FUTURE OF THE RESOURCE IN ALASKA’S OFFSHORE WATERS

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ABSTRACT

Since implementation of the Magnuson Fishery Conservation and Management Act of 1976, the fisheries of the North Pacific Ocean have reversed from dominance by foreign interests to 100% American in 1989. Though the commercial fishing industry in Alaska is typically associated with salmon, the groundfish resources of the Bering Sea and Gulf of Alaska have supported an annual harvest of about two million metric tons for the past several years.

There are 10 commercially viable species of groundfish including: pollock, cod, atka mackerel, soles and flounders, sablefish, rockfish, and perch. Pollock forms the primary source of raw material for the manufacture of surimi, a flavorless paste from which a variety of imitation fish and meat products are produced. Cod forms the basis for several other products processed at the Alyeska Seafoods plant in Dutch Harbor. These products include the front portion of the face, the stomach, roe, and milk. As processing methods and markets evolve, more and more protein that has been either discarded at sea or ground to meal is being processed to a widening variety of food products.

Some feel there is no end to the plentiful fisheries of the North Pacific Ocean, yet within the next year the fishery is in jeopardy of overcapitalization, which has led to the collapse of virtually every other commercial fishery in U.S. history. None have been singled out as declining, but wasteful harvest techniques may be creating a bust cycle for some species. Fishermen have to discard whatever portion of their harvest is illegal or unprofitable to keep. The harvest by bottom trawlers during 1989 was 330 million pounds, with the incidental harvest estimated at 160 million pounds.

Roe-stripping of pollock has been an accepted practice until 1990. This activity consists of separating the female pollock from all other fish, removing the mature roe, and discarding everything else. This wasteful practice was responsible for the premature closure of the pollock fishery in the Gulf of Alaska during March 1989. Resolution of the issue of waste will require the efforts of both government and industry. We all have a responsibility to assure that the groundfish resources of the North Pacific are managed in a manner to make them available for future generations.

GROUNDFISH HARVEST

Commercial fishing in Alaska has typically been associated with the harvest of salmon, yet annual groundfish harvests in the Gulf of Alaska and the Bering Sea have approximated two million metric tons in the past several years. If it were considered a separate country, this volume of harvest would rank Alaska eighth in the world as a source of fish protein. The groundfish resource in these waters includes 10 commercially viable species: pollock, cod, atka mackerel, soles and flounders, sablefish, rockfish, and perch. The Alaska groundfish industry has provided opportunities for developing products that would not be practical in other fisheries. One such product is surimi, a flavorless paste that can be molded into a wide variety of imitation fish and meat products.

Pollock forms the primary source for all surimi producers in the North Pacific (Figure 1). In recent years, the annual harvests of pollock have been regulated at just over one million metric tons. The lucrative harvests during the early 1970s were followed by what appeared to be a precipitous decline. Without implementation of the Magnuson Fishery Conservation and Management Act of 1976, the pollock and other resources might well have declined beyond the possibility of recovery.

The Magnuson Act gave the Secretary of Commerce regulatory authority over fishing from within three to 200 miles off American shores. The vehicle of}

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this authority in waters off Alaska is the North Pacific Fishery Management Council. When it became law in 1976, there were few American fishermen harvesting bottomfish in the North Pacific. At that time, trawlers and processors from Japan, Taiwan, Korea, the Soviet Union, and Poland comprised the bulk of the fishing fleet and the pollock resources were considered inexhaustible. Since enactment, the fleet composition converted to 100% American fishermen in 1989, and under guidance from the council, the harvests of groundfish from the North Pacific Ocean have sustained a rapidly expanding fleet of fishing boats and processor vessels.

Although pollock constitutes the bulk of the groundfish harvest, the ex-vessel value of other, less abundant species is higher and accounts for a larger portion of the overall revenues generated. For the past two years, the combined revenues for groundfish in the North Pacific have approached $250 million (Figure 2). It is hoped that as the markets for fish by-products evolve, more and more of the protein that has been ground to fish meal, and in particular that which is being discarded at sea, will instead be processed into a widening variety of food products.

As has been established by the North Pacific Fishery Management Council, the harvest of pollock this year will be more than 2.7 billion pounds. Alyeska Seafoods purchased more than 175 million pounds of pollock in 1989 and produced 30 million pounds of surimi, 5 million pounds of meal, and 200 thousand gallons of fish oil (Figure 3). The fish meal was produced from unusable skin, bones, viscera, and flesh that automatic filleting machinery cannot remove.

One immediately useful by-product of pollock is the oil removed from the flesh during processing. A gallon of diesel fuel in Dutch Harbor currently costs more than a gallon of fish oil. Fish oil is burned in boilers at Alyeska Seafoods and constitutes an immediate benefit from processing. Roe production amounted to less than one half of a percent in terms of weight, and occurs over a limited period in the spring when the female pollock are sexually mature.

Alaskan surimi production during 1989 is estimated at 100,000 tons, twice the level of production in 1988 (Figure 4). Two land-based plants operating year round in Dutch Harbor, one in Akutan and two in Kodiak, produced approximately 30,000 tons of the total. The remaining production was divided unequally among 13 at-sea surimi processors, six of which are at sea year round. Twenty and fifty percent, respectively, were exported to Korea and Japan, and the remaining 30 percent was transferred to imitation crab producers in the United States.
Figure 2. Ex-vessel value of pollock and other groundfish, 1984–1989.

Figure 3. Products derived from raw pollock in 1989, Alyeska Seafoods. Total raw pollock was over 175 million pounds.
Pacific cod is another important fish that we've been able to market in various forms (Figure 5). The bulk of salt cod we produced from the more than one million pounds of fish purchased was exported to Korea. Special markets for the front portion of the face, the stomach, and milt, as well as roe, exist in Japan, Korea, and Portugal. Any remaining body fragments were processed into fish meal.

Last year, Ayleska Seafoods processed more than 200 million pounds of seafood including salmon, scallops, herring, and various species of crab, in addition to pollock and Pacific cod (Figure 6).

The high seas fisheries of the North Pacific have been operating at an increasingly frenzied pace since the late 1950s. To some there is no end to the plentiful fish resources. However, we have seen a decline in the Shelikof Strait pollock biomass and there is concern in many areas over the impact of unregulated fisheries in the Exclusive Economic Zone on the health of the stocks in the Bering Sea. In the course of human history, periods of seemingly endless resources have always spawned a decline. I need only mention the Alaska king crab, Kodiak shrimp, and the California herring. We hope there will be no more harvest-accelerated collapses in Alaska.

**FISH WASTE**

An area of concern to all in the groundfish fishery is the non-utilization of fish and fish waste in the present fishery. Different gear types account for varying degrees of mortality in fish caught, and despite the high mortality inflicted by some gear types, regulations and economic pressures forbid the retention of several species even if the fish is dead.

Wasteful harvest techniques brought upon by overcapitalization and the struggle by fishermen to catch a larger percentage of a finite harvest allocation may lead to a bust cycle for several fish species. The amount of fish caught and discarded is difficult to estimate because little reliable information is currently available. Trawl nets account for a great deal of discarded fish each year because they scoop up anything that will not pass through the webbing. Groundfish typically dwell at great depth, and the rapid ascent in fishing gear causes shock and usually death. In spite of efforts to avoid over-filling their gear, trawl fishermen occasionally bring in too much fish and the gear physically cannot be brought on board. In this instance fishermen have to release the excess fish, which may all be dead.
The harvest of groundfish species by bottom trawl off Alaska in 1989 was 330 million pounds. One recent estimate states that up to 160 million pounds of other fish were incidentally harvested and discarded that season. In addition, depending upon the time of season, some fish have poor flesh quality, as in post-spawn pollock or sablefish which are found with jellied flesh. Fishermen have to dump hundreds of millions of pounds of fish each year because it's illegal or unprofitable to keep everything.

Wastage includes not only the discard of excess, unusable, or prohibited species catch, but also the discard of undersized fish and body parts after processing. Until it was made illegal this season, roe-stripping of pollock has been a legitimate practice in the North Pacific. During the pollock spawning season in March and April, it became more economical to harvest pollock, separate the females, and remove only the mature roe. All other fish, including the carcasses of the females, were then discarded at sea without further processing.

An example of this practice occurred during March of 1989 near Kodiak Island. A fleet of 17 vessels, some up to 340 feet long and costing about 35 million dollars, harvested more than 37,000 metric tons of pollock in just 11 days, saving only the roe as product. Approximately 35,000 metric tons, or over 77 million pounds, of pollock was discarded over the side. No estimates are available for incidentally harvested species.

There are five land-based surimi plants in Alaska, and two of those plants are in Kodiak. These two plants were forced to stop production and lay off workers when the pollock allocation in the Gulf of Alaska was reached and the season closed. By the beginning of 1991, the seafood industry's ability to harvest and process the fisheries resources of the Bering Sea will exceed the available resource. This overcapitalization will cause reduced fishing seasons as the allowable catch is taken before the year is over. Each individual operator will therefore have increasingly smaller amounts of product to process and market. As competition for the finite fisheries allocations increases, the owners of the modern fishing vessels will look for innovative ways to increase their share of an allocated resource. One such innovation was the capability to catch and subsequently process surimi at sea, an innovation that is expensive, and necessitates a bountiful
catch to prove profitable. A more recent innovation is a "mega trawl" net. This type of net will be deployed in the North Pacific Ocean this year and is of sufficient size to engulf the entire Egan Civic and Convention Center in Anchorage.

By now it should be clear that under present regulatory regimes and harvesting and processing methods, enormous amounts of protein are either wasted or are being returned to the ecosystem. The requirement that perfectly good fish be discarded as prohibited species is seen by some as being morally offensive and by others as a necessary management tool. The discarding of unwanted species is a long standing practice, but as we are starting to see in the Gulf of Mexico shrimp fishery, discarding "scrap" fish can raise both environmental concerns and concern for the health of the stocks that are being discarded.

**MANAGEMENT OF THE RESOURCE**

It will take cooperation by the regulatory agencies and industry to find uses for fish presently being discarded, and economic pressure to maximize returns from harvested fish will very likely lead to increased attempts to make better use of protein that is now being discarded.

In the meantime, resolution of the issue of discarded fish or processing waste will require balancing of fishery management and economic operating considerations. It will be the task of the North Pacific Fishery Management Council and the National Marine Fisheries Service to try and strike a balance. In the face of all these concerns, however, we must never lose sight of our most important objective—the maintenance of a vital biological resource. Those of us who have been engaged in Alaska fisheries over the past 25 years have seen a number of boom and bust cycles. We are at a stage where the Alaska salmon resource appears to be in a healthy condition following a number of years of reduced returns. We are still living with the results of the shrimp and king crab collapse, and we saw the scallop industry in the Gulf of Alaska disappear virtually overnight. Alaska's groundfish resource is our last chance. We all have a responsibility to see that it's managed in a manner to make it available for generations to come.
TRENDS FOR THE FUTURE

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In being asked to discuss trends for the future, I was given a very broad scope—trends in what? And how far into the future? I think 10 years ahead is ambitious enough; and I will concentrate on fish meal—production, uses, and quality.

"Trends" is an appropriate term, as changes in fish meal quality and use have been gradual, and are continuing. To review them, one needs to look back for about 10 years, in some cases 20 years.

World production of fish meal at present is about 6.5 million metric tons. Figure 1 shows the proportion of world fish landings, which total about 92 million metric tons, converted to fish meal and oil. You will note that about 30% of this still represents the largest single use of fish.

Figure 2 shows production with exports. Chile, Japan, and Peru produce around one million tons each. The 1986 world production of fish meal was 6.7 million metric tons, the highest production yet attained. The last official total available is for 1987, at 6.4 million metric tons.

There is always a considerable delay in obtaining the world total. Although some countries report their total production promptly and accurately, others, such as the USSR, are notoriously slow in producing statistics.

My own estimates for 1988 and 1989 respectively are 6.4 and 6.5 million metric tons. 1986 was the year of the maximum production to date, 6.7 million metric tons. To put this in perspective, production in 1970 was about five million metric tons, and the first six million metric ton year was 1984, with 6.08 million metric tons. Last year, Chile produced 1.33 million metric tons, Peru produced 1.10 million, Denmark 324,000. These figures I obtained from the International Association of Fish Meal Manufacturers.

You will note that Japan is not a major exporter. Actually with its import-export trade, it is a net importer. The great preponderance of exports comes from Chile and Peru. Iceland exported more than it produced, due to carryover of stocks. Iceland normally exports a high proportion of its production. World exports are about half of total world production. The USSR, while a significant producer, is not an exporter at all.

Figure 3 shows fish meal relative to other world protein meals. Fish meal is only 7% of the world production of over 90 million metric tons, dominated by soybean meal.

As to the uses and changes in use, as shown in Figure 4, world poultry meat production is about 30 million metric tons. About 3.5 million metric tons of fish meal goes into poultry diets, or 55% to 60% of all world fish meal production. What develops here is obviously critical to the future of the fish meal industry. Present indications suggest strongly this use will decline. Substitute proteins and synthetic amino acids will be formulated in by the computer. One poultry feed producer has already described fish meal as "an expensive luxury."

This brings us to the growing worldwide aquaculture industry. Where is the fish meal used? And where will it be used? There are wide variations between species, with the maximum use in such species as salmon and low levels in such species as catfish. The price and availability of fish meal could affect the future species mix.

Figure 5 shows fish meal use in aquaculture in 1987 and 1992. At present, about 10% of world fish meal is used in aquaculture feeds. This is projected to increase to 14% in 1992 and to around 20% to 22% in the year 2000.

To see trends in the characteristics and quality of fish meals, we can start by looking back about 20 years. There were some false starts, but better quality meals started to be produced in Scandinavia, especially Norway. Considerable work was done on fish protein concentrate for human consumption. Special fish meals were developed for fur bearing animals,
particularly mink. Hence, the introduction of NorSeaMink.

About that time, salmon farming was developing in Norway, and the positive effects of high-quality fish meal on fish health and growth were soon recognized.

NorSeaMink was used successfully in diets for salmon. An even better quality, Norse LT 94 was introduced in 1979. This still sets the standard for fish meal quality; it has been developed and improved over the last 10 years. Danish Special A and other superior grades have also appeared. In 1988, 68% of Norway’s fish meal was of special quality, and this proportion is still increasing.

The special quality meal has required changes in equipment, in the quality control of the raw material, and, I would stress, the method of operation of the plant. A common misconception is that you just buy the equipment and you are in business. This sometimes carries through in the promotional literature. I saw a brochure that asked the question “What is LT meal?” And answered it, “Quite simply it is fish meal dried by a special low temperature drying process.” That can be a fatal misconception. It is vital to control the quality of raw material, the processing parameters, and the storage and handling of the meal.

Raw material freshness depends on storage time and storage temperature. This includes all the time until the fish enters the cooker. Particularly in South America, one may see fish delivered in eight hours which then can take 36 hours to run.

Ice is used in Norway but not in South America. Used ashore ice may cost $10 to $14 per ton. To cool the stored fish effectively, this equates to $10–$14 per ton of fish meal. That doesn’t look bad if you consider going from FAQ (fair average quality) to LT quality meal with the cooled raw material.

One sees other details of process control as important—for example, blood water accumulates in stored fish and spoils much more quickly than the fish. It finishes up in the solubles and hence in whole meal. But blood water can be drained continuously and chilled, or used only in batches of solubles for lower quality meal.

I will summarize here. What do we see over the next ten years?

1. We see the proportion of world fish meal going to aquaculture feeds up to around 20%, or about 1.3 to 1.5 million metric tons.
2. We see a considerable increase in the proportion of LT quality meals.
3. We see an increase in competition for lower quality fish meal by substitutes. This will mean the premium for LT meal over standard quality increases in percentage terms.
4. While fish meal may be an “expensive luxury” for poultry diets, it will be a very necessary ingredient of many aquaculture diets. But quality and consistency will be essential, and will be measured more critically than they are now.

There are some other concerns to address: Salmonella contamination of fish meal has been a recent
Figure 2. World fish meal production and exports, 1986.

Figure 3. Major protein meals, 1986.

major focus in the United Kingdom. We must ensure Salmonella-free fish meal. This requires attention to detail in both plant design and operation. Plants need to be designed to be sanitary, with proper cleaning systems and sanitation programs.

These problems are being addressed, with clean in-place, sealed systems, and superior design going into many new plants. At one new plant in southern Chile, I was shown how they have even eliminated "I" beams where dust can collect, and the whole plant has smooth, closed-box-section structural steel. Infected dust can be a source of Salmonella contamination.

In storage of meal, we see much more use of silos, both for sanitary purposes and to enable blending for better consistency. Variations in analysis within lots will not be acceptable.

Environmental concerns will increase the demand for low-ash fish meals. Already Denmark has regulations limiting phosphorus discharge from farms and phosphorus content of the feed, and requiring—already—a 1.2:1 conversion ratio, shortly to be 1.0:1. This can only be achieved by special quality, high protein-low ash fish meals.

This sort of regulation can be expected to be copied elsewhere. After 1992, when many economic barriers in Europe are removed, regulations such as the Danish one probably will be adopted in other European Eco-
Figure 4. World animal meat production in 1987, dressed weight. Aquaculture production is projected for 1992.

Figure 5. Fish meal use in commercial aquaculture.
nomic Community countries. Incidentally, this also means that dry feeds will further displace wet feeds. Wet feeds are already prohibited in Denmark. To illustrate what is possible, in 1974 Denmark’s trout production was 12,000 metric tons, and feed used was 60,000 metric tons wet, 4,000 metric tons dry. By 1987-88, production had almost doubled to 22,500 metric tons, and this was produced on 36,000 metric tons of feed, all dry.

Finally, to look beyond 2000, I am sure aquaculture production of fish will continue to grow. As demand for seafood continues to increase and the human consumption of wild fish remains static or declines, I expect the use of fish meal by aquaculture to continue to increase, until over half of all world fish meal is used to feed fish and shrimp. The quantity now used for poultry will be used for fish and shrimp—the necessary quality standards, especially raw material quality, being met.

QUESTIONS AND ANSWERS

Q. What is TROUW?
A. TROUW International is owned by British Petroleum, and it’s the parent company of many fish feed companies. It’s the specialty feed arm of British Petroleum. BP Nutrition’s sales are about $4 billion. They are active in aquaculture feeds in most parts of the world, most recently in Chile and Thailand, but earlier in Norway, Canada, and the U.S.

Q. In working toward an ideal ash level, what do you consider an optimum or desirable phosphorus requirement in a salmon ordered ration? How low should the ash be to have the phosphorus make a maximum contribution?
A. Phosphorus content in the feed should be about 1%. That would mean in very round figures 2% phosphorus in the fish meal, and that relates to something on the order of 11% or 12% ash. Of course, you can blend meals, and if you have a very low-ash meal on the order of 7% or 8%, then that enables you to use some higher ash meal with it. But, it doesn’t mean that all the fish meal used in the feed would have to be on the order of 7% or 8%.

Q. As in herring meal, 11% or 12% would be desirable?
A. Yes.

Q. You have indicated that aquaculture will consume up to 20% of the fish meal output. You also kept at level the total fish meal production. Is that going to change from the 6.5 or 7 million tons you expect?
A. There’s a suggestion that it might decrease by about 5%. But how often have biologists been wrong? How often have they said, “We have a huge resource,” and it disappeared the next year? But the catches have been holding up well, and the key people, the Peruvians and the Chileans, are reasonably confident that they are managing the resource well. And they are becoming tighter in management.

Maybe this possible slight decrease will be replaced to some extent by much better utilization as for by-catch, and offal that is at present dumped. This is where you’re going to see small plants, or specialized production of some sort of protein meal such as presscake meal, or a special hydrolysate replacing other parts of fish meal.

Q. Do you have any numbers for the amount of fish heads or frames that would become available from aquaculture that would add to the production of fish meal?
A. That depends to some extent on the way aquaculture develops. One thing that’s been rather noticeable with salmon farming in Norway, for instance, has been just how much of the fish was shipped to restaurants in France. Quite often even the gills were shipped to France. That’s what they wanted. People are going to start producing skinless, boneless fillets. And then offal will be developed, and it won’t be just heads, but it will be the sort of offal you get from a typical filleting plant, and it will be available for fish meal.

Q. What would help the situation?
A. Already this has happened with catfish. There is now meal that goes right back into catfish feeds. And catfish oil is also being put back into the diet.
CLOSING REMARKS

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Based on comments you have made to me and other members of the conference planning committee, the first international conference on seafood by-product opportunities has been a great success. The connections made between members of the international seafood industry are exciting to me and others from the Alaskan processing sector, which was well represented here.

We realize we have a long way to go in utilizing our harvested marine resources more fully, and we are thankful for the economically viable options that have been delivered to our doorstep from all over the world these past three days. On that note, I would like to recognize and thank the speakers and participants from foreign countries who made the effort to prepare for and travel to this conference in Alaska. Their willingness to share their ideas for solutions to our "waste" opportunity in English, their second or perhaps third language, is much appreciated by all of us. I was most impressed by those of you who not only wrote and delivered your papers in English, but who also answered questions in your second or third tongue.

For the record, there were 189 participants from 10 countries and 21 states of the United States. As several of you have said, this exchange of ideas should become an annual event. Already I have heard of some rewarding connections made between participants—Rae McFarland of Diamond Stainless and AFDF will provide Elsen Karstad of Kenya with some technical assistance to upgrade equipment in Elsen’s processing plant in Nairobi, allowing for more utilization of his raw material. Baldur Hjaltason of Lísi in Reykjavik will work with plants in both Cordova and Kodiak to analyze the viability of salmon and groundfish oil production. Svanur Víðjalmsson of Kvikk in Reykjavik has found great interest among Alaskan salmon processors in his latest invention, a machine that removes the usable flesh from salmon heads, thereby increasing recovery of the round fish weight by 5% to 12%.

The true test of the success of this conference, however, will be in the coming year and years when we hope that some of the ideas discussed during the last three days will be applied to our by-products opportunities. In your efforts to do this, I encourage you to work with the Alaska Fisheries Development Foundation to demonstrate, on- and offshore, some of these innovative solutions to the by-products utilization riddle. Direct your proposals to the foundation c/o Mel Monsen, or to Rae McFarland, of AFDF’s Program Development Committee. Thanks for coming.
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