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top-quality fresh produce to year-round markets. Reducing the wild catch in order to increase escapements is probably the most cost-effective short-term means of increasing wild production -- certainly more so than constructing new public hatcheries. However, aquaculture can provide an efficient source of incremental fish production to meet the growing demand for fish products and to relieve increasing pressures on the wild resource.

Aquaculture and the Sport Fisheries

Some of the pioneering efforts in Canadian aquaculture involved the construction and operation of hatcheries for sport fisheries. At present some of the private trout hatcheries across Canada stock lakes for the inland sport fisheries; the salmon and steelhead trout sport fisheries are enhanced through the work of the Department of Fisheries and Oceans. These sport fisheries are extremely important to Canada. On the west coast alone, the direct income impact of resident tidal and nontidal angling in 1980 was estimated at between \$38 million and \$40 million, with direct employment in the range of 3500 to 4000 person-years.

An emerging aquaculture industry with efficient methods of producing juvenile fish has a role to play in supplying the needs of sport fisheries. Reducing commercial pressure on salmon stocks by farming these species would help to meet growing sport and Native food requirements without further depleting the wild resource.

There is no reason why the aquaculture industry should not develop alongside a flourishing sport fishery. As the sport fisheries develop, so will their need for suitable stocks of juvenile fish for stocking rivers and lakes. Commercial aquaculture can supply these future needs at lower cost than current government-run hatcheries can.

Canadian Commitment to Aquaculture

Aquaculture has an important part to play in the Canadian fisheries. However, to realize its benefits, a firm commitment from both federal and provincial governments is needed. Therefore,

1. The Science Council of Canada recommends that federal and provincial governments state clearly their intention to develop a commercial aquaculture industry in Canada. In consultation with industry, specified production targets for identified species should be set. Governments should take concerted action to ensure that aquaculture is made an attractive area for investment and create lead agencies, as outlined in the final report of the Industry Task Force, to coordinate the development strategy for this emerging science-based industry.

Chapter 2

The Viability of Canadian Aquaculture

Other countries, when faced with declines in their traditional fisheries caused by environmental problems or jurisdictional limitations, have turned to large-scale aquaculture development. A recent survey of salmon farms in Norway showed that they produce an average annual operating surplus equivalent to about Cdn \$30 000 per employee. A study by the Department of Fisheries and Oceans recently determined that the gross profit of Norwegian salmon farms was approximately 27 per cent of gross sales. There is every reason to believe that if an integrated industry is launched in Canada, similar profit levels could be achieved in less than a decade. Marketing studies done for salmon farming on both Canadian coasts conclude that even with the expanding production of farmed fish from other countries, Canada has sufficient market potential to support an aquaculture industry.

In order to establish a commercially viable aquaculture industry in this country, several essential components must be developed in concert.

Sites and Leasing Policy

The extensive coastline and abundant freshwater resources of Canada offer many possible sites for aquaculture, well within the acceptable temperature limits for the growth of commercially significant species. Indeed, the coasts of Canada could ultimately sustain a very large scale of production. Across Canada good sites for the cage, pond, and raceway cultivation of trout and other species abound. However, only a few have been developed even on an experimental scale.

Site availability will not limit the development of an aquaculture industry in Canada. However, the sites identified by the private sector must be opened up to commercial aquaculture development

without adversely affecting other users of coastal and shoreline areas. This requires the creation of appropriate leasing policies. Various ways of influencing the development of the industry through leasing policies might include:

- (a) the attachment of specific terms and conditions to aquaculture permits to limit ownership of the resource to resident individuals or companies;
- (b) the provision of special incentives, such as grants, access to low-interest loans, and technical services, to locally-owned operations;
- (c) the provision of similar special incentives to scattered small producers to enable them to organize into more efficient integrated cooperatives or large firms.

Clearly, aquaculture developments in rural areas can provide employment and income for the local residents. If leases can be reserved for these people (or for applicants who will ensure significant local participation) without compromising the economic performance of the operations, the developments would be doubly beneficial -- they would provide a return on investment as well as badly needed income and employment.

Commercial Fishing Interests

The negative effects of reducing the commercial fishing fleet capacity can be mitigated if new employment in aquaculture is created at the same time. Preferential access to aquaculture leases or special opportunities offered to those displaced from the wild fisheries through the buy-back programs could achieve this goal. Governments may wish to promote entry into aquaculture for anyone participating in the A-licence

(salmon fishing) buy-back program. This would also offer the side-benefit of new productive uses for existing excess fishing vessels. Since moving into aquaculture production requires new skills, training and extension courses must be organized.

Special Native Interests

For Native people, the issue of certain leasing policies affects not only economic development opportunities but also aboriginal land claims. Confrontation between Native people and private-sector entrepreneurial interests over aquaculture development must be avoided.

If leases are not allocated in an equitable way, Native people will undoubtedly argue that future land claims settlements may be compromised. This would not only be perceived as an injustice to Native groups, but might also result in the obstruction of aquaculture development with legal and political actions challenging the issuance of leases to non-Natives. Thus, in developing leasing policy, all levels of government should consult with Native groups prepared to enter into this new industry. The federal Department of Indian and Northern Affairs should ensure that Native interests are represented in all aspects of aquaculture policy and planning. Federal/provincial coordination in the development of leasing policies is also needed to ensure that matters of aboriginal and usufructuary rights within federal jurisdiction are not ignored by provincial leasing initiatives.

2. The Science Council of Canada recommends that both federal and provincial levels of governments work with the private sector and with representatives of Native groups to prepare enabling legislation to establish a legal framework for the conduct of

commercial aquaculture, to clarify or create the necessary rights, supply financial incentives, and regulate the industry as appropriate.

Salmonid Enhancement and Private-Sector Ranching

Salmonid enhancement programs for Pacific salmon evolved from efforts to conserve salmon stocks, increase returns to the west-coast fishery, and improve incomes, regional employment, and economic development. Enhancement of wild salmon stocks employs extensive aquaculture techniques to artificially propagate salmon eggs in hatcheries and release juvenile salmon (smolts) into the wild. Salmonid enhancement programs (SEPs) have considerable facilities, personnel skills, research capabilities, and some brood stocks. The aquaculture industry should have access to these resources from which they could draw assistance to accelerate the growth of commercial aquaculture. Research on pathological, nutritional, genetic, and physiological problems of salmonids relate to the needs of the aquaculture industry. The aquaculture of salmonids in sea pens offers many opportunities for research investigations that could assist the enhancement of wild stocks.

Commercial salmon ranching involves technology transfer of government hatchery research and practices into the private sector as a business. Elsewhere, economic incentives for salmon enhancement that are directly linked to harvest opportunities have encouraged the private sector to share more of the responsibilities and costs for enhancement, habitat protection, and harvest management. Although biological and social concerns must be considered, there are also strong arguments in support of Canada increasing the extent of private-sector involvement in both enhancement and private-sector ranching as an adjunct to commercial aquaculture. Proponents of commercial

salmon ranching argue that it would lead to more efficient management of the fishery and to greater economic benefits for those employed in it.

A key element in the cost of salmonid enhancement is the cost of rearing juvenile salmon. The improved, more efficient techniques used in the fish-farming industry, if applied to salmonid enhancement, could help reduce rearing costs. Contracting out more of this work to the private sector could also improve the efficiency of salmonid enhancement. This might include placing some existing SEP hatcheries under private-sector management and allowing them to reduce costs by the sale of surplus eggs, fry, and smolts to salmon farmers. SEPs could also contract out new commercial hatcheries to rear fry specifically for enhancement purposes.

Tests of commercial ocean-ranching ventures, involving both Pacific and Atlantic salmon and other species, are being carried out in other countries such as the United States, Iceland, Chile, and Scotland. To enhance the public fisheries, Alaska has encouraged the development of non-profit salmon hatcheries operated by fishing cooperatives and interested individuals. Along the Pacific coast (in California, Oregon, Washington State, and Alaska), both public and private sectors are involved in enhancement, but only in Oregon and California has this been permitted on a profit-making basis. It is still premature to evaluate the success of such ventures. However, Canada should not preclude private-sector experimentation and involvement in this interesting field. In particular, using surplus fry and smolt production for ranching operations alongside farming operations may work well in Canada.

3. The Science Council of Canada recommends that the Department of

Fisheries and Oceans develop policies integrating the needs of fish population enhancement with the needs of a commercial aquaculture industry. Private-sector management of enhancement programs should be permitted.

Seed Stocks

Supplies of hatchery-reared seed stock are an essential component of the industry. Mussel farmers and oyster farmers in Canada currently depend largely on the collection of wild seed. These seed collection areas must be protected from environmental degradation, commercial exploitation, and depletion of the brood stock to allow expansion of mussel and oyster production. As the oyster industry moves toward more intensive forms of cultivation and the volume of production increases, wild sources of seed (spat) will become inadequate to supply the industry. On the Pacific coast the oyster industry is already beginning to use hatchery-reared spat, and in Nova Scotia the developing industry of rearing European oysters depends exclusively on supplies of hatchery-reared seed.

Allied to seed stock availability is the need for genetic selection of suitable genotypes and for selective breeding programs. Their importance to aquaculture parallels the importance of selecting suitable strains in the poultry, pig, and cattle industries.

The supply of juvenile salmon (smolts) that have suitable genetic strains for rearing under farm conditions is an important limiting factor in the production of farmed salmon in Europe. Farmed salmon production in Canada cannot expand significantly until appropriate supplies of smolts are available from government hatcheries and a sufficient number of commercial smolt production facilities are established by the industry.

4. The Science Council of Canada recommends that Canadian governments at all levels cooperate closely with the industry to support the creation of private-sector hatcheries sufficient to supply the needs of a rapidly growing industry with superior strains of seed stock.

Feed

Shellfish cultivation usually uses the natural planktonic food in the water. Thus feed costs contribute little to the cost of production, except in the intensive hatchery production of oysters and other shellfish. However, finfish aquaculture requires the feeding of artificially formulated diets to fish enclosed in cages, tanks, ponds, or raceways. The cost of fish feed is critically important to the viability of the industry.

As in the production of feeds for poultry and other agricultural industries, feed production in fish farming involves the formulation of relatively low-cost protein, fat, and carbohydrate sources into nutritionally adequate packages. Canada is well endowed with supplies of the raw fish wastes that are used for such feed. At the moment, much of this raw product is exported rather than being upgraded by producing pellets in Canada.

Feed technology also requires scientific knowledge of the nutritional needs of fish species. Several groups of Canadian researchers already have substantial expertise in this area. To date, much of their research has been applied by feed-stock producers in other countries. Tapping these resources would lead to the development of a domestic fish-feed industry, replacing imported feed stocks. The fish-farming industry that can be supported on the west coast alone is expected to be at least as large as that of Norway where there are several fish-feed producers.

5. The Science Council of Canada recommends that the aquaculture industry develop commercial applications for Canadian raw fish wastes and sponsor research, particularly in fields such as fish nutrition and feed technology.

Technology

In order to establish an efficient, profitable industry, it is essential to reduce the costs of production. This can be done by introducing automated techniques and expanding commercial production using the most modern methods and technologies available. A great deal of the necessary commercial-scale production technology and know-how is already available. The techniques of commercial production and sea-farm management must be transferred to Canadian industry as rapidly as possible, to adapt them to Canadian conditions and to deploy them in expanding commercial ventures.

There are many ways of obtaining foreign technology and know-how. In the present context, the most relevant mechanisms are the negotiation of technology transfer agreements, attracting direct investment by companies with this know-how to Canada by joint ventures, special licensing arrangements, and technical exchange training programs.

Arrangements like these are essential to accelerate the development of Canadian aquaculture. First, they will inspire greater confidence in the growth of the industry and will attract sources of risk capital. Second, these arrangements will help Canadian companies to earn profits more rapidly. Third, they will accelerate the rate at which production increases, thereby enabling Canadian production to become known and established in world markets in the next decade. Therefore, Canadians must acquaint themselves with overseas firms from which they could

buy technology, or to which they could sell their produce.

6. The Science Council of Canada recommends that industry, with the support of the relevant government agencies and centres of aquaculture research and development, seize opportunities for technology transfer and develop new markets for species under commercial production in Canada.

This process of adapting foreign technology to the Canadian situation can draw on existing scientific capability in Canada. If some of the substantial research capability in Canada were applied to the problems inherent in commercial aquaculture, considerable advances in commercial production could be achieved in a relatively short time. The research community has an important role to play together with industry in the three distinct facets of technology development and transfer through:

- a) the transfer of already-established commercial technologies and know-how to Canada;
- b) research and development programs to create the indigenous technologies that will allow commercial-scale aquaculture in Canada;
- c) the export of improved aquacultural technologies from Canada.

7. The Science Council of Canada recommends that governments direct their lead agencies for aquaculture to coordinate funding from all sources and, with the advice of the Regional Aquaculture Coordinating Committees recommended by the Industry Task Force, channel funds into development of the species identified as having the greatest commercial potential in each region.

Although it may be premature to discuss the export of aquacultural technologies from Canada before a commercial aquaculture industry has been established, the long term could bring significant spin-off benefits to other Canadian industries as well as constituting a component of Canadian aid to less developed nations. The International Development Research Centre and the Canadian International Development Agency are already involved in aquaculture assistance to less developed nations. The creation of an indigenous aquaculture industry in Canada could only strengthen these initiatives.

Capital

The success stories of aquaculture in other developed countries should encourage Canadian sources of capital to invest in this new area of opportunity. As the federal government's report, A New Direction for Canada: An Agenda for Economic Renewal, states:

If we are to be competitive, we must become effective in applying leading-edge technologies in producing goods and services. Economic success will stem not only from producing technology, but from using new technology in established industries.

The basis of a successful aquaculture industry will be a core of integrated, self-sufficient companies and cooperatives that use the most advanced technologies available. Operations like this are the mainstay of the industries established in Europe. These operations need several million dollars in investment and equivalent sums of working capital. When such enterprises are fully established, smaller grow-out operations can prosper. However, the front-end costs are high, there are inherent risks in cultivating living organisms, and a

relatively long-term investment is needed (a minimum of three years before there is a return on capital), therefore it may prove difficult to attract domestic capital.

To make the transition from pioneering efforts in aquaculture to a highly capitalized industry employing sophisticated technology, four likely sources of capital could be tapped:

1. Existing Canadian aquaculture enterprises could achieve the necessary rapid growth by entering into joint ventures with large firms that have capital to invest. These might include, for example, Canadian firms with an interest in fisheries, related resource-based firms, or the food industry. They could also include foreign firms that already have expertise in aquaculture. Entering into such joint ventures may turn current owner/managers of aquaculture enterprises into minor shareholders, or even managers of their firms.
2. Existing Canadian firms already involved in fisheries or in the resources sector may invest in aquaculture on their own. They will then need to buy the necessary expertise either from domestic or from foreign sources.
3. Governments could take minority-share status in aquaculture firms. This route has been successful in remote areas of the Highlands and Islands of Scotland as a way of enabling small producers to establish new enterprises.
4. Foreign firms with capital or expertise could be encouraged to establish "greenfield operations," i.e., new businesses involving specially constructed facilities.

Canada may ultimately have to depend on a judicious blend of foreign and domestic capital to develop this sector,

despite the tradition of giving preference to Canadian capital. In any case, Canadian firms must improve their operations, especially to attract capital and enhance their reputation as business partners. Before new investors will support this area of new technology, entrepreneurs must strengthen their managerial capabilities and incorporate the most modern techniques and technologies currently available.

8. The Science Council of Canada recommends that entrepreneurs in the aquaculture industry create the appropriate conditions to attract investment capital by:
 - a) participating in technical exchange agreements and adapting foreign and domestic best-practice technology;
 - b) examining ways of reducing risk to meet the standards set for aquaculture insurance;
 - c) raising the quality of their business planning.

Although investment money is available in Canada, most of it is put into more secure, better-understood areas of investment. Government policies are needed that will create a climate of certainty to elicit the necessary investment. At the moment, jurisdictional competition between levels of government and among different departments only adds to confusion and uncertainty. A clear signal would be sent to the investment community if the government announced the development of a commercial aquaculture industry with specified production targets for particular species as a provincial or even a national goal and launched a concerted effort to achieve this goal within the decade.

9. The Science Council of Canada recommends that federal and provincial ministries clarify their departmental mandates regarding

aquaculture and evaluate their programs with a view to enhancing their support for commercial aquaculture.

Governments must reorder their investment incentives to attract Canadian capital into promising new areas of knowledge-intensive development, such as aquaculture. Tax measures that ensure the eligibility of new capital for these emerging opportunities should be instituted. There are also sound economic reasons for direct government support to sectors such as aquaculture, that are relatively risky and require "patient" capital. The federal and provincial governments could identify the most appropriate mechanisms to enhance the development of these sectors. Given its proposed new proactive mandate, Investment Canada might help by attracting new foreign investment. Similarly, governments could provide the appropriate communication, transportation, and veterinary infrastructure to signal their support for the industry and the investment community.

10. The Science Council of Canada recommends that Investment Canada use its new proactive mandate to seek out sources of both domestic and foreign capital with a view to facilitating investments that will stimulate the development of Canadian aquaculture capabilities. It further recommends that External Affairs, through its science counsellor network, assist entrepreneurs to identify opportunities for international technical exchange agreements.

Markets and Quality Assurance

Marketing is a crucial part of a successful industry. Aquaculture in other countries expanded on the basis of

developing new markets and providing fresh produce to these markets "in the right place, at the right time, and at the right price." Good market potential in the United States, Europe, and the Pacific Rim countries exists for all the prime candidate species of Canadian aquaculture. To penetrate these markets, marketing strategies must be based on consistent supply and quality assurance. This requires an informed and disciplined approach to marketing and close cooperation among individual producers through their organizations and interaction with government regulatory agencies.

Indeed, it would greatly benefit the entire fishing industry if quality-assurance standards and marketing strategies developed in the context of aquacultural production were integrated with the standards and strategies that apply to the harvesting of wild stocks.

11. The Science Council of Canada recommends that the aquaculture industry create effective producer organizations to provide a forum for continuing consultations with government, to cooperate and share knowledge within the industry and enable producers to develop self-discipline concerning quality-assurance standards and market promotion.

The Role of Producer Organizations

Producer organizations are perhaps the most powerful force to influence the course of development of aquaculture. In the wild fisheries, fishing cooperatives and other industrial organizations have exerted powerful political and economic influence on the shape of the industry in the production, processing, and marketing sectors. Farmers' organizations have had a similar influence on the development of government policies and programs for agriculture.

In countries in which commercial aquaculture flourishes, producers' organizations with strong marketing interests are supported by a levy on farmers' sales or production totals. The European Economic Community offers incentives to newly created producers' associations, such as 80 per cent of their operating costs in their first year, declining gradually over five years.

Canadian aquaculture producers must work toward the development of a disciplined industry that uniformly upholds high standards of quality assurance and that can agree on the seasonal distribution of production to available markets. Strong producers' organizations can provide a coherent voice for the industry to all levels of government on the development of policy and can assist in communications and technology transfer within the industry. They must work to ensure the orderly development of the industry and to prevent destructive local competition among producers when they pool their resources to compete effectively on international markets.

However, at present, the embryonic industry does not have the resources or personnel to establish an effective organization to represent the national interests of aquaculture producers. The creation of national producer groups under the umbrella of the Aquaculture Association of Canada (formed in 1983 at the first National Aquaculture Conference) should be assisted at these early stages with government support. As the industry takes shape, such assistance should be phased out in favour of self-supporting industrial associations.

12. The Science Council of Canada recommends that governments extend assistance to the aquaculture industry for an initial five-year period to help create effective producer organizations.

Infrastructural Needs

The range of programs already in place to manage the wild fisheries is impressive. Many of the skills and resources in these programs could be applied to the development of commercial aquaculture. For example, expansion of the existing fish pathology capabilities in universities and in the federal Department of Fisheries and Oceans would provide an efficient veterinary and diagnostic service for fish farmers. Applying existing fisheries research capabilities could bring promising candidate species into commercial cultivation and initiate research on relevant diseases, nutritional problems, breeding programs, and other topics of economic significance to the industry.

An aquaculture industry will require a range of supporting services, including veterinary and diagnostic services, research and development work, quality-assurance requirements, and an advisory extension service to fish farmers (comparable to that in place for agriculture). These were outlined in more detail in the Industry Task Force report, Aquaculture: A Development Plan for Canada.

13. The Science Council of Canada recommends that the federal government work with provincial governments, in consultation with the industry, to establish appropriate services, particularly aquacultural veterinary and pathology services.

Furthermore, federal and provincial governments should cooperate to develop centres of excellence that would serve the needs of the aquaculture industry. Research and education facilities already exist in Nanaimo, Guelph, and Halifax, which could serve as the nuclei for such centres. Cooperative education programs, such as those developed at the University of Waterloo (involving several

months of practical on-site experience), and the curriculum of the University of Stirling's Institute of Aquaculture in Scotland should be considered as models for curriculum development.

14. The Science Council of Canada recommends that federal and provincial governments cooperate to develop centres of excellence to serve the needs of the aquaculture industry.

Local Community Economic Development, Job Creation, and the Public Involvement and Small Projects components of the Department of Fisheries and Oceans' Salmonid Enhancement Program has done much to interest Native people, young people, and local residents in the "hands-on" management of fish. However, technicians must be trained in the basics of commercial aquaculture and business management techniques. This can best be accomplished at the level of community colleges and technical schools in short basic learning programs augmented by extension courses (such as seminars on specific species or problems). Again, these training programs should be integrated with practical on-site experience; Scottish extension programs should be examined. Video-taped learning modules should also be prepared by Canadian colleges and universities in cooperation with universities and agencies abroad and distributed to fish farmers to show specific fish diseases or new technologies that could be adapted to Canadian fish farms. (This is already being done on a commercial basis in Norway.)

15. The Science Council of Canada recommends that federal and provincial governments support the development of commercial aquaculture with retraining programs, local employment programs, and community development projects.

Agenda for Action

Canadian aquaculture is on the threshold of commercial development. Although Canada is currently lagging behind other nations in developing this technology, it now has an opportunity to develop this industry very rapidly. During the next decade, it could create an indigenous Canadian aquaculture industry of at least the same capacity as Norwegian aquaculture. Canadians must quickly adopt, adapt, and develop the necessary techniques for a viable aquaculture industry before the window on market opportunities closes. One thing is clear. At both the level of governmental policy and industrial application, a great deal can be learned from other countries.

The recommendations for aquaculture are summarized below. They are grouped according to sector and listed in order of priority.

The Science Council of Canada recommends that federal and provincial governments:

- recognize commercial aquaculture as a high-priority opportunity for development (see recommendation 1);
- establish lead agencies to coordinate and encourage the development of this emerging science-based industry (recommendation 1);
- direct these lead agencies for aquaculture to coordinate funding from all sources and, with the advice of Regional Aquaculture Coordinating Committees, channel funds into development of the species identified as having the greatest commercial potential in each region (recommendation 7);
- cooperate closely with the industry to support the creation of private-sector hatcheries sufficient to supply the needs of a rapidly

growing industry with superior strains of seed stock (recommendation 4);

- extend assistance to the industry for an initial five-year period to assist in the creation of effective producer organizations to provide a forum for continuing consultations with government, to cooperate and share knowledge within the industry and to enable producers to develop self-discipline concerning quality assurance standards and market promotion (recommendation 12);
- work with the private sector and with representatives of Native groups to prepare enabling legislation to establish a legal framework for the conduct of commercial aquaculture, to clarify or create the necessary rights, supply financial incentives, and regulate the industry as appropriate (recommendation 2);
- support the development of commercial aquaculture with retraining programs, local employment programs, and community development projects (recommendation 15);
- cooperate to develop centres of excellence to serve the needs of the aquaculture industry (recommendation 14);
- clarify departmental mandates regarding aquaculture and evaluate programs with a view to enhancing support for aquaculture; in particular, Investment Canada should use its new proactive mandate to seek out sources of domestic and foreign capital with a view to facilitating investments that will stimulate the development of Canadian aquaculture capabilities; and External Affairs, through its science counsellor network, should assist entrepreneurs to identify opportunities for international technical exchange agreements (recommendations 9 and 10);

- develop policies integrating the needs of fish population enhancement with the needs of a commercial aquaculture industry (recommendation 3);
- establish appropriate services for the industry, particularly veterinary and pathology services, in consultation with the industry (recommendation 13).

The industry should:

- create effective producer organizations to provide a forum for continuing consultations with government, to cooperate and share knowledge within the industry and enable producers to develop self-discipline concerning quality assurance standards and market promotion (see recommendation 11);
- seize opportunities for technology transfer and develop new markets for species under commercial production in Canada (recommendation 6);
- create the appropriate conditions to attract investment capital by:
 - a) participating in technical exchange agreements and adapting foreign and domestic best-practice technology;
 - b) examining ways of reducing risk to meet the standards set for aquaculture insurance;
 - c) raising the quality of their business planning (recommendation 8);
- develop commercial applications for Canadian raw fish wastes and promote scientific research, particularly in fields such as fish nutrition and feed technology (recommendation 5).

SALMON CULTURE, FISH HEALTH AND THE ENVIRONMENT

By John Pitts, D.V.M.

Opponents of salmon farming in Washington State have claimed that wild populations of salmon will suffer from increased disease problems if salmon farming is allowed to proceed. Salmon aquaculture has prospered in Puget Sound for nearly 20 years in net-pens and for over a hundred years in state and federal hatchery programs. There has been no evidence of disease transmission to wild stocks because of these programs in Washington State. In addition, our neighbors to the north have been planting fish for over 100 years and there is no evidence that Canadian fish stocks have been adversely affected by diseases introduced from hatchery aquaculture (Hicks, pers.comm., 1988).

When fish biologists and pathologists have been asked to comment on this question, the answer has been consistent: Transmission of disease from farmed salmon to wild fish could happen, but it is very unlikely and has not been observed. More probable is the transmission of disease from wild fish to cultured fish (Kevin Amos, Washington State Department of Fisheries; Dr. Ralph Elston, Batelle NW; Dr. Lee Harrell, National Marine Fisheries Service; Dr. Brad Hicks, British Columbia Veterinary Service; Dr. Mike Kent, Batelle NW; Dr. Marsha Landbolt, University of Washington; Dr. Gary Wedemeyer, United States Fish and Wildlife Service; Dr. Jim Winton, United States Fish and Wildlife Service, pers.comm., 1988). The same response was given by scientists from Europe experienced in fish culture (Dr. Hans Achevors, University of Stockholm; Dr. Ron Roberts, Stirling University; Dr. Harald Rosenthal, Hamburg, West Germany). In no case has any evidence been presented to show that disease has moved from private sector aquaculture to the wild fishery (Needham, 1981; Neuman, 1986). As stated, the opposite is true, fish in private culture frequently become sick from communicable diseases when they are exposed to wild fish (Hicks & Ferguson, 1986; Hedick, et.al., 1986; Ostland, et.al., 1987). Although we must be aware of the interaction of disease in wild and cultured stocks it is much more likely that the private sector aquaculture will be adversely affected by diseases present in wild populations than vice versa.

The potential for any disease transmission, be it direct contact, air borne or water borne, is much greater when the organism is under stress. Experience has shown that a wide variety of bacterial, parasitic and other diseases become a problem only if fish are being held under environmental conditions unfavorable

for that particular species or strain. Such unfavorable conditions include crowding, temperature fluctuations, inadequate dissolved oxygen, excessive rough handling, sublethal levels of toxic materials, etc. (Wedemeyer, et. al., 1976). It is not in the best interests of the fish or fish farmer to crowd his farm or he may suffer crop losses. The farm itself must be located in an area of good oxygen supply and good flushing. Siting guidelines prepared by Washington State Department of Ecology require minimum depth and current requirements to ensure that the environment is protected while the fish prosper. The recent mortalities at two farm sites in Port Townsend caused by an unknown toxin in the water, points out the sensitivity of the farmed fish in a compromised environment. These fish are biological monitors, and along with our shellfish, are among the first to alert us to potential problems with water quality.

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A STIR IN THE SALMON MARKET

How new supplies
are changing the picture.

BY PEGGY PARKER



Salmon farmers are banking on high quality and reliable supply to sell their fresh product, while domestic producers of wild-caught fish are looking to create a market niche based on the price and year-round availability of high-quality frozen salmon.

Despite the salmon family's abundant market forms and diverse species, the attention of today's market seems riveted on fresh and frozen salmon, both farmed and wild.

Much of the stir in the fresh market is due to the Norwegians, who began exporting large volumes of fresh Atlantic salmon to both the East and West coasts in the early 1980s. The Norwegian exports meant that, for the first time, high-quality fresh salmon was available in the winter — and in reliable quantities.

It used to be that fresh salmon was sold only from June to September. There were regional exceptions where winter runs of kings or steelhead (a member of the trout family, often sold as salmon) put fresh salmon on the tables of gourmet restaurants in February and March, but volumes were minuscule. The savvy Norwegians created a whole new market with their product, a market that went far beyond the niche of the domestic product in winter.

The urge to target this market is strong among domestic producers: returns are high, and the potential for growth is excellent. There are only two rules in this high-stakes game, but they must be followed to the letter. First, the product must be of highest quality; and second, supply must be

reliable.

Salmon producers are taking two approaches to the market. One is to join the competition. Interest and investment in farming operations are high on the coasts of both Canada and the U.S. Another is to promote high-quality frozen salmon as a product that meets the aesthetic standards of fresh, yet is available — usually at lower prices — all year.

The Alaska Seafood Marketing Institute introduced "Premium Quality" salmon to the winter market this year in an effort to prove that frozen salmon beats fresh in the overall picture. The cohos selected for the promotion were troll-caught, bled and immediately iced on board, then frozen on shore using meticulous handling techniques.

No time for kid gloves

But it is unlikely that Alaskan plants will produce an elite product in great quantity anytime soon. With half a billion pounds of salmon returning to Alaskan rivers in a period of four months, processors have little time for kid-glove treatment on the majority of the catch.

Harvest timing is more critical with salmon than with any other seafood. Wild salmon must be caught



between the time they enter the fishing grounds (often a several-hour boat run from the fish plant) and the time they reach the fresh water of their spawning streams. It is during this window of time — often only a matter of hours — that wild salmon are at their peak.

Processors market the cream of this crop — troll-caught chinooks and cohos and gillnet-caught sockeyes — to high-ticket restaurants. Like fine wine, they are sold with the area of origin and the date of harvest identified. While the percentage of wild salmon that is sold fresh or frozen is much higher than it was six years ago, growth in this area has slowed. Last year, fresh and frozen salmon amounted to 53 percent of the entire pack, 10 percent below the 1985

figure. Short-term growth in the market for fresh and frozen salmon will most likely come from farming operations.

A rush to the fjords

Much as in the westward homestead rush of the 1850s, salmon farmers are stampeding to the fjords of Maine, Washington, and British Columbia to set up sea pens and claim their share of the market. The U.S. has been slow to embrace sea-pen salmon farming, but British Columbia has issued more than 100 permits for the floating farms.

In July 1984, the B.C. Salmon Farmers Association was formed to allocate eggs from the federal hatcheries (the surplus from the government's salmon-enhancement program) to the farmers. Today the industry-funded group not only divvies up the eggs, but screens them for disease. B.C. farmers are building their own brood stock for secure supply and quality. Garth Hopkins, the association's director of communications, says, "In another five to seven years, we will be self-sufficient on eggs."

Following the Norwegian lead, Hopkins' group is developing a marketing strategy for B.C. salmon. It expects to implement the plan before the end of the third quarter this year. Membership, at 75 firms today, is expected to grow to 250 by next year. B.C. production of farmed cohos and chinooks was about 500 metric tons last year. In 1988, that number is expected to reach 10,000 mt.

Right now, world production of farmed salmon is less than 50,000 mt. But salmon farms in New Zealand and Chile are just beginning to produce salmon in large volumes, and in the U.S., successful farms are expanding in Washington and Maine, while others wait in line for permits.

The world's first land-based fish farm is expected to open in June in Westport, Washington. Financed by Seacom A/S of Norway, the plant will raise pan-sized coho in salt water pumped from the ocean. A second facility is slated to open in British Columbia in August.

In Alaska, where pen-rearing of salmon is illegal, the legislature is considering a bill to develop a mariculture industry.

"Although the Norwegians certainly have a jump on prospective Alaska fish farmers," says Brent Paine of the Alaska Mariculture Association, "we do have some advantages, such as sharply lower transportation costs, no import duties, and the lack of currency fluctuations between producers and customers." Paine has marketed Nor-

1986 U.S. Imports of Salmon (IN METRIC TONS)		
FROZEN:		FRESH:
136.9	NORWAY	8,871.4
5,078.6	CANADA	2,485.0
4.2	CHILE	680.8
3.0	U.K.	367.5
263.0	OTHER	540.7
5,486.0	TOTAL	12,945.4
GRAND TOTAL FRESH & FROZEN: 18,431.4		

wegian salmon in the U.S. and worked on fish farms in both the U.S. and Norway.

Will prices drop?

These advantages and high wholesale prices are what make the gamble worth it for many aquaculturists in North America. But will rapid growth in the farmed sector mean a drop in prices at the wholesale level?

Norwegian producers are betting their kroner that the market will expand to support price levels, even with the added supply. Their strategy is to provide consistently excellent fish, and sell them with flair. Branded products — not often seen in the fresh-seafood market — will become more common. Designer tags in the gill plate, such as MOWI of Norway's "Superior" tag, have great snob appeal; they also identify the fish and guarantee quality standards. The Scottish Salmon Growers Association now marks its boxes with a special "British Food Quality, Scottish Salmon" stamp. The Shetland Seafood Quality Company and the Shetland Salmon Farmers Association use a grading scheme that awards top quality a "Grade A" sticker.

But not all salmon-farming countries have the quality schemes of Norway, the U.K., or Canada. Some brokers fear that large volumes of farmed salmon may be "dumped" at low prices to gain a foothold in the U.S. market in the next year or so. That could be disastrous to small or recently established farming operations, but the major producers would likely survive.

Just how large could U.S. imports become, and how does that potential compare with domestic supply?

Norwegian salmon farmers are now producing about 30,000 mt per year. Of that amount, about 9,000 mt reached the U.S. market last year, an increase of 34 percent over 1985 imports. Total imports from other countries were just over 18,000 mt.

U.S. fishermen landed 285,000 mt last year, of which about 110,000 mt were exported. About 100,000 tons went into the domestic canned market, leaving about 75,000 mt in the domestic fresh/frozen market. Imports from all countries, then, account for about 24 percent of the domestic supply of fresh and frozen salmon.

These figures could change rapidly. Japanese sea ranching could supply more of that country's needs for salmon, which would leave more sockeyes and cohos for the domestic market. Alaska salmon landings are mercurial, but generally have been increasing over the past decade. Imports are likely to rise — perhaps even double — in the next five years. But a rapidly expanding market will move these supplies quickly. □

What is real?

A word or two about real salmon. There are two genera, or classifications of salmon: *Oncorhynchus* (on ko rin kus) and *Salmo*. Members of the *Oncorhynchus* genus are found in the Pacific and are all called salmon. Members of the *Salmo* genus are most often found in the sea pens of Norway (although there are still some small wild runs in the Atlantic), and are called, depending on the species, either salmon or trout. The fish that created such a splash on the winter market in the early 1980s is *Salmo salar*, or Atlantic salmon. In the wild, both Pacific and Atlantic salmon hatch in streams, migrate to open ocean for a growing period, then return to the streams of their birth to spawn. A major difference between the two groups is that *Oncorhynchus* spawn once and die; *Salmo* spawn several times.

cost of
production

January 28, 1988

Management
Consulting

Mr. Paul Peyton
Director, Division of Business Development
Department of Commerce & Economic Development
State of Alaska
Juneau, Alaska

Dear Paul:

The purpose of this letter is to provide you with a progress report of our study of the feasibility study of pen-rearing salmon in aquaculture.

Our progress is described in three areas:

- . comparative cost of production analysis;
- . cost of production analysis; and
- . site suitability of pen-rearing salmon in Alaska.

Comparative Cost of Production Analysis:

For each major supply region we are developing cost of production models for a typical size farm. The following format for presentation will be followed for each region:

- . Farm Management Plan
- . Capital Investment
- . Production Assumptions
- . Costs of Major Inputs
- . Costs of Production

The comparisons between Norway, Scotland, Chile and B.C. are nearly completed. For Japan we have not yet received any cost data. However, a comprehensive report on the Japanese salmon farming industry is being sent to us by the U.S. Embassy in Tokyo. Combined with information Trond Bjorndal collected on a recent visit to Japan, we should be able to come up with a similar profile as the other industries.

To determine the level of government support provided to each industry we made requests to agencies in each country. These include:

Norway	Ministry of Fisheries, Norway
Scotland	Highland & Islands Development Board, Scotland
Chile	Subsecretariat de Pesca, Chile
B.C.	B.C. Ministry of Agriculture and Fisheries and Department of Fisheries and Oceans
Japan	U.S. Embassy in Tokyo

To date, we have received results back for Norway and B.C. We expect to receive the results from the other regions shortly.

We anticipate that an interim report on the comparative cost of production analysis will be ready by February 15th.

Cost of Production Analysis

Our cost model study for the B.C. Ministry of Agriculture and Fisheries has progressed somewhat slower than anticipated because of a small delay in finalizing the contract and it has taken more time than anticipated for B.C. Research to provide us with the growth data. As a result, the first prototype model is not expected to be completed until the first week of February.

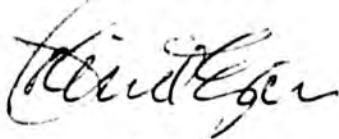
Site Suitability Analysis:

We have obtained excellent data from Alaska on environmental conditions. Preliminary analysis indicate the following findings:

- . Winter ice covering is a major obstacle to salmon farming in Cook Inlet.
- . Icebergs calving in Prince William Sound and northern Southeast Alaska cause very cold summer temperatures and limit production in these areas.
- . In Southeast Alaska, conditions are quite different between east and west. On the eastern side there is a strong oceanographic influence. While temperatures are lower they are more stable and salinities are higher and more stable, suggesting that this may be the most suitable area for salmon farming.

This analysis will be completed in early February. We feel confident that we can then adjust the B.C. growth curves for chinook and coho to conditions in Alaska based on published data available on the relationship between temperature and growth.

Yours truly,

A handwritten signature in cursive script, appearing to read "David Egan".

David Egan
Senior Consultant

DE:kp

Overview of the B.C. Aquaculture Industry

Prepared by

THE DPA GROUP INC.

Vancouver, B.C.

January, 1988

Production

Production in 1986 and 1987 is shown below:

B.C. SALMON AQUACULTURE PRODUCTION (metric tonnes)

Species	1986 ¹	1987 ²
Chinook	89	600
Coho	<u>400</u>	<u>900</u>
	489	1,500

Sources: 1 Fisheries Production Statistics of British Columbia, B.C. Ministry of Agriculture and Fisheries
 2 B.C. Salmon Farmers Association estimates

Industry Structure

The number of operating saltwater sites has increased from 54 in 1986 to 113 in December, 1987. Areas with the largest amount of new development were north of Campbell River. According to a recent survey conducted by the B.C. Ministry of Agriculture and Fisheries, the total installed net pen capacity in B.C. was 2.12 million cubic metres. At average stocking densities of four kilograms per cubic metre, the total production capacity was about 8,500 tonnes. However, most of the increase in production capacity in 1987 was not from new entrants but from the expansion of a few large farms. For example, Aquarius Seafarms, B.C.'s largest farm, announced plans to double its production capacity from 2,000 tonnes to 4,000 tonnes beginning in the fall of 1987.

New investment was shown by existing Canadian seafood processors, including the purchase of Pacific Aqua Foods by National Sea Products Inc., one of Canada's largest integrated seafood companies. Foreign investment, particularly from Norway, also increased substantially in 1987.

Smolt production capacity in the industry also increased significantly in 1987 to about 30 million smolts. Most of the expansion in capacity was by existing smolt producers already integrated with fish farms.

Feed production is becoming increasingly dominated by the two foreign-owned feed manufacturers: Moore-Clark, a subsidiary of Trouw, the specialty feed division of B.P. Nutrition Ltd. and EWOS Canada Ltd.

Costs of Production

Costs of production at an industry level are not known because costs of production surveys have yet to be undertaken. It is therefore difficult to generalize the industry's financial performance.

In comparison to livestock industries, the salmon farming industry has a high cost structure. For example, feed, the largest operating cost in salmon farming, is now about \$1,000 tonne, or about three times the cost of chicken feed.

Based on cost models developed by DPA for individual farms, cash costs of production range between \$4.00 and \$5.00 per kilogram. Unit cost data for a typical farm is being developed by DPA in an on-going study being conducted jointly with B.C. Research for BCMAF. In the study, growth data from about 20 fish groups at 25 farms, developed by B.C. Research from a broodstock management program, form the basis of the model.

Processing and Marketing

The majority of production in 1987 was processed and marketed by seafood processors in B.C. namely, B.C. Packers Ltd. and J.S. MacMillan Fisheries Ltd.

In turn almost all production is being sold by these processors to seafood wholesalers in major cities outside of B.C., particularly in central Canada and the U.S.

Farmed salmon prices like most seafoods were very high in 1987. However, production was almost entirely in the 2-4 pound and 4-6 pound size categories and as a result sold for less than Norwegian and Scottish farmed salmon in larger size categories. In future when competition increases, it will be critical that the industry produce fish in excess of 6 pounds.

The B.C. Salmon Farmers Association began a generic promotion campaign in 1987, advertising the availability of fresh B.C.

salmon in seafood trade journals. The BCSFA was also presented at several major seafood trade shows.

CONSTRAINTS

Egg Supply

Acute chinook egg shortages occurred in 1987 when low returns were caused by low water levels in rivers throughout the province. The low water levels were caused by an unusually dry autumn. The salmon farming industry expected to receive 20 million chinook eggs from DFO but only received 2-3 million eggs. Unlike previous years, farmers were reluctant to switch to coho eggs which were more plentiful, because of high jacking rates with regular coho and slow growth with neutered coho. A further 8 million chinook smolts from domestic broodstock should be available bringing the total

to about 10 million smolts. This means that smolt production in the spring of 1988 will be about one-third of its potential and production in 1989/90 will be less than earlier projected.

Financing

Financing is one of the major constraints facing the industry. Lack of financing resulted in several bankruptcies, reorganizations and mergers in 1987. With the exception of financing provided by seafood processors, access to capital is largely limited to those who have access to foreign sources. For example, the majority of the combined \$25 million in financing obtained in 1987 by Aquarius Seafarms and Royal Pacific Seafoods, two of the three largest fish farms in B.C., was financed by European sources.

No Canadian banks, including the Federal Business Development Bank are providing loans to the industry unless they are fully guaranteed (by other than inventory and/or accounts receivable). In addition, the Western Diversification Program has not yet made any loans to the industry.

The financial assistance programs offered by BCMAF and the joint federal/provincial Subsidiary Agreement on Industrial Development to the industry are limited to a maximum of \$300,000 and \$100,000, respectively, per farm. The total outstanding loans at the end of 1987 from these programs were \$0.3 million and \$3.8 million, respectively. Since the total average working capital requirements for a typical farm can often exceed \$1 million, these programs can only provide a portion of most farms' total financing requirements.

Fish Feed

Improved husbandry has led to improved growth and survival rates in the industry. However, the industry is still faced by severe production constraints. These include the high

incidences of diseases, particularly bacterial kidney disease, and the lack of domesticated strains of Pacific salmon.

New evidence is suggesting that the quality of feed may be one of the major impediments to overcoming these constraints. An on-going study being conducted by DPA to develop an industry strategy for access to high quality raw materials for feed has found that the most important raw materials in fish feed being used by the feed industry in B.C. have nutritional deficiencies. These can likely be overcome by a combination of the use of higher quality raw materials produced in an improved reduction process. However, there are several biological, technical, economic and regulatory barriers to achieve these objectives. As a result, the industry's high cost structure is likely to continue in the short and medium term, particularly in the absence of major public or private research programs targetted at adult Pacific salmon.

DRAFT

World Markets for Salmon: Pen-Reared Salmon Impacts

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World Market
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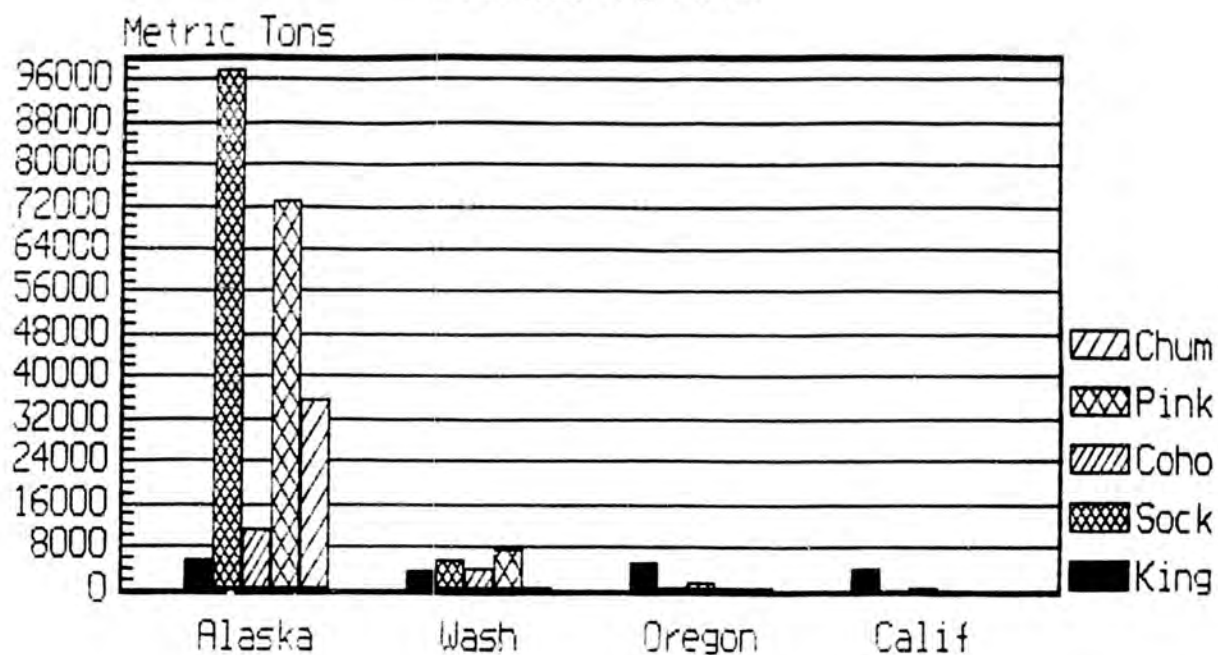
U.S. Fish and Wildlife Service
 1986=298,047
 1987=252,411

Source: Seafood Reporter



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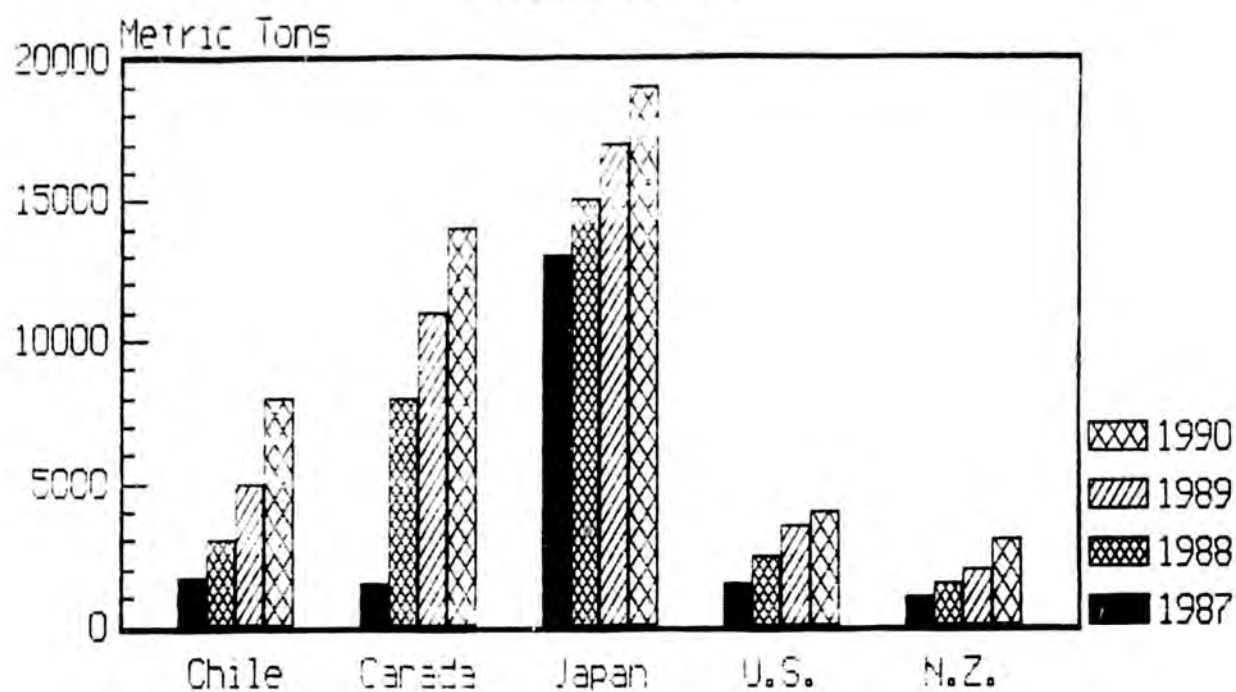
1987 U.S. Pacific Salmon Catch
By State
(Preliminary Data)



Source: State's Dept's of F&G

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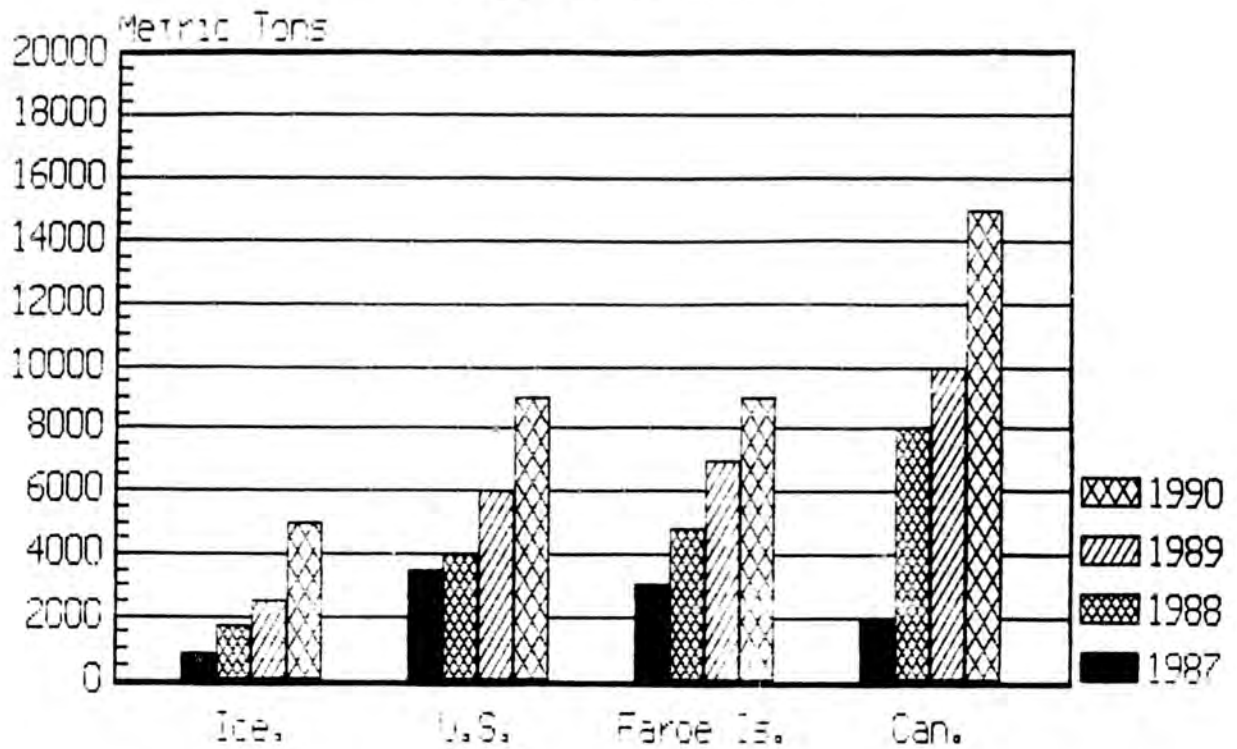
Projected Production of Farmed
Pacific Salmon



Source: Sea Fare Group

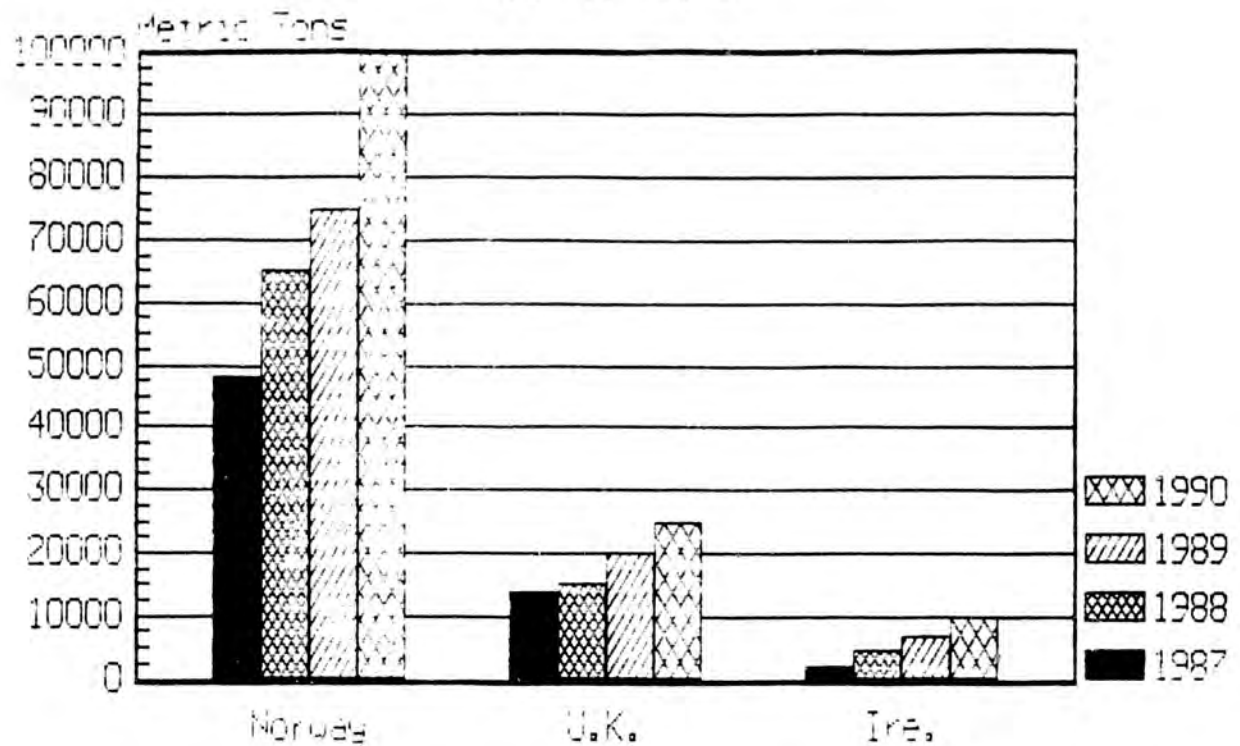
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Projected Production of Farmed
Atlantic Salmon



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Projected Production of Farmed
Atlantic Salmon



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World Production of Farmed Salmon

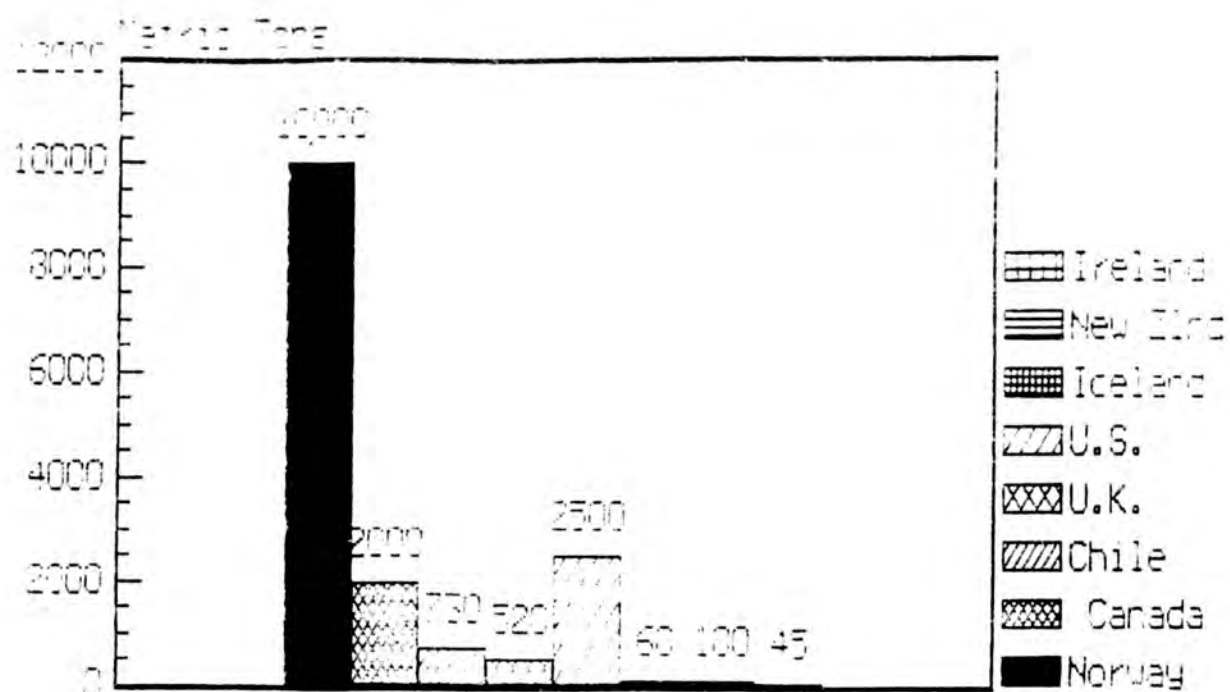
By Species and Quantity
(MT)

<u>Year</u>	<u>Atlantic</u>	<u>Pacific</u>	<u>Total</u>
1982	12,812	2,584	11,244
1983	20,213	1,992	22,205
1984	27,184	5,375	32,559
1985	37,399	7,450	44,849
1986	60,006	10,394	70,400
1987	75,259	20,120	95,379

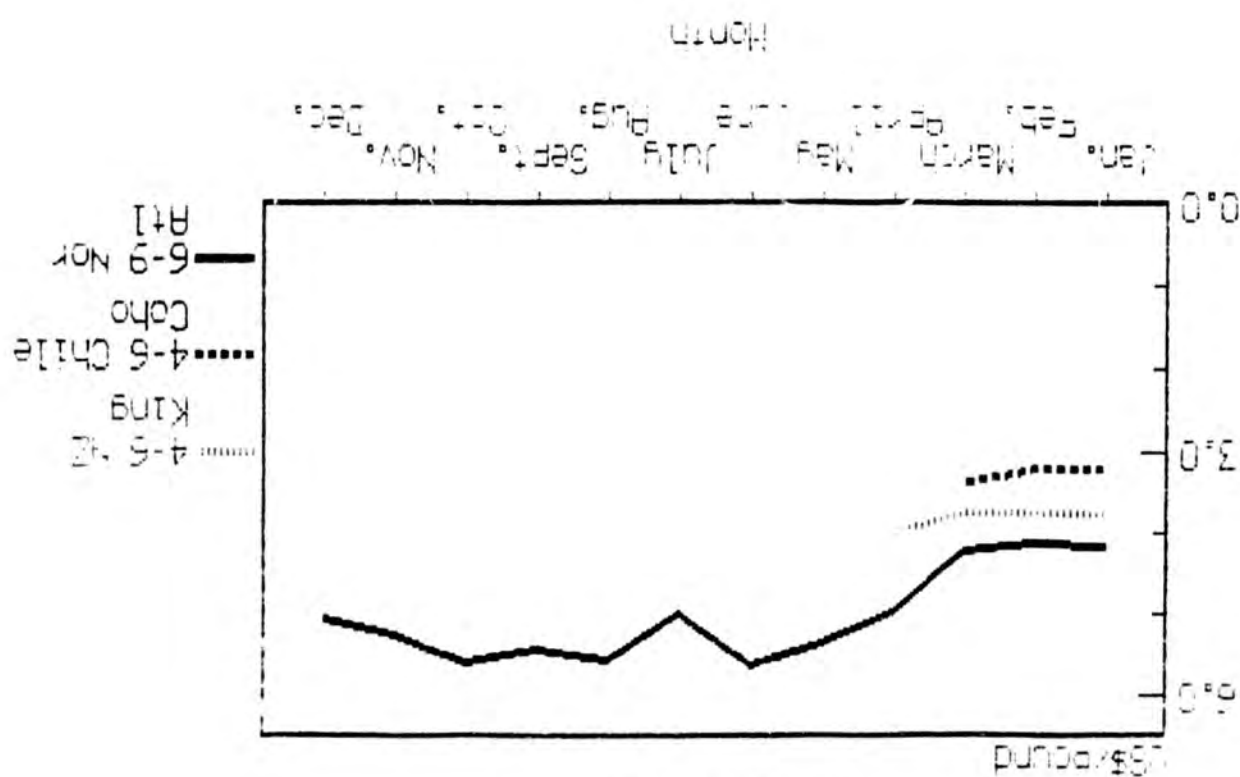
Source: World Salmon Aquaculture, 1980-87
NMFS (Draft, Oct. 1987)

DRAFT

U.S. Supplies to Far East, 1967



Source: Sea Fare Group



1970

1971



3510 1st Ave. NW

Seattle, WA 98107

206/547-6030

Telex 298 558 SFE UR

INVOICE

Bill To: State of Alaska
Department of Commerce and
Economic Development
Division of Business Development
333 Willoughby
Juneau, Alaska 99811
ATTN: Mr. Paul Peyton

Members

Russ Lamb

Catherine Olier

Sandi McKenzie

Peter Redmayne M.M.A.

Roland Henin C.M.C.

Jill Hertzke

Michele Tennyson

Date: February 2, 1988

RE: Project 88-198

World Markets for Salmon--Pen-Reared Salmon Impacts

Invoice No. 1 of 2

Amount due for professional services
rendered to date =
(See attached Interim Report
of today's date)

\$10,000

(Total contract amount= \$20,000 - 10,000 = 10,000 remaining
balance for Invoice No. 2 on completion of project)



Mr. Paul Peyton
Department of Commerce and Economic Development
Division of Business Development
333 Willoughby
Juneau, Alaska 99811

3510 1st Ave. NW

Seattle, WA 98107

206/547-6030

Telex 298 558 SFE UR

February 2, 1988

RE: Interim Report, World Markets for
Salmon--Pen-Reared Salmon Impacts,
88-198

Members

Russ Lamb

Catherine Oller

Sandi McKenzie

Peter Redmayne M.M.A.

Roland Henin C.M.C.

Jill Hertzke

Michele Tennyson

Dear Paul,

As we discussed last Friday, this letter will provide you with an overview of where our investigations stand to date and how we plan to proceed in the remaining weeks.

In addition, we have attached a copy of the table of contents from our draft baseline report. Dr. Anderson will be expanding the number of Market Forecast sections once he performs his computer analysis. We have also attached, for your information, several tables and graphs generated from our progress thus far.

Per our contract, also enclosed is our invoice for services rendered to date.

Just to reiterate, the overall objectives of this study are to, 1) Provide a baseline of production and marketing information, and address the potential for market competition between 1) Alaska wild salmon fisheries and Alaska pen-reared salmon, and 2) farmed salmon from any country with either type of Alaska salmon.

Task 1: Baseline Market and Price Information

Wild Salmon

A thorough overview of the Pacific salmon fishing industry and markets has been done. The Consultants identified, collected and reviewed available literature and information pertaining to the five Pacific species, their biological cycles, landings, catch methods, seasonalities and usual product forms.

Quantities of U.S. salmon exports have been gathered as well as the tariff schedules for the major world salmon markets. A description has been drafted about the general market characteristics of these countries and guidelines for purchase arrangements with them.

February 2, 1988
Page 2

Market and distribution channels for the U.S. as well as those countries identified as major world markets in salmon are also defined and illustrated. This also includes the typical fresh salmon shipping methods and packaging. Based on available secondary information, the demographics of salmon consumption in the U.S. is described.

With a number of gaps, price data has been collected for the Pacific species over the past ten years. We are looking for additional sources of information.

As you mentioned Paul, the economic study which was undertaken by the State of Alaska but unfortunately not completed due to lack of funding, would be very helpful, even if it is just raw price data. We would appreciate receiving this information as soon as possible.

In the mean time we will utilize other sources of price data and continue to work with the information we have.

Farmed Salmon

Data has been collected and assembled pertaining to the current and projected production of world farmed salmon. The major producing countries are identified and their production levels are given for the past five years. General information about their salmon farming industries is also described.

Most major farmed salmon producing countries have estimates of projected production to the year 1990, several to 1995, but most of these latter figures are very suspect.

This will give indications as to the amount of farmed salmon which will be entering the world markets.

Price data for the major exporting countries to the U.S. has been collected, although there are some gaps at this time in the data due to many pricing sources not really tracking the prices of farmed salmon until the past couple of years. Further discussions with price sources are continuing to determine where the information can be obtained to fill the gaps.

The major world markets for farmed salmon have been described. The quantities of imports and exports, preferred species, product forms, sizes and market channels are presented.

Preliminary information has been gathered concerning the effects of the exchange rate on international trade in salmon by the Consultants, and more will be written as Dr. Anderson proceeds with his analysis.

3
Mr. Paul Peyton
February 2, 1988
Page 3

Task 2: Market Forecasts

Concerning the future markets, price level expectations and degree of market competition, last week Sea Fare Group with Dr. Anderson and his associates performed a series of surveys in the Seattle area with Japanese trading companies, restaurants, individual supermarket behind-the-counter staff as well as seafood buyers for supermarket chains and large wholesale/distributors.

We also plan to conduct phone interviews with Southern California supermarket seafood buyers as well as several salmon smoking companies here in Seattle. This would provide an adequate sample for the West Coast.

These surveys are similar to the surveys Dr. Anderson used in his East Coast studies. They will provide answers to questions including the seafood buyers' species preferences, the influence of price on the decision, species substitutability and perceived differences between wild and farmed salmon, if any perceptions are held by the buyer, preferred packaging and shipment sizes.

A large amount of data has been collected through the surveys and will be entered into the computer for analysis.

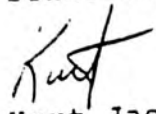
As the input by Dr. Anderson is received by us, we will begin the task of editing and merging it with our report.

In regards to our discussions last Friday concerning the time schedule for this project, we will continue on the premise that it remains unchanged until we hear from you otherwise, with the draft report due on February 26 and the final report due on March 4.

In our discussions it was determined that an additional week or two would assist the consultants in preparing a more finalized quality report, as well as preparations for a workshop or presentation in Alaska. You indicated the possibility of extending the project due date to perhaps March 11 for the final report and a presentation on the 18th, but this would first have to be approved by either you or your office.

Please let us know as soon as you can concerning the decision on the project completion date. Should you have any questions regarding this interim report or the project due date please give us a call.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Kurt', with a stylized flourish extending from the end.

Kurt Jacobsen

encls.

Se

**MARKET ACCESS
AND
PENETRATION STRATEGY
B.C. FARMED SALMON**

FINAL REPORT

The DPA Group Inc.

MARKET ACCESS AND
PENETRATION STRATEGY
B.C. FARMED SALMON

FINAL REPORT

Prepared for:

B.C. Salmon Farmers
Association

Prepared by:

The DPA Group Inc.
and Dr. J. Anderson
and Michael D. Hurst
File: 14487

February, 1987

ACKNOWLEDGEMENT

This study was funded by the British Columbia Salmon Farmers Association and the governments of Canada and British Columbia under the Opportunity Identification and Assessment Program of the Canada-British Columbia Subsidiary Agreement on Industrial Development. The opinions expressed in this report are those of the consultants only who accept full responsibility for any errors or omissions.

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Salmon has a high quality image in European countries, and markets for fresh salmon will continue to grow because of rising per capita incomes and existing low per capita consumption levels. However, some market analysts feel that further growth in demand will depend on decreases in the real price of Atlantic salmon. A recent University of Stirling study concludes that a price decline of 20-30% at the retail level would be sufficient to absorb the expected doubling of Atlantic farmed salmon supply by 1990.

B.C. farmed salmon producers would have great difficulty successfully competing in Europe because the competitive position of producers of farmed Atlantic salmon is very strong, due to proximity to markets and changing preferences toward Atlantics. European prospects for B.C. farmed salmon are not expected to improve given anticipated real price declines for Atlantic salmon. Significant air transportation costs will probably lead to uneconomic prices at the B.C. producer level.

At present, North America represents the largest, most immediate market for B.C. farmed salmon. In particular, the U.S. marketplace has the greatest potential for sales. For this reason, our research efforts concentrated on that market. The following section describes the North American market for fresh and frozen salmon in more detail, providing estimates of current and potential demand by principal market segment and region.

3.0 CURRENT CONSUMPTION AND POTENTIAL DEMAND FOR FRESH AND FROZEN SALMON IN NORTH AMERICA

This section describes the current size of the fresh and frozen salmon market in North America by region and market segment and presents the results of the conjoint analysis indicating the growth potential of each segment.

3.1 Current Consumption

No statistics are available on the amount of fresh salmon consumed in the U.S. and Canada; nor is there much data on the quantity of fresh or frozen salmon shipped into food service and retail markets.

We used two approaches for estimating current consumption. Both yielded similar results. One estimate of total consumption can be derived from analysis of catch and other statistics, as shown in Exhibit 3.1. Consumption in the U.S. is calculated as a residual amount. In contrast to the U.S., Canadian production of fresh/frozen salmon is actually compiled. (Only B.C. production totals are included in the Canadian total because Atlantic production is nominal.)

EXHIBIT 3.1: SIZE OF THE NORTH AMERICAN FRESH AND FROZEN SALMON MARKET IN 1985 (TONNES)

	U.S. ¹	Canada	Total
Total Salmon Catch	329,815	38,158 ²	
Less: Exports	(151,172)	(23,698) ³	
Less: Canned pack	(112,616)		
Plus: Imports	14,474		
Changes in Inventory	<u>10,293</u>		
Apparent Consumption	70,208	14,460	84,668

Sources: 1. National Marine Fisheries Service.
 2. B.C. Ministry of Environment and Parks.
 3. Statistics Canada.

The size of the market can also be estimated by extrapolating Anderson's conjoint analysis results to the rest of North America. Using this method, the size of the fresh/frozen market is estimated at 86,200 tonnes. This figure is within 4% of the estimate in Exhibit 3.1. A further advantage of Anderson's market estimate is that it provides a detailed breakdown by both market segment and geographic area.

Size of Segments

A summary of current consumption in the U.S. in 1985 by segment is shown in Exhibit 3.2. The quantities shown are estimates only; actual quantities will vary somewhat due to idiosyncrasies in various markets.

As indicated in the exhibit, restaurants comprise the largest segment for fresh/frozen salmon. The split shown in Exhibit 3.2 is generally consistent with splits determined in other recent studies of the U.S. market, which are summarized in Exhibit 3.3. The percentage sold in each segment as identified in the Ference and Lin studies are based on surveys of wholesalers; the Oslo and Woods Gordon percentages are estimates only.

EXHIBIT 3.2: CONSUMPTION BY SEGMENT IN THE U.S. IN 1985

	Tonnes	% of Total
Food Service		
Restaurants	43,200	60%
Retail		
Grocery Supermarkets	14,100	19%
Fish Markets	<u>15,400</u>	<u>21%</u>
Total	72,700	100%

Source: The DPA Group Inc. and J. Anderson

EXHIBIT 3.3: PERCENTAGE OF CONSUMPTION IN RETAIL VS FOOD SERVICE SEGMENTS IN THE U.S.

	DPA (1985)	Ference ¹ (1986)	Rogness ² & Lin (1986)	Oslo ³ (1986)	Woods ⁴ Gordon (1983)
Food Service	60	45	59	55	50
Retail	<u>40</u>	<u>55</u>	<u>41</u>	<u>45</u>	<u>50</u>
	100	100	100	100	100

Sources:

- 1 Don Ference & Associates Ltd., B.C. Indian Aquaculture Study - Market Potential for Farm Salmon Products, B.C. Aboriginal People's Fisheries Commission, June 1986.
 - 2 R.V. Rogness, B. Lin The Marketing Relationship Between Pacific and Pen-raised Salmon: A Survey of U.S. Seafood Wholesalers, University of Alaska, Alaska Sea Grant Report 86-3, September, 1986.
 - 3 E. Dale, J. Owens, A. Stenseth: Tilling the Sea - Prospects for Norwegian Aquaculture, Royal Norwegian Council for Scientific and Industrial Research, July, 1986.
 - 4 Woods Gordon, U.S. Market Opportunities for Farmed Atlantic Salmon, New Brunswick Commerce and Development, October, 1983.
-

An analysis of production statistics for fresh wild-caught salmon from B.C. and Alaska and the level of imports of fresh farmed salmon indicate that total consumption of fresh salmon varies between a quarter and one-third of the total fresh/frozen salmon. This is confirmed by results of the survey of wholesalers conducted in the Ference study.

Exhibit 3.4 shows an estimate of fresh and frozen salmon production by species in 1984. Estimates were developed from a breakdown of B.C. wild and farmed salmon production and imports of farmed Atlantic salmon in 1984. As indicated in the exhibit, two-thirds of total production is frozen. Production of coho is highest, and is mostly frozen. Production of coho and chinook constitutes 40% of the total market. Atlantic production constitutes 11%. The majority of Atlantic is sold fresh.

EXHIBIT 3.4: PERCENTAGE OF FRESH AND FROZEN SALMON
PRODUCTION BY SPECIES IN 1984¹

	Frozen	Fresh	Total
Coho	22%	5%	27%
Chum	17%	6%	23%
Sockeye	12%	3%	15%
Chinook	7%	6%	13%
Pink	8%	3%	11%
Atlantic	<u>1%</u>	<u>10%</u>	<u>11%</u>
	67%	33%	100%

- 1 A breakdown for 1984 is shown because more recent statistics on fresh production from Alaska were not available.

Source: DPA Group Inc.

Atlantics, chinook, coho, and sockeye compete at the upper end of the market, as would premium quality farmed salmon products. Chums and pinks, which constitute 34% of the market, are at the lower end of the price scale. Lower quality farmed salmon products would compete in this category.

According to FAO statistics, approximately 10% of current supplies of frozen salmon production are further processed into smoked salmon.

3.1.1 Regional Demand

A summary of current demand in North America by region is shown in Exhibit 3.5. The results are extensions of Anderson's survey of buyers conducted in the spring of 1986 which reflects consumption during the June, 1985 to June, 1986 period.

As indicated in the exhibit, the U.S. represents 84% of total North American demand. Demand is highest in the Mid Atlantic region, followed by the Pacific and South Atlantic regions. Combined, these three regions represent 61% of the U.S.

demand and 52% of the total North American demand. A detailed breakdown of the U.S. market by state is included in Appendix B. As indicated in the appendix, the majority of demand in the Mid Atlantic regions is in New York and the majority of demand in the Pacific region is in California.

Canada represents 16% of total North American demand. Ontario and Quebec account for 62% of Canadian demand and 10% of North American demand. B.C., with a small population compared to other regions, accounts for only 2% of total demand.

Some differences in the relative size of segments also exist between Canada and the U.S. Canada has a higher proportion of sales to restaurants than the U.S. Also, more sales are made to grocery chainstores than to fish markets in Canada.

EXHIBIT 3.5: EXISTING REGIONAL CONSUMPTION FOR FRESH/FROZEN SALMON IN NORTH AMERICA IN 1985 (TONNES)

	Restaurants	Grocery Supermarkets	Fish Markets	Total	% of Total
US					
New England	4,600	1,000	2,500	8,200	10%
Mid Atlantic	9,000	3,300	5,000	17,300	20
NE Central	5,500	1,500	700	7,700	9
NW Central	1,100	400	100	1,600	2
SO Atlantic	5,600	2,900	3,000	12,000	14
SE Central	2,600	1,200	1,000	4,800	6
SW Central	2,700	1,400	500	4,700	5
Mountain	700	300	100	1,100	1
Pacific	<u>10,900</u>	<u>2,000</u>	<u>2,400</u>	<u>15,300</u>	<u>18</u>
	43,200	14,100	15,400	72,700	84%
	60%	19%	21%		
Canada					
B.C.	1,000	300	200	1,500	2
Prairies	1,600	500	300	2,400	3
Ontario	3,200	1,000	600	4,800	6
Quebec	2,300	800	400	3,500	4
Maritimes	<u>800</u>	<u>300</u>	<u>200</u>	<u>1,200</u>	<u>1</u>
	8,900	2,900	1,700	13,500	16%
	66%	22%	12%		
Total	52,100	17,000	17,100	86,200	100%
	60%	20%	20%	100%	

Source: The DPA Group Inc. and J. Anderson

3.2 Potential Demand

The conjoint analysis model can be used to predict growth by segment based on the availability of preferred products. In the model, preference, price, and demographic variables, such as changes in population and per capita income, are held constant. The model predicts additional quantities demanded as a result of perfect supply availability of most preferred salmon products. These were comprised of the highest-ranked products from the list of 77 we assumed would be available from a variety of farmed and wild salmon supply regions, including B.C. In effect, the buyers in the sample were asked how much more salmon they would buy at current prices if their preferred salmon products were available.

The growth potential for each segment is shown in Exhibit 3.6.

EXHIBIT 3.6: GROWTH POTENTIAL BY SEGMENT

	Existing Shares	Growth Potential	Potential Shares
Food Service:			
Restaurants	60%	42%	55%
Retail:			
Groceries/Supermarkets	20%	109%	27%
Specialty Fish Stores	<u>20%</u>	<u>43%</u>	<u>18%</u>
Total	100%	<u>overall</u> 57%	100%

As indicated above, good growth potential exists in all segments. The largest growth opportunity is in the grocery supermarket segment, but it is at present the smallest segment. Overall growth potential for all segments is 57%.

Potential demand by region for existing production is shown in Exhibit 3.7. The results are extrapolated from New England

(1572 of 1985)
at current
prices

survey data and modified to account for per capita consumption by region; the exception is Canada where per capita consumption by province is not known.

EXHIBIT 3.7: POTENTIAL REGIONAL DEMAND FOR FRESH/FROZEN SALMON IN NORTH AMERICA

	Restaurants	Grocery Supermarkets	Fish Markets	Total
US				
New England	6,600	2,200	3,600	12,400
Mid Atlantic	12,800	6,900	7,100	26,800
NE Central	7,900	3,000	1,100	12,000
NW Central	1,600	900	100	2,600
SO Atlantic	8,500	6,100	4,400	18,900
SE Central	3,800	2,500	1,400	7,600
SW Central	3,900	3,000	700	7,600
Mountain	900	700	200	1,800
Pacific	<u>15,600</u>	<u>4,200</u>	<u>3,500</u>	<u>23,200</u>
	61,400	29,400	22,100	113,000
	54%	26%	20%	
Canada				
B.C.	1,400	900	300	2,400
Prairies	2,000	1,100	400	3,700
Ontario	4,500	2,200	900	7,600
Quebec	3,300	1,600	600	5,500
Maritimes	<u>1,100</u>	<u>500</u>	<u>200</u>	<u>1,800</u>
	12,600	6,100	2,400	21,000
	60%	29%	11%	
Total	74,000	35,500	24,500	134,000
	55%	27%	18%	
	21,900	18,500	7,400	47,800

Source: The DPA Group Inc. and J. Anderson.

As shown in the exhibit, existing and unfulfilled (or latent) demand in North America for fresh/frozen salmon is estimated to be 134,000 tonnes. When unfulfilled demand is included with existing demand, restaurants still represent the largest market segment. However, the percentage sold in restaurants decreases from 60% to 55%. The percentage sold in grocery supermarkets increases from 20% to 27%. The percentage sold in fish markets decreases from 20% to 18%.

3.3 Summary and Implications of Demand Projections

There appears to be considerable scope to increase consumption of fresh and frozen salmon in North America without dramatic shifts in determinants of demand such as prices or preferences. The analysis presented above suggests that potential demand for fresh/frozen salmon could increase by more than 50% if supply of preferred salmon products were consistently available.

It also implies that restaurants will remain a large, important market outlet for fresh salmon. Although the expected growth rate in the grocery/supermarket sector is by far the largest, it presently handles only 20% of demand.

Further implications of these results on the overall demand/supply balance, prices, and the design of strategies are discussed in later sections.

FOOTNOTES

1. The components used to estimate aggregate demand using Anderson's sample results are shown below.

Current demand by segment (New England)	X	Adjusted No. establishments by segment in each state	X	Adjustment factor for variations in regional per capita consumption	=	Aggregate Demand
---	---	--	---	---	---	------------------

The current demand by segment was derived from Anderson's survey of buyers (see Appendix A). Weekly demand adjusted for demand differences in summer and winter by segment was multiplied by 52 to estimate annual demand. The number of establishments by sector in each state was determined from the 1986 edition of American Business List Inc. This publication contains current yellow page listings of the total number of establishments by state and province. An adjustment was

made to the food store totals: only one-third of the total food stores was assumed to be grocery supermarkets, which effectively eliminated food convenience stores. An adjustment was also made to restaurant totals to capture those most likely to use salmon. Based on Anderson's New England sample, only 32% of all restaurants had salmon on their menus. (The remainder were fast food/coffee shops, ethnic restaurants, bars, or firms out of business.)

An adjustment factor for variations in regional per capita consumption of finfish was included in the calculation because per capita fish consumption in New England is higher than in other regions. The most recent national fish consumption survey conducted in the U.S. by the National Marine Fisheries Service was used.

5.0 PROJECTED SUPPLIES OF FARMED SALMON IN NORTH AMERICA

This section estimates the production for B.C. and competing regions during the next five years. The expected overall supply/demand balance and the expected impact on prices are also discussed.

Worldwide farmed salmon production is increasing rapidly. As shown in Exhibit 5.1, farmed salmon production increased by 94% from 1983 to 1986. The distribution of U.S. imports by country of origin and port of entry for 1985 and 1986 is shown in Exhibit 5.2.

EXHIBIT 5.1: FARMED SALMON PRODUCTION 1983-1986 (TONNES)

	1983	1984	1985	1986
Atlantic Salmon				
Norway	17,016	22,196	28,656	38,000
Scotland	2,536	3,912	6,921	9,700
Ireland	256	340	700	1,500
Faroes	160	300	500	1,200
Other European	190	250	400	1,100
North American	<u>180</u>	<u>250</u>	<u>300</u>	<u>1,000</u>
	20,338	27,248	37,477	52,500
Pacific Salmon				
B.C.	125	107	120	1,000
Chile	250	530	870	1,000
New Zealand	10	20	500	500
U.S.	833	1,176	1,257	1,500
Japan	2,760	5,049	6,990	7,200
France	<u>80</u>	<u>100</u>	<u>100</u>	<u>-</u>
	4,058	6,982	9,837	11,300
Total	24,396	34,230	47,314	63,800

Sources: Norwegian Fish Farmers' Association, Irish Sea Fisheries Board, B.C. Ministry of Agriculture and Fisheries, Canadian Embassy in Tokyo, and others.

EXHIBIT 5.2: U.S. IMPORTS OF FRESH WILD AND FARMED SALMON^a, BY PORT OF ENTRY, 1985

		<u>Canada</u>	<u>Norway</u>	<u>United Kingdom</u>	<u>Ireland</u>	<u>Chile</u>	<u>New Zealand</u>	<u>Other Countries</u>	<u>TOTAL</u>
Boston	M.T.	2.33	1,422.98	189.98	3.82	-	-	20.22	1,639.23
	% of Total	0.15	22.74	48.26	25.69	-	-	5.50	18.76
New York City	M.T.	2.74	3,157.98	13.95	3.42	47.04	-	81.26	3,306.39
	% of Total	0.19	50.47	3.54	23.00	32.53	-	22.09	37.84
Los Angeles	M.T.	16.68	731.80	1.94	3.74	42.89	57.39	82.08	936.52
	% of Total	1.14	11.70	0.49	25.15	29.66	58.64	22.32	10.72
San Francisco	M.T.	1.92	554.12	4.69	-	-	13.91	11.59	586.23
	% of Total	0.13	8.86	1.19	-	-	14.21	3.15	6.71
Seattle	M.T.	1,329.50	94.77	2.43	-	47.72	26.57	10.80	1,511.79
	% of Total	90.97	1.51	0.62	-	33.00	27.15	2.94	17.30
Washington, D.C.	M.T.	-	130.25	81.01	-	-	-	0.69	211.95
	% of Total	-	2.08	20.58	-	-	-	0.19	2.43
Chicago	M.T.	-	24.94	4.03	2.84	-	-	25.56	57.37
	% of Total	-	0.40	1.02	19.10	-	-	6.95	0.66
Miami	M.T.	-	51.83	2.28	-	3.02	-	0.10	57.23
	% of Total	-	0.83	0.58	-	2.09	-	0.03	0.66
Other Ports	M.T.	108.40	88.49	93.32	1.05	3.92	-	135.51	430.69
	% of Total	7.42	1.41	23.71	7.06	2.71	-	36.84	4.93
TOTAL	M.T.	1,461.47	6,257.16	393.63	14.87	144.59	97.87	367.81	8,737.40
	% of Total	16.73	71.61	4.51	0.17	1.65	1.12	4.21	100.00

^a Excludes fresh fish fillets

Source: U.S. Department of Commerce, Washington, D.C.

British Columbia

The B.C. Salmon Farmers Association forecasts production of about 10,000 tonnes in 1988/89. Based on the proportion of eggs by species distributed to the industry in 1986 and interviews with producers, a breakdown of the estimated production by species and size was derived and is shown in Exhibit 5.3.

EXHIBIT 5.3: ESTIMATED BC FARMED SALMON PRODUCTION IN 1988/89¹
(TONNES)

Size (lbs)	Coho	Chinook	Atlantic	Trout	Total Production	% of Total
Pan size	500	-	-	-	500	4%
2-4	1,500	500	-	500	2,500	22%
4-6	1,750	1,250	250	500	3,750	33%
6-9	1,750	1,750	250	-	3,750	32%
9+	-	1,000	-	-	1,000	9%
Total	5,500	4,500	500	1,000	11,500	100%
% of Total Production	48%	34%	4%	9%	100%	

¹ Production is shown in live weight equivalents.

Source: The DPA Group Inc.

As indicated, nearly one-half of total production is likely to be coho. Chinook should comprise nearly 40% of the industry's production based on a declared surplus availability of chinook eggs from DFO hatcheries in 1986.

Norway

Norway has the world's largest farmed salmon industry, producing nearly 80% of all farmed Atlantic salmon. Production has increased from 100 tonnes in 1971 to 38,000 tonnes in 1986. In 1985, nearly 600 licensed fish farms were in operation. Production is forecast to increase to 30,000 tonnes by 1990. The industry is dominated by small independent farms because of government restrictions on size and ownership. A strong producers association has, among

EXHIBIT 5.2a: U.S. IMPORTS OF FRESH WILD AND FARMED SALMON^a, BY PORT OF ENTRY, 1986

		<u>Canada</u>	<u>Norway</u>	<u>United Kingdom</u>	<u>Ireland</u>	<u>Chile</u>	<u>New Zealand</u>	<u>Other Countries</u>	<u>TOTAL</u>
Boston	M.T.	4.39	2,196.50	169.89	9.41	8.79	1.64	34.35	2,424.97
	% of Total	0.18	24.81	46.33	45.39	1.29	1.02	9.59	18.77
New York City	M.T.	0.39	4,462.73	41.46	0.31	179.30	5.16	108.87	4,798.22
	% of Total	-	50.41	11.31	1.50	26.39	3.21	30.39	37.14
Los Angeles	M.T.	22.37	900.49	12.12	0.26	265.03	86.76	95.45	1,382.48
	% of Total	0.90	10.17	3.31	1.25	39.01	53.96	26.65	10.70
San Francisco	M.T.	8.74	464.80	3.68	-	42.28	16.78	38.07	574.35
	% of Total	0.35	5.25	1.00	-	6.22	10.44	10.63	4.45
Seattle	M.T.	2,244.66	94.45	2.13	-	104.94	50.46	7.58	2,504.22
	% of Total	90.52	1.07	0.58	-	15.45	31.38	2.12	19.39
Washington, D.C.	M.T.	-	219.42	43.57	-	-	-	2.71	265.70
	% of Total	-	2.48	11.88	-	-	-	0.76	2.06
Chicago	M.T.	-	104.69	0.62	4.16	16.04	-	43.08	168.59
	% of Total	-	1.18	0.17	20.07	2.36	-	12.03	1.31
Miami	M.T.	1.01	151.74	-	-	60.93	-	4.17	217.85
	% of Total	-	1.71	-	-	8.97	-	1.16	1.69
Other Ports	M.T.	198.19	257.96	93.19	6.59	2.09	-	23.92	581.88
	% of Total	7.79	2.91	75.42	31.79	0.31	-	6.68	4.50
TOTAL	M.T.	2,479.75	8,852.78	366.66	20.73	679.40	160.80	358.20	12,918.26
	% of Total	19.20	68.53	2.84	0.16	5.25	1.24	2.77	100.00

^a Excludes fresh fish fillets

Source: U.S. Department of Commerce, Washington, D.C.

other things, established quality control and grading standards, set minimum prices for farmers, licensed exporters, and promoted sales.

The proportion of production in 1985 in various size categories are shown in Exhibit 5.4. As indicated in the exhibit, the highest proportion is in the 2-3 kilogram size class.

EXHIBIT 5.4: PROPORTION OF NORWEGIAN PRODUCTION IN 1985 IN VARIOUS SIZE CATEGORIES

<u>Size range</u> Kg	<u>Proportion</u> %
0-1	8
1-2	20
2-3	32
3-4	20
4-5	10
5-6	4
6+	6
	<u>100%</u>

Source: Norwegian Fish Farmers Sales Organization

In 1985, about 90% of farmed salmon production was exported from Norway. Most exports were to France and other European countries. Approximately 24% of export sales were to the U.S. Markets in Europe are expected to remain the largest during the next five years, followed by the U.S. and Japan.

In order to sell the substantial increase in production forecast to 1990, Norway will have to develop an aggressive marketing strategy with traditional customers and in new market areas. This will probably include more marketing directed at retail outlets, improved packaging and advertising, and added-value processing. Increased concentration will probably occur at the exporter level and more influence over foreign distribution will be sought. In addition, Norwegians hope to maintain a technological edge over other producing regions.

Several constraints may limit this growth potential. The limit on the size of farms may actually result in farms producing at sub-optimal levels from a cost minimization perspective. This could put them at a disadvantage in the long term.

Increased exports to the U.S. will result in increased vulnerability to currency fluctuations. As a non-member of the EEC, Norway could also face high tariff rates for exports to Europe. Pollution from aquaculture is becoming more of a problem in Norway and may result in increased disease problems. Lack of capacity in commercial airlines serving the U.S. and Japan may require planes to be chartered. This would result in increased transportation costs, which already average between \$1.75 and \$2.00 per kilogram to Boston or New York. Maximum current capacity on commercial airlines from Norway is 15,000 tonnes to the U.S. and 6,000 tonnes to Japan.

United Kingdom

Farmed Atlantic salmon production in the U.K. is concentrated in Scotland. Although the industry began at about the same time as Norway's, production has not grown as quickly, rising from 600 tonnes in 1980 to nearly 9,700 tonnes in 1986. Projected production in 1990 is 25,000 tonnes. Fifty-seven companies reported production in 1984, but five companies produced 66% of total production in 1984. The larger companies are either part of conglomerate multi-national companies or have Norwegian investment. Combined hatchery and grow-out sites are the predominant form of vertical integration. Salmon farming companies are not heavily involved in downstream fish processing. Most members in the industry belong to the Scottish Salmon Growers Association. The association has developed voluntary quality control and grading standards and is active in the promotion of Scottish farmed salmon.

Most production is consumed within the U.K. About 25% is exported. At present, major export markets are continental Europe and the U.S. These markets are expected to increase in importance during the next five years. The Scottish industry is more advanced than other areas in packaging farmed salmon in consumer-sized packages. As a result, it may possibly have more success than other competitors in penetrating the grocery supermarket segments in the U.S.

Chile

Production of farmed salmon in Chile has been mostly coho, and is concentrated near Puerto Montt in the southern third of Chile. Production in 1986 from nine sites was nearly 1,000 tonnes, a four-fold increase over 1983 production. Eleven companies operate nine hatcheries and 15 cage sites. Companies are mostly large and four are owned by commercial fish processors. Nichino, a large Japanese fish processing company, has an interest in one farm. Another farm, producing Atlantic salmon, has Norwegian backing. Ocean ranching of coho has also begun in Chile. Projected production in 1990 from pen reared and ocean ranching operations is 3,500 tonnes.

Almost all production will probably be sold in the U.S. At present there is no producers association or joint marketing efforts, but both will probably be established in the near future. Growing conditions in Chile are similar to B.C.'s, if not slightly better. However, the industry is less capital intensive. Operating costs are also considerably lower than in B.C., particularly labour. In addition, the value of the peso relative to the Canadian and other currencies has decreased considerably in recent years. As a result of these factors, the Chileans will probably be able to underprice other competition.

The constraints the industry faces are transportation disadvantages from Puerto Montt, reliance on egg supplies from Oregon and Washington, and a short selling season.

New Zealand

Chinook salmon farming has recently been introduced in New Zealand. Eight farms produced about 500 tonnes in 1986. Ocean ranching has also begun. Projected production by 1990 is 3,000 tonnes.

Producers recently formed an association which has developed quality control and grading standards. Sales to date have been mostly to the U.S. and Japan.

The main disadvantage the industry faces is high transportation costs due to its remote location. However, its ocean ranching activities may result in lower production costs than B.C.'s farming industry because there is no high seas interception of its releases. Ocean ranching is essentially a wild fishery. Production from it will therefore be mostly inflexible from a timing perspective.

New Brunswick

Atlantic salmon production in New Brunswick was 180 tonnes in 1985. Ten companies operate in the St. Andrews area in the Bay of Fundy, including a joint venture between Sea Farm and Canada Packers. Connor Brothers, a major commercial fish processor, has recently constructed a grow-out site, in addition to a hatchery and fish feed plant. The company is reportedly entering contract farming arrangements with some smaller firms. Projected production in 1990 is estimated at over 4,000 tonnes.

A producers' association does not exist, but is yet to be involved in marketing. Six companies have formed a marketing co-operative under the name Atlantic Silver. Target markets to date have been Central Canada and the U.S. Eastern Seaboard.

One production constraint is the risk of lethal water temperatures in winter, particularly outside of the Bay of Fundy. As a result, future production in the Maritimes will probably be restricted to the Fundy area.

United States

On the west coast, production is dominated by one large Washington producer of pan-sized coho, Domsea Farms Inc., which is owned by the Campbell Soup Co. This company annually produces in excess of 1,000 tonnes. A few, small, pan-sized coho producers also operate in Washington. Atlantic salmon is also being raised by a Norwegian backed firm in the San Juan Islands. Projected production in 1990 is 2,000 tonnes.

On the East Coast there were seven active farms in the early part of 1987. The most established of these was Ocean Products Inc. (OPI) near Eastport, Maine. OPI production from sea pens in 1986 was approximately 100 tonnes, which represented about 90% of total production. Active farms include two recently constructed land-based systems located in Maine. These facilities will produce mostly Atlantic salmon with some coho production. An ocean ranching operation is also reportedly underway. Two major processors have invested in farms and two other farms have minority interests from Norway. Projected production from the region in 1990 is estimated to be 2,000 tonnes.

All U.S. production will probably be sold in domestic markets. Co-operative marketing is not likely. Production on both coasts is restricted because of availability of suitable sites and conflicts with recreational and other users.

Ireland

Ireland's fish farming industry has been producing since 1977. Production has increased from 21 tonnes in 1980 to 722 tonnes in 1985 from 12 farms. Forecasted output by 1990 is 10,000 tonnes. The structure of the industry is similar to Scotland's. Norwegian investment in the industry has occurred. For example, Mowi AS has an interest in the largest fish farm, Fanad Sea Fisheries Ltd.

The Irish industry is represented by the Irish Sea Fisheries Board. Quality control and grading standards have yet to be adopted by the industry. Only limited generic promotion activities have been undertaken, although Ireland is moving toward programs similar to Scotland's.

Ireland exported about 15 tonnes of salmon to the U.S. in 1985. Exports are expected to increase considerably during the next five years.

Summary of World Production and Supply to the U.S. Market

Projected production of farmed salmon in 1990, shown in Exhibit 5.5, is expected to increase to over 185,000 tonnes in 1990, more than double the 1986 estimate. Norway is expected to remain the dominant producer, but significant production is forecast for other regions, particularly Scotland, B.C. and Chile. Production of Pacific farmed salmon is projected to increase from 14% of world farmed salmon production in 1985 to 27% in 1990.

The production forecasts indicate that farmed salmon will increasingly dominate the fresh salmon market worldwide.

Farmed salmon production in 1985 was approximately 5% of total salmon production. Since the wild salmon fishery is not expected to increase significantly, farmed salmon production could by 1990 represent about 15% of worldwide

output. Salmon farming is also likely feasible in other areas such as South-east Alaska. Therefore farmed salmon production may even exceed the estimates shown above.

**EXHIBIT 5.5: PROJECTIONS FOR FARMED SALMON PRODUCTION 1987-1990
(TONNES)**

	1987	1988	1989	1990
Atlantic Salmon				
Norway	50,000	65,000	75,000	100,000
Scotland	14,000	20,000	22,000	25,000
Ireland	2,200	4,500	6,600	10,000
Faroes	2,000	4,000	5,000	6,000
Other European	500	2,000	3,000	4,000
North American	<u>2,000</u>	<u>3,000</u>	<u>4,000</u>	<u>5,000</u>
	70,700	98,000	115,000	150,000
Pacific Salmon				
B.C.	2,500	10,000	13,000	16,000
Chile	1,500	2,500	3,000	3,500
New Zealand	1,500	2,000	2,500	3,000
U.S.	2,000	2,500	3,500	4,000
Japan	<u>6,000</u>	<u>7,000</u>	<u>8,000</u>	<u>9,000</u>
	13,500	24,000	30,000	35,500
Total	84,200	122,500	145,600	185,500

Sources: Norwegian Fish Farmers' Association, Irish Sea Fisheries Board, B.C. Ministry of Agriculture and Fisheries, Canadian Embassy in Tokyo, and others.

Of particular importance to the B.C. industry is that the U.S. will probably become the most competitive market for fresh salmon within a short period. By 1990, the supply of farmed salmon in the U.S. is projected to be approximately 49,400 tonnes, as shown in Exhibit 5.6.

Supply/Demand Balance and Impact on Prices

The total supply of fresh/frozen salmon in the U.S. to 1990 is projected in Exhibit 5.7. No increases over 1985 levels for wild catches and no shift in product mix are assumed. This was considered realistic since 1985 catch levels were high and are not likely to be exceeded by any significant degree during the next five years.

Total supply of fresh/frozen salmon in the U.S. is projected to be about 109,000 tonnes which is similar to our estimate of existing and unfulfilled demand developed in Section 3.0.

EXHIBIT 5.6: PROJECTED SUPPLIES OF FARMED SALMON TO THE U.S. MARKET

Producing Area	Exports to the U.S. (tonnes)				% of Production
	1987	1988	1989	1990	
Norway	10,000	13,000	15,000	20,000	20%
B.C.	2,300	7,500	9,800	12,000	75%
U.S.	2,000	2,500	3,500	4,000	100%
Chile	1,400	2,300	2,600	3,100	90%
Scotland	2,100	3,000	3,300	3,800	15%
Ireland	300	700	1,000	1,500	15%
New Zealand	1,000	1,300	1,700	2,000	66%
Atlantic Canada	1,000	1,300	1,700	2,000	66%
Others	400	600	800	1,000	N/A
Total	20,500	32,200	39,400	49,400	

Source: The DPA Group Inc.

EXHIBIT 5.7: PROJECTED SUPPLY OF FRESH/FROZEN SALMON 1987-1990 IN THE U.S. (tonnes)

	Farmed	Wild	Total Supply
1987	20,500	60,000	80,500
1988	32,200	60,000	92,200
1989	39,400	60,000	99,400
1990	49,400	60,000	109,400

Source: The DPA Group Inc.

This result suggests that the forecasted supply of salmon to the U.S. market until 1990 could be absorbed by the market at current prices, provided no supply and distribution constraints existed. (Our estimate of potential demand assumes salmon supplies were 'perfectly' available, i.e., a supply of quality salmon was continuously available to existing consumers throughout North America.)

In reality, average real prices for farmed salmon likely will continue to decline until 1990 but not greater than 25-30% below current prices.

There are a number of factors which are creating downward pressure on farmed salmon prices. Production efficiencies in regions like Norway and Chile are improving, and increasing competition is forcing producers to reduce the fairly healthy profit margins they have enjoyed to date. For example, average prices dropped approximately 15% in Europe between 1985 and 1986.

There will be inevitable lags in the growth of distribution capabilities and consumption as marketers in North America work to open up new market segments and territories for farmed salmon. Price declines will intensify if all production is directed at existing market segments for farmed salmon in large, urban centres. Already, evidence of saturation in some markets (e.g. expensive seafood restaurants in the mid-Atlantic region) is occurring at certain times of the year.

Finally, the increase in the available sources of supply could increase the market "power" of major U.S. distributors. Brokers and wholesalers will be able to buy farmed salmon from as many as ten regions. The position of the Norwegians as price setters will be more tenuous as a result. Increasingly, distributors will play one source of supply against another in order to bid down prices.

In the face of these downward pressures, there are a number of factors which could counter the extent of expected price declines, and create a strong floor price for fresh salmon. The principal factor is the continued forecasted shortages of most other wild fish species that are potential substitutes for fresh salmon.

Fresh swordfish, halibut, flounder, and tuna are currently forecasted to remain in short supply. This has led to a significant upsurge in prices for these species over the last 18 months. All of these species currently sell for over eight dollars per pound at the retail level in the Eastern U.S., for example. Fresh cod fillets have even attained prices of close to five dollars per pound in fish shops. Continued supply shortages of these substitutes in the face of rising overall demand for seafood will help to maintain a high floor price for fresh farmed salmon.

Some industry observers point to continuity of supply advantages of farmed salmon as another factor which will both open up new retail markets and help to maintain price levels. Once the industry is capable of continuously supplying large weekly volumes of fish, new retail chain markets will open up which will help absorb the large forecasted increases in supply to the U.S.

In summary, current prices in the U.S. for farmed salmon will likely constitute the ceiling for expected prices until 1990. Some continued decline in prices can be expected, but the prices of other fresh fish substitutes should create a strong floor because farmed salmon currently sells for higher prices than most other species.

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SPECIAL LEGISLATIVE SUMMARY

This special summary of legislative action on mariculture combines the April and May issues of the Alaska Mariculture Report. The crush of the last weeks of the session did not allow a regular issue during April. We hope to make amends with this 12-page issue focusing on legislative action. Included are some additional items, including another installment in a series of articles on what Alaska can learn about salmon farming from British Columbia and other areas.

'Anti-Mariculture' Bill Passes in Final Days of Session

by Rodger Painter, AMA Executive Director

Legislation dubbed by some reporters as the "anti-mariculture" bill was pushed through the legislature in the final days of the session, despite indications of widespread support for mariculture development.

The legislation (Senate Bill 514) extended the moratorium on finfish farming for two years, established a finfish farming task force, and gave shellfish farmers a mixed bag of benefits and heavy regulations. The measure was approved by wide margins in both houses, although many lawmakers made it clear they were unhappy with the bill and did not regard it as a good compromise.

The In.rigue

After being bottled up in committee for months, mariculture legislation hit the fast track in the final two weeks of the session when Gov. Steve Cowper combined forces with Senator Dick Eliason, a leading critic of finfish farming. Widespread support for mariculture development crumbled under intense pressure applied by the powerful Sitka Republican, Gov. Cowper, fishermen and environmentalists.

After attracting little attention throughout the session, mariculture became a major adjournment item, taking some participants by surprise. However, some observers have been predicting for months that an extension of the moratorium would be shoved through at the eleventh hour.

SB 514 was introduced by Eliason in late April after a similar

measure (Senate Bill 482) became bogged down in a sharply divided Senate Resources Committee. The Resources Committee debated SB 482 for weeks and had adopted numerous amendments to the measure suggested by the Alaska Mariculture Association (AMA).

At various points in the Resources Committee process, SB 482 allowed many forms of finfish mariculture and removed many of the provisions opposed by shellfish farmers. Frustrated by the revisions and slow movement, Eliason introduced SB 514 as a "shellfish-only" bill that avoided addressing finfish farming.

The new legislation failed to resolve the deadlock, and with as little as two weeks left in the session it appeared that no mariculture bill would clear the legislative process. Most committee members were caught off guard when Fairbanks Senator Ken Fanning moved to pass out both bills for action by the Senate Finance Committee.

Confused by what appeared to be conflicting legislation moving forward, the Finance Committee appeared to be prepared to let the legislation die with less than two weeks in the session. Kodiak Senator Fred Zharoff, who earlier had introduced a pro-mariculture bill, then attempted to hammer out a compromise imposing a three-year moratorium on the pen rearing of salmon, and one year moratoriums on freshwater finfish farming and salt water to upland salmon farms.

Zharoff's compromise failed when the United Fishermen of Alaska and other groups balked at the package because it would allow finfish farming to proceed after the moratoriums lapsed. The final version hammered out by Zharoff, Eliason and the governor's office leaves finfish farming in an ambiguous legal situation at the end of the two-year moratorium.

Eliason's insistence that the bill be unamended, concern over the falling of the moratorium and the lobbying pressure combined to head off such popular amendments as freshwater finfish farming and upland salmon farms with pumped sea water.

How Shellfish Farming will be Affected

SB 514 brings mixed blessings to shellfish farmers. In testimony before the House and on the floor of the Senate, Eliason proudly pointed to a list of benefits under SB 514 to shellfish farmers:

Lease preference. "The commissioner may offer to the public for lease a site that has been developed for aquatic farming or related hatchery operations... Before offering the site to the public, the commissioner shall offer the site to the permittee." Presently, shellfish farmers have no preference and could be outbid by a competitor when securing a long-term lease.

Grandfather clause. All shellfish farmers with a valid tideland permit will automatically qualify for a lease preference or permit on that parcel. SB 514 stipulates that farmer "must agree that during the term of the lease or permit the person will not change the use of the site." This clause apparently is designed to protect against speculators who may wish later modify a shellfish lease to farm salmon or other finfish.

Shellfish hatcheries allowed. SB 514 allows private for-profit shellfish and aquatic plant hatcheries. The state says current law does not provide for private-for profit hatcheries, although some attorneys counter that since private hatcheries are not prohibited by statute they're permissible.

Positive mariculture policy established. A positive findings section in SB 514 is followed by a policy section: "It is the policy of the state (1) to encourage the establishment and responsible growth of an aquatic farming industry in the state; and (2) that allocation of aquatic farming sites be made with full consideration of established and ongoing activities in an area."

Legal status of aquatic plant and shellfish farming firmly clarified in law.

Despite these attractive features, SB 514 was opposed by AMA, Kodiak Mariculture Association and the Alaskan Shellfish Growers Association and individual shellfish farmers because of restrictive siting provisions and wide-ranging powers granted various state agencies.

The most objectionable provision to shellfish growers is a section which prompted weeks of debate before the Senate Resources Committee and had been stripped from SB 482. Under the bill, DNR is required to follow this procedure:

Divide the state into aquatic farming districts.

Schedule at least one 60-day period per year in each district when tideland permit application would be processed.

Consult with the Alaska Department of Fish and Game (ADFG) and the Department of Environmental Conservation (DEC), then issue a preliminary finding proposing sites within the district for which permits may be issued. This preliminary finding and other aquatic farming tidelands actions are to be subject to a broader statutory notice than requirements for any other state land action.

Provide notice and hold a public hearing for all proposed permits, then identify eligible sites with specific conditions and limitations on farming activities.

These siting provisions created considerable controversy because mariculture proponents said they are far more restrictive than what is applied to any other users of public water. The area-wide siting process was devised by DNR, but the agency testified against putting them into statute. AMA and other farmers preferred elimination of the process entirely.

SB 514 also is riddled with open-ended sections giving the agencies broad discretion in regulatory action. For example, ADFG "may attach conditions to a permit issued under this section that are necessary to protect natural fish and wildlife resources." While this sounds pretty reasonable, it also provides the agencies with broad

discretionary authority.

There are numerous examples of overkill in the legislation. For instance, detailed provisions on disease control and inspection provide a framework to be applied to all forms of mariculture, but most are mandatory procedures written primarily to protect wild stocks from salmon farming. Many of the precautions are unnecessary for shellfish and aquatic plant farming.

The agreement between Eliason and Cowper to push through SB 514 with no amendments was quite effective, although the House allowed mariculture advocate Rep. Johnny Ellis to add a couple of minor changes. One amendment removed a provisions requiring DEC to force the labeling of all farm products grown in Alaska as "aquatic farm products."

The labeling requirement, which apparently was designed to differentiate farmed from wild-caught products, was opposed by AMA and many shellfish farmers as unnecessary and ineffective. Ellis argued the section did not make any sense if applied to only shellfish and aquatic plants, since there are no oysters or mussels harvested from the wild.

The Cost of Regulating

Just how much of SB 514 is actually implemented during the coming year probably depends upon how much money the bureaucrats are given. In the rush to push the legislation through at the last minute, funds to the agencies to implement the legislation fell between the cracks.

State agencies are required to prepare "fiscal notes" detailing the cost of implementing each piece of legislation. Last year, fiscal notes were submitted totalling about \$100,000, although all agencies had not compiled estimates.

The fiscal notes for SB 482 and SB 514 escalated to more than \$500,000 each. Perhaps the most surprising feature of the fiscal notes was that the version of SB 482 including freshwater finfish farms and upland saltwater farms only cost \$6,000 more in the first year than SB 514 which excluded finfish farming.

When it became clear the SB 514 fiscal notes had to be trimmed substantially if the measure was to pass, the Cowper Administration came up with an estimate of \$100,000 for the agencies and \$50,000 for the task force.

However, the Finance Committees failed to include the fiscal note in the budget bill and no funds were made available. When the glitch was pointed out, some legislators suggested Gov. Cowper might have to fund the measure out of funds set aside for the governor's office. No funds had been identified by late May.

Even if the \$150,000 is eventually secured, however, it appears highly unlikely that it will be sufficient to allow the agencies to implement many provisions of SB 514.

An example of new programs unlikely to proceed forward even if the entire \$150,000 is secured is DEC's plan to examine shellfish for concentrations of heavy metals. Under its broad authority granted by SB 514, DEC had planned to initiate new shellfish test for heavy metal concentrations.

The agency says there is growing national concern that farmed shellfish may retain significant quantities of heavy metals in their

flesh, and Alaska should be the first jurisdiction to initiate testing programs to avoid potential future problems from adverse consumer reactions.

How Finfish Farming is Affected

The short answer to the question of how SB 514 will affect finfish farming is that it leaves the contentious issue unresolved for another two years.

Extension of the finfish farming moratorium effectively prohibits farmers from proceeding beyond the conceptual stage, and even the one freshwater salmon farm established last year is likely to be stuck in place. The moratorium is exceedingly tight, allowing only a fish farming license and fish transport permit to be issued for "commercial finfish farming in a privately owned freshwater body that has no outlet to state water."

Under the terms of the moratorium, finfish farmers would not be allowed to capture broodstock, or obtain a land-use permit/lease or permits to appropriate water. The state also contends that private for profit hatcheries are not sanctioned by current state law.

Andrew Wescott of Fairbanks has obtained a commercial fish transport permit and fish farming license for farming coho in a spring-fed gravel pit. He also will be receiving 5,000 coho fry from a state hatchery in exchange for his volunteer labor in remote egg takes. The fry will be raised in tanks in Wescott's work shop on an experimental basis.

However, some questions apparently are being raised by state officials over whether Wescott should have been given a fish transport permit or fry without approval of the Board of Fisheries. One attorney general's opinion said existing fish transport regulations should be modified before permits could be granted to finfish farms.

Department of Fish and Game officials also have stated that the Board of Fisheries must approve all sales or transfers of eggs from state hatcheries for fish farming as it involves an allocation issue, even if the eggs are surplus and would otherwise be destroyed. Mariculture advocates question the likelihood of the Board of Fisheries (a seven-member citizens board which traditionally includes five commercial salmon fishermen) approving an egg allocation to foster a fish farming industry.

Even with cooperation from the Board, Wescott apparently will not be allowed to start a hatchery operation. This means he will have to take eggs and rearing space that normally would be used to enhance sport, commercial and subsistence fisheries.

If his initial rearing experiments are successful, Wescott wants to obtain about 500,000 fry next year. This seems highly unlikely to occur, and it appears Wescott will be stopped short of commercial scale production during the life of the moratorium.

A non-binding letter of intent was adopted in the Senate to help Wescott move forward:

It is the intent of the Senate that, for the period of the moratorium on finfish farming, the farming of finfish in a privately owned freshwater body with no outlet to state water

should proceed. By enacting this bill, the Senate also directs the Commissioner of Fish and Game to work with prospective farmers and the Board of Fisheries to develop appropriate proposals to meet the goals of this legislation."

The path for others interested in finfish farming appears to be a deadend. For example, Thorne Ferguson of Anchorage has invested about \$600,000 into a proposed upland saltwater salmon farm near Hydaburg. Ferguson, owner of a small construction company, has been pursuing the farm for about six years. He and his son have hired upland farming expert Jon Lindbergh to design a farm and traveled to Norway, Canada and other areas gathering information.

Ferguson had gained strong support for his project in Hydaburg because he had offered to process his fish in the community-owned cold storage which has had difficulty securing enough product and to hire local residents to work on the farm. Native leaders from other Southeast communities also had voiced support.

Ferguson was caught short by last year's moratorium, but proceeded forward under the good faith assumption that it would expire this July. His options appear to be to try to fit within the narrow confines of the moratorium, abandon fish farming, or declare bankruptcy.

The same situation is faced by Juneau-based Wilderness Acquisitions which sued the state over water rights denied a salmon farming hatchery on Baranof Island (see later article), Indicator, Inc. which is seeking financing for a fish farm located on Ship Creek in downtown Anchorage, and a score of other smaller scale finfish farming projects scattered from Ketchikan to Unalaska.

The Finfish Farming Task Force

The only positive piece of finfish farming news in SB 514 is the creation of the Alaska Finfish Farming Task Force. The task force was a major priority of Sen. Arliss Sturgulewski and other mariculture advocates as a method of getting the debate focused on a good factual plane, rather than emotionalism and fear of the unknown.

Of course, the task force will be hamstrung if no funding is made available.

The moratorium language in SB 514 needs no elaboration:

ALASKA FINFISH FARMING TASK FORCE. (a) The Legislature finds that the farming of finfish raises a series of socio-economic, biological, and environmental issues requiring an in-depth examination.

(b) The Alaska Finfish Farming Task Force is established to study the issue and make a report of findings for administrative and legislative consideration. The governor shall appoint a five-member task force composed of state residents who are not state employees and who represent a broad spectrum of expertise, including one representative of commercial salmon fishermen, one aquatic farming advocate, one private economist, one fisheries biologist, and one public member with no involvement in the seafood or aquatic farming industry.

The task force shall submit an interim report to the legislature not later than January 30, 1989, and a final report to the legislature not later than January 30, 1990. The reports must address finfish farming in the state in freshwater, in marine environments, and in tanks or other enclosed structures that contain marine water and that are located on land, and shall address related hatchery operations. The reports may address other issues the task force considers appropriate. The reports must examine

(1) whether the farming of finfish can be conducted in a manner that protects the health of the state's fishery resources;

(2) criteria for the siting of finfish farms to minimize land use conflicts and to protect the environment;

(3) net economic costs and benefits of finfish farming in the state to state residents, including jobs created or lost for state residents, tax revenue (assuming an appropriate tax rate), cost of state regulation and monitoring, and effects on markets for salmon caught by the state's commercial fishing fleets.

(4) the cost of providing adequate regulation of finfish farming to protect wild stocks, the environment, public health, and existing beneficial uses of the state's coastal water and land, and the role of the private sector in providing pathological and other services;

(5) identification and analysis of appropriate sources of supply for stock for finfish farms, including but limited to private nonprofit hatcheries, private for-profit hatcheries, and wild stock, and their likely effect on existing state policy; and

(6) strategies for improving the marketability of Alaska salmon, particularly those high-value species competing with farmed salmon for domestic and export sales.

Ending of Legislative Saga Anticlimatic

The legislature was so deeply divided over mariculture that nearly everyone was expecting major fireworks when the issue finally hit the floor of the Senate. But, the floor debate was relatively subdued and very anticlimatic, as the issue was settled before the bill ever came up for debate.

As Chairman of the Rules Committee and majority leader, Eliason wielded enormous power at the end of the session, in deciding which legislation would see the light of day, and Eliason's only priority appeared to be pushing through SB 514 unamended. The fate of the mariculture issue was sealed when Eliason was joined in a pact to push through an unamended bill by Gov. Cowper, Sen. Zharoff who supports shellfish farming, Rep. Mike Navarre (chairman of the House Rule Committee), House Speaker Ben Grussendorf, United Fishermen of Alaska, and lobbyists for environmentalists.

Lobbying on the other side of the issue were the AMA, Resource

Development Council and Alaska State Chamber of Commerce. Senate opposition to SB 514 was led by Senators Sturgulewski and Jack Coghill, chairman of the Resources Committee.

It was no contest when push came to shove. On the day of the Senate vote, pro-mariculture forces counted as many as 12 votes in favor of a Sturgulewski amendment to allow the farming of finfish in freshwater and in upland saltwater farms. By the time the vote was taken, however, seven remained in support: Coghill, Fahrenkamp, Faiks, Fanning, Halford, Rodey and Sturgulewski. Only Coghill, Fahrenkamp and Sturgulewski voted against the unamended SB 514.

House supporters of mariculture decided the battle was settled by the time they received the bill and only minor resistance was mounted in the face of the powerful lobbying force mounted by Eliason and company. Rep. Johnny Ellis, who had championed mariculture for the past two years, managed to convince the House Rules Committee to add two minor shellfish amendments, but in the end even he voted for the bill. The House vote was a lopsided 31-6, with Reps. Boyer, Frank, Miller, Pearce, Rieger and Shultz voting no.

Superior Court Decision Ducks Salmon Farming Issue

Superior Court Judge Duane Craske ruled against a Juneau company seeking water rights to build a hatchery to supply brood stock for salmon farms, but the decision failed to clarify the legal status of salmon farming.

Wilderness Acquisitions, Inc., had appealed the denial of a water appropriation permit at Warm Spring Bay on Baranof Island by the Department of Natural Resources (DNR). The City and Borough of Sitka filed an amicus curiae brief in support of the state, and an intervening brief backing DNR was filed in behalf of the United Fishermen of Alaska, Alaska Trollers Association, Sierra Club and Southeast Alaska Conservation Council.

DNR based its denial upon two separate points: (1) the company could not complete an appropriation because salmon farming is not legal, and (2) an ocean ranching salmon hatchery proposed by the Alaska Department of Fish and Game was a better use of the water. Wilderness Acquisitions argued that DNR erred in ruling it could not obtain all permits necessary to get into the salmon farming business, and that it should not be denied water rights for a legal commercial activity, particularly since it applied before ADFG proposed a hatchery for ocean releases.

Sitka and the environmental and fishing groups stressed that the 200 cubic feet per second request by Wilderness Acquisitions was excessive and could periodically dry up Baranof River and its unique waterfall emptying into Warm Spring Bay.

"When reading (then-DNR Commissioner Esther Wunnicke's) decision in its entirety, there can be no question that she had a rational basis for concluding the public interest would best be met by denying the permit," Craske said. The ruling said it appeared the 200 cfs appropriation would adversely affect the ADFG hatchery.

The arguments advanced by Sitka and the brief filed in behalf of the fishing and environmental groups also appeared to sway Craske.

"Based on the foregoing, the court concludes the commissioner's

decision denying WAI's application was reasonably based on its conclusion that the permit was not in the public interest," Craske said. "Because the public interest determination alone is sufficient justification for denying the water permit, the court will not express its opinion as to whether ADFG could preclude fish farming."

Siting a Salmon Farm

One of the most difficult and critical decisions faced by a prospective salmon farmer--where to locate the farm--comes at a time when he or she knows the least. An improperly sited farm is a mistake you may get no opportunity to correct because you may go bankrupt first.

A host of factors are involved in siting, but they probably can be boiled down into two major categories: (1) biophysical criteria; and (2) economics.

Improper siting can lead to disastrous results such as massive mortalities from algae blooms, pollution or swift fluctuations in water temperatures, or slow growth rates from low marine temperatures. Look for areas with strong oceanic conditions and water exchange, stable water temperatures, and high salinity and dissolved oxygen.

Economic considerations obviously are important. If your site is too remote, it will cost a fortune to haul in feed and haul out your fish, and you will be non-competitive. The location of your farm also can affect the stability of your work force and your access to support services.

While economic considerations are important, siting should not be decided upon cost of operation. In the long run, the biological factors involved in siting may be the most important.

The best available report on siting a salmon farming is a 1987 study by the Fisheries Branch in the Ministry of Agriculture and Fisheries entitled: Biophysical Criteria for Siting Salmon Farms in British Columbia. The report provides these guidelines:

Temperature--Summer: 10-15 Centigrade (good); 16-21 C. (medium); greater than 21 C. (poor). Winter: greater than 7 C. (good); 5-7 C. (medium); 4 C. or less (poor). Salmon have low tolerance to sudden temperature change, such as 5 C. change in 12 hours. Avoid poorly flushed enclosed bays and warm water bays subject to upwelling during offshore breezes.

Dissolved Oxygen--Minimum concentration: 8.1 mg/l (good); 6.2 mg/l (medium); 4.5 mg/l (poor). Maximum saturation: 100% (good); 79% (medium); 57% (poor). Salmon require higher levels of dissolved oxygen than other marine fish. For example, coho and chinook show symptoms of oxygen distress when oxygen is below saturation, while Atlantic salmon do not show signs until saturation drops to about 44%.

Salinity--Long term: greater than 24/00 (good); 15-24/00 (medium); less than 15/00 (poor). Fluctuations: 3/00 change (good); 3-5/00 change (medium); greater than 5/00 change (poor). Salinity probably affects growth and mortalities. Full oceanic salinity (28-30/00) is preferred.

Currents--Slack water: 10-15 cm/s (good); 10-2 cm/s (medium);

less than 2 cm/s (poor). Flood: 10-15 cm/s (good); 10-100 cm/s (medium); 100-200 cm/s (poor). Good current flows is important to produce water exchange within net pens, and to disperse waste feed and feces. Avoid excessive flows.

Depth--Greater than 50 meters deep at low tide (good); 20-49 meters (medium); 10-19 meters (poor). Deep waters are preferred for dispersal of waste feed and feces, but you must be able to anchor at a reasonable price.

Geomorphology & Substrate--The best seabed has a 30 degree slope or greater, with rock, sand or gravel. Acceptable is 15-30 degree slope, with sand or mixed rock. A poor seabed is less than a 15 degree slope, with mud or organic ooze. The bottom will affect dispersal of waste feed and feces and water exchange. Dive at your site to check out the ocean floor.

Plankton--One of the biggest problems facing B.C. salmon farmers is the frequent occurrences of phytoplankton blooms, the most dangerous of which are a diatom (non-swimming phytoplankton) called Chaetoseros convolutus and a flagellate (swimming or mobile phytoplankton) Heterosigma akashiwo. Select a site with no history of these algae blooms, and avoid sites where deep nutrient-rich water wells up within the zone of light penetration.

Hydrology--Depth of freshwater lens: less than 1 meter (good); 1-4 meters (medium); and greater than 4 meters (poor). Avoid sites with potential for high runoff of freshwater such as streams that drain large watersheds. Best sites from a hydrological perspective are located in areas of low relief, away from mountain areas.

Predators--Most troublesome predators are seals, sea lions and otter. Locate well away from seal and seal lion rookeries or haul outs.

Marine Plants and Fouling Organisms--Locate away from eel grass beds which are important habitats for many fish and shellfish, and avoid herring spawning areas. Kelp beds can interfere with navigation, foul nets during storms and alter currents. Avoid areas with fouling organisms, such as mussels, barnacles and small plants.

Wind and Waves--Rough water not only causes problems with anchoring systems and makes it difficult for farm workers, but some farmers believe fish in net pens can get sea sick. Excessive wave action can stress the fish.

Pollution--Water pollution problems to avoid: industrial and municipal effluents; discharges from anchored and passing boats; debris from logged watersheds or log-handling areas; accidental spills from transport vessels (oil tankers); upland runoff contaminated with sediment or toxic substances. Water pollution problems are probably not as severe in Alaska as in lower B.C., but should be watched for, particularly in urban areas.

B.C. Aquaculture Show to be World Class

Vancouver, B.C. will host what's believed to be the largest aquaculture trade show ever held in the world on September 6-9, with about 400 exhibition spaces attracting thousands of visitors.

According to event organizers, exhibits are planned from 26 states, eight Canadian provinces, Sweden, Norway, Switzerland, West

Germany, Italy, Iceland, Ecuador, Taiwan, Finland France and the United Kingdom. The 1988 Aquaculture International Congress & Exposition will feature close to 100 speakers from all over the world, addressing a broad range of key and controversial topics.

"The Congress Program is designed to be quite international in scope," said Bill Ellwyn, marketing manager for the event. "We have 30 plenary and concurrent sessions addressing global issues such as production of salmon, trout, oysters and shrimp in cold water and warm water environments, post harvest technology and quality, and a stimulating subject for processors and marketers, that of value-added products." Other topics will cover transportation techniques, packaging technologies, marketing to the domestic and export trades, public and private financing and aquaculture as a viable investment.

The show will be held in Canada's premier convention center, the Vancouver Trade and Convention Centre, which was built for Vancouver's EXPO 86. Admission to the event is \$440 (Canadian) for registrations prior to Aug. 1 and \$500 (Canadian) after that date. For more information, contact: Aquaculture International Secretariat, #801 - 750 Jervis Street, Vancouver, B.C., CANADA, V6E 2A9. (604) 681-5226. FAX: (604) 681-2503.

Mariculture Management Shaped by Studies

While the legislature has been grappling with a state policy on mariculture, state land managers have several study efforts in various stages of completion that will set a framework for hands-on decision making.

The most significant may be two area management plans by the Department of Natural Resources (DNR) that set management policies for Prince William Sound and Prince of Wales Island. The POW plan is nearing completion with release of an April public review draft, while a public version of the PWS was circulated several months ago and is in the final revision stage.

A third project underway is the Etolin Island Area Mariculture Pilot Project, a state-federal agency effort spearheaded by DNR. The Etolin Island plan is designed to "examine the major elements common to mariculture development in a defined area," according to a March agency review draft.

The two area land use plans have almost identical areawide land management policies for mariculture, but specific restrictions and conditions vary from management unit to management unit. Examples of the specific area approach can be found in the POW plan for the Edna Bay and adjoining Coronation Island management units:

Edna Bay--Because of limited area for access, navigation, and anchorage, mariculture will be precluded from Fisherman Harbor and Pole Anchorage. Mariculture may be allowed in the rest of the subunit. However, mariculture should not preclude upland residential uses, including access of planned disposal of land.

Coronation Island--Mariculture will be allowed only to the extent it is consistent with the management intent of this unit (wilderness). Mariculture should not be located in this unit if there are feasible and prudent alternatives. Only mariculture

growing facilities that are submerged and do not impact the visual characteristics of the wilderness or wildlife refuge may be considered for authorization. Mariculture support or caretaker facilities will not be authorized within the subunit.

The areawide management guidelines in the two plans cover competing uses, separation between facilities, upland owner support for mariculture objections, mariculture caretaker facilities, siting near anadromous fish streams, siting in certain habitats, siting near marine mammals and birds, performance standards, development plans, preferred storage sites, dispersion of organic deposits, Coast Guard approval, and other guidelines affecting mariculture.

Regarding competing uses, the POW plan said: "Mariculture may be allowed on state tidelands where there is no significant conflict. The siting of mariculture facilities may be more difficult on tidelands designated for log transfer or storage, mineral transfer or access, commercial activities, crucial fish and wildlife habitat, intensive harvest areas, adjacent to existing or proposed land sales, or developed recreation.

"These areas will be available for mariculture (a) if the land manager determines that it is possible to site, design, and operate the two or more uses compatibly in the same area, or (b) there is no feasible and prudent alternative for mariculture while one exists for the competing use.

"In no case will mariculture be allowed to foreclose access to mineral, timber, or recreational resources unless feasible or prudent alternative access exists. However, in some cases it may be in the public interest to concentrate uses in one bay, (i.e., pen reared salmon and timber transfers) rather than allowing the proliferation of uses in many bays."

Comments on the POW plan are due June 16. For more information, contact: Dee Koester or Chas Dense at 465-3400, DNR, Resource Allocations Section, 400 Willoughby, Suite 400, Juneau, AK 99801.

For information on the PWS plan, contact: Bob Loeffler, Prince William Sound Area Plan, DNR, P.O. Box 107005, Anchorage, AK 99510-7005.

A public review draft of the Etolin Island project will be released in the near future. For more details, contact: Terry Rader, Etolin Area Mariculture Project, DNR, 400 Willoughby Ave., Suite 400, Juneau, AK 99801-1000. 465-3400.

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The Alaska Mariculture Report is a monthly newsletter published by the Alaska Mariculture Association. We encourage contributions. AMA members receive the publication at no cost. Annual subscriptions are available to non-members for \$20 domestic or Canada, or \$25 foreign. For more information, contact: Alaska Mariculture Association, 130 Seward St., Suite 201, Juneau, Alaska 99801. (907) 463-3600.

STEVE COWPER
GOVERNOR



STATE OF ALASKA
OFFICE OF THE GOVERNOR
JUNEAU

June 8, 1988

The Honorable Jan Faiks
President of the Senate
Alaska State Legislature
P.O. Box V
Juneau, AK 99811

Dear Senator Faiks:

On this date I have signed the following bill and am transmitting the engrossed and enrolled copies to the Lieutenant Governor's Office for permanent filing:

HOUSE COMMITTEE SUBSTITUTE FOR
COMMITTEE SUBSTITUTE FOR
SENATE BILL NO. 514(R1s)

(Relating to the farming of aquatic plants and shellfish;
prohibiting the farming of Atlantic salmon; extending
the moratorium on finfish farming until July 1, 1990;
establishing the Alaska Finfish Farming Task Force;
and providing for an effective date.)
Chapter No. 145, SLA 1988

Our existing seafood industry is extremely important to our coastal communities and Alaska's economy as a whole and must be protected, while at the same time taking advantage of new opportunities. Mariculture may well prove to be one of the more significant opportunities we have to diversify and expand our seafood industry.

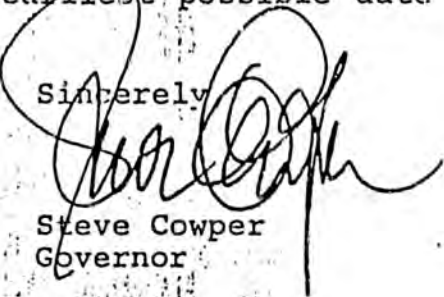
I believe there remain many unanswered questions regarding finfish farming, particularly salmon. I will not do anything to jeopardize either existing markets or our natural fisheries stocks. Therefore, I support the concept of this bill to proceed cautiously on the issue of finfish farming. I am interested, however, in continuing to collect factual information about the potential of salmon farming in Alaska. I remain open to considering other species of finfish mariculture besides salmon.

Potential use conflicts of areas for mariculture activities are going to be a problem which we will have to address and consider when permitting mariculture activities. This legislation places additional permitting responsibilities and requirements on state agencies. It also calls for the establishment of a task force to evaluate technical aspects of finfish farming, particularly salmon.

Unfortunately, the Legislature did not see fit to appropriate the funds necessary to implement the task force or to accomodate the additional regualtory requirements that this legislation imposes on permitting agencies.

Until such time as the necessary funds are appropriated by the Legislature, we will not be able to meet all of the requirements of the legislation. The members of the new task force, for example, will not be appointed until the Legislature provides sufficient funding to allow them to carry out the responsibilities they are charged with. It is my hope that an early appropriation by the Legislature will allow us to proceed at the earliest possible date with the work which is needed.

Sincerely,



Steve Cowper
Governor

ALASKA STATE LEGISLATURE - SENATE

SENATOR RICHARD I. ELIASON

RULES COMMITTEE, CHAIRMAN
LABOR & COMMERCE COMMITTEE, VICE-CHAIRMAN
LEGISLATIVE COUNCIL
RESOURCES COMMITTEE
FISHERIES SUBCOMMITTEE, CHAIRMAN



P.O. BOX 143
SITKA, ALASKA 99835
P.O. BOX V
JUNEAU, ALASKA 99811
(907) 465-4916

May 25, 1988

The Honorable Steve Cowper, Governor
State of Alaska
P. O. Box A
Juneau, Alaska 99811

Dear Governor Cowper:

Due to what appears to have been an oversight, SB 514, relating to the farming of aquatic plants and shellfish, was not included among the items of new legislation funded as part of the operating budget. At its May 6 meeting, the Conference Committee on the operating budget approved for funding those bills with fiscal impact expected to pass before adjournment. SB 514 did not appear on this list, and consequently the fiscal note of \$150,000 is not funded.

The Legislature intended that the Office of the Governor receive the \$150,000 in order that you might have maximum flexibility in coordinating the expenditure of these funds; they were to have been used for the activities of the Alaska Finfish Farming Task Force and for expediting mariculture permitting activities within the three state agencies involved.

The lapse date on FY '88 operating budget funds for the Office of the Governor has been extended by language in the reappropriations bill. I hope that you will consider using a portion of this money to fund the activities of the Alaska Finfish Farming Task Force and the mariculture-related permitting activities of the departments of Fish and Game, Environmental Conservation, and Natural Resources.

Please let me know if I can provide more information. Thank you for your consideration of this suggested solution to an unanticipated problem.

Sincerely,

A handwritten signature in dark ink, appearing to read "Dick Eliason".
Sen. Dick Eliason

cleaner copy
-original

5-1806A ✓
Hein
2/17/88

S.F. R. 110

~~BY ELIASON~~

1 IN THE SENATE

2 SENATE BILL NO.

3 IN THE LEGISLATURE OF THE STATE OF ALASKA

4 FIFTEENTH LEGISLATURE - SECOND SESSION

5 A BILL

6 For an Act entitled: ("An Act relating to the farming of aquatic plants and
7 aquatic animals; prohibiting the aquatic farming of
8 finfish in saltwater; and providing for an effective
9 date.")

10 BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

11 * Section. 1. AS 16.40 is amended by adding new sections to read:

12 ARTICLE 2. AQUATIC FARMING.

13 Sec. 16.40.100. AQUATIC FARM AND HATCHERY PERMITS. (a) A
14 person may not, without a permit from the commissioner, construct or
15 operate

16 (1) an aquatic farm; or

17 (2) a hatchery for the purpose of supplying aquatic plants
18 or aquatic animals to an aquatic farm.

19 (b) A permit issued under this section authorizes the permittee,
20 subject to the conditions of AS 16.40.100 - 16.40.199, to acquire,
21 purchase, offer to purchase, transfer, possess, sell, and offer to
22 sell stock and aquatic farm products that are used or reared at the
23 hatchery or aquatic farm.

24 (c) The commissioner, after consulting with the commissioner of
25 environmental conservation, may attach conditions to a permit issued
26 under this section that are necessary to protect the public health or
27 natural stock.

28 (d) A permit issued under this section is nontransferable.

29 (e) Notwithstanding other provisions of law, the commissioner