence of events in the marine and fisheries education program development process should be as follows:

1) Identify need--accomplished at December conference.

2) Literature search.

3) Writing conference--rough draft on program development.

4) Disseminate for comments (possible public hearing).

5) Incorporate comments into position paper (program).

6) Develop resource directory.

7) Implement fisheries and marine education plan.

PLANNING FOR VOCATIONAL AND TECHNICAL EDUCATION

Outline Submitted by
Hank Pennington,
Marine Advisory Program
University of Alaska
and
Terry A. Whitbeck,
Fisheries Education Supervisor
Alaska Department of Education

Who needs vocational and technical training?

1) Secondary students--those entering the industry.
2) Entry level--those out of school, age 16-80, with no skills.
3) Industry--those who are employed and need:

   a) basic skills,
   b) update of existing skills, and
   c) retraining in a new technique or occupation.

CURRICULUM AREAS

Five needed curriculum areas were identified: fishery resource management, harvesting, seafood production, business and marketing, and aquaculture and mariculture.

Fishery Resource Management Skills

Orientation to Resource Management
Communications--oral and written
Management and Conservation
Laws and Regulations
Economic, Social, and Political
  Implications of Management Decisions
Applied Fisheries Oceanology

Harvesting Skills

Seamanship
Safety and Survival
Marine Engineering
Fishing Gear
Maintenance and Repair
Cooking
Communications
Navigation
Ergonomics
Quality Assurance
Marketing
Laws and Regulations
Sanitation
Waste Disposal
Business and Recordkeeping

Seafood Production Skills

This section focuses on the operation of the seafood plant by technical specialists.

Production Overview
Quality Control
Refrigeration
Machinist--To include plant maintenance, electrical, power units, generator sets, portable engine, retort steam, water and waste, rolling stock, and hydraulics.
Personnel Management
Personnel Safety

Seafood Production Management Skills

This section focuses on the management of the seafood plant by management/ technical specialists.

Seafood Technology and Production Management
Food Processing and Preservation
Marketing Strategies
Laws and Regulations
Water and Waste Management
Accounting
Operation and Maintenance of Processing Equipment
Quality Control and Quality Assurance
Sanitation Policies and Procedures

Business and Marketing Skills

Marketing
Distribution
Promoting
Clerical and Office Skills
Permits
Consumer Education
Retailer Education
Finance
Taxes
Insurance
Bookkeeping: payroll, profit and loss, budgeting
Recordkeeping: fish catch records, engine logs, depreciation, and record retention.
Laws, Regulations, Political Process
Quality Control and Quality Assurance
Domestic and International Economic Overview
Planning and Scheduling: decision-making and research skills

Aquaculture and Mariculture Skills

Orientation to Mariculture and Aquaculture
Fish Husbandry (Rearing Technology)
Species Life Cycles
Species Pathology
Water Quality Testing
Water Systems
Site Location
Holding, Harvesting, and Marketing
Data, Statistics, and Records
Sanitation and Waste Control
Mechanics, Electricity, and Electronics
Stock Assessment
Experimental Design and Research: Systems and Gear
Permits, Laws, Regulations, and Politics

RECOMMENDATIONS

Recommendations for Local Consideration

Local needs should be demonstrated.

Local programs and delivery systems should be designed to meet those needs.

Should consider local programs, resources, materials, and planning done in other areas of Alaska. Cooperation and coordination between other programs and industry should occur.

The instructor is the key to successful fisheries and marine education. Care should be taken to select instructors with work experience in the curriculum area.

Coordination and cooperation must occur among educational institutions so that comprehensive planning can take place to ensure that the duplication of equipment, facilities, and resources does not occur in fisheries education.

It is imperative that Alaska native groups be actively involved in fisheries and marine education planning and implementation.

Packaged programs need to be developed for delivery to rural areas which consider the local needs of the students.

Local programs need to promote, to a maximum extent, contacts with industry for supplying faculty, facilities, or both.

Both hands-on experience and on-the-job training need to be an integral part of a vocational and technical program in fisheries and marine education.

Interface with industry should be a top priority of vocational and technical fisheries and marine education at the local level.

Recommendations to State Entities

The state should develop a resource bank of facilities, materials, and personnel which includes industry resources.

A fisheries and marine advisory committee made up of industry, educators, and Alaska native representatives needs to be established to oversee the development of fisheries and marine education in the State of Alaska.

A directory of state and federal agencies, organizations, and educational institutions and groups that may be able to provide services and information to fisheries and marine education programs needs to be developed and disseminated.

It is imperative that Alaska native groups be actively involved in fisheries and marine education planning and implementation.

Packaged programs need to be developed for delivery to rural areas which consider the local needs of the students.

Promote to a maximum extent, contracts with industry for supplying faculty and facilities.

UNIVERSITY LEVEL PROGRAMS

SURVEY OF EDUCATIONAL NEEDS OF FISHERIES BIOLOGISTS

John Clark, Chief of Research
and
Ben Van Alen, Fisheries Biologist
Commercial Fisheries Division
Alaska Department of Fish and Game

An education survey was conducted in the Commercial Fisheries Division of the Alaska Department of Fish and Game (ADF&G) during November and December 1980 and January 1981. The survey was aimed at determining the academic backgrounds of Commercial Fisheries Division personnel and what their interest is in continued education. The survey was completed by all permanent personnel in the division. The material presented here summarizes the results of the survey.

The total number of respondents was 192. For analysis of the survey, the respondents were divided into four groups, as follows:

Group	Job Type	Number
1	Biologists (Fishery Biologists I, II, & III)	103
2	Supervisors (Fishery Biologist IV and higher)	15
3	Administrative and clerical staff	50
4	Scientific support staff (Biometricians, programmers, pilots, and others)	24

Of the 150 degrees reported by Commercial Fisheries Division biologists and supervisors, 113 (75 percent) are B.S.'s, 34 (23 percent) are M.S.'s, and 3 (2 percent) are Ph.D.'s. (The American Fisheries Society reported that in 1979 the educational index of ADF&G fisheries biologists ranked 40th among the 50 states [Fisheries, May-June 1980].) Most degrees were received outside of Alaska: 89 percent of the B.S. degrees, and 76 percent of the M.S. degrees; only one of the three Ph.D.'s was awarded by the University of Alaska.

Most of the Commercial Fisheries Division personnel felt that their education prepared them well for ADF&G work. The biologists were satisfied with their ability as resource scientists, but less satisfied with their ability as personnel supervisors or managers or as budget managers. Most of the biologists, supervisors, and scientific support staff felt they did not need

fourths of the administrative/clerical and scientific support staff felt they needed additional training to prepare them for promotion or transfer.

Personnel in all job classes felt a broader education and training program would improve their job performance and increase their satisfaction with the State of Alaska as an employer: 76 percent of the biologists, 86 percent of the supervisors, 85 percent of the administrative and clerical staff, and 95 percent of the scientific support staff. Personnel in all job classes also felt that ADF&G does not place adequate emphasis on training and education: 77 percent of the biologists, 86 percent of the supervisors, 82 percent of the administrative and clerical staff, and 100 percent of the scientific support staff.

Eighty percent of the division's personnel would participate in an education and training program if one existed. If a state-supported return-to-college program existed, the following personnel would participate: 51 (50 percent) of the biologists, 3 (20 percent) of the supervisors, 23 (62 percent) of the administrative and clerical staff, and 15 (65 percent) of the scientific support staff. Of the personnel who would participate in a state return-to-college program, over 60 percent of the biologists, supervisors, and scientific support staff, and 30 percent of the administrative and clerical staff wish to apply course work towards an advanced degree.

Approximately 55 percent of the division's personnel would enroll for a short course if ADF&G paid all course costs, 28 percent would enroll if partial support was provided, and 14 percent would enroll if no financial support was given. The conditions for enrolling in a short course were felt to be best left between the employee and his or her supervisor. Most people would not object if they were required to complete the course or reimburse the state for expenses.

The most desirable form of course work for all job classes is part-time, and the least desirable form is correspondence (Table 1). Additional education in mathematics, business, and fisheries sciences is desired by personnel in all job classes (Table 2). Sampling and statistics, population dynamics, resource management, technical writing, and resource economics are the top science courses desired (Table 3).

The results from this survey show that there definitely is a need within ADF&G for a continuing education program. Personnel from all job classes would participate. Most people are interested in part-time and short courses, but not in applying them towards an advanced degree. However, some of the staff are interested in participating in a return-to-college program which would lead towards an advanced degree. The Commercial Fisheries Division should establish a broad education and training program.

Table 1.--Results of Survey Question: "If you want to take a class or classes, what form would this course work ideally take, ignoring job constraints, etc.? (rank numerically, 1 for first choice, etc.)."

Options	Ranking by-- Biologists	Supervisors	Admin. & Clerical	Scientific Support
Part-time during work hours, if leave provided	1	1	1	1
Short courses	2	2	2	3
Evening courses	3	3	3	4
Full-time on campus	4	4	4	2
Correspondence courses	5	5	5	5

Table 2.--Results of Survey Question: "If you want to take a class or classes, what type of training do you think would benefit you most? Mathematical sciences ___, Fisheries sciences, ___, Business and personnel management ___, Other fields* ___."

Options	Number of Affirmative Responses Biologists	Supervisors	Admin. & Clerical	Scientific Support
Mathematical sciences	65	6	11	13
Fisheries sciences	51	7	11	6
Business and personnel management	50	10	37	9

*Under "other fields" 33 respondents listed computer sciences, 8 listed data processing and management, 4 listed report writing, and 4 listed law.

Table 3.--Results of Survey Question: "Within the science category, number by priority the specific type of training you would sign up for if available to you, using 0 for not required and 1 for first preference. Reuse numbers for items of equal rank."

Type of Training	Ranking by-- Biologists	Supervisors	Admin. & Clerical	Scientific Support
Sampling and statistics	1	1	2	1
Population dynamics	2	3	6	2
Resource management	3	2	4	3
Technical writing	3	4	1	4
Resource economics	4	1	3	5
Marine sciences	5	4	3	6
Ichthyology	6	5	6	6
Freshwater sciences	6	6	5	7
Bioclimatology	7	6	6	6
Hydrology	8	7	7	7
Genetics	9	6	5	7
Chemistry and physiology	9	7	5	6

CURRENT PROGRAMS AT THE UNIVERSITY OF ALASKA

Fisheries Education for Alaska--Today and Tomorrow

Hank Pennington, Editor
Alaska Seas and Coasts

For most Americans the era of Jacques Cousteau stirred a romantic awareness of the world's oceans. Many quickly unfurled the banners of preservation and conservation with little understanding of the relationships and distinctions between the concepts.

In the same breath we talk of the rape and plunder of the oceans' resources, and yet say that the oceans are the world's hope for a continuous supply of protein. Today, in the minds of many, the fishermen of the world and the fishing industries embody some fuzzy blend of world saviors and condemned pillagers confused with the romantic notion of "going down to the sea in ships."

Within the industry the concepts of full-scale harvesting of resources at levels that meet world need, but tempered by the concept of sustained yield, are similarly fuzzy. Complicated by rampant inflation and state, national, and international politics, the free life of pulling a fish from the water and selling it has lost its romance. Around the world, huge factory fleets follow the dwindling schools of protein, daily rousing new fears that man can indeed overharvest the "limitless resources of the world ocean."

The State of Alaska views its wealth from oil and gas as a short-term source of essential funds for development of its renewable resources, especially fisheries. Both the fishing industry and the state recognize that if those fisheries, once developed, are truly to be renewable, they will have to be carefully and professionally managed: the harvest of the resources and the production of fisheries products must be efficient and profitable.

If development of the fishing industry to its fullest sustained potential is to be a realistic goal of the state, it follows that the state must place high priority on the understanding and solution of the problems facing that industry and the management agencies.

In all nations, universities have assumed the roles of performing basic and practical research and of training the people needed for problem solving and development.. In the United States these activities are focused on the needs of local communities and individuals through the training and information services of an extension program. The University of Alaska has offered these services within the limits of its funding and personnel, but it also recognizes that the present and future needs of the fishing industry, the coastal communities, and the State of Alaska far exceed the university's present capabilities to respond effectively.

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*From Alaska Seas and Coasts, Volume 9, Number 1 (February-March 1981).

Over the last six months, the University of Alaska and a panel of experts on fisheries and education have studied the present and future needs of the fishing industry and management agencies. Based on their evaluation, the university and the panel developed a 10-year plan for the improvement and expansion of education, research, and public service programs.

In this issue of Alaska Seas and Coasts a brief description of that plan is presented along with a summary of the University of Alaska's present capabilities and activities. We invite you to review the materials, and based on your experiences with the industry, give us your criticism and comments. If the University of Alaska is to develop and improve its capabilities to work with the industry and the management agencies, its plans must be based on a clear understanding of the problems and needs. Only through the direct cooperation of the people of the industry, the University of Alaska, and the management agencies can we maintain proper emphasis and focus in fisheries education programs.

Vocational and Technical Fisheries Education and the University of Alaska

John P. Doyle
Marine Advisory Program

A Fishery Industrial Technology Center is proposed as the hub of vocational fisheries education in Alaska. To be located in one of the state's major fishing communities, the Center will be a joint industry-University enterprise. It is the major effort in the University's proposal for extensive improvement and expansion of its technical and vocational fishery programs.

Researchers at the Center will pursue the development of new technology for the fishing and processing industries. Technical assistance will be available through the Center for individuals and businesses in the application of the new advances in technology and in the development of new business ventures. The community college system will provide development of curricula, training, and instruction in fishing and food processing.

The core of the activities of the Center will be fishing technology and seafood processing science and technology. In fishing technology, the programs will include development and training in the use of more energy efficient gear types, gear that is less destructive of other resources, and new fishing methods and fishing operations.

Applied research and development in seafood processing will include improvement of existing techniques and the development of techniques for handling new resources. And as the industry leans ever heavier on technology and new skills, continuing education must be part of anyone's life whose business is fishing. The University of Alaska's plan provides for the active fisherman whose job must be the first priority of business, and for whom course work and study have to be meshed in where and when they will fit. The Marine Advisory Program and the community college network are to be expanded to meet this growing need.

The Marine Advisory Program is designed to deliver information through one-to-one encounters, workshops, seminars, and publications. Presently general agents are located in Kotzebue, Atmautlauk, Kodiak, Cordova, and Petersburg. There is a staff of specialists in Anchorage in the fields of seafood science, aquaculture, marine safety, fisheries and marine biology, and business management.

Formal Degree Programs in Fisheries at the University of Alaska

Donald H. Rosenberg, Director
Alaska Sea Grant College Program

A university's traditional role is to educate and train people, to do basic and practical research, and to extend information to the public. The University of Alaska has acknowledged that in a state where fisheries are as important as they are here, the state university must provide excellence in fisheries education. The direction and approach for expansion and improvement of fisheries at the University of Alaska are outlined in its 10-year plan. This plan describes in detail the personnel, facilities, and resources which will be necessary to provide what Alaska needs.

This improvement and expansion in fisheries and marine affairs at the University of Alaska will include academic programs for training management personnel and industry and community leaders.

The proposed programs will help Alaska manage and develop its natural and human resources to their fullest potential, while ensuring that "sustained yield" and "profit" are not just the latest jargon from a growing body of scientists, managers, and public servants devoted to the maritime industries.

The University of Alaska now offers a Bachelor of Science degree in Fishery Science; Master of Science degrees in Fishery Science, Fisheries Oceanography, and Marine Biology; and an Associate of Applied Science degree in Marine Technology (fishing option).

The expansion that is planned will add an Associate of Applied Science in Seafood Technology, a Bachelor of Science in Fishing Technology, Master of Science degrees in Fishery Resource Management (non-thesis), Limnology, Seafood Science Food Technology, Fishing Technology, Ocean/Marine Policy and Law, and Marine Affairs. A Doctor of Philosophy degree will be available in Fishery Science.

You can obtain a copy of the Fisheries Education Plan (Sea Grant Report 81-1) from the Alaska Sea Grant College Program, University of Alaska, Fairbanks, Alaska 99701, telephone (907) 479-7806.