TECHNOLOGY OF THE FISHING INDUSTRY  
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COMMUNITY COLLEGE-LEVEL PROGRAMS:  
CLATSOP COMMUNITY COLLEGE, ASTORIA, OREGON

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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 Chromoscope 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 ecometer, 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.
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.

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.

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.

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.

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 riggs 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? Thebiologists 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, Espco 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 Mette 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.
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.
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 serving 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 really 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 longer, 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 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 breeding 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 peo-
ple 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 stu-
dents 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. Depend-
ing 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 situ-
action has resulted mainly from increased operating costs,
and increased competition from imports and other food pro-
ducts. Over-investment in boats and gear has added to the
problem. Also, problems of maintaining quality have pyra-
mided 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 Schmeringer 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.