Salmon Farming in British Columbia:
Industry Evolution and Government Response

By David Conley, M.Sc.

The Aquaculture Communications Group, LLC
154 Gray Crescent, Kanata, Ontario, Canada K2K 3L9

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This document is a synthesis of the events as compiled by me from a wide variety of sources, both written and oral. Being a freelance contributor to several industry publications, this document was intended for public education purposes only. This document was compiled in the spring of 1996 in advance of the public meetings of the Salmon Aquaculture Review, conducted by the Environmental Assessment Office of British Columbia, Canada. Any errors or omissions are mine.

Introduction

Salmon farming is a relatively new industry in British Columbia's coastal communities. Starting in the early 1970s, it experienced tremendous growth between 1985 and 1989, went through a period of consolidation between 1989 and 1992, and then stabilized and matured.

The phenomenal growth of the industry during the latter half of the 1980s aroused concerns in some citizens in coastal communities and certain public interest groups that felt that salmon farming was being allowed to proliferate uncontrolled. They called for public investigations of the industry and demanded regulatory curbs to certain practices. After two decades of salmon farming and three public reviews, following which the ministries involved acted upon the majority of recommendations, salmon farming and its management by the Province will again be reviewed, this time under the Environmental Assessment Act (BC).

The Ministry of Agriculture, Fisheries and Food (MAFF) is the lead provincial agency for setting policy and regulating aquaculture in BC. As such, MAFF has been instrumental in fostering the growth and development of salmon farming since 1986.

Prior to 1986, the Ministries of Environment (MoE) and Crown Lands administered regulations governing salmon farming. MoE transferred some of its responsibilities in this regard when the Marine Resources Section was shifted to the Ministry of Agriculture in 1986. The reorganized Ministry of Environment, Lands and Parks (MELP) maintains its environmental protection role under the authority of the Waste Management Act, and BC Lands administers tenure allocations. The Department of Fisheries and Oceans (DFO) is the lead federal agency with regulatory powers affecting aquaculture in Canada.

The purpose of this document is to highlight the birth, growth and evolution of salmon farming in BC and the response of government to this new industry. It puts into historical perspective the nature of salmon farming practices and how government has attempted to deal with an industry which is experiencing constant change.

Modern Salmon Farming

The modern era of salmon farming started in Norway in the early 1960s. Wild salmon stocks had been declining for decades due to overfishing and habitat destruction through hydroelectric development. The commercial fishing industry was experiencing declining harvests in the cod and groundfish fisheries, which threatened to displace a large proportion of jobs. To compensate for job losses and ensure sustainable regional economies, the Norwegian government looked for ways to encourage economic development in coastal communities.

The successful Danish trout farming industry that supplied rainbow trout to markets all over Europe attracted attention as a possible model for a Norwegian fish farming industry. Attempts to farm rainbow trout in freshwater and then in saltwater in Norway, although biologically successful, were not economically viable due to the high costs of production and low market prices. Attention then shifted to Atlantic salmon, which proved to be more suitable.

Swedish scientists had developed Atlantic salmon culture techniques to the smolt stage (when the freshwater juvenile is capable of entering the marine environment) during the 1940s and 1950s. Hydroelectric development on major salmon producing rivers in that country during this period required enhancement efforts to compensate for lost natural production. Adapting this scientific and technical knowledge to the farming of Atlantic salmon paid large dividends for the Norwegian aquaculture industry.

By the mid 1970s the Norwegian industry was making noticeable gains in the farmed production of salmon. Government supported research and development programs supplied the growing industry with new knowledge and technologies which enabled the growth of a supporting infrastructure, such as fish feed producers, equipment suppliers, pharmaceutical / fish health product suppliers, seafood processors, extension and technical specialists, etc.

Because of the government's goal of enhancing jobs and economic opportunities in coastal communities, the size of salmon farms was restricted to discourage the natural trend towards larger production units that would have undermined these objectives. This action severely constrained salmon farmers from achieving economies of scale and laid the foundation for future problems, such as farm site pollution and outbreaks of disease due to the high densities at which the fish were held.

By the mid 1980s, a large pool of capital and technical expertise had accumulated. Some Norwegian banks and entrepreneurs began looking elsewhere for salmon farming business opportunities and British Columbia was one of the areas that attracted their attention.

Salmon Farming in British Columbia

Some British Columbians observed with interest the development of the Norwegian salmon farming industry. When the first pilot operation to raise pan-sized Coho salmon in Puget Sound, Washington, USA, began in 1968, a small number of local research scientists and entrepreneurs seriously considered entering the industry. This was the beginning of the investigative or pioneering phase of salmon farming in BC which would continue until 1985.

The Investigative Phase, 1970-85

The first marine salmon farm was established in Sechelt Inlet on the mainland in 1972 followed by another in Alberni Inlet on Vancouver Island in 1973. The number of farms grew to 5 by 1976 and to 10 by the end of 1984. The majority of these farms were located on the Sunshine Coast but a few sprang up in other areas, such as the Gulf Islands and along the east coast of Vancouver Island between Duncan and Campbell River. During this period, total industry production went from 0 to 100 metric tonnes, composed primarily of Coho, with some Chinook starting to be harvested in the early 1980s.

British Columbia was not prepared for salmon farming. There was no government infrastructure to deal with this new industry, nor were there any industry support services to provide the required human

resources, capital, and biological and physical inputs. This was a completely new enterprise, which had to create all of its own requirements or adapt what was available from other industries. BC salmon farmers were pioneers on a new frontier.

The federal Department of Fisheries and Oceans (DFO), responsible for managing the commercial and saltwater recreational salmon fisheries, had no interest in salmon farming in the beginning. However, due to regulations in the federal Fisheries Act and Navigable Waters Protection Act, DFO was drawn into the permitting of salmon farms, eventually developing an Aquaculture Enterprise License in 1975.

Provincially, the Ministry of Crown Lands became involved because salmon farms used a public resource, the marine foreshore, and required tenures for farm sites. The Ministry of Environment became involved because of its responsibility for environmental protection under the Waste Management Act and because of its responsibilities associated with trout and oyster culture.

These three agencies thus became the government overseers of salmon farming. Their failure to adopt the Norwegian model of developing appropriate aquaculture policies and developmental guidelines during this pioneer phase created serious impediments to the growth and responsible development of the industry in the 1980s.

The novelty of salmon farming in the Pacific Northwest meant that there was little to nothing in the way of local expertise. Although Canadians have a long and internationally recognized competence in fisheries research for stock management and enhancement, little had been directly applied to the cultivation of fish as livestock up to that point. Consequently, pioneering salmon farmers had to learn to grow fish by trial and error. In the process, they discovered that they required more knowledge and understanding in the areas of fish stocking density, fish nutritional requirements in the marine environment, fish disease detection and treatment, fish husbandry and general fish farm management skills. In response to these identified needs, DFO created an experimental salmon farm in Departure Bay adjacent to the Pacific Biological Station in 1973 and published a handbook on rearing pan-sized Pacific salmon in 1978 based on its experiences.

Although the Norwegians were making strides in developing domesticated strains of Atlantic salmon, BC farmers only had access to Pacific species which were untried as livestock. This circumstance was a contributing factor to the rationalization of the BC industry in the late 1980s.

Coho was the first Pacific species to be farmed because of the abundance of surplus eggs from enhancement activities and the existence of an established market. Initial production focused on pan-sized fish (200 - 400 g), using information from government scientists at the Pacific Biological Station. In the early 1980s, farmers started growing Chinook salmon to the 1-2 kg and 2-4 kg range.

The importation of salmonid eggs and the transplanting of salmonid species from other provinces and countries took place in BC at various periods in this century. To deal with the requests for the importation of eggs and fish by government agencies and the salmon farming industry, the Federal / Provincial Transplant Committee (BC) was created in 1977. The federal Fisheries Act and the BC Wildlife Act provided its mandate, with the intent to control who may engage in importation and transplant activities. Its purpose was to prevent the possible introduction and spread of diseases. At this time, the Canadian Fish Health Protection Regulations were developed by DFO.

Access to eggs was a critical problem for the new industry in the early 1980s. It was dependent upon surpluses from the Salmonid Enhancement Program (SEP) started by DFO in 1977. When the BC Salmon Farmers Association was formed in 1984, a key element of its mandate was to provide equitable distribution of salmon eggs to farmers.

Transition Period

In the early 1980s a number of events occurred which prepared the way for the transition to the next stage, the entrepreneurial or growth phase, in the development of the industry.

Due to an increasing awareness within the federal and provincial governments of the day, the Canadian scientific community and industry pioneers that aquaculture had many potential benefits for Canadians, a national aquaculture conference was held in July of 1983 in St. Andrews, NB, where research was already underway on culturing Atlantic salmon. Organized by DFO and the Science Council of Canada, the meeting's purpose was to take stock of the Canadian aquaculture industry and identify measures needed to promote its development. Shortly afterwards, the Aquaculture Association of Canada (AAC) was created to fill the identified need for a national body to represent the aquaculture industry.

In August of 1984 the Industry Task Force on Aquaculture, sponsored by the Science Council of Canada, released a report titled "Aquaculture: A Development Plan for Canada" which identified the opportunities and needs for development of aquaculture in Canada and provided a development plan for Canadians. In March of 1985 the Science Council of Canada released its statement, "Aquaculture: An Opportunity for Canadians" which outlined the significance and viability of aquaculture and its role in Canadian fisheries and concluded with an agenda for action.

The British Columbia government of the day, aware of the preceding developments, encouraged local investors and entrepreneurs to consider aquaculture as a business and actively promoted salmon farming as an enterprise with tremendous potential. At this time, Norwegian salmon farmers and investors were searching for business expansion opportunities and were encouraged by the potential benefits offered by British Columbia, with its immense coastal resources and proximity to the huge seafood markets of the United States and Japan.

The local Sechelt Economic Development Officer, an expatriate Norwegian with connections in his homeland, invited Norwegian bankers and entrepreneurs to visit BC to explore salmon farming opportunities. Those who came were favorably impressed and began to investigate the process of acquiring the necessary permits to start up salmon farms.

The Entrepreneurial Phase, 1985-89

From 10 farms at the end of 1984, the industry grew to 119 farms in 1987 and to 140 farms in 1989. At its peak the industry was comprised of about 100 companies, decreasing to 75 by August of 1989. Total industry production went from 100 metric tonnes in 1985 to 12,400 metric tonnes in 1989. This rapid growth created a number of problems which have tainted the industry ever since.

The attitude of the provincial government of the day toward salmon farming was one of "laissez-faire". It had no intention of hindering the growth of the new industry, nor did it provide any help in the way of economic incentives, planning or policies to facilitate orderly growth as the Norwegians had done.

The Marine Resources Section of the Ministry of Environment was responsible for advising BC Lands on site capability but the Ministry failed to formulate any land use planning for the industry. Staff was few and, like the industry, relatively inexperienced in the biophysical realities that defines a successful salmon farming site. Although they were able to eliminate the obviously bad sites, it was largely up to the prospective farmer to determine the suitability of a site.

This opened up an exploitive situation where unscrupulous consultants acquired Investigative Permits from BC Lands to examine the suitability of potential farm sites and then sold them to prospective salmon farmers as fulfilling the necessary biophysical criteria. This speculation in and consequent use of unproved farm sites had devastating results for some fledgling companies.

The influx of investors and entrepreneurs between 1985 and 1987 created a "gold rush" mentality, which blinded people to the realities of the industry. Salmon farming in BC, despite its existence since the early

1970s, was still in a learning stage and relatively unproved for large volume production. There were too few experienced biologists, farm managers and technicians to fill the many jobs created by the emergence of so many new companies. There were still no domesticated strains of Coho and Chinook, which could be grown out and harvested in a cost-effective production cycle. The domestic infrastructure of industry support services was inadequate to cope with the demands of explosive growth. Government supported research and development for the industry was limited. Salmon feeds for Pacific species were still in the developmental stages and local feed manufacturers were few. The need to transfer knowledge and technology from other areas, such as Norway, had mixed consequences.

The growth of salmon farming during this phase was largely privately financed. Although salmon farmers had access to several financial assistance programs, they often failed to satisfy all funding criteria. Salmon farming was not considered agriculture by conventional Canadian lending institutions because salmon farmers had no secure title to the aquatic resource, the marine environment, upon which they depended to grow-out their livestock. Without secure title, a salmon farmer was in effect a renter and could not provide collateral for loans, unlike land-based farmers who owned the land they farmed. It was Norwegian banks and investors that had experience with the industry in Norway that fueled much of this expansion phase, although some capital was raised on the Vancouver Stock Exchange.

Industry Challenges

With the influx of Norwegian capital came Norwegian knowledge, technical expertise, supplies and services. The industry's technical support infrastructure appeared to arrive overnight. However, the application of the Norwegian salmon-farming model in British Columbia, using Pacific species, was problematic.

From the beginning of 1985 to the end of 1987 the number of salmon farms went from 10 to 119. A significant number were located on the Sunshine Coast and Lower Mainland (47) with the balance scattered around Vancouver Island, the next largest group being in the Campbell River / Desolation Sound region (32). The Sunshine Coast fit the Norwegian preference for locating farms close to established business and transportation networks within proximity of a large commercial center, such as Vancouver. Labour was readily available and workers did not have to commute too far to the farm sites. The research facilities of universities and governments could be readily accessed. However, the Norwegian belief that salmon farming was beneficial for coastal communities was not shared by some residents of the Sunshine Coast and eventually created resource user conflicts.

The Norwegian salmon-farming model was based upon certain assumptions. It worked with a known animal, the Atlantic salmon, which had been domesticated and could be managed in a cost-effective production cycle. Atlantic salmon was fast growing and slow to sexually mature, providing continuous harvesting options for fresh fish year round. It was relatively hardy and resistant to the stresses inherent to a livestock-rearing environment. Common diseases had been identified and treatment strategies had been or were being developed. It was also widely recognized in the global fish market and had consumer confidence.

Coho and Chinook, on the other hand, were the only species available to BC salmon farmers and were unproved for the large volume production systems used by the Norwegians. Whereas Atlantic salmon could be held at high densities, which maximized the use of capital investment, Coho and Chinook were less tolerant of the crowding and routine stresses in such farming situations, as the industry painfully learned.

The life cycles of Coho and Chinook salmon also presented obstacles. Both species had a tendency for a proportion of the population, mostly males, to sexually mature early. This created management problems with respect to harvesting and marketing. Sexually maturing fish, being less attractive due to changes in coloration, also have poorer quality flesh. Hence they receive a lower price in the market place. To obtain better prices and an adequate return on investment, farmers had to grade their stocks to get rid of the early maturing fish, called "jacks", before the onset of sexual maturation. Grading had to take place during the summer, which coincided with the peak of the wild harvest and when prices were at their seasonal

lowest. This made it difficult for farmers to earn a profit. In addition, grading and handling fish is stressful and was later found to be a contributing factor in disease outbreaks.

To address the problem of early maturing fish, scientists at DFO developed the means to produce neutered coho and monosexed (all female) Chinook under experimental conditions. Unfortunately, in actual farm production, Coho were found to lack the natural sex hormone stimulus to start the growth burst up to maturity. Tonnes of feed were wasted trying to get these fish to market size. It proved a financial hardship for some operations and Coho was eventually all but abandoned by the industry, making up only 2% of production by 1995. Monosexed (all female) Chinook yielded some positive results but the technology and management needed refinement. This was not effectively achieved until 1991, well into the industry's rationalization phase.

Access to adequate supplies of Coho and Chinook eggs to produce the volume of smolts for stocking the growing number of marine fish farms was a major problem between 1985 and 1988. Farmers were restricted by DFO from obtaining a larger proportion of the surplus eggs from SEP, the federal Salmon Enhancement Program, as well as from importing eggs from the United States. This created an insatiable demand for smolts, which allowed the limited number of smolt producers in the early years to sell far more poor quality smolts than would have been possible otherwise. This had detrimental consequences for the industry by pushing up the cost of production while contributing to poor growth performance and survival. However, the high smolt demand caused a large investment to be made in private hatcheries which made the industry self-sufficient in eggs from their own captive broodstocks by 1989.

Restricted numbers of Atlantic salmon eggs were allowed into British Columbia beginning in 1986, but it took several years before sufficient numbers of Atlantic salmon smolts were produced from domestic broodstocks to provide for local industry needs. However, during that time, Atlantic salmon proved its suitability as the species of choice for farming in British Columbia.

Nutritional requirements for the Pacific species were less understood than for Atlantic salmon, which had been fed formulated rations since the late 1960s. Whereas Norwegian feed suppliers had a long history of developing diets for high volume fish production, local feed manufacturers were still learning how to develop feed formulations for the various developmental stages of Coho and Chinook. Inadequate diets and nutritional stresses during the early years of this period are now thought to have been a significant contributing factor in the high incidence of certain diseases.

Diseases, such as Bacterial Kidney Disease (BKD), vibriosis and marine anaemia, took a large toll during this period. Attempts to maximize capital investment by holding fish at high densities only served to maximize stress for the Pacific salmon, resulting in severe disease outbreaks. The industry averaged losses of 30% of its production per year and some farms suffered losses as high as 70% in a given year. Handling and grading also brought on outbreaks of disease.

The lack of trained farm staff with skills in fish health and fish husbandry, combined with a shortage of veterinarians experienced in fish disease diagnosis and treatment, compounded the problems. Antibiotics were applied in feeds to stem the losses but were ineffective because sick fish stop eating. This challenged the industry and research institutions to find better ways to detect and monitor disease organisms, as well as to develop preventative strategies, such as vaccination, to provide long term protection for the fish.

In addition to disease problems, the Sunshine Coast was prone to nearly annual episodes of plankton blooms that killed the farmed Coho and Chinook in great numbers. The recurring blooms caused salmon farmers to leave the Sunshine Coast, beginning in 1987 and accelerating through 1988-89. Most migrated north to the Campbell River / Desolation Sound area while others went to the west coast of Vancouver Island in the area of Clayoquot Sound. These regions had cooler summer water temperatures and less likelihood of blooms. More important, the new areas were less populated, which reduced possible conflicts with other resource users.

The large volume of dead fish produced by diseases and blooms created a waste handling crisis and a negative public image for the industry. Salmon farmers were completely unprepared for the volume of fish mortalities that occurred. Municipal landfills were used until public protests prevented access. As a result, some farmers dumped dead fish into the ocean or buried them in private landfill sites. More public protests ensued. Eventually, various composting techniques were investigated and developed. Today they provide an economically viable and publicly acceptable way to handle fish wastes. Unfortunately, the poor earlier practices left a tainted image of the industry in the minds of many.

Ultimately, the industry could not make the Pacific salmon species fit into the Norwegian fish-farming model within the given financial cycle. The huge amounts of financial, biological, and physical resources consumed in the exercise impaired the industry's growth potential and slowed its progress relative to other salmon farming areas in the world. At the same time, many of the negative events of this period, such as the fish losses to diseases, blooms, predators and escapes, remained in the minds of some members of the public and continue to haunt the industry even to the present day.

Government Initiatives

The ministries of Environment (MoE) and Crown Lands were the lead provincial agencies administering to the aquaculture industry in 1985. The Marine Resources Section of MoE, which issued the farm permits, was understaffed and lacked the necessary technical background to deal effectively with the rush of applications for fish farm sites. The government of the day failed to give the Ministry a mandate to formulate appropriate regulatory tools, and the Ministry did not develop a strategy or put regulatory tools in place. Consequently, the potential for salmon farming to become a public issue grew.

In 1986, the Marine Resources Section was transferred to the Ministry of Agriculture, which became the Ministry of Agriculture and Fisheries and more recently the Ministry of Agriculture, Fisheries and Food (MAFF). This benefited the salmon farmers because now they were dealing with an agency that was familiar with livestock production systems and the needs of agribusinessmen. MAFF's resources in areas of technology transfer and extension services, animal health, etc. provided the government support necessary for the industry to develop.

Between 1986 and 1989, MAFF undertook a number of initiatives to assist the industry. The first provincial veterinarian with fish health expertise was hired in 1986 to conduct disease investigations and to advise salmon farmers on appropriate treatment strategies. Aquaculture Resource Centers were established in Sechelt and Campbell River, equipped with libraries and staffed with biologists. Training opportunities initiated by staff followed throughout this period. MAFF funded meetings, seminars, and conferences to facilitate the transfer of information and technology to BC salmon farmers and printed numerous Industry Development Reports. It also undertook to produce a variety of fact sheets explaining a host of issues related to the salmon farming industry. The ministry even moved its extension staff to Courtenay in 1989 to be close to the industry, which was now centered in the Campbell River area.

Despite its many efforts to facilitate the growth and development of the industry, MAFF was forced by circumstances to deal with one crisis after another. Its involvement in the planning and regulatory process came too late to be effectively implemented before the cracks started to appear in the Norwegian salmon-farming model.

The convergence of the factors previously discussed created a situation that aroused concern among residents in the vicinity of salmon farms. This concern was expressed in the media and eventually became a political issue in the provincial capital of Victoria.

The commercial salmon fishing industry also voiced concerns about the growth of salmon farming in BC because of its perceived threat to their industry, which was already seeing the erosion of prices for wild fish in the market place. However, the global salmon market was shifting to farmed fish because of its consistent quality and year round availability, which the wild fishery could not compete with. The global market was undergoing a fundamental change that the commercial fishing sector was powerless to deal with.

In response to the concerns, the provincial government instituted a moratorium on the issuance of fish farm tenures lasting from October 1986 to March 1987. At the same time a Commission of Inquiry into Finfish Aquaculture was ordered and David Gillespie appointed to chair it. Gillespie, a lawyer specializing in mediation and consensus building, conducted his inquiry between November 6th and December 12th, 1986. His report examined fish farming's effect on commercial fishery operations and markets, its effect on the environment and on wild fish stocks, government approval and monitoring procedures, and the involvement of local governments and interest groups in awarding of fish farm tenures.

The document contained 52 broad recommendations covering government support for the aquaculture industry, protection of the marine environment, First Nations' involvement, government approval systems, marketing and processing, resolution of user and siting conflicts, and the need for better information and extension services.

Following the Gillespie Commission, the Provincial Aquaculture Steering Committee (PASC) was established to provide a provincial body to respond to Gillespie's recommendations and prepare an action plan. Included in this committee was staff from MAFF and MELP.

The action plan developed by the PASC was approved by Cabinet in January 1987, following which the Minister's Aquaculture Industry Advisory Council (MAIAC) was established to provide the Minister of Agriculture with expert guidance and advice from representatives of all sectors of the coastal community regarding aquaculture development. The purpose of MAIAC was to advise the Minister on various means to develop aquaculture and to identify concerns or major problems that might result from aquaculture industry activities or government policies.

Acting upon the recommendations of the Gillespie Commission, government initiatives were undertaken to assess and manage the environmental effects of marine fish farming. These initiatives focused on prediction, prevention and mitigation of impacts through site selection, environmental monitoring and acceptable farm management practices. MAFF developed guidelines and a simulation model for siting fish farms to facilitate more sustainable siting and development of the industry.

Specific initiatives included preparation of Coastal Resource Interests Studies, changes to the Crown Land application process, creation of waste management regulations and an environmental monitoring program, creation of a Crown Land policy for aquaculture, and development of guidelines to aid local governments in the drafting of bylaws to regulate aquaculture.

The Coastal Resource Interests Studies (CRIS) were instigated to avoid conflict with other coastal resources and activities and included the Desolation Sound / Johnstone Strait regions, Sunshine Coast, southern Gulf Islands, Nootka and Clayoquot Sounds, and the Broughton Archipelago in the Port McNeill area. These studies were not intended to serve as regulations, but to facilitate discussion between various resource users to reach mutually acceptable concessions. This purpose was never adequately communicated to the public. As a result, the CRIS documents became an instrument for special interest groups to block the siting of salmon farms in certain areas of the coast. The government was even criticized for failing to comply with its own regulations.

During 1988, MAFF published two biophysical studies of the southern portions of the British Columbia coast that assessed the region's ability to support salmon farming, while Crown Lands continued its series of Coastal Resource Interest Studies.

In September of 1988, a Memorandum of Understanding (MOU) was signed between Canada and BC that recognized the Province's right to license the aquaculture industry. The MOU aimed to facilitate cooperation from both levels of government in assisting industry through joint regulation, research, extension, and marketing efforts.

Not long afterwards, the Province instituted two main approvals to practice aquaculture in BC: 1) approval to locate, which might include a Crown Land tenure, navigation compliance and / or local zoning compliance, and 2) approval to operate, which required obtaining an Aquaculture License from MAFF.

Despite these initiatives, the government continued to receive letters of concern from members of the public regarding resource use planning, the tenure granting process, environmental safety and conflict resolution. In response, Ombudsman Stephen Owen examined these issues and released his report "Aquaculture and the Administration of Coastal Resources in British Columbia (Public Report No.15) in December of 1988.

Owen had three major recommendations: 1) Government should consider enactment of a separate Aquaculture Act, or make amendments to existing statutes and regulations to provide clear, coordinated and express authority for aquaculture administration; 2) A legislative framework for integrated management of coastal resources and activities should be created to enhance administrative fairness in resource allocation and management; 3) Consensual dispute resolution techniques should be recognized, promoted and applied as official policy by all relevant ministries, and should (where appropriate) be recognized and implemented through amendments to existing legislation, for the resolution of aquaculture related disputes at any stage of the development process.

By taking these steps to resolve the concerns that some of the public may have had with finfish aquaculture, the provincial government implicitly recognized that aquaculture might be the most economically sustainable and environmentally benign use of the public resource.

The planning strategy and regulatory framework that should have been in place prior to the growth phase of salmon farming was finally achieved at its conclusion. However, despite the lack of these tools, the government attempted to deal with the many events and issues of this period in a responsible manner.

The Restructuring Phase, 1989-92

Salmon farming experienced significant growth worldwide during the latter half of the 1980s. From a total production of just under 45,000 tonnes in 1985, it grew to over 200,000 tonnes in 1989. Norway's production of 130,000 tonnes that year exceeded 50% of the world's total. Canada's production of 16,500 tonnes put it in third place behind Scotland's 28,000 tonnes. British Columbian salmon farmers produced 12,400 tonnes, about 75% of Canada's total.

Prices for salmon in the global market began to soften in the latter months of 1988 and continued to fall in 1989. Although the huge amount of farmed salmon entering the market was the primary cause for declining prices, other factors were also to blame. There had been little investment in market development to stimulate increased consumption or in market expansion to keep pace with the rate of growth in production. Record inventories of frozen salmon in Japan, North America and Europe had been carried over from 1988. Then the Alaskan salmon catch came in at an all-time record of 317,000 tonnes, 30% more than the previous year.

The combined supply of salmon from farmed and wild sources was more than the market could absorb and prices fell sharply, dropping more than 30% worldwide.

The impact of the lower prices on the BC industry was especially severe because of its relative newness. The majority of operations brought in their first sizable harvests in 1989. Many were highly leveraged with debt financing and had high production costs associated with the start-up husbandry challenges of raising Coho and Chinook. With prices dropping 30-40% (CDN$1.50/lb), many companies were unable to cover their costs of production and were forced into bankruptcy.

From approximately 75 operating salmon farming companies in August of 1989, the industry shrank to 50 in 1990 and to 20 by 1992. Of those, 7 accounted for 70% of production.

The results of the industry's restructuring were an increase in foreign ownership, primarily Norwegian, and more vertical and horizontal integration. The Norwegian banks used receiverships to reorganize and consolidate their investments in BC salmon farms. Companies that weathered the turmoil acquired assets that allowed them to increase their security of supply (i.e., more hatcheries), to increase production capacity (i.e., more grow-out sites), and to increase and diversify marketing options (i.e., primary and secondary processing facilities). Ownership mix shifted from small independent operators to corporate enterprises that were better equipped to survive in the more competitive global salmon farming industry.

At the same time, the geographic distribution of the industry shifted from the Sechelt area to the Campbell River and Northern Vancouver Island regions. An intense plankton bloom in the Sechelt area in the fall of 1989 bankrupted many companies and the survivors moved north to more suitable growing sites. The Sunshine Coast ceased to be the center of salmon farming while Campbell River became the preferred site for company head offices.

Throughout the rationalization phase, salmon production continued to grow from 12,400 tonnes in 1989 to 19,000 tonnes in 1992. Species composition also began to change. In 1990, Chinook represented 77% and Atlantic salmon 12% of total production. By the end of 1992, Chinook had declined to 57% while Atlantic salmon had grown to 43% of total production. The industry shifted to Atlantics because of their superior growth, better feed conversion, and ease of husbandry. Some farms continued to refine their Chinook culture strategies but these operations relocated to the west coast of Vancouver Island where conditions appeared to suit this species.

MAFF initiated the Cooperative Assessment of Salmonid Health (CASH) Program in 1989 to provide an industry-wide comparative information system to assist with improvements in farm management and enhance the industry's competitiveness in the global industry. At about the same time, the BC Salmon Farmers Association (BCSFA) created a subsidiary company, the BC Farmed Salmon Institute (BCFSI), to undertake marketing activities for the industry.

In 1991 the BCFSI began the first year of a 6-year $4.25 million generic marketing campaign targeted at increasing demand for BC salmon in the U.S., its largest market. Learning from its mistakes, the industry realized the importance of building a larger market for its product and embarked upon a strategic plan to do so.

At this time, the large environmental / special interest groups began to wage a campaign against salmon farming, using much of the earlier negative publicity arising from between 1985 and 1988. Their ability to get media coverage and the salmon farming industry's seeming inability to counter the attacks left the public with the impression that salmon farming should be more tightly controlled.

As the industry struggled to get through the financial and operational challenges of this period, it was also confronted with new aquaculture licensing regulations, environmental monitoring requirements, and disease certification requirements. The increased regulation and associated costs of compliance just added to the already stressful situation that the industry was experiencing.

Industry recognized that the government needed to safeguard the public's interests, but it also needed some help from the government to create jobs and income for BC. Industry sought assistance from the government in the areas of market development, research, and tax exemption on certain equipment used for production. Salmon farming was not yet accepted as another farming sector, placing the BC industry at a competitive disadvantage.

During this period total farm gate value reached $115 million, making it the fourth major agribusiness commodity in BC, behind dairy, beef and poultry, although it had dropped from 3rd to 5th largest salmon producer in the world.

Government Initiatives

The Provincial Aquaculture Regulation, proclaimed in October of 1989, recognized that the environment, wild stocks, and public interests must be protected. Consequently, operational farms required a Transplant Permit for moving live fish and an Import Permit for bringing Atlantic salmon eggs into BC Farmers had to submit annual production reports detailing the amounts of fish purchased and sold as well as report accidental fish releases or heavy disease losses.

Environmental impacts of fish farms were to be monitored according to a program developed by the Ministry of Environment (MoE) in cooperation with the BC Salmon Farmers Association and MAFF and large operations were required to obtain a waste discharge permit. For a variety of reasons, the data collected during the first few years of this program was never tabulated and analyzed by MoE and the program was not effectively implemented.

Responding to input from the salmon farming industry, the Provincial government consolidated aquaculture licensing procedures by reducing the number of agencies involved in the process and established criteria for the industry which provided a workable framework for industry guidelines and controls.

Federally, the Department of Fisheries and Oceans (DFO) brought in new fish inspection regulations which set out requirements for processing plant operations and aquaculture finfish products in response to the need for regulation of therapeutants in fish production. Farmers had to provide processors with information on any chemical treatment used and the date of usage as well as ensure that prescribed withdrawal periods were adhered to by maintaining records of husbandry practices. DFO Inspection Branch started to conduct in-plant sampling for lab testing of residue levels to meet national health protection standards.

To promote the growth and development of the aquaculture industry, the BC Aquaculture Research and Development Council (BCARDC) was established with funding from the Science Council of BC and MAFF. Its role was to identify research needs and establish priorities with the goal of increasing knowledge on matters critical to the industry.

Critics of the salmon farming industry used the provincial election in 1991 to highlight their opposition. When the New Democratic Party (NDP) formed the government, one of their campaign promises had been to stop the expansion of the salmon farming industry in BC. They accomplished this by establishing an unofficial moratorium on the granting of new farm licenses, effectively blocking the industry from any growth into new areas.

In an effort to inform the public and industry about the administrative framework under which aquaculture was conducted, MAFF released a report in 1991 entitled, “Aquaculture Legislation in British Columbia: A Comparative Legal Analysis”. Comparing the various jurisdictions - constitutional, territorial, federal, provincial and municipal - and the existing legislation in BC with legislation in foreign jurisdictions revealed that aquaculture was far from being an unregulated activity in BC. The authors, lawyers with professional interests in maritime and fisheries law, stated that aquaculture was in fact over-regulated in light of their investigations.

In March of 1992, MAIAC was given two tasks by the Minister of Agriculture, Fisheries and Food: 1) to provide direction to a consultant to complete a report on the salmon farming industry that would provide information and background on key issues, and 2) based on the information from the report and other sources, to develop specific recommendations on needs for further research, policy clarification, and regulatory or procedural changes.

The Maturing Phase, 1993-96

Emerging from the restructuring phase, stronger and leaner, the industry was poised to grow. The remaining companies, managed by knowledgeable and experienced staff, were focused on cost-effective production through careful husbandry and the application of sound agribusiness principles.

The trend to larger, vertically integrated companies continued. From 19 operating companies in 1993, of which 7 produced 70% of total production, the industry was reduced to 17 companies by 1996, of which 6 produced 80% of total production. The number of fish farm sites remained fairly constant during most of this period at about 80-100, occupying approximately 200 ha of marine foreshore, while the number of hatcheries grew from 12 to 14. Some firms now manufactured their own feed, processed fish, handled their own marketing and operated fish composting facilities.

Total industry production during this period plateaued at 22,000 tonnes in 1993, 20,000 tonnes in 1994, and 22,500 tonnes in 1995.

Farmers continued to prefer culturing Atlantics, which comprised 65% of 1995's total production versus 33% Chinook and 2% Coho. The industry's reduced commitment to Pacific salmon in favor of Atlantics was due to the overall lower cost of production.

Higher returns in the marketplace proved Atlantics to be the species of choice, with total farm gate value reaching $130 million in 1994 and $165 million in 1995, in spite of almost no growth in production. More significantly, the value of farmed salmon more than doubled that of the commercial salmon fishery in 1995. In fact, farmed salmon has become BC's largest agricultural export.

In 1992, the U.S. aquaculture industry was successful in proving that Norway was dumping its salmon into the U.S. market and restricted Norway's access by imposing a 24% duty. As a result, Chile emerged as BC's main competitor, producing 64,000 tonnes in 1993. This was almost 3 times BC's output, making Chile the second largest farmed salmon producer after Norway. A remarkable achievement considering that in 1988 Chile produced an insignificant 4,400 tonnes. More remarkable is the fact that all of the salmonid species farmed in Chile are not native to the Southern Hemisphere but are introduced species.

Chilean salmon farmers were strongly supported by their government and investment was quick to follow, unlike BC's industry, which stagnated during this period because it could not get access to new sites. As a result, several BC companies invested in Chilean farming operations in order to expand. Salmon farming is an integral part of the provincial seafood industry, providing jobs in coastal communities experiencing a decline in employment in other resource sectors. It is ironic that the one industry in the province that has the greatest potential to grow and provide jobs and incomes for British Columbians has had to look outside of the province in order to expand.

Recent Developments

In the summer of 1994, one of Canada's leading polling companies, Angus Reid, published the results of a national survey about "Canadians and their Environment". The Department of Fisheries and Oceans (DFO) had submitted several questions to establish a baseline reading of public opinion on the subject of aquaculture. Highlights of the survey revealed that: 69% of respondents were familiar with the concept of aquaculture; 72% were in favor of aquaculture; 69% agreed that aquaculture was an environmentally sound use of resources; 74% believed that aquaculture contributed to regional economic growth; and 76% felt that government should encourage aquaculture development in Canada.

The industry continued to seek improvements in its production practices, both to be more competitive and to address environmental concerns. In 1993 a new type of "seal scarer" was tried and found promising. By emitting high pitch sounds through the water, these acoustic deterrent devices (ADD) reduced predatory attacks by seals and sea lions on penned salmon in a number of cases. Unfortunately, critics of the industry opposed this "electronic" solution and requested a study be conducted to determine the long-

term effectiveness of the devices and possible impacts on migrating marine mammals, such as whales and dolphins. Results indicate that harbour porpoises appear to be affected by the devices.

Feed manufacturers began making high fat, high energy salmon feeds that accelerated fish growth and shortened the production cycle by 1-2 months. With improved feed conversion and reduced waste, due to better feeding and monitoring strategies, some farmers noticed less sedimentation occurring below grow-out sites.

Diseases were much less of a problem to the industry than in the past due to better feeds, more sophisticated diagnostic tools and improved husbandry practices. Vaccination strategies drastically reduced the need for antibiotic treatment.

Recently, privately funded research and development has been focused on developing more environmentally controlled fish farming systems. This technology, if successful, may solve many of the ongoing criticisms of the industry by recovering waste products, reducing escapes, blocking disease transmission between wild and farmed fish and between fish rearing units, as well as providing a healthier environment in which to grow the fish. However, the costs of using this technology and the competitive challenges it would place upon the industry have yet to be assessed.

Lake rearing of smolts has been employed to a small extent in BC, whereas other salmon farming areas use it more routinely, providing a competitive edge due to lower smolt costs for on-growing. The use of environmentally controlled rearing systems would address concerns that have prevented more lake usage to date.

The industry, in its efforts to remain competitive in the global market, continues to adapt new technologies, as they become available.

Regulatory Environment

A report entitled “Review of Salmon Farming in British Columbia” was published in January of 1993. This was the report prepared by consultants on behalf of MAIAC to be used in making recommendations to the Minister. The document assessed the status and prospects for growth of the salmon farming industry in BC and identified and assessed critical biological, economic, social, and administrative issues associated with salmon farming. The report also reviewed administrative and regulatory procedures with respect to adequacy in addressing issues defined in the task above, examined existing literature and recent research, and evaluated communication efforts by industry and government.

Around this time, the Management Committee responsible for implementing the Canada / BC MOU on Aquaculture requested a review of the potential interactions between farm and wild salmonids. Staff from DFO, MELP and MAFF completed a discussion paper in March 1993 titled “Wild and Farmed Salmonid Interactions: Review of Potential Impacts and Recommended Action”. The document recommended strategies and mitigative means resulting in research and monitoring activities being initiated.

Following review of the previously mentioned consultant’s report, MAIAC made public its recommendations in May of 1993. These centered on: wild and farm fish interactions; lake cage culturing of farm fish; First Nations involvement in salmon aquaculture; communications and education; clarification and coordination of various government policies; coastal zone management; environmental monitoring, research, compliance and enforcement; health and safety of wild and farm fish and farm workers; interactions with other coastal interests such as commercial fisheries interests. MAFF and MELP staff then reviewed the recommendations and developed an action plan to guide the government’s response.

Throughout 1993, MAFF was extensively involved in the preparation and review of the Vancouver Island Land Use Plan, implementation of the Protected Areas Strategy and landscape level planning processes such as the Barkley Sound Plan and the Clayoquot Landscape Management Plan. These initiatives had significant implications for the salmon farming sector in that some recognized aquaculture as a legitimate activity for specific coastal areas while others might have created conflicts for existing farming activities.

Late in 1993, approvals for new salmon farms and amendments to existing farms were delayed pending an internal government review precipitated by environmental concerns raised by MELP, First Nations, environmental groups, fishermen and the public. Meanwhile MAFF led and published the results of a coastal resources strategy study that involved public interest groups and recommended development of a provincial coastal resource strategy.

By June of 1994, the government had completed an assessment of interactions between wild and farmed fish, signed an MOU between the Province (represented by MAFF and MELP BC Lands) and the Kwakiutl Territorial Fisheries Commission (KTFC) regarding management of aquaculture and aquatic resources in the Johnstone Strait area, and given approval to the “National Policy Goals for Canadian Aquaculture”.

Finally, the government accepted the Vancouver Island Land Use Plan that included the designation of some of the aquatic areas within its boundaries as Cultivation Use Areas, essentially identifying aquaculture as a priority use in those areas.

In the latest initiatives, the government announced its Action Plan for Provincial Salmon Aquaculture in April of 1995, committing itself to: conducting the necessary research and technology transfer to ready the industry to switch to production of non-reproductive (all-female) Atlantic salmon, should it be required; working with industry to develop a Code of Practice; revising MELP waste discharge, monitoring, inspection and enforcement program; establishing a MAFF fish health monitoring program; and assessing the Land Act tenure application and referral process. The Action Plan also included an environmental review of salmon farming activities and examination of provincial salmon aquaculture policy by the Environmental Assessment Office. At the same time, the Province granted 9 new salmon farming tenures, the first since 1993.

While the specifics of these recent regulatory initiatives were being discussed, MAFF completed and published a comprehensive biophysical capability study of the Central Coast for fish farming, as well as became involved in the development of a Marine Protected Area Strategy in order to ensure a seafood sustainability perspective.

A First Nations Aquaculture Symposium, jointly sponsored by DFO, MAFF and KTFC, was held in Campbell River in March of 1996 to provide information on employment and economic benefits of aquaculture for First Nations. Some support was shown by First Nations towards aquaculture as a means of reducing the chronically high unemployment in their communities as well as diversifying local economies.

Summary

Salmon farming in British Columbia has come a long way since the first tentative attempts to raise Coho in the early 1970s. From those days of trial-and-error to the current application of state-of-the-art technologies, salmon farmers have succeeded in overcoming numerous challenges.

The Provincial government has also succeeded in coming to terms with an industry that it was not at first prepared to handle. It has developed an administrative and regulatory infrastructure that has adapted to changing circumstances and is continuing to evolve. At the same time, the government has dedicated resources to answer many of the lingering questions about the aquaculture industry by way of reviews, funded research and public information bulletins.

The industry recognizes the critical need to present itself to the public, to inform them of its successes in addressing the mistakes of the past and of its desire to develop a better future. The new Code of Practice being developed by the BC Salmon Farmers Association acknowledges many public concerns.

Salmon farming has matured and proven it to be a viable industry and a responsible corporate citizen, providing sustainable employment in BC's coastal communities. Many of the adverse environmental effects predicted by industry critics have not occurred, partly due to improved management practices but also because of government regulation.

Public perception of the industry has not kept pace with its progressive development. Consequently, both industry and government realize the need to better inform and educate the public as to the realities of modern salmon farming and the benefits it offers to British Columbians.