

SCOMM

75:20

Chapter 40 is
"Commercial Use of Fish
and Game."

Article 2. is
"Aquatic Farming"

The new section 16.40.155
comes under Article 2.

Fairbanks

219 entry permits
290 crewmember
licenses

509 total

Anchorage

1432 entry permits

1961 crewmember
licenses

3393 total

Cowper Administration Position on Mariculture

Mariculture may provide substantial economic benefits to our coastal communities and help diversify and stabilize our economy if it is developed in an orderly fashion which provides the maximum benefit to Alaskans while ensuring protection for our fisheries resources, other resource users and the environment. In order to accomplish these objectives, any legislation authorizing a mariculture industry must satisfy the following principles:

1. The mariculture industry must benefit Alaskans.

The mariculture industry must be developed in a manner which does not result in unfair competition with existing fisheries or cause undue economic displacement in our coastal communities. Legislation should, to the extent possible under the law, provide for local hire at mariculture facilities and give preferential access to mariculture permits and mariculture related tidelands leases to Alaskans.

2. The mariculture industry must pay for itself and the state should get a fair return for the use of state resources.

Legislation should contain provisions for recovering administrative and other state costs associated with managing the industry. The legislation should also ensure that the state gets a fair return for the use of tidelands and other resources.

3. The development of the mariculture industry in Alaska should be done in an orderly fashion which encourages a stable, dependable industry.

Legislation should provide general criteria which will lead to the development of a regulatory program which discourages speculation on permits and tidelands leases, encourages sound financial planning, and provides for a diverse industry ranging from "Mom and Pop" ventures to larger corporate operations.

4. The mariculture industry must meet all state and federal requirements for human health, product quality and sanitation.

Legislation should ensure that mariculture facilities meet all state and federal requirements for human health, safety, and sanitation. Legislation should also require that mariculture products meet or exceed

all state and federal product quality and human health standards, and provide the means to ensure that state

regulators can protect human health and product quality.

5. Mariculture activities must be managed to ensure protection of the biological integrity of natural plant and animal stocks.

Legislation must address the issues of pathological and genetic protections for natural sea vegetable and fish stocks.

6. Mariculture activities must be managed in a manner which ensures adequate environmental safeguards and habitat protection.

Legislation must ensure that mariculture facilities are sited, designed and operated to protect air and water quality, to provide for proper disposal of wastes, and to minimize adverse effects to important fish and wildlife habitat.

7. Mariculture facilities must be sited to minimize land-use conflicts, maintain navigation and ensure access to upland areas.

Legislation should provide guidance for siting facilities to minimize conflicts with other tidelands users, reducing visual and aesthetic impacts, maintaining navigation and ensuring access across state tidelands.

8. Broodstock acquisition for mariculture purposes should be carefully regulated, especially for species subject to limited entry fisheries.

Legislation should contain provisions limiting the acquisition of broodstock for species subject to limited entry fisheries. Legislation should grant the Department of Fish and Game the authority to regulate the acquisition, transport, and propagation of mariculture broodstock, and provide the Board of Fisheries the ability to resolve allocation decisions regarding broodstock acquisition if necessary.

Interagency Mariculture Workgroup
Report on Activities Over the Legislative Interim

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MEMORANDUM

State of Alaska

TO: Fisheries Cabinet

DATE: January 12, 1988

FILE NO:

TELEPHONE NO: 465-4100

FROM:  Interagency Mariculture
Workgroup

SUBJECT: Report on Activities
Conducted During the
Legislative Interim

The Interagency Mariculture Workgroup is pleased to present to you this report on our activities conducted over the legislative interim. The products contained in this report are in response to the tasks the Cabinet outlined last May. In the report you will find eight issue papers on a variety of biological, land-use, water quality and product quality issues which are central to the mariculture debate. Other products include a matrix summarizing how four other areas address these subjects, a description of the on-going socioeconomic studies, and the uniform shellfish permitting system we developed. Additional information is contained in the appendices.

Background

Last legislative session, the issue of authorizing expanded mariculture in Alaska received considerable attention. In particular, the prospect of pen-rearing salmon in Alaska became one of the hottest topics in the state. The market success of the Norwegian salmon farming industry, and the growth worldwide in fish farming generally have spurred interest in all forms of mariculture in Alaska. During last year's session of the Alaska State Legislature, bills were introduced to legalize expanded mariculture activities, including salmon pen-rearing. Senate Bill 106 and House Bill 108 would "encourage the establishment and growth of an aquatic farming industry" in Alaska. The bills would establish a permit system which would be administered by the Department of Commerce and Economic Development for aquatic farms and private-for-profit hatcheries.

In response to this action in the Legislature, Governor Cowper directed the Fisheries Cabinet to review the mariculture issue and prepare a recommendation to him. The Cabinet, after careful consideration, prepared for the Governor a set of criteria for judging any authorizing legislation. The Governor approved these criteria, which were then presented to the Legislature.

Late in the session it became apparent that authorizing legislation was not going to pass. All parties became concerned that the questionable legal status of pen-rearing

salmon could lead to speculation on tidelands sites and a "gold rush" mentality similar to the situation which developed in British Columbia. The resulting confusion and inevitable litigation would not be to anyone's advantage, so a carefully crafted moratorium bill was introduced and passed in the waning hours of the session. This bill, Senate Bill 297, placed a moratorium which expires July 1, 1988 on issuing permits for most finfish farming. It also authorized shellfish farming and limited finfish farming in fresh water.

The Fisheries Cabinet met on May 19, 1987 to develop a plan of action for addressing the mariculture issue over the legislative interim. At that time the Cabinet identified two general tasks which needed to be performed.

First, the administration needed to develop a uniform approach to permitting shellfish mariculture. This has been done. The staff workgroup reviewed existing authorities and permitting procedures, and developed the consolidated permit application form to establish a uniform application process. In conjunction with this, the Department of Fish and Game prepared regulations authorizing a shellfish farm permit, and a Fish Transport Permit for holding and transporting shellfish for commercial farming purposes. This cleared the way to allow expanded shellfish mariculture activities.

The second task identified by the Cabinet was to systematically address the issues raised during the legislative hearings. Senator Eliason and Representative Herrmann presented us additional questions which needed to be addressed as well. The issue papers, matrix, and the socioeconomic studies are the products we prepared to address this task.

The issues papers are designed to briefly discuss and summarize a number of biological, land-use, product quality, and water quality issues which are central to the mariculture debate. The matrix briefly summarizes how British Columbia, Maine, California, and Washington address many of these same issues. The socioeconomic studies, which are in progress, will address the questions regarding markets and cost of production.

Also included in the appendices are copies of SB 297, the issues lists from Senator Eliason and Representative Herrmann, a list of the staff on the workgroup, and Governor Cowper's Position on Mariculture.

LAND USE
Department of Natural Resources

ISSUE:

How will the state encourage the development of tide and submerged lands through mariculture while at the same time minimize conflicts with existing uses?

DISCUSSION:

Mariculture is a new and expanding industry in Alaska, and may become a significant long-term use of tide and submerged lands. Currently, mariculture activities are being permitted on a case-by-case basis with little or no comprehensive planning. Notable exceptions include the Prince William Sound Area Plan and the Prince of Wales Island Plan. The state needs a comprehensive approach to planning for mariculture activities in order to ensure the stable growth of this new industry and to minimize conflicts with existing uses. Such an approach should provide guidance to minimize conflicts on individual proposals and address the potential cumulative impact of numerous mariculture developments taking place over time.

Some of the potential land use problems associated with mariculture include: displacement of public uses such as recreation and subsistence; conflicts with other commercial uses of tide and submerged lands; land speculation; impacts on adjacent land holders; and cumulative impacts over time from the incremental expansion of mariculture activities.

Displacement of Public Uses such as Recreation and Subsistence

Mariculture sites may block or inhibit public access to important recreation and subsistence use areas. The expectation and desire for seclusion when recreating in rural Alaska is highly valued by residents and visitors. If the sense of seclusion is lost, an important part of the aesthetics of many bays is lost, and the recreational experience is less valuable. A mariculture facility, particularly with caretaker facilities located in a smaller cove, will essentially eliminate that sense of seclusion for recreational users other than the permit holder. In essence, the tendency will be for traditional recreational users of the cove to try to find other secluded and aesthetically pleasing areas.

Subsistence is an important activity in most of the areas where mariculture may occur. Conflicts between mariculturists and subsistence users could occur as more and more facilities are developed over time. This could entail

direct competition for subsistence resources as new residents enter rural areas, or loss of subsistence opportunities if mariculture facilities are placed in important subsistence resource areas. Siting criteria can minimize most of these problems.

And finally, the mariculturist may not want any intrusions into his or her area. There could be concerns over pollution, theft, damage, interference, or just the loss of privacy. This could lead to conflicts between the farmer and other users, in the end excluding other uses of the coastal area.

Conflicts with Other Commercial Uses of the Tide and Submerged Land

The best sites for mariculture facilities may often be the best sites for other uses such as mineral or timber transfer and support facilities, log storage, commercial fishing grounds or anchorages, or commercial recreation development. Although mariculture is a new industry in Alaska, experiences in British Columbia and Washington have demonstrated there can be conflicts with other uses. The potential for such conflicts has already surfaced in Kodiak, Prince William Sound, and Southeast.

Besides the need for space, water quality standards for mariculture may preclude the use of favored sites for other commercial or industrial facilities. Forcing more stringent mitigation measures or alternative siting for timber or mineral transfer or tailings disposal could reduce or eliminate the economic viability of the resource extraction industry in a given area.

Conversely, mineral or timber transfer, log storage, and floating camps associated with resource development activities may limit the space available or degrade water quality for mariculture facilities, thus making mariculture development more difficult and less likely.

Land Speculation

British Columbia experienced a dramatic rush for Section 10 permits prior to 1986. These permits allow the holder to enter and occupy a site to conduct research for up to one year. It appears that these permits were being issued for large areas of land with little regard for potential impacts to the public. This created a gold rush image which resulted in a great deal of public concern, and subsequently a moratorium was imposed. Alaska does not have an investigative permit similar to the Section 10 permit but we could experience land speculation in other forms, most notably by applying for tidelands and leases to tie-up a site.

Land speculation in this case is described as obtaining land use rights with the intent of not using the land for the proposed use but selling those rights for a profit. This problem is not unique to mariculture and it can occur in any use of state land. Speculation can be greatly reduced by close monitoring of development schedules and writing conditions in the land use document that would allow the state to revoke that document if the development is not proceeding as proposed.

Impacts on Adjacent Land Owners

Mariculture can impact adjacent land owners in a variety of ways: loss of tidelands access or boat moorage, loss of view, noise and loss of privacy, loss of habitat or water quality. This has been a significant issue in Washington and British Columbia, and may become a matter of concern in Alaska as well.

The adjacent land owner has a number of ways to influence the siting of mariculture facilities. They can participate in development of state land use plans, coastal zone management plans, and local comprehensive plans. The adjacent owner or owners are notified by mail of pending applications and are given an opportunity to comment on the project. A 30-day public notice pursuant to AS 38.05.945 is required for leases and the local government or regional native corporation is also notified if the project is within their boundaries. The local government or regional native corporation may hold public hearings if necessary. The Department of Natural Resources reviews all of these comments and weighs the use and enjoyment of the adjacent owner against what is considered to be the state's best interest. These determinations are made on a case-by-case basis and may or may not include consideration of cumulative impacts.

Cumulative Effects of Expanding Tidelands Use

The vast majority of the tide and submerged lands in Alaska are owned and managed by the State of Alaska. The remainder is owned by the federal government or by individuals and first class cities that acquired the land pursuant to AS 38.05.820.

The State of Alaska allows the development of its tide and submerged lands by granting leases and permits. The sale of tide and submerged land to a private entity is presently not legal. AS 38.05.045 excludes tide and submerged land from the public land that can be sold.

Tideland permits may be issued for a term not to exceed 5 years (11 AAC 62.720). This permit allows the use of tide and submerged lands for mariculture but does not provide the

security of a lease and does not constitute a preference to a lease.

Leases for tide and submerged land are issued in two ways, by public auction or negotiation. Leases may be negotiated for a term up to 55 years to an adjacent upland owner or upland lessee if the lease is for water transportation or another water-dependent purpose (AS 38.05.075(c)). Leases may also be negotiated for a period of no more than 10 years if the appraised value of the transaction is \$5000.00 a year or less (AS 38.05.070(b)). All other tideland leases are offered at public auction and anyone may bid on the lease parcel (AS 38.05.075(a)). The procedures for processing a tideland lease in each case is the same with the exception of the negotiated leases which do not have a public auction prior to the issuance of the lease.

For most of coastal Alaska, mariculture facilities will be permitted on an individual basis. The impact from one or two farms may be minimal, but the cumulative effects of numerous farms on existing uses may be dramatic. Under current statutes, management and area plans provide a process for resolving use conflicts on a regional basis, and the best interest finding required under AS 38.05.035(e) provides a mechanism for resolving conflicts on individual permits/leases. Although a regional perspective is preferred, the cost of management and area plans prohibits their use as a routine method of sorting out problems and resolving conflicts. This lack of a regional perspective could lead to significant conflicts over time and is one of the major problems with the existing system.

In developing statewide guidelines, Alaska should evaluate what British Columbia experienced during its initiation to finfish aquaculture. They had an immediate need for coastal planning because they were seeing a loss of access, a loss of anchorages, impacts on upland owners, and impacts on recreation and tourism. British Columbia placed a moratorium on leases and licenses for finfish farming and began an inquiry into finfish aquaculture and its impacts. The inquiry was completed in 1986 and many of their recommendations could be applied to Alaska. Some of the recommendations that apply to land use in Alaska are as follows:

1. The government should develop an aquaculture policy which clarifies direction, agency roles, and the responsibilities of both government and the private sector for the industry. The inquiry indicated that a clear policy would alleviate public concerns over lack of controls and lack of protection of the public resource. It would also serve to offset creation of the image of an uncontrolled land rush, which has

generated misunderstanding and suspicion about government objectives.

2. Initiate land use studies that would identify sites of high value for other important coastal interests. Use these studies to direct aquaculture away from major resource and user conflict areas.
3. Local governments should be encouraged to develop or revise local zoning laws to address mariculture within their boundaries. This would also involve modifications of local coastal zone management plans.
4. The land management agencies should review their practices involving advertising and notification for proposed aquaculture facilities. This includes notification to local governments. The inquiry recommended a 60-day review period.
5. The land management agencies should require a commitment bond to reduce speculation and a clean-up bond in the event of abandonment.
6. The aquaculture industry should be encouraged to institute a program to provide anchorage, access, and emergency assistance to other coastal users.
7. Establish a minimum distance separation guideline for farms as a means of reducing impacts on upland owners and other resource users.

Fees

Current statutes and regulations provide only two methods to collect fees for use of state land. AS 38.05.085 provides for a percentage of the fair market value as determined by appraisal. The parcel is not reappraised for 25 years. There are fees attached to permits which may be set by the regions. These fees may not provide a fair return to the state for the use of its resources. Options to consider for legislation may include: 1) a percentage of gross receipts; 2) revise lease terms to require reappraisal every five years (private sector norm).

Preference

Current statutes provide only a preference for adjacent owners. Any preference for Alaskan's would require a change in statutes.

Other statutory changes might include a lottery for new sites or a negotiated lease as well as the high bid method currently available.

SUMMARY:

It appears that most land use problems associated with mariculture can be resolved through state land use plans and the permit review process. The most comprehensive procedure to determine areas of public use is to develop state land use plans, such as the Prince of Wales Island Area Plan and the Prince William Sound Area Plan. Developing comprehensive area plans is desirable but time consuming (2-3 years) and expensive. A streamlined process needs to be developed and implemented which evaluates land-use issues, including the cumulative effect of multiple mariculture operations. Such a process should include provisions for strong local participation and be designed to meet the needs of reconciling land-use conflicts in a timely manner.

While the land use plans address siting considerations they do not resolve current statutory restrictions such as: how fees are charged; should and can Alaskans be allowed a preference to lease tide and submerged land.

WATER QUALITY
Department of Environmental Conservation
Division of Environmental Quality

ISSUE:

Ensure that high water quality is maintained during mariculture operations and that measures are taken so that preexisting uses and activities can continue without adversely affecting mariculture activities.

DISCUSSION:

Mariculture requires clean water. Water quality in areas surrounding the culture facility, however, can be affected by both the mariculture activity itself and by other nearby uses or activities. The state needs to ensure that water quality is adequate for mariculture, that high water quality is maintained during culture operations, and that measures are taken so that preexisting permitted uses and activities can continue.

Two key water quality issues associated with mariculture are:

1. Changes in water quality caused by mariculture operations; and
2. Potential siting conflicts with other uses or activities.

1. Changes to water quality from mariculture operations

Mariculture facilities can have significant impacts on local water quality and habitats if not properly sited, operated, and monitored. The impacts on water quality can be in three areas: 1) the creation of water quality and environmental conditions unfavorable for the growth and survival of cultured species; 2) a reduction of water circulation near culture facilities; and 3) the introduction of toxic or deleterious substances to the water.

One of the major concerns with mariculture operations is the unfavorable changes in water quality and environmental conditions that may develop during normal facility operations. Specific changes that may occur include:

- a) increased concentrations of particulates and organic matter (feed and fecal material) as byproducts of the culturing activity which accumulate as organic-rich deposits beneath culture facilities;
- b) increase in fecal coliform bacteria and ammonia due to increased production of waste; and

- c) decrease in dissolved oxygen due to increased oxygen demand by the cultured organisms and the bacteria that feed on their waste.

DEC has developed water quality criteria applicable to aquaculture operations (18 AAC 70.020). These criteria specify standards that must be met and maintained for aquaculture activities to take place. Specific criteria concern: fecal coliform bacteria, dissolved gas, pH, turbidity, temperature, dissolved inorganic substances, and sediments, among others. Mariculture operations, however, generate substantial amounts of waste products, unconsumed food and other debris which can settle, accumulate and affect nearby water quality and the benthic substrate.

The amount of organic matter which is produced and can subsequently accumulate below culture facilities is dependent upon several factors including the size of the mariculture facility, its production level, and environmental factors such as water depth, current velocity, flushing, and bottom topography at the facility site. This accumulation of wastes and sediments can also induce chemical and biological changes in the natural bottom habitat and water column.

An extensive accumulation of waste would stimulate the bacterial decomposition process. The biochemical oxygen demand (BOD) of this accumulated material can deplete dissolved oxygen in the water column, causing stress for the cultured organisms. Salmonids, for example, have a high dissolved oxygen requirement, 5.0 - 7.0 mg/l, which must be maintained in a crowded culture situation. Water quality criteria for aquaculture also specify that dissolved oxygen concentrations may not be less than 4.0 mg/l at any point beneath the water surface, and not greater than 17.0 mg/l in any location.

Another possible problem resulting from the deposition of excess food and feces is a change in the benthic macroinvertebrate community. Species unable to tolerate organic enrichment may disappear, and other more tolerant species become dominant. These changes may persist for the duration of the culture activity and for at least several years following its cessation.

Most, if not all of the unfavorable changes in water quality and environmental conditions can be avoided by properly siting mariculture facilities. Water quality problems would be anticipated only in areas of limited flushing or intensive culturing activity. Field studies rarely have shown organic deposition or dissolved oxygen to be a problem around culture facilities in well-flushed areas.

The second concern is that the culturing structure itself may reduce water circulation in the local area, particularly in the down-current direction. A number of variables can affect this flow reduction including flow rate, density of water, enclosure size and shape, degree of fouling, mesh type and material, and stocking density. This reduced circulation can also reduce dilution and dispersal of waste products from the culture facility. A reduction of this sort in water circulation, combined with an increased level of nutrients in the water from excess feed and feces, can promote phytoplankton blooms. This may be a particular problem in water bodies with naturally low levels of nutrients which normally result in nutrient-limited phytoplankton production. Some types of dinoflagellate blooms are associated with paralytic shellfish poisoning (PSP) and may pose a health hazard to humans who consume shellfish. Other dinoflagellate blooms can directly affect fish health and growth rates. These and other phytoplankton blooms also compete with cultured organisms for available dissolved oxygen, which could exacerbate problems of low oxygen stress. These water quality problems would be most likely to occur in areas of inadequate flushing or intensive culturing activity.

The third concern for water quality is that toxic or deleterious substances could be introduced during mariculture operations. The major problem substances include, but are not limited to, antibiotics, anti-fouling agents, and pathogens and parasites that could affect product quality and be transmitted to consumers. Chemical usage is highly regulated but also needs to be closely monitored. The accumulation of chemicals or pathogens in the cultured product must also be carefully monitored. Additional concerns regarding regulation of antibiotics, antifouling agents and shellfish pathogens are covered in the issue paper prepared by the Division of Environmental Health on the use of chemicals and additives.

Research has shown that properly sited and operated facilities will avoid many of the water quality problems described above. The state needs to develop siting criteria and guidelines to use in permitting these facilities. Specifically, criteria for tidal volumes, flushing action, currents, and water depth need to be developed. Certain of these criteria will need to be specific to the species being cultured, as environmental requirements may vary. It is also vital to have adequate information about the proposed facility during the permit review so that potential water quality problems can be avoided.

2. Potential siting conflicts with other uses or activities

The most suitable sites for mariculture facilities often are the most suitable sites for other water-dependent and water-related activities. Because mariculture facilities need clean water to operate, they may be incompatible with other activities in the surrounding area. Proper siting of the mariculture facility and subsequent monitoring of activities that occur around them are critical. A mariculture facility proposal may be submitted for an area which has historically been used for other activities, and these activities may not easily coexist. For example, some preexisting activities could have a discharge that would be detrimental to the cultured organisms. Non-point sources of pollution (e.g., sediment runoff from upland activities) may also affect water quality of embayments suitable for mariculture facility siting.

Another specific area of potential conflict with mariculture operations is the discharge for sewage from upland development, caretaker facilities associated with the mariculture project, and boat traffic. Shellfish are filter feeders and thus easily concentrate fecal coliform bacteria and heavy metals in their bodies. The National Seafood Sanitation Program has set strict standards for fecal coliform levels and heavy metal concentrations in shellfish. Currently, all shellfish growing areas in the state must be certified by DEC, Division of Environmental Health. In addition, all shellfish that will be marketed must also be certified by the Division of Environmental Health to ensure the the product is within safe limits. The State of Alaska Water Quality Standards also specify the levels of allowable fecal coliforms that are required by designated water use. These levels vary depending on the use under consideration. For example, in waters designated for industrial use, the allowable level of fecal coliforms (FC) is not to exceed 200 FC/100ml, based on a minimum of five samples taken over a period of 30 days. The allowable level of fecal coliforms for harvesting and consumption of raw mollusks or other aquatic life is 14 FC/100ml. Since all marine waters are classified to protect all uses, the most stringent use requirements prevail (e.g., 14 FC/100ml).

Siting conflicts arise when an area has historically been used for something other than mariculture and mixing zones have been established which allow fecal coliform or other water quality parameters to be above acceptable limits for an adjacent proposed mariculture operation. The determination before the department is whether to reduce the size of mixing zones for existing uses to allow mariculture facilities in the vicinity, or whether to find that the area is unsuitable for mariculture. DEC also needs to determine how long fecal coliforms persist in marine waters and the

size of contaminated areas. Information of this sort will give us an idea of the necessary separation distance between mariculture facilities and sewage discharges. It is essential information for the responsible permitting of mariculture facilities.

Summary

Mariculture requires clean water. Two key water quality issues associated with mariculture are changes in water quality caused by mariculture operations and potential siting conflicts with other uses and activities. The impacts on water quality can be in three areas: 1) the creation of water quality and environmental conditions unfavorable for the growth and survival of cultured species; 2) a reduction of water circulation near culture facilities; and 3) the introduction of toxic or deleterious substances to the water. Most, if not all of the unfavorable changes in water quality and environmental conditions can be avoided by properly siting and operating mariculture facilities. The state needs to develop siting guidelines to be used in permitting these facilities.

The most suitable sites for mariculture facilities often are the most suitable sites for other water-dependent and water-related activities. Because mariculture facilities need clean water to operate, they may be incompatible with other preexisting activities. The state needs to take measures to ensure that preexisting permitted uses and activities can continue.

DISEASE
Department of Fish and Game
Division of Fisheries, Rehabilitation,
and Development

ISSUE:

Protect native and hatchery stocks from potential disease arising from salmon farming operations.

DISCUSSION:

All populations of fishes, whether in saltwater or fresh, in the wild or in captivity, at some time contain disease agents such as bacteria, viruses, fungi, and invertebrate parasites. In Alaska, endemic disease agents are present throughout wild stocks and the marine environment. Many are opportunistic, causing disease primarily when the fish are crowded or stressed. However, it is extremely important to recognize that populations of fishes differ in the disease agents they carry, and that diseases newly introduced to fish populations can be very devastating.

To control disease in the ocean ranching program, Alaska set in place stringent regulations that govern the movement of salmon and their gametes within the state, and prohibited the import of any fish species or their gametes for aquaculture purposes. These regulations have applied for some 16 years and include requirements for thorough broodstock screening for disease agents, routine treatment of eggs to prevent disease outbreaks, annual inspections and strict reporting requirements, and the destruction of stocks if the state finds that this is necessary to control disease. The state's prohibition on importing species ensures that no new diseases are introduced into the state. For example, many chinook salmon stocks in Washington and Oregon carry IHN virus. Importing these fish could introduce new strains of IHN virus to indigenous stocks. Similarly, importing Atlantic salmon would bring the risk of importing exotic viral and bacterial diseases not found in Alaska. This could have serious impacts on the health of existing native and hatchery stocks, and must be avoided.

To maintain adequate protection of existing fishery resources, any future fish farming industry must be governed by the same fish health regulations currently governing Alaska's ocean ranching program. The species made available for farming should be from native or hatchery stocks having complete and acceptable disease histories. Prohibitions on importing species including Atlantic salmon must be maintained. This way, any diseases would be those already present in wild populations, not exotic diseases which could cause serious harm to the native stocks. All transport and possession of fishes and their gametes needs to be closely

controlled through Fish Transport Permits, and strict reporting and inspection requirements need to be enforced.

However, extending the Department of Fish and Game's fish health services to this new industry cannot be accomplished without the addition of new staff and monies to support these activities. Private sector fish health practitioners could pick up some of this additional workload. Such private practitioners would need to be certified by the state and monitored on a routine basis to ensure acceptable performance, but presently there are no private sector fish health practitioners currently operating in-state.

SUMMARY:

Assuming that imports of Atlantic salmon or other fish species to Alaska remain prohibited, that the state continues to meet its responsibilities in fish disease control, and that monies are provided for additional fish health services, this new industry can be accommodated without the threat of disease to existing native and hatchery stocks of fish.

GENETICS
Department of Fish and Game
Division of Fisheries Rehabilitation,
Enhancement, and Development

ISSUE:

Ensure that salmon farming does not impact the genetic integrity of existing natural and hatchery stocks of salmon and trout.

DISCUSSION:

Preserving the genetic diversity of Alaska's fishery resources has been recognized as an important fisheries management goal. This is especially true for the state's enormous salmon resources.

Alaska, in maintaining the health and perpetuity of its salmon resources, subscribes to the theory that identifiable units of salmon (populations, stocks, races) have through natural selection become adapted to the particular watershed that serves as home. This adaptation is preserved in the genetic make-up (gene pool) of the stock. State fisheries managers have sought to maintain stock diversity to ensure the long-term health of our salmon populations. Loss of stock diversity can occur through dilution brought about by interbreeding with other stocks. For these reasons, Alaska at the outset of its salmon ocean ranching program set in place stringent regulations that govern the movement of salmon and trout within the state and prohibited the import of salmon and trout for aquaculture purposes.

The Department of Fish and Game's genetics policy prohibits the importation of live salmonids (salmon family) into the state, and does not allow stocks to be transported between major geographic areas, such as Southeast, Kodiak Island, Prince William Sound, Cook Inlet, Bristol Bay, and AYK/Interior. The policy has been adopted in order to protect Alaska's diverse natural salmon and trout stocks.

Any new aquaculture venture, such as salmon farming, must be governed by the same policy, transport regulations, and statutes that have applied to the salmon ocean ranching program for the past 16 years. This is particularly true for provisions prohibiting the importation of exotic species, such as Atlantic salmon. Atlantic salmon are actually a trout and are the ecological counterpart of Alaska's indigenous or native steelhead trout. Since these species have not evolved together and thereby have not developed mechanisms to avoid competition with steelhead

trout or other trout, there is a concern about negative impacts on Alaska's indigenous trout.

Therefore, the genetics policy advocates the use of locally adapted stocks of salmon and trout of natural or hatchery origin because this will maintain the state's genetic diversity. This is important in the event of escape or "leakage" through holes in nets or other damage. The magnitude of impact on natural stocks is a function of numbers of fish that escape and that survive to spawn. It is assumed that low levels (less than 5 percent) of escapees can be managed by properly designed net-pen rearing units. Impacts on natural stocks from salmon farming would be minimized because of the policy of using locally adapted stocks.

SUMMARY:

Assuming that imports of exotic species such as Atlantic salmon or other fishes remain prohibited, that current regulations and policies remain in place, and that "leakage" of fish from the pens is kept low, salmon farming can be accommodated without the threat of impact to the genetic integrity of native and hatchery stocks of salmon and trout.

Broodstock
Alaska Department of Fish and Game
Division of Fisheries, Rehabilitation,
Enhancement and Development

ISSUE:

Availability of salmon eggs, fry, and smolts for salmon farming.

DISCUSSION:

The current form of salmon aquaculture in Alaska is ocean ranching. In this system, adult salmon return to their point of release after undergoing an extensive marine migration and contribute to the commercial, sport, subsistence, and personal-use fishery. This ocean ranching program is made up of public and private nonprofit (PNP) freshwater hatcheries and estuarine, juvenile net-pen rearing facilities. Enabling legislation created the public system in 1971, and in 1974, legalized the PNP Program.

Ocean ranching is not only the most successful form of aquaculture in Alaska, it is the largest program in North America and about the third largest in the world being Japan and Russia. The combined public and PNP ocean ranching harvest to the common property fishery in 1987 was in excess of 16 million salmon; this is projected to grow to 34 million for an estimated gross value of approximately \$79 million by 1993. In terms of evaluating the economic impact of the statewide ocean ranching program on the Alaskan economy, it represents \$75 million in resident-only personal income and 2,030 jobs for Alaskans. It is in the context of a successful and building ocean ranching program that we need to evaluate the availability of salmon smolts for the proposed salmon farming industry.

When salmon farming is initially legalized in Alaska, a major factor limiting development will be the availability of smolts for these saltwater farms. The current public and PNP ocean ranching program produces salmon smolts which, as adults, contribute to the common property fishery. Since the common property fishery harvest is regulated by the Alaska Board of Fisheries, it also follows that the availability of smolts is also part of the allocation process. The principle reason salmon smolts would be surplus to the common property fishery is that the present ocean ranching program is operating below capacity due to funding constraints. However, if the salmon smolts are determined by the Board of Fisheries to be surplus to the common property fishery, then they could be sold by the Commissioner. Under existing law, only the state through the Commissioner of the Department of Fish and Game (ADF&G) can sell eggs, fry, or smolts. The PNP hatcheries are

prohibited from selling eggs, fry, or smolt except to another PNP hatchery or to the state. therefore, a change in the law would be required in order to extend the sales opportunity to the private sector. Once the private for-profit salmon farming industry begins to evolve, there will be a demand to have private for-profit freshwater hatcheries to produce smolts for the mariculture industry. These will come from either eggs taken by permit from natural salmon stocks, or by purchase of eggs from public or PNP hatcheries, or eventually from private broodstock produced from the saltwater farming operations. The latter will represent the preferred source of eggs because of the need to develop domesticated broodstock. This will take at least one generation, 4-5 years for chinook salmon to provide eggs, but generally three generations to initiate change towards domestication. Therefore, in the interim, the availability of eggs for salmon farmers with freshwater hatcheries or smolts for those with only saltwater farms will need to be addressed.

On the one hand, sale of eggs or smolts could assist in the financial health of the salmon ocean ranching program which benefits the common property fishery. This dilemma represents the heart of the public policy debate; specifically, the allocation of resources from an established common property fishery to a proposed private for-profit industry. This issue clearly belongs in the legislative arena, but it needs to be resolved so that agencies such as ADF&G know how to allocate eggs, fry, or smolts to the potentially new salmon farming industry.

SUMMARY:

The availability of eggs, fry and smolts for the salmon farming industry is an allocation decision, and is central to the public policy debate regarding allocation of resources from the common property fishery to the private for-profit farmer. Under the current law, the Board of Fisheries would probably make the determination of whether or not eggs, fry, or smolts are surplus. If the Legislature legalizes salmon farming and the Board of Fisheries determines that a surplus exists, then eggs, fry or smolts could be sold to potential salmon farmers by the commissioner of ADF&G.

HABITAT PROTECTION
Department of Fish and Game
Division of Habitat

ISSUE:

Ensure protection of important habitat through proper siting and design of mariculture facilities.

DISCUSSION:

Floating mariculture operations can result in one or both of the following environmental effects: (1) accumulation of organic-rich sediments on the benthic substrate beneath the facility, and (2) changes in water quality.

Proper siting of mariculture facilities is essential if there is to be minimal environmental effect from a mariculture operation. If not properly sited, the accumulation of organic-rich sediments in the form of wastes, uneaten food, and shell debris below the facility can cause physical and chemical changes in the natural bottom sediments. Included in these changes are increased oxygen consumption within the sediment; and increased concentrations of total volatile solids, total organic carbon, sulfides, nitrogenous compounds, and phosphates.

Accumulation of such sediments and resultant oxygen depletion in the interstitial water can have effects upon the infaunal invertebrate community in the immediate area. Loss of species that are intolerant of organic enrichment often occurs in these areas. In addition, if such accumulation occurs in an area of extensive bottom vegetation such as eelgrass beds, important habitats can be lost. It should be noted, however, that wastes generated by the farming operation generally are not similar to city wastes which can contain detergents, heavy metals, and other contaminants. The wastes referred to here are purely organic in nature.

In order to prevent organic-rich sediments from building up on the benthic substrate and affecting infaunal invertebrates and important habitats, facilities should be sited in areas known to be well flushed in water with adequate depth. Facilities should not be sited in sensitive habitats such as eelgrass beds, herring spawning areas, or mouths of anadromous fish streams. Siting over eelgrass beds or other marine vegetation can result in degradation of these habitat types by sediment accumulation or possibly shading. Likewise, if these habitat types are providing substrate for herring spawn, additional impacts would result from their loss. The mouths and intertidal areas of anadromous fish streams serve as feeding and marine

accumulation areas for outmigrating fry and smolts. Such areas should be avoided to minimize impacts to these sensitive areas and prevent possible disturbance to returning adults.

High concentrations of marine mammals and waterfowl can result in increased predation problems. In addition, disturbance to important wildlife could occur from increased human activity in the area. To minimize such problems, known concentration areas such as haulouts, nesting areas, and marine mammal or bird feeding areas should be avoided when possible.

SUMMARY:

Mariculture facilities could have a significant impact on important habitat areas if improperly designed and sited. These problems can be minimized by implementing proper siting and design criteria.

PREDATION
Department of Fish and Game
Division of Habitat

ISSUE:

Minimizing Predation and Bear/Human Conflicts

DISCUSSION:

Predation is a common problem with mariculture operations. The list of predators includes all types of fish or shellfish-eating mammals, fish and birds. Generally, the most serious problems with predator control involve mammals and birds. In Alaska, these categories can be expected to include seals, sea lions, mink, marten, otters, and various birds. If shore-based facilities are involved, improperly disposed garbage and wastes will attract bears and result in confrontation problems.

The problem of predation can be reduced by installation of screening or netting, and attempting to avoid known concentration areas such as bird nesting areas, marine mammal haulouts, or heavily used bird or mammal feeding areas. The department will consider mariculture facilities to be "attractive nuisances" to predators and would not favor destruction of predators under 5 AAC 92.410(a) (2), defense of life or property. The Department of Fish and Game is working closely with the Department of Environmental Conservation and the U.S. Forest Service to address the problem of bears and garbage, and garbage and wastes at shore-based facilities must be disposed of properly.

SUMMARY:

Predation could be a significant problem at mariculture facilities, but with proper design and siting predation can be minimized or prevented altogether.

PRODUCT WHOLESOMENESS
Department of Environmental Conservation
Division of Environmental Health

ISSUE:

Ensure product wholesomeness through site certification and by regulating the use of chemicals in mariculture operations.

DISCUSSION:

Currently, Alaskan seafood products have a world-wide reputation for quality and wholesomeness. The state has invested considerable resources in this reputation, through DEC's seafood inspection program and Alaska Seafood Marketing Institute's promotional efforts. It is important to ensure the safety and wholesomeness of any seafood produced through a mariculture industry. The Department of Environmental Conservation believes that safe and wholesome mariculture products can be produced if the department is given the authority to regulate certain aspects of the industry.

The Department of Environmental Conservation needs additional authorities to develop standards and regulation for the certification of mariculture sites and for the control of chemicals used to treat the product or their environment.

Chemical Usage

Currently the use of chemicals in mariculture operations is regulated by the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA). The FDA regulates the use of medicines and food colorings, and the EPA controls the use of chemicals such as anti-fouling compounds and parasiticide.

These chemicals must be registered with the appropriate federal agency. The manufacturer for registration submits scientific data supporting claims for efficacy and safety and identifying any environmental hazards. If the regulating agency finds the data to be adequate, the agency issues a label for the product, including instructions for use and safety precautions.

The regulatory agencies have established, for some of these chemicals, required minimum time periods between the time when the chemicals are applied to food products and the time when the food product may be marketed. For some chemicals, there are restrictions on levels allowable in the tissues of

the product when it is sold. If label instructions for these chemicals are followed, use of these products should be safe and not present any harm to the consumer.

Chemical compounds are used as anesthetics to reduce trauma to the animals during handling; disinfectants are used to remove pathogens from gear and equipment; food colorings are used to alter the color of the animal's flesh; and antiseptics, antibacterials, viricides, fungicides, and parasiticides are used to control disease organisms.

The potential problem with the use of chemicals is ensuring that they are being applied according to the label instructions. Currently, the FDA and EPA are responsible for monitoring their use. However, both agencies have limited resources available for surveillance in Alaska. To maintain consumer confidence in the safety of mariculture products, the Department of Environmental Conservation needs specific authority to develop regulations to control the use of chemicals and authority to conduct inspections to confirm application according to label instructions. State regulations adopted pursuant to such statutory authority would refer to federal regulations so that federal labels would be accepted by the state. The purpose of monitoring would be to confirm that the chemicals were used properly. Regulations would likely include requirements for training and certification of applicators of these chemicals and requirements for record keeping and testing.

Site Certification

In order for any state's shellfish to be sold in interstate commerce, it is necessary for the state to have a shellfish site certification and processing inspection program that meets the requirements of the federal Food and Drug Administration. The Department of Environmental Conservation administers an Alaskan shellfish program which has been approved by the FDA. Under this program, all shellfish growing areas in Alaska must be certified, and harvesters and processors must be permitted by the Department of Environmental Conservation.

The Department of Environmental Conservation surveys growing areas for sources of pollution and extensively samples and tests the water quality to determine if it meets regulatory requirements. Sampling and testing is also conducted to determine levels of paralytic shellfish toxins.

If the site is acceptable, then it is certified by the Department of Environmental Conservation. Only shellfish from certified growing areas may enter commerce. The specific requirements for growing area water quality and site surveys are contained in the National Shellfish

Sanitation Programs Manuals which are referred to in Department of Environmental Conservation's regulations.

Legislation should give the Department of Environmental Conservation the authority to develop a certification and permitting program for other mariculture species similar to the one presently in place for shellfish. Mariculture sites should be surveyed and certified. The site certification program would ensure that Alaskan mariculture products were free from exposure to pollutants and contamination in the growing site. The site certification program would prevent mariculture products from being raised in areas which are subject to pollution.

Labeling

DEC is responsible for ensuring that seafood produced in Alaska is safe and wholesome. DEC also assists the Alaska Seafood Marketing Institute in developing programs to produce and promote quality products. It is important to ensure the safety and wholesomeness of any seafood produced through a mariculture industry. Current statutes and regulations would not require any differentiation in labeling between wild products and farmed products. It might be helpful to consumers to distinguish mariculture products from "wild" products. The Department of Environmental Conservation would enforce such requirements if they are instituted.

SUMMARY:

The production of safe and wholesome mariculture products and the preservation of Alaska's seafood product's reputation for quality can be maintained and enhanced by giving the the Department of Environmental Conservation's Division of Environmental Health the authority necessary to regulate the use of chemicals and insure that mariculture sites are free from contaminants which might affect public health.

Summary of Mariculture Requirements

(British Columbia, Maine, California, Washington)

The following chart is a compendium of information from four separate systems of implementing mariculture programs. For detailed information regarding actions taken by each program, please refer to the corresponding footnotes.

	Y Issue addressed	N Issue not addressed	? Information not available	¹ Footnote
	British Columbia	Maine	California	Washington
General				
Lead Agency	Y	Y	Y	Y
Site Survey	Y ¹	N ²	N ³	Y ⁴
Public Notice/Hearings	Y	Y ⁵	Y ⁶	Y
Application Fees	Y ⁷	?	Y ⁸	Y ⁹
Annual Report	Y ¹⁰	?	Y ¹¹	Y ¹²
Land Use				
Size/Density of Farm	?	Y ¹³	?	Y ¹⁴
Land Use Planning Designation for Mariculture	?	?	?	Y
Leases Issued for Mariculture	Y ¹⁵	Y ¹⁶	Y ¹⁷	Y ¹⁸
Land Use Preferences	?	Y ¹⁹	?	Y ²⁰
Conflict Resolution	Y	Y	Y	Y
Clean-up/Performance Bonds	Y	Y	?	Y
Land Rent	Y	Y ²¹	Y ²²	Y ²³
Survey Plat Required	?	?	Y ²⁴	Y ²⁵
Water Quality				
Separation of Facilities	Y ²⁶	N	N ²⁷	Y ²⁸
Waste Discharge	Y ²⁹	N	Y ³⁰	Y ³¹
Water Quality Siting Criteria	Y ³²	N	Y ³³	Y ³⁴
Water Quality Monitoring	Y ³⁵	Y ³⁶	Y ³⁷	Y ³⁸
Fish and Wildlife				
Broodstock Acquisition	Y ³⁹	?	Y ⁴⁰	?
Disease Controls	Y ⁴¹	?	Y ⁴²	Y ⁴³
Genetic Controls	Y ⁴⁴	?	Y ⁴⁵	Y ⁴⁶
Exotic Species	Y ⁴⁷	?	Y ⁴⁸	Y ⁴⁹
Private For-Profit Hatcheries	Y ⁵⁰	?	Y ⁵¹	?
Protection of Existing Wild Stocks or Other Fish & Wildlife	Y ⁵²	?	Y ⁵³	Y ⁵⁴
Measures to Protect Sensitive Habitats	Y ⁵⁵	Y ⁵⁶	Y ⁵⁷	Y ⁵⁸
Product Quality/Wholesomeness				
Site Certification and Evaluation	Y ⁵⁹	Y ⁶⁰	Y ⁶¹	Y ⁶²
Control and Monitoring of Chemicals and Additives	Y ⁶³	?	Y ⁶⁴	Y ⁶⁵
Product Labeling	Y ⁶⁶	?	Y ⁶⁷	Y ⁶⁸

General

1. **Finfish:** An environmental assessment of site suitability must be completed for every potential net pen site. Possible requirements, in addition to a site plan (location and boundaries), include: depth contours, current patterns, maps of sub-tidal vegetation, invertebrate studies and pre-installation water quality data. A SCUBA survey is required in areas where water depth is less than 20 meters to describe substrate, vegetation and faunal presence. In areas deemed "sensitive", may also require: seasonal assessment of oceanographic characteristics, identification of other effluent discharges in the same area, measurements of background water quality and sediment quality characteristics, vegetation mapping, and compilation of fisheries resources information.

Other species: The culture of molluscs, crustaceans and marine plants may also have significant environmental impacts. Site survey information required may vary depending on the proposal. Department of Fisheries and Oceans (DFO) offices should be contacted. Information required may include certain of the survey elements required for finfish culture.

2. No requirements at present. Maine is in the process of developing standards for siting and other criteria for management of mariculture activities.
3. No standardized site survey requirements. The Sanitary Engineering Branch of the Department of Fish and Game studies and decides on the acceptability of all shellfish areas. Applicants are required to provide preliminary water quality data (no specifics listed) to evaluate the areas for pollution. Also, the application for the lease of state water bottoms for aquaculture must include, when available, high and low tide lines.
4. **Finfish:** Prior to permit application, an initial site characterization survey is required. Requirements vary by facility size (i.e. Class I = production capacity less than 25,000 lbs/year; Class II = production capacity greater than 25,000 lbs/year but less than 100,000 lbs/year; Class III = production capacity greater than 100,000 lbs/year). Requirements for all classes: recommended consultation with state and local authorities, bathymetric survey, hydrographic survey (i.e. current and velocity), and diver survey of biological resources done April thru September. Class III additional requirements: drogue tracking, vertical hydrographic profiling (as part of hydrographic survey), sediment chemistry sampling and benthic infauna sampling.

Other species: Site survey requirements vary; are dependent upon local SEPA (State Environmental Policy Act) requirements.

5. Mandatory public hearings after 20 day notice in newspaper and trade journal.
6. Mandatory public hearings after 90 day notice in newspaper.
7. \$25
8. \$100
9. \$25
10. Annual health report required by the Fish Transport Committee, Department of Fisheries and Oceans (DFO). Operational log with monthly or quarterly production figures required. Water quality monitoring report specified on a site-specific basis.
11. Yearly registration with the California Department of Fish and Game required.
12. Annual report must be submitted to the Department of Natural Resources which distributes it to other resource agencies. Facilities with less than 20,000 lbs/year production are exempt. Those with productions of 20,000 to 100,000 lbs/year must submit benthic dive survey only. Facilities with production greater than 100,000 lbs/year must submit complete report (benthic survey, water quality survey and hydrographic survey).

Land Use

13. 5 acres per lease with a maximum acreage of 200 acres per person.
14. Maximum of 40 acres per oyster farm, salmon farms are divided into Class I, Class II and Class III farms depending on the carrying capacity of the site. The class determines how many thousands of pounds can be produced at the site.
15. Lease or license of occupation issued, section 10 permit used for one year to allow site research.
16. Leases issued up to 10 years, negotiated if there is no competitive interest.
17. Leases issued for up to 25 years auctioned.
18. Leases issued for 5 to 10 years.
19. First to the state, second to riparian owner of the intertidal area within the lease area, third to fisherman who have traditionally fished in or near the lease, fourth to the riparian owner within 100 feet of the lease area.
20. To adjacent upland owner.
21. Based on type of use.
22. Auction amount plus privilege tax charged for amount of product sold.
23. Fair market value plus value of existing edible shellfish within the lease.
24. Paper plat tied to existing upland monuments.
25. Paper plat tied to existing upland monuments.

Water Quality

26. Minimum distance between operation lease boundaries must be at least 5 km to minimize risk of disease transfer and minimize potential cumulative water quality impacts.
27. No spacing or size limits; many sites are contiguous. The size and location of allotments is decided by the Department of Fish and Game on a case-by-case basis as they work with the applicants.
28. No specific distance limits, however, may limit fish production due to local water conditions (i.e. they restrict production in areas with chronic water problems due to dissolved oxygen and nitrogen concentrations). Washington also limits maximum production to 1,000,000 lbs/year/square nautical mile.
29. The Ministry of Environment, Waste Management Branch, has draft regulations that exempt finfish farm effluent (feces and feed) from waste management permit requirements. Shellfish farms are also exempt. Sewage facilities associated with farm facilities are required to get a waste management permit for water discharge, although this permit requirement has not been strictly enforced. B.C.'s main waste concern at this time is dead fish and possible disease transmission from disposal in open water. They are hoping a multi-collection and disposal service can be arranged.
30. Regional Water Quality Boards (9 in state) issue water quality discharge permits - NPDES permits. Water quality discharge standards are the same as the federal standards.

31. A NPDES permit is required for the discharge of pollutants into surface waters of the state by a point source. Both aquaculture activities and processing operations require permits. For aquaculture, this includes "Concentrated Aquatic Animal Production Facilities" such as ponds, raceways, or similar structures which produce 20,000 pounds per year of cold water species or more, and which feed 5,000 pounds per month of feed or more, and which discharge at least 30 days per year. Permits for such facilities require sedimentation basins for cleaning wastewater and require monitoring of effluent quality. Also included are in-water aquaculture projects in which a discharge of pollutants is used to grow aquatic organisms. Washington has water quality and effluent standards that all discharges must meet. Also, any activity or action which would cause short-term violation of the state's Water Quality Standards requires a Water Quality Standards modification from the State Department of Ecology.
32. For finfish: Pens must be anchored in not less than 10 meters of water at zero tide. Minimum of 2 meters between bottom of pen and ocean floor. Net pens should be located in areas of good circulation and tidal flushing. No direct sewage discharge from living quarters on the lease site.
33. No preconceived rules or standards. Decisions are made on a case-by-case basis. The proposed area must have good flushing.
34. For finfish: Required minimum depth between pen bottom and ocean floor ranges from 20 to 60 feet, depending on the size of operations and local currents.
35. Monitoring of approved net pen operations may be required to provide information on substrate quality, water quality (distribution of dissolved and suspended solids, nutrients, pathogens, chemicals), accumulation patterns of organic deposits, alterations in vegetation distribution patterns, change in benthic structure or other site-specific information. Once a site has been in operation for some time, reporting requirements may be required if there is increased production, negative impact on the environment, or as part of a general coastwide aquaculture impact assessment program. Sample measures, replicates and frequency are specified on a site-specific basis.
36. The Department of Marine Resources may conduct an annual review of each aquaculture lease if the operation has been conducted in a manner injurious to marine organisms.
37. Operators are required to provide on-going water quality data as deemed necessary to evaluate the area and ensure year-round protection of the shellfish consumer. The amount of sampling required depends on the location and susceptibility of harvest sites to pollution problems. At any time the state may obtain water samples.
38. Annual monitoring requirements vary by facility size. Class I = none; Class II = Benthic survey/diver survey; Class III = Annual summer monitoring to include benthic/diver survey, sediment chemistry, benthic infauna, water quality sampling, current velocity and direction.

Fish and Wildlife

39. Eggs obtained from surplus eggs at federal hatcheries or purchased from private hatcheries.
40. Broodstock purchased from commercial sources (commercial license holders or registered aquaculturists). If no commercial supply available, then broodstock can be collected from wild stocks under permit from the California Department of Fish and Game (CFG). The broodstock remains the property of the state, but the progeny belong to the applicant.
41. Eggs must be certified as disease free by the Department of Fisheries and Oceans (DFO). Fish Health Protection Regulations (DFO) apply.
42. Covered by Aquaculture Disease Control Regulations of the CFG.

43. Requires permit from the Washington Department of Ecology (WDE) for transportation or import of live fish or viable sexual parts.
44. DFO and Provincial Ministry of Environment require approval for transport of eggs, smolts, or fish over 50km.
45. Any fish planting requires approval of the CFG.
46. Covered by fish transport permit (WDF).
47. All salmonid importation must comply with Federal-Provincial Policy for the importation of live salmonids into British Columbia.
48. All importation, transportation, and planting of fish is controlled by the CFG.
49. Covered by fish transport permit (WDF).
50. Must be licensed by DFO.
51. Controlled by CFG regulations.
52. Federal-Provincial importation policy for salmonids.
53. Importation, transportation, and planting of fish is controlled by the CFG.
54. Site location controlled by Interim Guidelines of the Department of Ecology. WDF and the Washington Department of Game review site locations.
55. Location approval by DFO. Detailed dive survey required. No finfish pens located within 1km radius of the mouth of anadromous fish streams. No net pens in "sensitive habitats" as defined by Sec. 31(5) of the Fisheries Act.
56. Applicant cannot unreasonably interfere with ingress and egress of riparian owners, navigation, fishing or other uses of the area (Department of Marine Resources regulation).
57. Leasee may not unreasonably impede public access to state waters, but may limit public access to the extent necessary to protect facility (CFG regulations). CFG reviews location of sites.
58. Interim guidelines do not allow siting over "habitats of special significance" (determined by WDF) in waters 75 feet or less in depth.

Product Quality and Wholesomeness

59. Siting criteria is considered one of the most important criteria for aquaculture development. Information may be required for current patterns, sub-tidal vegetation mapping, invertebrate studies, and water quality parameters.
- Net pens are restricted by distance from shellfish operations and from other lease operations. This restriction prevents contamination of shellfish or other fish from transfer of pathogenic organisms and chemicals.
60. No information on product quality or wholesomeness available from materials on hand.
61. Requires an actual on-site inspection by a representative before a permit is given. Aquaculture proposals are required to include a description of plans and maps showing locations of proposed harvesting areas. They also must include a description of type and location of any facilities to be used for handling, packaging, or string products within the state.

62. Applicants must have submitted a site assessment prior to the application process which included 1) a bathymetric survey 2) a hydrographic survey and 3) a dive survey of biological resources.

Washington has also divided the coastline into "habitats of special significance" which identify 1) areas important to commercial or sport fisheries, 2) those of critical ecological importance and 3) those especially sensitive to degradation by culture activities.

63. They are looking into effects of anti-foulant and antibiotic use on net pen farms. Initial indications show that oysters accumulate chemicals that are used to treat nets with the result of reduced growth and poisonous flesh. No research available yet on accumulation in farm fish of anti-foulants. Because of this, distance restrictions are in place for proximity of net pens to shellfish and other fish farms. From literature, it does not appear that B.C. has any definite restrictions or federal guidelines regarding the use of chemicals or additives.

64. Use of chemicals was not mentioned in material available.

65. Applications for aquaculture must go through an environmental assessment by submitting an operations plan which includes chemical and anti-foulant use. Also as a guideline, Washington has determined that TBT should not be used as an anti-foulant agent. Use of other anti-foulants must be reviewed on a case-by-case basis and reported to the Washington Department of Ecology.

Only antibiotics licensed by FDA are allowed to be used at the present time. This limits use to oxytetracycline, sulfamerazine, and Romet 30. These should be used sparingly on a short-term basis (there did not appear to be minimum time and dosage requirements for this).

Annual monitoring report includes types of antibiotics used and frequency of use over past year. Also includes types of anti-foulants used and frequency of net treatment.

66. Fish crossing provincial lines must have proof of coming from registered facility. This is also true for exporting fish.
67. Department of Health Services, Food and Drug Branch sets requirements for proper packaging and labeling of fish and shellfish moved in commerce.
68. No information on labeling from information available.

STATE OF ALASKA

OFFICE OF THE GOVERNOR

DIVISION OF GOVERNMENTAL COORDINATION

STEVE COWPER, GOVERNOR

CENTRAL OFFICE

P.O. BOX AW
JUNEAU, ALASKA 99811-0165
PHONE: (907) 465-3562

SOUTHEAST REGIONAL OFFICE

431 NORTH FRANKLIN
P.O. BOX AW, SUITE 101
JUNEAU, ALASKA 99811-0165
PHONE: (907) 465-3562

SOUTHCENTRAL REGIONAL OFFICE

2600 DENALI STREET
SUITE 700
ANCHORAGE, ALASKA 99503-2798
PHONE: (907) 274-1581

NORTHERN REGIONAL OFFICE

675 SEVENTH AVENUE
STATION H
FAIRBANKS, ALASKA 99701-4596
PHONE: (907) 456-3084

Dear Applicant:

The Shellfish Farm Application is designed to help you obtain most of the authorizations you will need from the State of Alaska Departments of Natural Resources (DNR), Fish and Game (ADF&G), Environmental Conservation (DEC), and Division of Governmental Coordination (DGC) in order to begin your shellfish mariculture project. A Coastal Project Questionnaire, which is available from any of these agency offices, must also be submitted with your application to help determine which specific permits must be obtained prior to constructing your project.

Please read this application carefully. A fully completed application will help the state agencies to process your request promptly. Incomplete or incorrect information may result in requests for additional information, processing delays, or the application may be returned to you for resubmission. You will receive a notice and processing schedule for the state coastal zone consistency review from DGC when your application has been accepted for processing. Your permits will also be processed on this schedule.

If you need technical assistance in completing this application, please refer to the list of agency representatives provided at the back of this application packet. If you have questions about this application process, or you are not able to determine which agency can best answer your technical questions, contact the Division of Governmental Coordination in Juneau at 465-3562, in Anchorage at 274-1581, or in Fairbanks at 451-2818.

Additional Permits

In addition to the permits and approvals which you are applying for in this consolidated permit application, you will also need to separately apply for and obtain a Fish

Transport Permit from ADF&G to obtain and hold broodstock; and a Growing-Area Certification and a Harvester's Permit from DEC in order to sell your product. These permits are not covered by this application since they are required for later phases of your project.

A Fish Transport Permit is required by ADF&G in order to hold, transport, and raise live fish including shellfish. You will need this permit before you can obtain, hold, or begin raising your product. We encourage you to contact the Fisheries Rehabilitation, Enhancement and Development (FRED) Division in Juneau at 465-4160 or in Anchorage at 267-2157 as early as possible in order to apply for and obtain a Fish Transport Permit.

You should contact DEC regarding area certification requirements so that you can be reasonably sure that your site will qualify. We recommend that you apply for growing area certification and a harvester's permit at least six months before you intend to harvest shellfish. To obtain more information on certification requirement please contact DEC in Anchorage at 272-1561 or in Juneau at 465-2609 or 465-2696.

jbak87122401DMF

Consolidated Shellfish Farm Permit Application

General Instructions

1. Fill in the blanks on the form provided.
2. If additional space is needed to fully answer a particular question, attach additional pages marked with the corresponding number in the application.
3. Applications must be *typed* or *printed* clearly in *ink*.
4. Applications must be signed by the applicant or an authorized representative.
5. The application should be forwarded to the appropriate regional office of the Office of Management and Budget's Division of Governmental Coordination for the region in which the farm is to be located (see attached map for regional boundaries).

Southeast Regional Office
431 North Franklin Street
P.O. Box AW, Suite 101
Juneau, Alaska 99811-0165
(907) 465-3562

Southcentral Regional Office
2600 Denali Street
Suite 700
Anchorage, Ak 99503-2798
(907) 274-1581

Northern Regional Office
675 Seventh Avenue
Station H
Fairbanks, AK 99701-4596
(907) 451-2818

6. **Please note:** This application is for a specific mariculture project. You will need to submit a new application if you change any of the following:
 - A. The species to be propagated
 - B. The size or design of your operation
 - C. The location of your operation
 - D. Request a long-term tidelands lease for a previously permitted site

APPLICANT INFORMATION

1. Name _____
 Mailing Address _____
 City _____ State _____ Zip Code _____
 Phone _____
2. Business Name (if applicable) _____
 Business Address _____
 City _____ State _____ Zip Code _____
 Phone _____
3. Authorized Agent (if applicable) _____
 Address _____
 City _____ State _____ Zip Code _____
 Phone _____

PROJECT INFORMATION

1. Provide a brief description of the facility and your overall proposal. Include upland facilities as well as tide and submerged land facilities.

2. What experience, expertise, and other resources do you have available for this project?

PROJECT LOCATION

1. Is the Project on: (please mark with ✓)
 State Land _____ Federal Land _____ Private Land _____ Municipal Land _____
2. Township _____ Range _____ Meridian _____ Section _____
3. Number of acres applied for:
 Uplands _____ Tidelands _____
4. Provide the names and addresses of the landowners of adjacent uplands and tidelands.

Uplands	Tidelands
A _____	A _____
B _____	B _____
C _____	C _____

5. Attach topographic maps (U.S.G.S. Scale 1: 63360) and nautical charts to this application that show the site location and general area. Clearly indicate the site location on the charts and maps.

SITE PLAN & PHYSICAL DESCRIPTION

1. Provide a site plan drawn to scale (no less than 1" = 50') which shows the layout and location of the following:
 - A. The rafts or other production facilities employed (please include size and number).
 - B. Anchoring systems and shoreties.
 - C. Docks, floathomes, or caretaker facilities, including source of freshwater for domestic use and processing water, wastewater disposal systems, and solid waste storage and disposal.
 - D. Any freshwater discharges.
 - E. Roads or air strips.
 - F. Other upland or tideland facilities at the site associated with the farming operation.
 - G. Fuel and chemical storage.
 - H. Property lines referenced in #4 of the previous section.
2. On the site plan, draw lines and identify the tide level at the following stages:
 - Mean Lower Low Water (MLLW)
 - Mean Higher High Water (MHHW)
 - Mean High Water (MHW)
3. Diagram surface tidal current speed and direction at maximum tide flow on the site plan or nautical chart.
4. Water depth at the site of culture gear at MLLW would be: _____

SITE SUITABILITY

1. Physical and Biological Characteristics
 - A. Have you conducted an on-site investigation? yes _____ no _____
 - B. Provide any information you may have regarding tidal flushing, water temperature, salinity, and turbidity/sedimentation at the site. Include the dates these data were obtained.

 - C. Describe the bottom type composition at the site (if more than one type, indicate percent).
sand _____ mud _____ rock _____ gravel _____ eelgrass _____
other: _____

 - D. Describe winter conditions at the site (temperatures, icing, storms, etc.).

E. Do anadromous fish (e.g. salmon) use any streams in the area for spawning? yes _____ no _____

If yes, indicate which streams are used and label them as such on the site plan.

F. Is the target species naturally present in the area? yes _____ no _____

If yes, describe abundance condition.

G. Describe measures you would propose to control predation by marine mammals, seabirds, or other potential predators.

WATER QUALITY

NOTE TO APPLICANT: Sewage or industrial discharge(s) may accumulate in, or harm the growth or consumptive use of your shellfish product. Oysters, mussels and scallops are filter feeders and may accumulate fecal coliform bacteria from sewage discharges. If a caretaker facility is located near the culturing operation there may be a risk of contamination. DEC will require that the wastewater treatment systems used on caretaker facilities meet Alaska State Water Quality Standards criteria for harvest or consumption of raw mollusks or other aquatic life.

A. Were there any sources of past pollution at the site, such as a shorebased seafood processor, industrial facility, or a town or village? yes _____ no _____

If you answered yes to the above, identify:

- The type of previous use (i.e. mine, village, seafood processor) _____
- The last known date of use _____
- The distance from site of previous use to your project site _____

B. Are there any currently active sources of human or industrial pollution in the area? yes _____ no _____

If yes, please describe:

- The type of discharge(s) _____
- The location and distance from your site _____
- The name of the discharger(s), if known _____

C. If there is a caretaker facility proposed for the site, please identify:

- The sewage treatment method to be used _____
- The expected volume of seawater and greywater _____
- The location of the treated sewage's discharge point _____

CURRENT LAND USE STATUS

Describe the type and intensity of present uses of the project site and the surrounding area (e.g. commercial development, recreation, commercial fishing, or residential use, etc.).

FARM OPERATION AND DEVELOPMENT

1. Species to be raised:

Species	Annual Production Goal
A _____	_____
B _____	_____
C _____	_____

2. Please provide a timetable showing approximate dates for installation of spat collection gear, placement of production facilities, date of first sale, and a schedule for reaching expected maximum production.

3. Donor Stock

Have you submitted a Fish Transport Permit application to the Department of Fish and Game?
yes _____ no _____

If yes, date of application _____

Certification Statement

I certify that all of the information contained herein is true and complete to the best of my knowledge. I also understand that I must separately apply for and hold a Fish Transport Permit from the Department of Fish and Game in order to hold, transport, and raise shellfish, and a Growing Area Certification and a Harvesters Permit from the Department of Environmental Conservation in order to sell my product.

Signature of Applicant or Agent

Date

TITLE 5.
FISH AND GAME
CHAPTER 41.
TRANSPORTATION, POSSESSION, AND RELEASE OF LIVE FISH

ARTICLE 1.
SCOPE OF REGULATIONS

5 AAC 41.001 is amended to read:

5 AAC 41.001. APPLICATION OF THIS CHAPTER. The provisions of this chapter govern the transportation, possession, or release of live fish transplanted for or cultivated for human consumption or sport fishing purposes, or as part of an aquaculture program for scientific, educational or propagative purposes, and the transportation and possession of shellfish for commercial purposes in conjunction with a shellfish farming operation.

(In effect before 1988; am __/__/88, Register __)

Authority: AS 16.05.251(a)

ARTICLE 3.
GENERAL PROVISIONS

5 AAC 41.100 is amended to read:

5 AAC 41.100. DEFINITIONS. In addition to the definitions set out in 5 AAC 41.10.060 and AS 16.05.940, in 5 AAC 41.001--

"application" means a letter, document, or form which provides information necessary for the commissioner or his designee to issue, condition, or deny a permit;

(2) "department regional office" means the Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement and Development Division offices located as follows:

Region I - Southeastern Region
Island Center Building
P. O. Box 2-
Douglas, Alaska 99824-0020

Region II - Central, Westward and
Arctic-Yukon-Kuskokwim Region
333 Raspberry Road
Anchorage, Alaska 99502

(3) "fish pathology section" means the Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement and Development Division, Fish Pathology Section, located at 333 Raspberry Road, Anchorage, Alaska 99502, telephone (907) 344-0541;

(4) "ornamental fish" means a fish commonly known as "tropical fish," "aquarium fish," or "goldfish" which are imported, cultured, or sold in the state customarily for viewing in aquaria or for raising in artificial systems, and not customarily used for sport fishing or human consumption purposes;

(5) "permit" means a fish transport permit, including any amendment or condition issued or approved by the commissioner or his authorized designee, which has not been suspended, terminated or expired;

(6) "permittee" means the holder of a permit and includes anyone employed, contracted, or assigned by the person to whom the permit was issued.

(In effect before 1988; am __/__/88, Register __)

Authority: AS 16.02.251(a)

5 AAC 41 is amended by adding a new article:

ARTICLE 4. SHELLFISH FARMING

Section.

- 200. Applicability of Regulations
- 210. Permit Required
- 220. Shellfish Farm Permit Application
- 230. Additional Information
- 240. Review and Determination
- 250. Permit Conditions
- 260. Inspection of a Farm
- 270. Annual Report
- 400. Definitions

5 AAC 41.200. **APPLICABILITY OF REGULATIONS.** The provisions of 5 AAC 41.200 -- 5 AAC 41.400 govern the permit application process for shellfish farm permits, and establish guidelines and procedures regarding the operation of permitted shellfish farms. (Eff. / / , Reg.)

Authority: AS 16.05.020
AS 16.05.092
AS 16.05.251
AS 16.05.340(b)

5 AAC 41.210. PERMIT REQUIRED. A shellfish farm permit, issued by the commissioner, is required for the operation of a shellfish farm. (Eff. / / , Reg.)

Authority: AS 16.05.020
AS 16.05.092
AS 16.05.251
AS 16.05.340(b)

5 AAC 41.220. SHELLFISH FARM PERMIT APPLICATION. An applicant must submit a consolidated shellfish farm permit application and coastal project questionnaire to the nearest office of the Office of Management and Budget, Division of Governmental Coordination for purposes of complying with the project consistency review of the Alaska Coastal Management Program as identified in 6 AAC 50.010- AAC 50.190. (Eff. / / , Reg.)

Authority: AS 16.05.020
AS 16.05.092
AS 16.05.251
AS 16.05.340(b)

5 AAC 41.230. ADDITIONAL INFORMATION. If, after an application has been distributed to the department, and the department determines that information in the application is insufficient for an adequate evaluation of the proposed shellfish farm, the department will request additional information from the applicant. (Eff. / / , Reg.)

Authority: AS 16.05.020
AS 16.05.092
AS 16.05.251
AS 16.05.340(b)

5 AAC 41.240. REVIEW AND DETERMINATION. (a) The commissioner will review the recommendations resulting from the department's review of the application before rendering a decision on an application.

(b) The commissioner will render a decision on the application within 5 days after a determination on project consistency with the Alaska Coastal Management Program has been issued by the Office of Management and Budget. The commissioner's decision will be based on the following considerations:

(1) the physical and biological characteristics of the proposed location must be suitable for a shellfish farming operation;

(2) the proposed farm may not unreasonably or adversely affect management of natural stocks, and must not

require significant alterations in traditional fisheries or other existing uses of fish and wildlife resources;

(3) the proposed farm may not significantly affect fisheries, wildlife or their habitats in an adverse manner; and

(4) the proposed shellfish farm plans and staffing plans must demonstrate technical and operational feasibility.

(c) An application for a shellfish farm permit which has been denied by the commissioner will, in the commissioner's discretion, be reconsidered if the applicant provides new or additional information that may have altered the original decision. (Eff. / / , Reg.)

Authority: AS 16.05.020
AS 16.05.092
AS 16.05.251
AS 16.05.340(b)

5 AAC 41.250. PERMIT. The commissioner will include conditions to the permit that are appropriate to ensure the shellfish farm does not significantly affect fisheries, wildlife or their habitats in an adverse manner. Permits will be issued for a period of three years. Permits may be renewed by submitting a request in writing to the commissioner. (Eff. / / , Reg.)

Authority: AS 16.05.020
AS 16.05.092
AS 16.05.251
AS 16.05.340(b)

5 AAC 41.260. INSPECTION OF A FARM. A permit holder shall allow inspection of the shellfish farm by department inspectors at any time the farm is operating. (Eff. / / , Reg.)

Authority: AS 16.05.020
AS 16.05.092
AS 16.05.251
AS 16.05.340(b)

5 AAC 41.270. ANNUAL REPORT. A person who holds a permit for a shellfish farm shall submit an annual report no later than December 15 to the department. The annual report form shall be distributed to permit holders by the department. (Eff. / / , Reg.)

Authority: AS 16.05.020
AS 16.05.092
AS 16.05.251
AS 16.05.340(b)

5 AAC 41.400. DEFINITIONS. In 5 AAC 41.200 -- 5 AAC 41.400

(1) "commissioner" means the commissioner of the Department of Fish and Game or his designee;

(2) "department" means the Alaska Department of Fish and Game;

(3) "farm" means a specific location where shellfish are raised in captivity or under positive control as in a pen, pond, raft, bottom culture or an area of water completely enclosed by a generally escape-proof barrier for the purposes listed in 5 AAC 41.200 -- 5 AAC 41.280;

(4) "shellfish" means any species of crustacean, mollusk, or other invertebrates, in any stage of their life cycle, found in or introduced into the state, consistent with the definition of "fish" in AS 16.10.296. (Eff. / / , Reg.)

Authority: AS 16.05.020
AS 16.05.092
AS 16.05.251
AS 16.05.340(b)

DOC 0062r

MEMO -- January 12, 1988

TO: Fisheries Cabinet

FROM: Paul Peyton

RE: Aquaculture socioeconomic studies

Legislators and others considering proposed regulation of aquaculture activities in Alaska have asked for additional information concerning the social and economic impacts of the various possible forms of development in Alaska. Central to most of the discussion is whether salmon can be profitably farmed in Alaska and compete in the marketplace with wild salmon and farmed fish from other areas. If farm production was to be permitted, what are the potential impacts to the existing common property fishery? What sort of commitment, in terms of time and dollars, would be required of the State to manage and support salmon farming activities?

The DCED has entered into a \$20,000 contract with the Sea Fare Group in Seattle to conduct a study of world salmon markets and evaluate the extent of market competition between wild and farmed salmon, including farmed salmon which potentially could be produced in Alaska. Principle investigator for this study will be Dr. James Anderson of the University of Rhode Island. Anderson is a recognized authority in the area and has authored several papers dealing with the market's response to increasing world supplies of farmed salmon. Market contacts, statistical research and report editing functions of the contract will be conducted by the Sea Fare Group which is a commercial consulting business operated by those people that put out the Seafood Leader magazine.

A second \$20,000 contract has been undertaken with the DPA group of Vancouver, B.C. DPA will evaluate the relative costs of farmed salmon production in major producing regions around the world, develop a proforma cost of production model for the Alaska situation and assess the sensitivity of major cost factors to overall costs of production. DPA has done similar work for the Government of British Columbia and others and has identified specific sources for the necessary data.

Both contracts call for an interim or progress report to be submitted about February 1st and the final report during the first week of March.

A third phase of the project, that of developing a policy options matrix will be postponed at least until preliminary results from the two contracted studies are reported. At that time we may elect to select a limited number of issues for policy option development and conduct the required work in-house or through an RSA agreement with ISER. There is about \$5,000 remaining in the project budget.



STATE OF ALASKA

STANDARD AGREEMENT FORM
FOR PROFESSIONAL SERVICES CONTRACT

1. Agency Contract Number	
2. ATN Number 88-0200	
3. Service Code(s) 5950	
4. Financial Coding 08751001	
5. Agency Assigned Encumbrance Number 0881427	
6. Vendor Number	7. AK Bus. Lic. #

This contract is between the State of Alaska.			
8. Department of Commerce and Economic Development		hereafter, the State, and	
9. Contractor The DPA Group, Inc.		hereafter, the Contractor	
Mailing Address 601 West Cordova Street	Street or P.O. Box	City Vancouver, B.C. (Canada)	State Zip Code V6B 1G1
10. ARTICLE 1. Appendices: Appendices referred to in this contract and attached to it are considered part of it.			
ARTICLE 2. Performance of Services:			
2.1. Appendix A (General Provisions), Articles 1 through 14, governs the performance of services under this contract.			
2.2. Appendix B sets forth the liability and insurance provisions of this contract.			
2.3. Appendix C sets forth the services to be performed by the contractor.			
ARTICLE 3. Period of Performance: The period of performance this contract begins <u>December 21</u> , 19 <u>87</u> , and ends <u>March 15</u> , 19 <u>88</u> . Performance may be extended for additional periods by the written agreement of the parties.			
ARTICLE 4. Consideration:			
4.1. In full consideration of the Contractor's performance under this contract, the State shall pay the Contractor a sum not to exceed \$ <u>20,000 (U.S.)</u> in accordance with the provisions of Appendix D.			
4.2. When billing the State, the Contractor shall refer to the ATN Number and send the billing to:			
11. Department of Commerce and Economic Development		Attn: Division of Business Development	
Mailing Address P.O. Box D, Juneau, AK 99811		Attention Larry Merculieff	
NOTICE: This contract has no effect as an offer by the Contractor until it is approved by the Department of Administration.			
12. CONTRACTOR		14. APPROVAL BY THE STATE CONTRACTING AGENCY	
Name of Firm The DPA Group, Inc.		NOTICE: This certifies the availability of funds. I am aware that certifying false, inaccurate, or misleading documents constitutes an unlawful falsification punishable under AS 11.56.210.	
Signature of Authorized Representative <i>[Signature]</i>		Signature of Head of Contracting Agency or Designee <i>[Signature]</i>	
Date <u>December 12, 1987</u>		Date <u>12/29/87</u>	
Typed or Printed Name of Authorized Representative H. D. Elmer		Typed or Printed Name of Authorizing Official John D. Williams	
Title SPECIAL ASSISTANT		Title Deputy Commissioner	
Employer I.D. No. (EIN) or SSN		15. APPROVAL BY THE DEPARTMENT OF ADMINISTRATION	
13. REQUESTING AGENCY #8751		<i>[Handwritten: n/c]</i>	
Department/Division Division of Business Development			
Signature of Project Director <i>[Signature]</i>			
Date <u>12/23/87</u>			
Name of Project Director Larry Merculieff			
Title Director			

APPENDIX A
GENERAL PROVISIONS

Article 1. Definitions.

- 1.1. In this contract and appendices, "Project Director" means the person who signs this contract on behalf of the Requesting Agency and includes a successor or authorized representative.
- 1.2. "State Contracting Agency" means the Department for which this contract is to be performed and for which the Commissioner or Authorized Designee acted in signing this contract.

Article 2. Inspection and Reports.

- 2.1. The Department may inspect, in the manner and at reasonable times it considers appropriate, all the Contractor's facilities and activities under this contract.
- 2.2. The Contractor shall make progress and other reports in the manner and at the times the Department reasonably requires.

APPENDIX C
SERVICES TO BE PERFORMED

COST OF PRODUCTION MODEL FOR PEN-REARING
OF SALMON IN ALASKA AND CURRENTLY PRODUCING REGIONS
ATN No. 88-0200

This study will be conducted in two phases. In the first phase, The contractor will determine the relative costs of production in major pen-rearing regions. In the second phase, the contractor will develop a cost of production model for pen-rearing salmon in Alaska and assess the sensitivity of major cost factors to overall costs of production.

Phase I - Comparative Cost of Production Analysis

The steps to be undertaken by the contractor in Phase I are detailed as follows:

1. Discuss with representatives of the Department of Commerce and Economic Development to clarify the scope of the study.
2. Conduct a literature review of recent studies (to include Bjorndal, Salvanes, Ridley, Shaw, BIM, Anderson, Wurmman, Nasaka) on cost of production in the five major supply regions.
3. Develop profiles for B.C. and Chile from previous models developed by study team members to complete the comparison of costs of production.
4. From a literature review, determine the public support provided to the five major supply regions. The types of public support to be quantified will include the following:
 - final assistance;
 - research and development;
 - education; and
 - other services (for example, diagnostic and extension).

In addition, the type of tax structure established to pay for the support provided by governments in each country will be determined.

5. Prepare an interim report that summarizes the findings of Phase I (refer to reporting requirements in appendix D).

Phase II - Cost of Production Analysis for Alaska

The detailed steps that are to be undertaken by the contractor in Phase II are listed as follows:

1. Collect and analyze background information on likely general development areas. This activity will include a preliminary assessment of expected salmon farm development locations in the southeastern and southcentral areas, to guide the formulation of general biophysical assumptions for the production model. The assessment will include a brief examination of:

- location of logistic centers;
- transportation methods;
- probable areas excluded based on pollution, major alternate user groups, proximity to river mouths, excessive exposure to wind, etc.;
- location of existing potential smolt suppliers; and
- location of possible new hatchery locations.

These data will be collected in part during discussions with personnel in the Department of Commerce and Economic Development and the Department of Fish and Game.

2. Collect and review general biophysical data from selected development areas. This activity will include examination of:

- marine and freshwater temperature data;
- salinity data;
- location of major streams entering saltwater;
- phytoplankton data;
- important marine mammal concentrations; and
- location of major spawning streams and hatcheries.

These data will be obtained through discussion with personnel in government agencies and review of published data and additional unpublished data provided by government personnel. Agencies to be contacted will include:

- the Alaska Department of Fish and Game; and
- the National Oceanic and Atmospheric Administration, National Fisheries Service (Auke Bay Laboratory, Alaska, and Northwest and Alaska Fisheries Centre, Seattle, Washington).

3. Collect and review recent salmon culture activities in Alaska. This activity will include a review of recent state hatchery production data, particularly for chinook and coho salmon, and experimental marine farming results within the state (e.g., Little Port Walter Research Station). These data will be obtained through discussion with personnel in the government agencies identified in Step 2. This information will be used together with the biophysical data (especially temperature) collected in Step 2 to develop growth projections.
4. Prepare production criteria and assumptions for site areas suitable for pen-rearing of salmon. The information analyzed in Step 1 will be used to identify:

- theoretical average monthly temperatures;
- expected growth rates based on the average temperatures;
- seasonal differences in feed conversion rates;
- average monthly feeding rates; and
- stocking densities.

Where possible, the data will indicate the range of values or conditions that could exist within the study area. In addition, the analysis will identify:

- the likelihood of problems with phytoplankton outbreaks and predator populations; and
 - expected smolt acquisition, transportation and acclimation requirements and problems.
5. Adapt the British Columbia growth models to Alaska by estimating the impact of differences in temperature and other factors between B.C. and Alaska on the likely growth of pen-reared salmon.
 6. Estimate the cost of critical inputs for the selected areas for site development. The inputs would include the following:
 - capital costs (net cages, nets, etc.);
 - smolts;
 - fish feed;
 - labor; and
 - diagnostic services.
 7. Conduct sensitivity analyses to establish break-even points for pen-rearing salmon in Alaska. This would include an assessment of the following scenarios:
 - production at small and large scales;
 - with and without fish feed production within the state;
 - with and without direct transport to market; and
 - with constant and changing prices.
 8. Write and present to the Project Director a draft report of the study findings (refer to the reporting schedule in Appendix D). In addition, the contractor will supply the State with a computer diskette in JAVELIN format containing the cost of production model with supporting documentation. The draft report will also incorporate the findings of the interim report.
 9. After review by the project director, make required changes, if any, to the report and to the cost of production model.

APPENDIX D
CONSIDERATION, REPORTING SCHEDULE AND GENERAL CONDITIONS

COST OF PRODUCTION MODEL FOR PEN-REARING
OF SALMON IN ALASKA AND CURRENTLY PRODUCING REGIONS
ATN No. 88-0200

REPORTING SCHEDULE: The contractor will submit an interim project report in writing to the Project Director which summarizes the findings of Phase I (Comparative cost of Production Analysis) by February 1, 1988.

A draft of the final project report containing all study findings, including those findings contained in the interim report, will be submitted in writing to the Project Director for review and approval by February 23, 1988. At the same time the contractor will submit a computer diskette containing the cost of production model with supporting documentation. The contractor will incorporate changes to the draft material suggested by the Project Director and submit ten copies of the approved final report and two copies of the production model diskette on or before March 4, 1988. This schedule allows three days for the Project Director to complete his review of the draft report.

CONSIDERATION: The contractor will submit an invoice for payment with the interim project report on or before February 1, 1988 which reflects all expenditures and services rendered for that period of the contract. A second and final invoice for payment will be submitted with the final project report on or before March 4, 1988 which reflects all expenditures and services rendered for the remaining period of the contract. Payments on both the interim and final invoices are subject to the limitations and conditions described below. All invoice amounts will be stated in U.S. dollars and all payments will be made in U.S. dollars.

Fees charged for services performed by the contractor's various study team members will not exceed the rates shown in the schedule below. (All amounts are in U.S. dollars):

<u>Study team member</u>	<u>Per day</u>	<u>Per hour</u>
D. Egan	\$375	\$47
J. Dale	200	25
M. Winsby	350	44
T. Bjorndal	520	65

Upon acceptance of the interim and final project reports and receipt of the accompanying invoices by the Project Director, the State will pay the contractor within 30 days. Failure of the contractor to comply with the reporting provisions of this contract will result in the State withholding payment until such compliance is obtained.

If the total amount due on the contractor's interim invoice exceeds \$12,000 (U.S. dollars), the State will withhold payment of the excess until the final project report and model is received and accepted by the Project Director. Payment of any excess due on the interim invoice will be made at the same time as the final payment. Under no circumstances will the State be liable for total project costs in excess of \$20,000 (U.S. dollars).

If the State cancels the project at any time during the course of this contract, the Contractor shall submit a final billing based on actual expenses incurred up to the termination date.

CONTRACT DISPUTES: All contract disputes will be subject to the provisions of Appendix A, Article 3 of the Standard Form For Professional Services Contract, unless other specifically identified statutes and/or legal requirements apply.

REQUESTS FOR CONTRACT EXTENSION: Requests to extend the ending date for contract performance must be submitted in writing at least 21 days prior to March 4, 1988. The written request should specify the reason why the contract extension is requested and the proposed date to which extension is needed. Upon receipt of the requested extension, the Project Director will send contract amendment forms to the contractor. Contract amendment forms must be signed by the Contractor's authorized agent and returned to the Project Director at least 10 days prior to expiration of the contract. Requests for contract amendments will not be considered if such requests are not received within the time frames specified. Because the value of this study to the State is highly dependent on having the required reports completed according to the schedule specified above, it is unlikely that the Project Director will approve an extension of the contract.



STATE OF ALASKA

STANDARD AGREEMENT FORM
FOR PROFESSIONAL SERVICES CONTRACT

1. Agency Contract Number	
2. ATN Number 88-0198	
3. Service Code(s) 5950	
4. Financial Coding 08751001	
5. Agency Assigned Encumbrance Number 0881428	
6. Vendor Number	7. AK Bus. Lic. #

This contract is between the State of Alaska.

8. Department of Commerce and Economic Development					hereafter, the State, and
9. Contractor The Sea Fare Group					hereafter, the Contractor
Mailing Address 3510 1st Avenue N.W.	Street or P.O. Box	City Seattle	State Washington	Zip Code 98107	
10. ARTICLE 1. Appendices: Appendices referred to in this contract and attached to it are considered part of it.					
ARTICLE 2. Performance of Services: 2.1. Appendix A (General Provisions), Articles 1 through 14, governs the performance of services under this contract. 2.2. Appendix B sets forth the liability and insurance provisions of this contract. 2.3. Appendix C sets forth the services to be performed by the contractor.					
ARTICLE 3. Period of Performance: The period of performance this contract begins <u>December 24</u> , 19 <u>87</u> , and ends <u>March 30</u> , 19 <u>88</u> . Performance may be extended for additional periods by the written agreement of the parties.					
ARTICLE 4. Consideration: 4.1. In full consideration of the Contractor's performance under this contract, the State shall pay the Contractor a sum not to exceed \$ <u>20,000</u> in accordance with the provisions of Appendix D. 4.2. When billing the State, the Contractor shall refer to the ATN Number and send the billing to:					

11. Department of Commerce and Economic Development	Attn: Division of Business Development
Mailing Address P.O. Box D, Juneau, Alaska 99811	Attention Bonnie Jo Borchick

NOTICE: This contract has no effect as an offer by the Contractor until it is approved by the Department of Administration.

12. CONTRACTOR		14. APPROVAL BY THE STATE CONTRACTING AGENCY NOTICE: This certifies the availability of funds. I am aware that certifying false, inaccurate, or misleading documents constitutes an unsworn falsification punishable under AS 11.56.210	
Name of Firm The Sea Fare Group	Signature of Authorized Representative <i>Sandi McKenzie</i>	Signature of Head of Contracting Agency or Designee <i>J. Anthony Smith</i>	Date 12/22/87
Typed or Printed Name of Authorized Representative Sandi McKenzie		Typed or Printed Name of Authorizing Official J. Anthony Smith	
Title President	Employer I.D. No. (EIN) or SSN 91-1224431	Title Commissioner	
13. REQUESTING AGENCY #8751		15. APPROVAL BY THE DEPARTMENT OF ADMINISTRATION <i>N/C</i>	
Department/Division DCED/Division of Business Development			
Signature of Project Director <i>Larry Merculieff</i>	Date 12/29/87		
Typed or Printed Name of Project Director Larry Merculieff			
Title Director			

APPENDIX A
GENERAL PROVISIONS

Article 1. Definitions.

- 1.1. In this contract and appendices, "Project Director" means the person who signs this contract on behalf of the Requesting Agency and includes a successor or authorized representative.
- 1.2. "State Contracting Agency" means the Department for which this contract is to be performed and for which the Commissioner or Authorized Designee acted in signing this contract.

Article 2. Inspection and Reports.

- 2.1. The Department may inspect, in the manner and at reasonable times if considers appropriate, all the Contractor's facilities and activities under this contract.
- 2.2. The Contractor shall make progress and other reports in the manner and at the times the Department reasonably requires.

APPENDIX C
SERVICES TO BE PERFORMED

WORLD MARKETS FOR SALMON -- PEN-REARED SALMON IMPACTS
ATN No. 88-198

The purpose of this project is to evaluate the extent of potential market competition between wild and farmed Alaska salmon, and between Alaska salmon and farmed salmon from other states and countries.

Questions such as the following are of key concern and will be addressed by the contractor:

- Will world markets be able to absorb farmed Alaskan salmon, from 1990 (when the potential first harvests of Alaskan pen-raised salmon would take place) onward at a price that will be profitable for the producers?
- Will the amount of farmed salmon projected for production worldwide in this time frame dampen current markets for Alaskan wild salmon, and if so, to what extent?
- Would the Alaskan pen-raised salmon be directly competitive with Alaskan wild salmon or simply a part of the farmed salmon supply?

TASK 1: BASELINE MARKET AND PRICE INFORMATION

In-house files of recent and on-going studies of the contractor, Dr. James Anderson's sources and other existing information will form the basis of data for this task, however, some original data gathering will be performed. In particular, supermarket representatives and Japanese salmon buyers will be interviewed. Interviews will be conducted so that the data gathered is consistent with work performed by Dr. Anderson for New England food service groups.

The contractor will first outline the current distribution channels for farmed salmon and Alaskan wild production and describe the areas in which wild and farmed stocks may directly compete.

Next, historical prices will be examined for any trends relative to supply for both farmed and wild salmon. While average prices will be reported in this step, exceptions to the rule will be noted. Of particular interest are exceptions that reflect higher prices through unique marketing or product identification efforts, particularly where products are specifically identified as Alaskan.

A. Where are Alaska's King, Coho and Sockeye Salmon Marketed?

The contractor will present a thorough overview of the current market and marketing conditions for Alaskan king, coho and sockeye salmon. The overview will be specific as to species, product form, transportation modes, purchase arrangements, export assistance, tariff barriers, trade promotion activities and other information which will help to thoroughly describe the existing markets for Alaska wild salmon.

A survey will be performed for major institutional and retail market sectors to delineate the geographic sales distribution, utilization of various product forms, seasonality of sales, and usual distribution channels.

B. Price Levels Over the Past 10 Years for King, Coho and Sockeye Salmon.

The contractor will present an accurate historical description of market price trends for Alaskan salmon. Government and private seafood price data sources will be analyzed to determine domestic and export price and volume of sales information by major product form. The contractor will include supply level (landings) figures and a comparison by product form.

C. Existing Markets for Farmed Salmon.

The contractor will present a thorough and quantitative overview of the major world supply sources and markets for farmed salmon. The overview will be specific as to species, product form, transportation modes, purchase arrangements, export assistance, tariff barriers, trade promotion activities and other information which will help to thoroughly describe existing market conditions. This will be drawn in part from the contractor's in-house studies of domestic and world salmon farming activities and markets, such as recent work by Anderson and Brooks analyzing buyer preferences for farmed and wild salmon in the northeast. The contractor will expand the analysis to include other countries and geographic regions of the United States as part of this task. Particular emphasis will be given to the market in Japan. Additional information will be obtained from interviews with trading companies and other firms and individuals active in and knowledgeable about the salmon industry.

D. Price Levels of Pen-Reared Salmon Over the Past Five Years.

The contractor will describe and compare the prices and volumes of pen-reared salmon products over the past five years in all major world markets.

E. Effects of the Exchange Rate and Supply Changes on Market and Price Distribution.

Exchange rate information will be collected and correlated with import/export figures and the price levels of major salmon products over the last five years. The contractor will compare the fluctuating value of the dollar to the price and volume of salmon products traded on the world market.

TASK 2: MARKET FORECASTS

Because farmed salmon production could not occur in Alaska for several years, forecasts of future market conditions are important to investment decisions. Forecasts of expected demand levels and prices will be presented by the contractor. Using information collected in Task 1, the relationship between wild and farmed products stocks will be examined.

A. Volume of Farmed Salmon Expected to Enter the Marketplace Over the Next 10 Years.

The contractor will review recent studies of farmed salmon production trends and projections for the next ten years. Where discrepancies are evident, the contractor will provide an evaluation of the accuracy of the studies presented.

B. Future Markets and Price Level Expectations for Potential Alaskan Farmed Salmon.

The contractor will develop a matrix of market size and price forecasts to be used in evaluating the effects of production increases expected over the next ten years. The matrix will be derived from available econometric work, interviews with industry, academic and government experts and research completed in the tasks above. The contractor will project a range of possible volumes of farmed Alaska salmon, and predict the effects on major markets, including the an analysis of the most likely market niches these salmon could occupy and the price ranges available. An analysis of the effects of possible exchange rate changes will be included.

C. Analyze the Degree of Overlap or Competition Between Alaskan Wild Salmon, Potential Alaskan Farmed Salmon and Other Farmed Salmon in Major Markets

The contractor will predict the degree of market competition expected in the future between Alaska wild salmon and potential farmed salmon products. The analysis will compare projected

prices, availability, product forms and characteristics (fresh/frozen, size, color, method of harvest and etc.), of the major Alaskan wild salmon fisheries and farmed salmon harvests. The major marketing attributes that may cause substitution or differentiation of the types of salmon will be analyzed in the particular areas where there might be market overlap or competition.

The contractor will suggest the probable outcome of any future market overlaps which are identified. This work will identify Alaska salmon products that may not be competitive in the marketplace and the characteristics which make them noncompetitive, which products would have advantages in specific markets and the reasons, and will analyze the possibilities of undertaking effective marketing programs to improve sales and maximize prices.

APPENDIX D
CONSIDERATION, REPORTING SCHEDULE AND GENERAL CONDITIONS

WORLD MARKETS FOR SALMON -- PEN-REARED SALMON IMPACTS
ATN No. 88-198

REPORTING SCHEDULE: The contractor will submit an interim project report in writing to the Project Director which summarizes the results of work completed to date by February 5, 1988, as described in Appendix C..

A draft of the final project report containing all study findings, including those findings contained in the interim report, will be submitted in writing to the Project Director for review and approval by February 25, 1988. The contractor will incorporate changes to the draft material suggested by the Project director and submit ten copies including the unbound original (for further duplication) of the approved final report on or before March 4, 1988. This schedule allows three days for the Project Director to complete his review of the draft report.

CONSIDERATION: The contractor will submit an invoice for payment with the interim project report on or before February 5, 1988 which reflects all expenditures and services rendered for that period of the contract for review and approval by the Department. A second and final invoice for payment will be submitted with the final project report on or before March 4, 1988 which reflects all expenditures and services rendered for the remaining period of the contract. Payments on both the interim and final invoices are subject to the limitations and conditions described below.

Fees charged for services performed by the contractor's various study team members will not exceed the rates of \$75 per hour. Upon acceptance of the interim and final project reports and receipt of the accompanying invoices by the Project Director, the State will pay the contractor within 30 days. Failure of the contractor to comply with the reporting provisions of this contract may result in the State withholding payment until such compliance is obtained.

If the total amount due on the contractor's interim invoice exceeds \$12,000, the State will withhold payment of the excess until the final project report and model is received and accepted by the Project Director. Payment of any excess due on the interim invoice will be made at the same time as the final payment. Under no circumstances will the State be liable for total project costs in excess of \$20,000 (twenty thousand dollars).

If the State cancels the project at any time during the course of this contract, the Contractor shall submit a final billing based on actual expenses incurred up to the termination date.

WORK PLAN: Work on the various segments of this contract will be shared by Dr. James L. Anderson and other individuals in The Sea Fare Group. The contractor will obtain written approval of the Project Manager, and if necessary an approved contract amendment, before any significant change is made in the following schedule:

TASK 1: BASELINE MARKET AND PRICE INFORMATION

Where are Alaska's king, coho and sockeye salmon marketed?

Sea Fare Group 90%
James L. Anderson 10%

Price levels over the past ten years for king, coho and sockeye salmon.

Sea Fare Group 98%
James L. Anderson 2%

Existing markets for farmed salmon

Sea Fare Group 70%
James L. Anderson 30%

Price levels of pen-reared salmon over the past five years

Sea Fare Group 98%
James L. Anderson 2%

Effects of the exchange rate and supply changes on market and price distribution.

James L. Anderson 100%

TASK 2: MARKET FORECASTS

Volume of farmed salmon expected to enter the market place over the next ten years.

Sea Fare Group 70%
James L. Anderson 30%

Future markets and price level expectations for potential Alaskan farmed salmon

James L. Anderson 100%

Analyse the degree of overlap or competition between Alaskan wild salmon, potential Alaskan farmed salmon and other farmed salmon in major markets.

James L. Anderson 100%

CONTRACT DISPUTES: All contract disputes will be subject to the provisions of Appendix A, Article 3 of the Standard Form For Professional Services Contract, unless other specifically identified statutes and/or legal requirements apply.

REQUESTS FOR CONTRACT EXTENSION: Requests to extend the ending date for contract performance must be submitted in writing at least 21 days prior to March 4, 1988. The written request should specify the reason why the contract extension is requested and the proposed date to which extension is needed. Upon receipt of the requested extension, the Project Director will send contract amendment forms to the contractor. Contract amendment forms must be signed by the Contractor's authorized agent and returned to the Project Director at least 10 days prior to expiration of the contract. Requests for contract amendments will not be considered if such requests are not received within the time frames specified. Because the value of this study to the State is highly dependent on having the required reports completed according to the schedule specified above, it is unlikely that the Project Director will approve an extension of the contract.

APPENDIX E

- A) For the purposes of this work it is understood that unless specified all data sources are secondary sources.
- B) Because of the tight schedule required by this contract, the final draft may be received chapter by chapter. Jim Anderson's original work may be part of the final draft.

A handwritten signature, possibly reading "Jim", is located to the right of the list items.

Original sponsors: Zharoff, Eliason
and Duncan

1 IN THE SENATE BY THE RESOURCES COMMITTEE
2 HOUSE CS FOR CS FOR SENATE BILL NO. 297 (Resources)
3 IN THE LEGISLATURE OF THE STATE OF ALASKA
4 IFTEENTH LEGISLATURE - FIRST SESSION
5 A BILL
6 For an Act entitled: "An Act placing a moratorium until July 1, 1988, on
7 the issuance or granting of licenses, permits,
8 leases, or authorizations for commercial finfish
9 farming; providing for a bivalve spat collection
10 permit; and providing for an effective date."
11 BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:
12 * Section 1. FINFISH FARMING MORATORIUM. (a) Except as provided in
13 (b) of this section, the following licenses, permits, leases, or authoriza-
14 tions may not be issued or granted for the construction or operation of a
15 commercial finfish farm:
16 (1) authorization for use of an interim-use permit for the
17 experimental commercial taking of a fishery resource (AS 16.05.050(10));
18 (2) fish farming license (AS 16.05.340(a)(14));
19 (3) collection permit (AS 16.05.340(b));
20 (4) land use or tidelands permit (AS 38.05.035);
21 (5) a land lease (AS 38.05.070);
22 (6) fish transport permit (5 AAC 41.005);
23 (7) permit to appropriate water (11 AAC 93.120);
24 (8) temporary water use permit (11 AAC 93.210 - 11 AAC 93.220).
25 (b) A fish farming license and a fish transport permit may be issued
26 for commercial finfish farming in a privately owned freshwater body that
27 has no outlet to state water.
28 * Sec. 2. NO PREFERENCE INTENDED. A license, permit, lease, or au-
29 thorization described in sec. 1 of this Act that is issued or granted for a

1 purpose other than commercial finfish farming and that is in effect during
2 the period of the moratorium imposed by sec. 1 of this Act does not create
3 a right or preference with regard to the issuance, granting, or renewal of,
4 or conditions or limitations placed on, any license, permit, lease, or
5 authorization for aquatic farming after the period of the moratorium.

6 * Sec. 3. AS 16.05.340(b) is amended to read:

7 (b) The commissioner of fish and game may issue without cost a
8 permit to collect fish and game, including fur animals, subject to
9 limitations and provisions that are appropriate, for a scientific,
10 propagative, or educational purpose. The commissioner also may issue
11 a permit for the collection of bivalve spat for use in connection with
12 an aquatic farm. In addition, the commissioner shall issue a permit
13 for the collecting of wild fur animals for improving the genetic stock
14 of fur farm animals. Permits issued under this subsection shall be in
15 accordance with current sustained yield management practices for the
16 species of wild game for which the permit is requested. The annual
17 permit fee for an Alaska resident to collect wild fur animals for fur
18 farming purposes is the same as the fee for resident trappers.

19 * Sec. 4. Section 1 of this Act is repealed July 1, 1988.

20 * Sec. 5. This Act takes effect immediately under AS 01.10.070(c).

ALASKA STATE LEGISLATURE . SENATE

5373

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) 485-4910

May 11, 1987

Commissioner Don Collinsworth
Department of Fish and Game
P.O. Box 3-2000
Juneau, Alaska 99802

COMMISSIONER'S OFFICE
RECEIVED
MAY 12 1987

Dear Commissioner Collinsworth,

DEPARTMENT OF FISH AND GAME

Recently hearings on Senate Bill 106, an act relating to aquatic farming, were conducted by the Senate Resources Subcommittee on Fisheries at five different locations -- Dillingham, Kodiak, Anchorage, Ketchikan, and Sitka. The individuals testifying at the hearings raised many concerns which must be addressed fully prior to the Legislature taking any formal action on permitting aquatic farming in Alaska.

Some of the unanswered questions asked are as follows:

- 1) How will land use conflicts be resolved?
- 2) How can favoritism or the appearance of favoritism be avoided in the awarding of tide land permits?
- 3) What steps will be implemented to reduce tide land speculation?
- 4) What is the role of the non-profit hatcheries in the sea farming industry?
- 5) Will the role of a non-profit hatchery change if the hatchery chooses to rear pen salmon?
- 6) What will be the role of borough governments if a sea farm is within the borough's jurisdiction?
- 7) What will be the procedures in determining the monetary value for the tide land sites?

- 8) Will additional safeguards be established if the potential sea farm site is in a designated wilderness area?
- 9) How will the upland owners' concerns be resolved?
- 10) What exactly is known regarding any potential environmental danger in raising salmon in a concentrated area?

As these questions and other unresolved concerns regarding aquatic farming are reviewed and discussed during the interim by the Subcommittee on Fisheries, it will be most helpful if the various affected state agencies take an active role in the discussion. As chair of the interdepartmental work group on mariculture, the subcommittee looks forward to working with you and other members of the working group during the interim.

Commissioner Collinsworth, hopefully time will allow the subcommittee to meet with the agency representatives prior to adjournment in order to formalize plans for the next few months.

Sincerely,



Senator Dick Eliason, Chair
Senate Resources Subcommittee on Fisheries

cc: Senate Resources Committee Members
House Resources Committee Members

Suggested questions to be addressed
from the Office of Representative Herrmann

1 BIOLOGICAL CONSIDERATIONS

- 1) What is the potential disease and genetic threat to wild stocks?
- 2) How can these be controlled
- 3) What type of oversight and supervision of mariculture operations is necessary to ensure that wild stocks are not threatened
- 4) How should pens be stocked?
- 5) Who should regulate egg take?
- 6) Should Atlantic Salmon be allowed? and should other species be imported?
- 7) What are the potential effects on habitat for anadromous fish streams?

11 MARKET QUESTIONS

- 1) Is foreign marketing of pen-reared salmon currently effecting markets for Alaska's wild stocks?
- 2) If Alaska got into pen-rearing of salmon, would our pen-raised salmon be able to compete?
- 3) Could increased efforts at marketing the advantages of wild salmon give Alaska fishermen a competitive edge in certain markets over pen-reared salmon?
- 4) Would development of pen-reared salmon in Alaska displace fishermen? - If so, How many?
- 5) How valid is the statement that the world market will be glutted with salmon by the time Alaska is ready to get into the industry?

111 ECONOMIC FEASIBILITY & BENEFITS

- 1) What is the range of options for proceeding with mariculture operations?
 - A) What would be the economic costs and benefits if the state only permitted small operations? or only large operations? (How many jobs would be created? How much would they pay, How much revenue would be generated? How many people would be displaced? What would be the economic impacts to the state if the fishing industry experienced displacement? Would these operations be economically viable?
 - B) What would be the best way to proceed if the goal of the state was to maximize the revenues generated?

5/20/87

III. Government Involvement

- B. To what extent should the state be involved in necessary monitoring/oversight. What is the state required to do? (i.e. Federal NSSP requirements).
- C. To what extent should the state be involved in providing technical assistance in site selection and necessary environmental analysis?
 - 1. How much should the industry contribute to offset administrative costs?
- D. 2. To what extent should the industry be required to pay for the use of the public resources and the resulting externalities such as pollution and landscape alterations?
- E. What role should the state play in market development?
- F. Given the fiscal and technical policy impacts of the different options - should we proceed to encourage various mariculture operations, and if so, in what areas?
- G. What criteria should be established to determine a whether or not a permit applicant is "fit, willing and able".
 - 1. How do we avoid excluding small, locally owned operations?
 - 2. Should bonding be required to discourage speculation and protect the state in the case of failure? (Clean-up costs).
- H. How are permits going to be transferred? Who decides?
- I. To what extent should the state provide investment incentives? (State subsidization through loans, tax credits ect.) Several sources say that tax credit incentives are necessary to attract venture capital.
- J. How much should the industry pay for necessary regulation, monitoring and oversight?

- C) What would be the best way to proceed to create the most jobs and steady employment?
- D) What would be the best way to provide economic benefits to rural areas?
- E) What would be the best way to provide economic benefits to urban areas?
- F) What would be the best way to minimize the effects on fishermen who may be displaced
- G) What would be the comparative costs and benefits of not going ahead with mariculture but instead increasing marketing strategies so that wild salmon could compete?

IV LAND USE & SITING CONFLICTS

- 1) How should best interest findings be made?
- 2) What guidelines should be established to determine whether a site should be permitted if there are competing uses (some of which may not be permitted?)

V ENVIRONMENTAL IMPACTS

- 1) Water Quality
- 2) Land Use Impacts
- 3) Impacts on habitat for wild stocks

VI GOVERNMENT INVOLVEMENT

Will financial resources be diverted from other fisheries programs such as hatcheries, and economic development of other existing fisheries?

(See Attached)

5/20/87

INTERAGENCY WORKGROUP ON MARICULTURE

David Benton	465-4100
Department of Fish and Game	
Doug Donegan	465-2609
Department of Environmental Conservation	
Rick Focht	465-4081
Commercial Fisheries Entry Commission	
Kerry Howard	465-2653
Department of Environmental Conservation	
Mike Kaill	465-4160
Department of Fish and Game	
Amy Kruse	789-3151
Department of Environmental Conservation	
Diane Mayer	465-3562
Office of Management and Budget	
Bob Palmer	465-3400
Department of Natural Resources	
Paul Peyton	465-2162
Department of Commerce & Economic Development	
Rick Reed	465-4290
Department of Fish and Game	
Jim Wakefield	465-2700
Department of Labor	



Send
back-up
info
to Canada
in
Hudson's
office

Any documentation ~~the~~ of:

- * Control of smolt owned by the 3 major corps?
- * Quote by scientist that in 10 yrs. there has been the destruction of 10,000 yrs. of salmon genetics
- * The release of diseased fish into the sea

Lørdag 2. desember 1989

Oppdrettsfisk DRUKNES I MEDISINER



SE: Enorm bruk av antibiotika i oppdrettsnæringen skaper motstandsdyktige bakterier og gjør medisinene virkningsløse.

Reidar Solberg
President
AIFMA Coop
4248 Squalicum Lake Road
Bellingham, WA 98226
(206) 592-5977

January 12, 1990

Pacific Fishery Legislative Task Force
Senator/Representative/Assemblyman
States of: Alaska, California, Idaho, Oregon, Washington

Dear Madam or Sir:

During this past summer, evidence began coming out of Norway that all was not well on the salmon farms. Visitors returning from Norway reported reading in local newspapers reports of widespread disease in farm fish and pollution in the fjords. Some of these diseases are known but there are some new ones that no one has seen before. The nature of these new diseases is unknown even to scientists.

My board of directors directed me to go and see first hand. My trip included interviews with journalists, scientists at the Institute of Marine Research at Bergen, a visit to a local salmon farm, and discussion with local townsfolk.

The Institute of Marine Research is the only scientific institute in the world that is looking into the disease and genetic effects of farmed salmon on wild stocks of salmon. There is a concern among scientists, whom I spoke to, that the Norwegian government may not continue to fund these programs in the future.

The local populace is in an uproar over what is happening on the local salmon farms.

I learned that many farmers, when faced with the need to destroy diseased fish, simply release them into the fjord where they can spread disease to wild stocks. Likewise, I have heard reports of Canadian farmers releasing contaminated farm fish in Vancouver, B.C..

Faced with the tragedy of economic disaster, it is understandable that a farmer would take this low-cost

way out. The cost of enforcing such clandestine activity, especially in remote areas of Alaska, would be very high.

I have taken the liberty of providing you with translations of several articles from local Norwegian newspapers which show the extent and the seriousness of a problem that "does not exist." Proponents of salmon farming have neglected to report on this critical issue.

We have to keep in mind that, while Norway has some 100,000 of wild stock salmon, Alaska is blessed with stocks in excess of 100 million salmon.

After personally seeing what is happening in Norway and listening to the public outcry, I can only hope that you conclude with me that the risks are too great for Alaska to entertain salmon farming.

Sincerely yours,



Reidar Solberg
President
AIFMA Coop

INTRODUCTION

The Board of Directors of the Alaska Independent Fisherman's Marketing Association, "AIFMA", in December of 1989 directed me to go to Norway and look into the effects of farm raised salmon on wild stocks of salmon. The areas of concern were disease and genetic intermingling. Where I received my information was at the Institute of Marine Research in Bergen, the Bergen Tidende newspaper, a fish farm on the island of Austrovul, and a number of local people through out western Norway.

My hope, after looking at the situation in Norway, is that we will hold off introducing fish farming in Alaska because of the threat of spreading disease to the hundreds of millions of wild stock salmon and the threat of spawning interruption by escaped or released farm raised salmon. The possibility also exists that diseased farm fish, or fish with heavy doses of antibiotics could effect the market conditions of natural salmon which have been handled and presented with so much care over the years.

A very unnerving bit of information, I learned, is that when faced with the need to destroy diseased salmon, many farmers simply release them into the fjord where they can mingle with the wild stocks of salmon. I have heard of this happening on farms on Vancouver Island, B.C. Diseased farm salmon were released at the direction of the British Columbia Fisheries Department.

SUMMARY

At this point in time the Institute of Marine Research in Bergen is the only one that is doing studies to determine what affect the farm raised salmon will have on wild stock of salmon.

we must remeber that Norway has only 100,000 wild stock spawners, where as we have returns as high as 60 million to Bristol Bay alone. If you tally up the return of salmon to all other Alaska fishing areas, and the river systems in Canada the potential loss would be devastating both ecologically and financially.

In Norway, the intent of the fish farms was to generate income for families in the island communities. There are a number of bankruptcies occurring at this time, even though the farms have be heavily subsidized by the Norwegian government. The interesting thing is that the control of smolt is in the hands of big busniness. The three major players in the smolt production is British Petroleum, Sea Farms (a multi-national corporation), and Mowi (this is Norsk Hydro, one of Norway's largest corporations).

In talking with the Norwegian scientist, their feeling is that fish farming has gone much faster then the scientific community has progressed in this area. There are 700 farms in Norway that can produce 250 tons of fish per year per farm. The question then arises, where is the food for the fish farms going to come from? Do we take the pollock, herring, and other fish with their high protein content and grind it up into a fish meal to feed salmon when we have starvation throughout the world.

Looking at possible risk of our wild stocks of salmon, whether it be through disease or through genetic destruction, allowing the onslaught of fish farms on the Pacific Coast is much to great of a risk. The statement made by a prominent Norwegian scientist, that in ten years there has been a destruction of ten thousand years of salmon genetics.

I come from the commercial fishing community and I think about the amount of damage one case of botulism in Belgium did to the market of salmon world wide, I have a real concern about the medications going into farm raised salmon. The amount of dollars generated by the commercial salmon fishery is much to great to risk loosing because of the efforts of certian special interest groups. Whether these groups be Weyerhauser Corporation in the state of Washington, B.C. Hydro with their push for dams on the Frazier River in Canada, or any group that would want to begin fish farming in Alaska, we cannot risk the value of wild stocks of salmon.

FISKERIDIREKTORATETS - HAVFORSKNINGSINSTITUTT
Nordnesparken 2, Postboks 1870- Nordnes
N - 5024 Bergen, Norway

Professors;

Snorre Tilseth
Brit Hjeltne
Arne Ervik
Geir Dahle
Dr. Oystein Skaala

Institute of Marine Research
P.O. Box 2906
5011 Bergen Nordnes
Norway
phone- 32 77 60

My meeting at the took place on the morning of November 30, with Magne Kalhovde also attending. Snorre Tilseth, the director of the fishery, was unable to attend. Brit Hjeltne was very helpful by giving us a tour of the facilities. She then gave us a run-down of the diseases affecting fish farms.

Farm fish diseases;

- (1)- Vibriosis (Vibrio bacteria)
Bacteria disease affecting salmon as well as trout
In farm fish as well as wild stocks
Detected as early as 1918
Virus is in the water, is much harder on farm fish due to the close environment which causes "stress."
- (2)- Hitra (Cold water vibriosis)
Seen in fish farms since 1977
Mostly in winter months
- (3)- Furunkulosis
Problem began on trout farms
The disease begins with blistering, then moves into the blood stream
Norway's problem began with fish brought in from Scotland in 1985
In 1988 the disease showed up in two other river systems in. No answer to where it came from.
- (4)- Salmon lice
A real problem for farm fish
Treatment is Nuvan (Neguvon insecticide that has an impact on crab, clams, etc.)
- (5)- Gyroactylus Salaris
Fresh water parasite
Appeared in farms in late 70's to early 80's
Created a huge problem
The thinking is that it came from Sweden due to movement of smolt from one river to another.
- (6)- BKD
First seen in Norway in 1980
- (7)- Infectious Anemia of Salmon (IAS)- was called (SAS)
New disease that appeared in 1984
They think it's a virus but aren't sure
To this point it has not appeared in wild stocks of salmon

(1) Furunkulose in two fish farms.

Even if the fish has got the infection it is still all right as food. That is as long as the fish is not ill and the illness has left no visible tracks, such as outward bleeding, sores, etc.

(2) Illness to live with. Furunkulose

It doesn't have to be a catastrophe for Norwegian fish farming. We already know how to live with Viberiose. We try not to "stress" the fish when the temperature in the water is high. Although the bacteria is in the water, it does not affect the fish as good food. To rid the water of Furukulose is impossible..

(3) Yersinia Ruckeri

The bacteria yersinia ruckeri is found in Norwegian fish farming. The bacteria was unknown in Norway untill a few years ago.. The illness is very infectious and can affect the fish if it is being "stressed" for example, under transportation. It can live both in sea water and in fresh water.

(4) Salmon Anemi Syndrom (SAS)

The veterinary institution thinks that SAS comes from a virus. The illness was first detected in 1984.. Six fish farms had to slaughter all their fish and begin all over again when they had SAS in their fish farms. SAS is a blood illness, the blood gets thin and it then affects the liver. At this time we don't know if the illness is contagious through roe, but it's contagious from fish to fish.

(5) Infeccious Salmon Anemi

The feared illness salmon anemi has attacked fish farms in west Norway county of Hordaland. (Bergen is in Hordaland.) Infeccious salmon anemi is so far only affecting Norway. The illness has a high rate of death. The salmon anemi has not entailed as big loses as the "Hitra disease" but the problem with salmon anemi is that we don't know what causes the infection. We don't have any drugs to attack the infection and it will take a long time to find a vaccine. The fish farms that get hit by the infection, all the fish must be slaughtered as soon as possible. We can not see that it spreads through roe, but we know that it spreads through the sea.

(6) Unknown fish illness

An unknown fish illness is ravaging at Stord. Over the whole bottom of a lake on Stord there have been found dead fish. The dead fish is being attacked by a fungus. It is not known if the fungus is the real reason for the dying of the fish.

(7) Hitra disease vaccine

Hitra disease vaccine is too expensive. Experiments this year with the "hitra disease" vaccine look very good so far. It may be necessary to us the vaccine on the same fish later. The problem is that the vaccine is very expensive, over \$100 for a liter.

(8) Bakteriell Nyresykdom

A fish farm had to slaughter all their fish fry because it was infected by the illness "bakteriell nyresykdom". This caused big loses for the owners with no money for compensation. This will probably mean that other fish farms with the illness will try to hide it in stead of slaughtering the infected fish.

(9) Gyrodactylus Salaris (salmon parasite)

Gyrodactylus Salaris (GS) is caught by wild fish in many of the rivers from fish farms which are dealing with rainbow trout. It will be a lot more difficult to get permission to have a rainbow trout farm.

(10) Furunculose

It's been found that Furunculose can begin in rivers as well as in the sea. It can act in four different ways.

1. High rate of death.. Interior bleeding and swelling of the spleen.
2. Not as high rate of death, outside sores visible.
3. Wrong color of the intestine of the fish.
4. No rate of death. The disease can begin in high water temperature.

(11) New illnesses

More new fish illnesses crop up. We know hardly nothing about these new illnesses. We think it has to do with viruses. As an unknown, we don't have any drugs against the viruses. The question is, how can new illnesses break out all of a sudden. Some of the illnesses can come from the fact that there are too many fish in the fish farms, and that the farms are giving too much medication. The other problem with medicine is that it can effect the export of the fish. The USA may say that they don't want to import any fish which has been given antibiotics.

(12) Bacterium Kidney Disease

This disease develops slowly and breaks out on fish as late as half a year later. It can be wounds in the fish meat and smoked fish can get a bit of a wrong color..

(13) Selling unslaughtered fish

Make it illegal to sell fish unslaughtered. The reason is that there may be a parasite in the fish. The parasite lives in the intestine of the fish. The parasite is not dangerous for human consumption.

(14) Gyrodactylus Salaris

Drammen watercourse has been hit by the freshwater parasite Gyrodactylus. It will cost millions to save the salmon stocks in the Drammen river.

(15) Furunculose

Tons of fish die. The only thing we can do is to work for better environments and hope that the researchers will find an effective vaccine.

(16) Gyrodactylus

32 rivers have parasites on the fish now (Feb. 24, 1989). To get rid of the infection we have to put poison in the rivers to kill all the fish so that the infection will dissipate and a new salmon stock can be brought in to the rivers.

(17) Gyrodactylus Salaris

The parasite hangs on small salmon in the rivers. As the parasite eats on the salmon it creates a sore on the skin which brings fungus, virus, bacteria into the salmon and kills it. The parasite doesn't have eggs, but gives birth to another parasite which is half formed with another, so the multiplication is fast.

(18) Virus from USA

A fish farm in North Trondelag has got a new virus that has not been found in Norway before. The virus is known on the Pacific Coast of the USA. The virus gives anemi to the fish.

(19) Furunkulose

Salmon that escape from fish farms bring infections to other areas. Escaped salmon which has been infected by furunkulose is on it's way up the river system. It is proven that fish which have escaped have brought furunkulose to another fish farm.

(20) Furunkulose

To try and restrict the Furunkulose, management has said that it is illegal to transport fish for one area to another.

(21) Vaccination

The vaccination of all the fish in the fish farms is out of the question at this time.

(22) Furunkulose

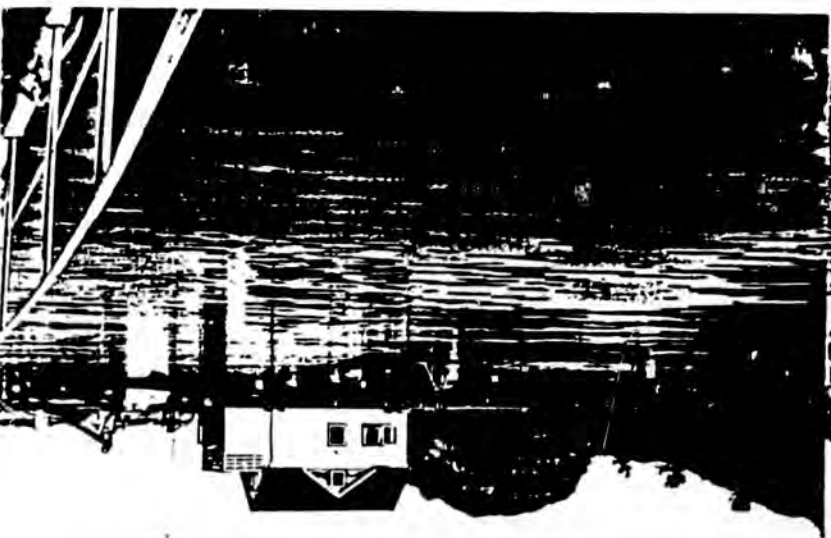
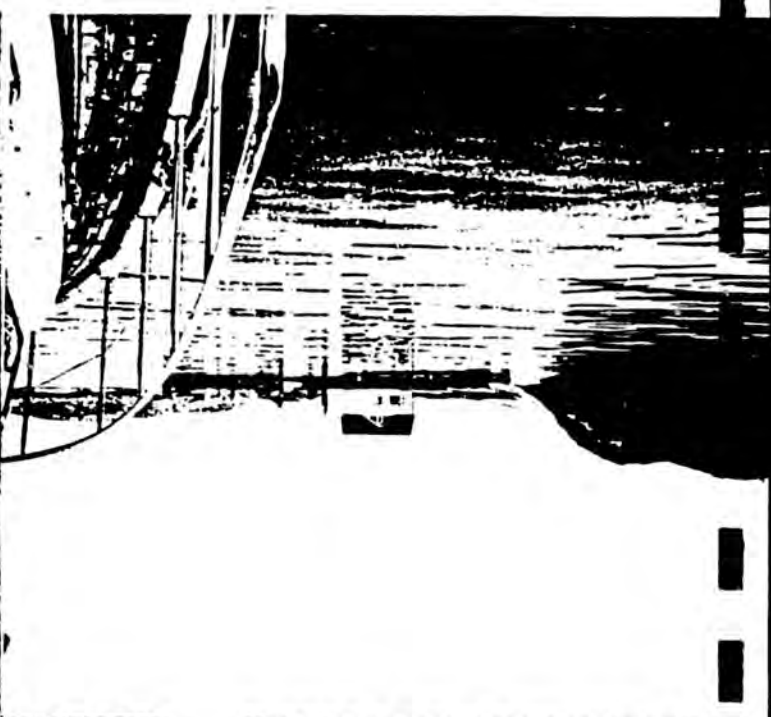
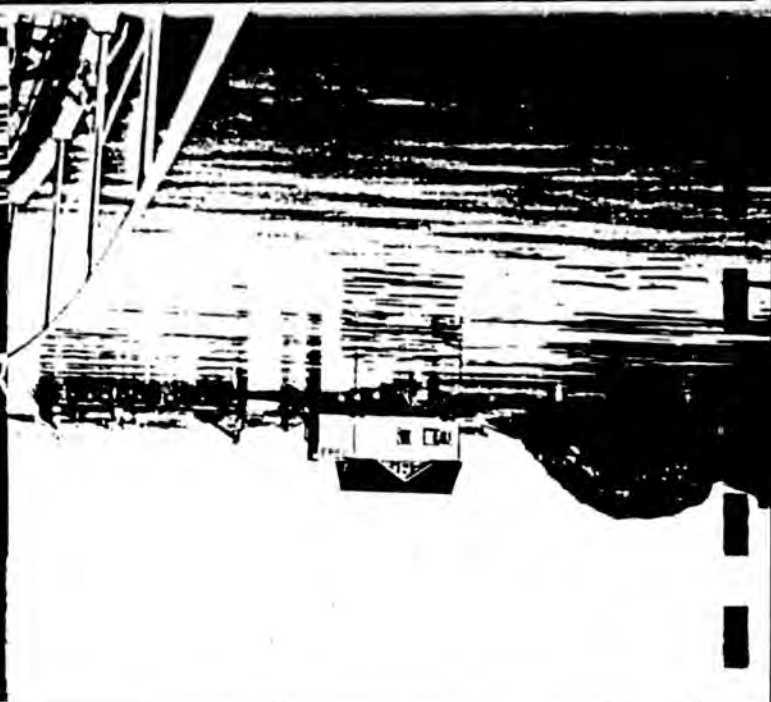
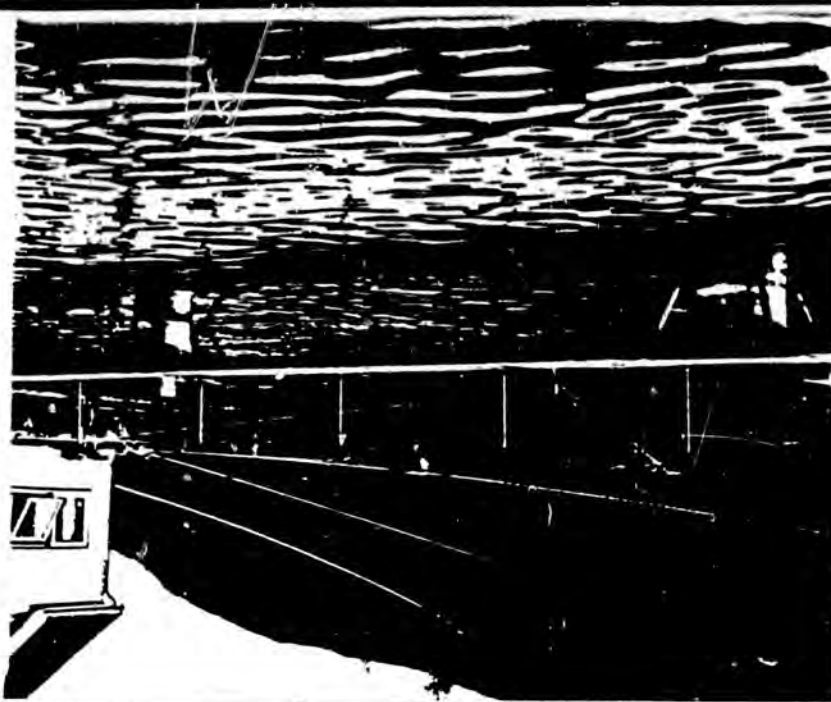
All fish with Furunkulose is to be slaughtered. Fish farmers are doing all they can to stop the infection of and spreading of Furunkulose. Now they are slaughtering all their fish that have Furunkulose.

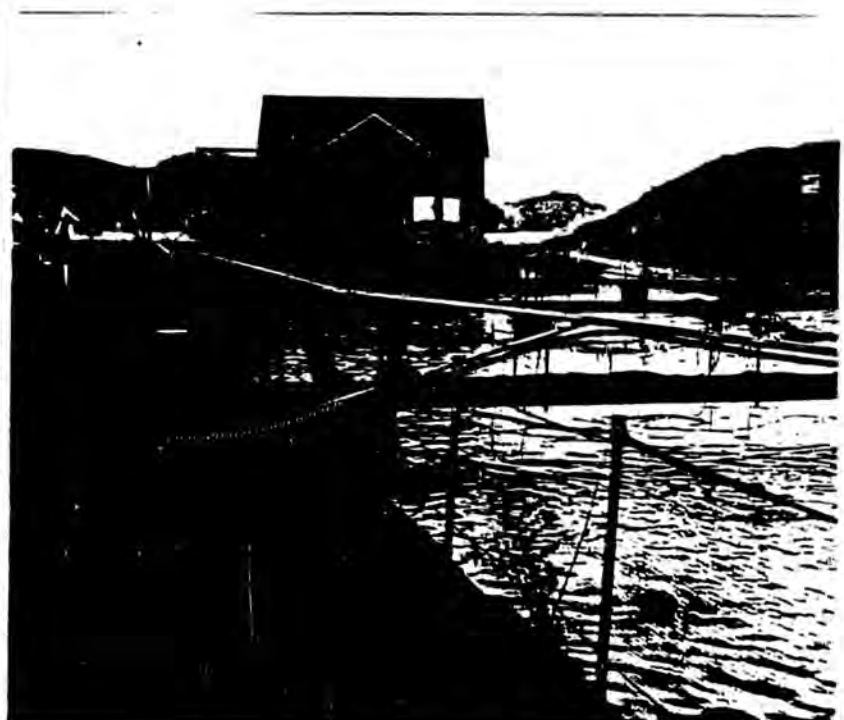
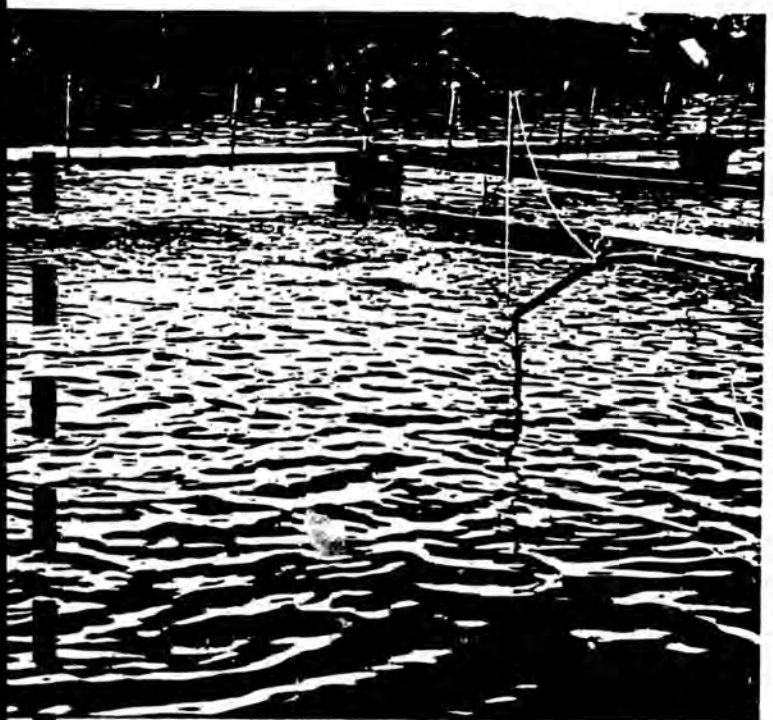
(23) Hitra disease

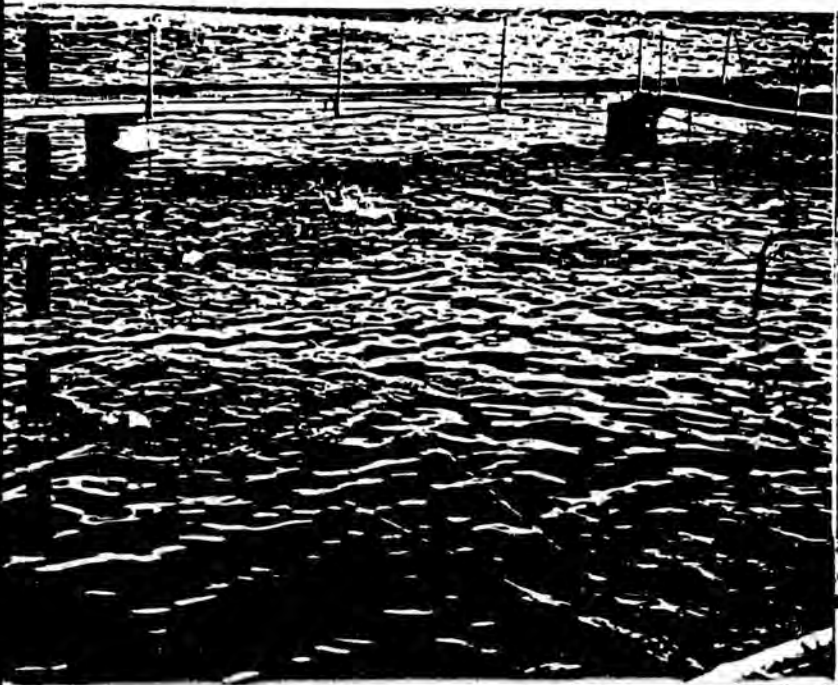
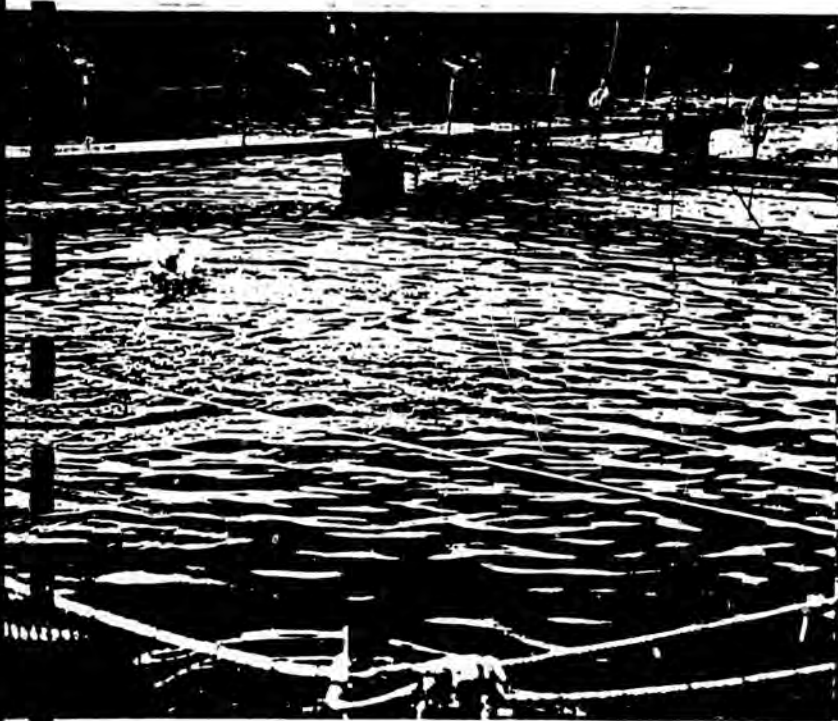
The return of Hitra disease after the winter of 1988 is taking place. Fish farmers along the west coast are cheering because of good growth of the fish, good temperatures in the sea, and not to much disease.

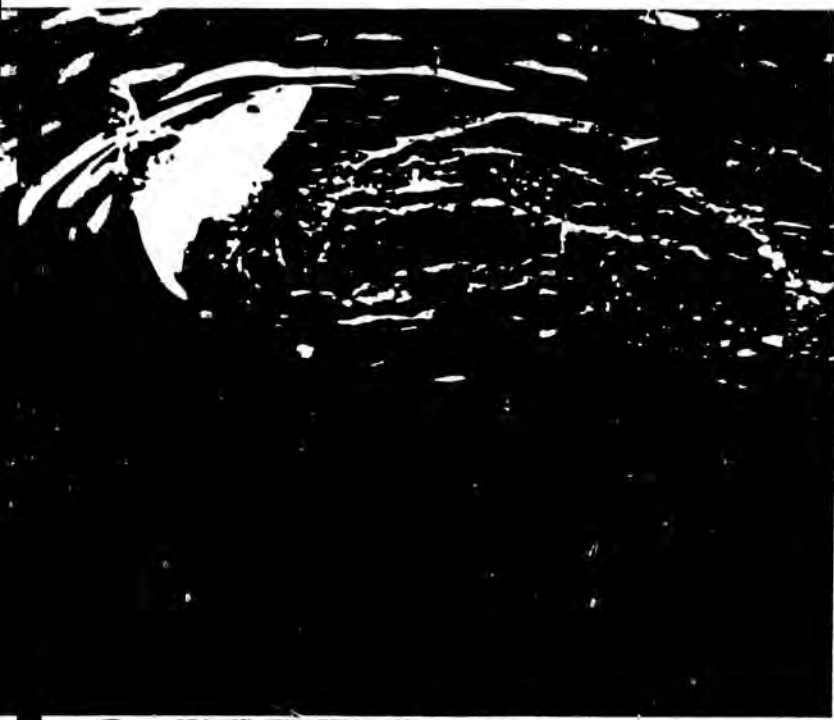
(24) Hitra disease

We have now developed an effective vaccine against "Hitra disease". It gives 95% protection to the fish. That means that the "Hitra disease" is on it's way to being wiped out. (April 1988)









— Eliason _____
— Mary _____
Sheila _____
Laura _____
Jo-Eve _____

NOTE:

Dile - This is
very interesting and
scarey!



UNITED STATES DEPARTMENT OF COMMERCE
International Trade Administration
District Office
222 West 7th Avenue, #32
Anchorage, Alaska 99513-7591 Tel.: 907/271-5041

January 25, 1990

RECEIVED
INTERNATIONAL TRADE

MEMORANDUM TO: Distribution

FROM: Charles F. Becker, Director
Anchorage District Office, ITA

OFFICE OF THE
GOVERNOR

SUBJECT: Frozen Norwegian Salmon

The following cable was received from the U.S. & Foreign Commercial Service in the American Embassy in Tokyo:

SUMMARY: Based on the current over supply of frozen salmon, the Japanese market will not accept 20,000 tons of frozen Norwegian salmon at the price of NOK 36, which is over 1,000 yen delivered to Japan. However, if the price is reduced to 600-800 yen/kilo, it will be a threat to U.S. frozen chum, coho and sockeye salmon. Although Japanese businessmen are concerned with the recent announcement of the Norwegian Fish Farmer's Sales Organization (NFFSO), they generally dismiss the plan of NFFSO on the grounds that the exporters of the salmon would have to suffer heavy losses in the Japanese market.

TEXT: U.S. & Foreign Commercial Service, Tokyo interviewed several Japanese sources (importers, brokers, wholesale market specialists, etc.) in the frozen salmon business to ascertain likely effect on the Japanese market after the recent announcement of NFFSO to produce 40,000 tons of frozen Norwegian salmon. Many Japanese businessmen doubt that any substantial quantity would be imported to Japan. The Japanese market is over-supplied with frozen salmon and is not in the position to accept a large amount of the frozen Norwegian salmon, especially at the current price of NOK 36 or over 1,000 yen/kilo delivered to Japan.

Frozen Norwegian salmon is comparable to Japanese fall chum, U.S. chum or coho salmon (because of the meat color), and their current market prices are below 800 yen/kilo. Additionally, the quantity indicated by NFFSO is large and it would take more than three months to sell 20,000 tons. Frozen Norwegian salmon is likely to sell in the same traditional market for chum which is generally limited to the Kanto Region (Tokyo, Kanagawa, Chiba, Saitama, Tochigi, and Gunma Prefectures). Because of its high fat content, the oxidation of fat is another concern when the fish is stored for a long period. Although it may be filleted or salted in addition to fresh frozen style, like chum and coho, for supermarket and department store sales, the price must be competitive or lower than those for chum or coho. This would be a new style (or market) for Norwegian salmon compared with their regular sales of fresh fish to restaurants or for the Sashimi market.



In February-March, 1989, Norway had a similar plan to sell 15,000 tons of frozen salmon. Even though the actual production is said to have been below 15,000 tons, total Japanese imports are estimated to have been only 400-500 tons. France is said to have been the largest importer, accepting 7,000-8,000 tons.

It is noteworthy that one importer thinks that almost the entire quantity of 20,000 tons currently offered to Japan and other Asian countries will eventually be imported at a low price into Japan, because the world market for frozen salmon is limited to only the EC and Japan. Further, he thinks that it will destroy the entire salmon market in Japan sometime in March through July. March or April are the most likely months that the salmon would be imported because that is when the salmon prices usually reach the highest level in the year. But, since the over-all salmon market is already depressed because of a large amount of imports in 1989, it will be difficult to sell all 20,000 tons before July when salmon fishing season in Bristol Bay enters its prime period.

EMBASSY COMMENT: This scenario, if true, is very critical for U.S. salmon fishermen, processors and exporters, because a decrease in the pre-season market price in Japan would reduce the base of price negotiation for frozen Alaskan salmon with Japanese buyers. Additionally, it would be possible for some Japanese importers to import frozen Norwegian salmon intentionally to manipulate the market for lower prices just before price negotiations commence with the exporters of Alaskan salmon.

A Japanese fishery industry newspaper on January 18 observed "for a successful outcome, NFFSO depends on unknown factors which are: a) a catch decrease forecast for Pacific salmon and, b) an expectation that other Atlantic salmon-producing countries will reduce their productions." It also comments that if Norway plans to produce 150,000 tons of salmon again in 1990, the proposed action plan will not solve their problems.

None of the sources contacted wanted to see frozen Norwegian salmon imported at this time. Post believes that it is likely a few hundred tons of frozen Norwegian salmon could be imported without any impact on the Japanese market. However, if NFFSO actually produces 40,000 tons of frozen salmon, whether or not any of it is imported to Japan, it will disturb the worldwide salmon market, possibly depressing the whole seafood market.



UNITED STATES DEPARTMENT OF COMMERCE
International Trade Administration
District Office
222 West 7th Avenue, #32
Anchorage, Alaska 99513-7591 Tel.: 907/271-5041

January 25, 1990

MEMORANDUM TO: Distribution

FROM: Charles F. Becker, Director
Anchorage District Office, ITA

SUBJECT: Surimi Product Exhibition: Japan

Tokai Denpun Company, Ltd. will sponsor the 15th Surimi Products Exhibition:

February 23, 1990, Friday
From: 11:00 AM till 19:30 PM
Shizuoka Terminal Hotel
Address: 56 Kurogane-Cho, Shizuoka-Shi, Shizuoka
Prefecture 420
Telephone: 0542-54-4141
FAX: 0542-55-3721

About 400 Japanese surimi product manufacturers, to which Tokai Denpun sells Japanese and imported surimi, will exhibit over 20,000 products under 2,000 different categories. Tokai Denpun invites overseas visitors to the exhibition. The exhibition will be educational and a good opportunity for overseas surimi processors and surimi products manufacturers to see and try many different products sold in Japan.

Anyone who wishes to visit the exhibition should directly contact:

Mr. Hitoshi Mori
Surimi Section, Marine Product Department
Tokai Denpun Company, Ltd.
4-15 Tenmachi, Shizuoka 420
Telephone: 0541-53-1181
FAX: 0542-51-3522

for pre-registration. Visitors are allowed to participate in all programs (Exhibition, Lectures and reception) at no charge. Tokai Denpun, a major surimi distributor, was established in 1947 and has 500 employees. Its paid-in capital is 470 million yen and the sales for 1989 was 120 billion yen. Its business includes domestic sales, import, export, processing and manufacturing of starch, agricultural products, marine products, livestock products, food additives, feed, brewing materials, oils and fats, medicine and industrial chemicals, chemical products, package materials and food machinery.



Shizuoka Terminal Hotel is near the JR Shizuoka Station. It takes about 1 hour from Tokyo on JR Tokaido Shinkansen. One-way fare is approximately 6,000 yen (145 yen/US\$1.00) from Tokyo. Although it is possible to return to Tokyo after reception on the same day, visitors wishing to stay in Shizuoka should contact hotel directly. Net room rates are 8,000-10,000 yen for single and 12,000-14,000 yen for double rooms. 10% service charge, any local tax and 3% consumption taxes will be added to the above room rate.

U.S. & Foreign Commercial Service representative, Tommy Asakawa, Mr. Mikio Kawasaki (Oregon State Office, Tokyo), Ms. Greta Anderson Goto and Ms. Kimiko Muguruma (Alaska State Office, Tokyo) will also attend the exhibition.

ABLE001
taly
GENCY

Description:

2092XXX-0000 FRESH (LIVE LOBSTERS) AND FROZEN FISH

Comments:

FIRM FOUNDED IN 1987 BY THREE PARTNERS, WHO MANAGE AND RUN THE BUSINESS. IT IS MAINLY AN IMPORTER/AGENT/DISTRIBUTOR AND EXPORTER OF LEATHERS. IT ALSO DEALS IN FRESH AND FROZEN FISH AND IN WOOD PULP. FIRM SELLS THROUGHOUT ITALY THROUGH SEVERAL REPRESENTATIVES AND REPORTED A SALES VOLUME OF APPROX. USD 2 MILLION FOR 1988. BANK REF.: CASSA DI RISPARMIO DI PISA, 56029 SANTA CROCE SULLARNO (PISA), ITALY.
MORRIS

WRITE TO:

MR. FRANCESCO BINI
OREGON PELLAMI SAS
VIA PROVINCIALE FRANCESCA SUD 49
56029 SANTA CROCE SULLARNO (PISA), ITALY

PH.: 39--571-30239 TELEX: 501262

FAX: 39--571-30239

Please send a copy of your response to:

COMMERCIAL OFFICER (TOP)
AMERICAN CONSULATE
FLORENCE, ITALY
APO NEW YORK 09019

Refer to -- P0009

GABLE032

Spain

DIRECT SALE/AGENCY/JOINT VENTURE

Description:

99733XX-0000 FRESH SHELLFISH

Comments:

SMALLED-SIZED FIRM, ESTABLISHED IN NOVEMBER 1989,
EMPLOYS 5. COMPANY ACTS AS IMPORTER/EXPORTER OF FRESH
AND FROZEN SEAFOOD. THEY ARE INTERESTED IN IMPORTING
SHELLFISH AND WOULD LIKE QUOTATION CIF BARCELONA. FIRM
IS ALSO LOOKING FOR A PARTNER TO INVEST ABOUT USD180,000
IN THEIR OPERATION. BANKREFS: BANCO HISPANO AMERICANO,
AG.13333, PI I MARGALL 39, 08140 CALDES DE MONTBUI
(BARCELONA).
DAVIS

WRITE TO:

MR. ANTONIO NSOUMB, MWNAGING DIRECTOR
COMERCIAL ANTONIO INC.
RONDA UNIVERSIDAD 21 - 4G
08007 BARCELONA

PHONE: 343/4125196

FAX: 343/412-5195

Please send a copy of your response to:
COMMERCIAL OFFICER (TOP)
BARCELONA, SPAIN
APO NEW YORK 09285

CABLE012
West Germany
DIRECT SALE FOR RESALE

Description:

9971XXX-0000 SURIMI PRODUCT
997342"-0000 FROZEN EELS

Comments:

FIRM WAS FOUNDED IN 1988, AND ACTS AS AGENT IN THE
FISH BUSINESS; EMPLOYS 3; ANNUAL TURNOVER DM 15 MILLION.
WHITLOCK

WRITE TO:

MR. ERNST W. SCHWARZ
SAS SEAFOOD AGENTUR SCHWARZ GMBH & CO.
NIIHOOGER 5
D-2280 MORSUM/SYLT

PHONE: (4654) 1421

FAX: (4654) 703

Please send a copy of your response to:

COMMERCIAL OFFICER (TOP)
AMERICAN CONSULATE GENERAL
HAMBURG, F.R. GERMANY
APO NEW YORK 09215

Refer to -- P0013

CABLE024

United Kingdom

DIRECT SALE FOR RESALE

Description:

IMPORT US GOODS FOR RESALE

209XXXX-0000 SEAFOOD

2253XXX-0000 TEXTILE GOODS

22628XX-0000 TEXTILE GOODS

3841XXX-0000 MEDICAL AND PHARMACEUTICAL PRODUCTS

3842XXX-0000 MEDICAL APPLIANCES AND SURGICAL
INSTRUMENTS

3541XXX-0000 MACHINE TOOLS FOR VARIOUS INDUSTRIES

2844XXX-0000 COSMETICS, AROMATIC FLAVORS AND
ADDITIVES

Comments:

OVERSEAS INTERNATIONAL CORPORATION WISH TO IMPORT
FOR RESALE A VARIETY OF PRODUCTS RANGING FROM MEDICAL
TO PERFUME AND MACHINE TOOLS. THEIR BUSINESS WAS
ORIGINALLY BASED IN THE MIDDLE EAST BUT TERMINATED AND
TRANSFERRED TO LONDON IN 1980. GOODS ARE TO BE OF A
HIGH STANDARD. (US/FCS/PJOWEN/GKNOWLES)CATTO

WRITE TO:

MR. E. K. DAVID, PRESIDENT
OVERSEAS INTERNATIONAL CORPORATION
1 CHEYNE CLOSE
PAGE HILL, BUCKINGHAM, MK18 1XP
UNITED KINGDOM

TEL: 0280-815112

Fisheries Cabinet Recommendation
Cowper Administration Position on Mariculture
March 13, 1987

Mariculture may provide substantial economic benefits to our coastal communities and help diversify and stabilize our economy if it is developed in an orderly fashion which provides the maximum benefit to Alaskans while ensuring protection for our fisheries resources, other resource users and the environment. In order to accomplish these objectives, any legislation authorizing a mariculture industry must satisfy the following principles:

1. The mariculture industry must benefit Alaskans.

The mariculture industry must be developed in a manner which does not result in unfair competition with existing fisheries or cause undue economic displacement in our coastal communities. Legislation should, to the extent possible under the law, provide for local hire at mariculture facilities and give preferential access to mariculture permits and mariculture related tidelands leases to Alaskans.

2. The mariculture industry must pay for itself and the state should get a fair return for the use of state resources.

Legislation should contain provisions for recovering administrative and other state costs associated with managing the industry. The legislation should also ensure that the state gets a fair return for the use of tidelands and other resources.

3. The development of the mariculture industry in Alaska should be done in an orderly fashion which encourages a stable, dependable industry.

Legislation should provide general criteria which will lead to the development of a regulatory program which discourages speculation on permits and tidelands leases, encourages sound financial planning, and provides for a diverse industry ranging from "Mom and Pop" ventures to larger corporate operations.

4. The mariculture industry must meet all state and federal requirements for human health, product quality and sanitation.

Legislation should ensure that mariculture facilities meet all state and federal requirements for human health, safety, and sanitation. Legislation should also require that mariculture products meet or exceed

all state and federal product quality and human health standards, and provide the means to ensure that state regulators can protect human health and product quality.

5. Mariculture activities must be managed to ensure protection of the biological integrity of natural plant and animal stocks.

Legislation must address the issues of pathological and genetic protections for natural sea vegetable and fish stocks.

6. Mariculture activities must be managed in a manner which ensures adequate environmental safeguards and habitat protection.

Legislation must ensure that mariculture facilities are sited, designed and operated to protect air and water quality, to provide for proper disposal of wastes, and to minimize adverse effects to important fish and wildlife habitat.

7. Mariculture facilities must be sited to minimize land-use conflicts, maintain navigation and ensure access to upland areas.

Legislation should provide guidance for siting facilities to minimize conflicts with other tidelands users, reducing visual and aesthetic impacts, maintaining navigation and ensuring access across state tidelands.

8. Broodstock acquisition for mariculture purposes should be carefully regulated, especially for species subject to limited entry fisheries.

Legislation should contain provisions limiting the acquisition of broodstock for species subject to limited entry fisheries. Legislation should grant the Department of Fish and Game the authority to regulate the acquisition, transport, and propagation of mariculture broodstock, and provide the Board of Fisheries the ability to resolve allocation decisions regarding broodstock acquisition if necessary.

**FISH FARMING IN ALASKA:
GAMBLING WITH RESOURCES AT PUBLIC EXPENSE**

**BY
SENATOR DICK ELIASON**

Article submitted for
publication in
special "Comfish" issue
of Kodiak Newspaper
(March 1990)

Alaska should move now to ban commercial finfish farming in the state. Development of a fish farming industry could jeopardize our natural resources, our sport and subsistence fisheries, and our billion-dollar commercial fishing industry.

Stewardship of common property resources is one of the most challenging responsibilities with which Alaska's government is charged. Our state Constitution (Art.VIII, Sec.2) provides, "The legislature shall provide for the utilization, development, and conservation of all natural resources belonging to the State...for the maximum benefit of its people." As a member of the legislature for nineteen years I can assure you that implementing this policy so that everyone is happy is an impossible task, but it is nonetheless essential to strive for the greatest common good.

The mandate to manage natural resources for the public good is, in itself, ample reason for the legislature to ban fish farming. Even fish farm advocates agree that risks to wild stocks can be minimized but not eliminated, and that the current economic potential for fishfarming is bleak. How can we justify spending public funds to help establish an industry which could bring catastrophe to natural resources and to the state's largest private sector employer?

The small group of individuals pushing for fish farming in Alaska is quick to point out that many countries around the globe are ardently pursuing mariculture, and that Alaska should jump on the bandwagon. Does any one of these other countries boast natural fishery resources on a par with

Alaska's? On the contrary. In most cases, they've either never had significant natural stocks or their fisheries have been decimated by poor management. These countries have little to lose by experimenting with fish farming.

The development of the world's finfish farming industry has been marked by an initial period of very rapid growth, and more recently by severe economic woes including many bankruptcies and the dumping of large quantities of farmed fish on the market at a loss. Farm operations have been established long enough in many places for us to see that the industry is plagued by problems Alaska does not have now, and and does not want.

Critical areas of concern include water quality, siting, and hazards to natural stocks. The degradation of water quality seems impossible for fish farms to avoid. According to a state report done in Washington, one typical fish farm using net-pens produces pollutants "equivalent to untreated sewage from approximately 10,000 persons." Pollutants are also laced with hormones and antibiotics given to the fish; these are believed to pose a serious threat to the public health by producing antibiotic-resistant bacteria in the human food chain. Over time, in a single site, tons of oxygen-demanding waste are produced. Complaints about pollution from salmon farms are cropping up in Ireland, Norway and Canada. Fish farms contributed to the pollution which likely was a key factor in the frightening killer-algae-bloom which destroyed all marine life in its path when it swept

through the North Sea in 1988. Maintaining the quality of the marine environment along our coasts is something in which most Alaskans have a stake.

The location of fish farms has sparked bitter public debate in places like Puget Sound. Even in Alaska a limited number of sites possess the features desirable for fish farms: accessibility, protection from heavy wave action, good flushing action, availability of a fresh water source, a good distance from anadromous fish streams, and so on. Many of these same attributes are desired for other uses: shellfish farms, hatcheries, recreation, boat moorage, residential development, etc. Conflict over siting is inevitable.

Perhaps the most unsettling of the potential dangers of fish farming center around the problems of fish disease, accidental escapement, and genetic intermingling.

These are serious concerns even in Norway, where mariculture is "state of the art" and fish farmers have access to extensive subsidized technical expertise. Fish escaping from pens pose a threat even if the renegade fish are free of disease. Renegade salmon may compete for space in a river inhabited by natural stocks, and inbreeding can weaken the qualities which suit a fish to life in the wild (such as the ability to migrate).

In Norway the escapement of large numbers of fish infected with a deadly disease has threatened wild stocks. Fish biologists there have concluded that disease in farms can lead to higher rates of infection in the vicinity of the net

pens, even if the disease itself already exists in natural stocks. When an exotic disease breaks out in a river inhabited by natural stocks, the entire river must be poisoned to eradicate it; this has happened in the U.S. and in Norway.

Recently the deadly VHS disease erupted again at a hatchery in Washington, and was also detected in wild salmon. The source of VHS is a mystery. But the fact that it never appeared in the U.S. until shortly after the establishment of fish farming, and that two of the three hatchery outbreaks of the disease in Washington have occurred within ten miles of major salmon farms, seems to lead to an apparent connection.

Those advocating fish farming in Alaska claim that all these risks can be minimized with the proper controls, siting guidelines and, of course, adequate funding. Indeed, to allow ANY fish farming, funding would be required for a whole new layer of bureaucracy spanning four departments (DEC, DNR, Fish and Game, and Public Safety), including lab space, state fish pathologists, biologists, and protection officers as well as office personnel.

But no amount of regulation can be effective if enforcement can't be guaranteed -- a costly and virtually impossible task when fish farms would be located in remote places and monitored sporadically. For example how can we prevent a farmer in some isolated bay from releasing diseased fish into the wild to save the huge expense of proper disposal? (Such actions are alleged to be taking place in Norway).

More than 70,000 people are employed seasonally in Alaska's seafood industry. They depend on the state to manage fisheries resources for a sustained yield. An average of only 3 people are needed to run the average fish farm. Fish farming has been touted as a fine "Mom & Pop" operation, a family business -- well, maybe if you're a member of the Rockefeller family, because it takes about \$1,000,000 to get started and it's a minimum of two years before you can expect any return on your investment! Financing for ventures in Alaska would likely come from out of state and foreign investors, so even if the industry were able to reap a profit, much of it would not benefit Alaskans. A much better "Mom & Pop" operation is shellfish farming, which has the legislature's full support (and mine), and which is now developing in various parts of Alaska.

Economic diversification and development deserve our support, but it should not be blind support of "anything at any cost." Potential benefits must always be weighed against potential harm. I concur that within human limitations, damage can be minimized in fish farming, but I doubt that adequate adherence to protective measures can be achieved, and I can't see a reason to take any risks when potential benefits are so minuscule.

We can best serve Alaska by responsibly managing our fisheries resources according to sustained yield principles, maximizing returns by controlled harvest and through enhancement efforts, continuing to support the "Americanizing"

and "Alaskanizing" of our fisheries, increasing incentives for shore-based processing, strengthening our marketing and quality assurance/education efforts, and by overall efforts to maintain a healthy marine environment.

The legislature recently received the final recommendations of the Finfish Farming Task Force appointed by Governor Cowper. The report confirms that the potential negative impacts of fish farming on natural stocks cannot to be eliminated, and does not present any evidence that Alaska stands to gain enough to justify taking the risks involved. The report recommends that the legislature act this session to resolve this issue.

To this end I have introduced Senate Bill 397, which would ban commercial finfish farming in Alaska. The current moratorium on fish farming will expire this July, unless action is taken. I hope that the members of the public will make their views known to their elected representatives in Juneau so that the legislature can resolve this issue once and for all.

WISE NATURAL RESOURCE MANAGEMENT DICTATES FISH FARM BAN

by

Senator Dick Eliason

After four years of discussion on the subject of mariculture, the time has come for the Legislature to end the debate and ban commercial finfish farming in Alaska. The current economic outlook for fish farming is bleak, and does not provide any justification for jeopardizing a natural resource base which supports subsistence, sport, and valuable commercial fisheries.

Economic development is important to our state, however one must weigh the the potential detriment of each economic development prospect against the potential benefits.

Unlike the other states and countries which have pursued fish farming, Alaska boasts a wealth of healthy natural fish stocks. These support a seafood industry payroll in Alaska which in 1988 exceeded \$1 billion; that's more than the combined payrolls of Alaska's other leading industries: oil and gas, tourism, mining and forest products. A fish farm, which costs about \$1 million to get started and takes two years to turn its earliest profit, employs an average of 3 people. Financing for fish farming ventures in Alaska would likely come from investors in other states and nations, with a large share of any profits flowing out of state. Fish farms in other states and in nearby British Columbia have been forced to sell their products at cost due to a glut of farmed

fish on the market, and some have faced bankruptcy.

Profitability is, at best, uncertain.

Unfortunately, nobody can guarantee that our wild fisheries resources would be safe from the risks posed by fish farming. The report submitted to the Legislature by the (non-legislative) Finfish Farming Task Force states that the potential negative impacts of fish farming on natural stocks cannot be eliminated, a finding with which even fish farming advocates reluctantly agree.

The chief areas of concern which have emerged during the course of the fish farming debate in Alaska are those of water quality, siting, and hazards to natural stocks.

Water pollution is hard to sidestep in an operation which generates tons of oxygen-demanding waste. One typical fish farm using net-pens produces pollutants equivalent to untreated sewage from about 10,000 people, according to a Washington state report. Hormones and antibiotics given to the fish are part of this waste, and their use is believed to constitute a threat to public health.

Conflict over the location of fish farms will be inevitable, as many of the attributes sought in a fish farm site (good flushing action, fresh water source, accessibility, protection from heavy wave action, etc.) also make it desirable for other uses: shellfish farms, hatcheries, boat moorage, recreation, and residential development, for example.

The likelihood of irreversible damage is greatest, however, in the threat to natural stocks posed by disease, accidental

escapement, and genetic intermingling, all of which have presented genuine problems in Norway, home of the world's most advanced fish farming operations. Despite the advanced technology and massive government subsidies supporting the industry in Norway, masses of diseased fish have escaped from farms and threatened wild stocks. Even when a certain disease exists in wild fish, studies have indicated higher rates of infection near net pens. Renegade farm fish, even if they are free of disease, may constitute a threat by competing for space in rivers inhabited by wild fish, and inbreeding can weaken the qualities which suit a fish to life in the wild (such as the ability to migrate). Rivers in Norway and the U.S. have been poisoned, and their wild stocks exterminated to control outbreaks of exotic disease unknown prior to the advent of fish farming.

These various risks to wild stocks can be minimized, according to fish farm proponents, with proper controls, siting guidelines and adequate funding. The cost of these controls and the attendant layers of bureaucracy would be considerable, and regulations would be ineffective unless accompanied by rigorous enforcement efforts. From Norway to British Columbia there have been documented cases of flagrant violations of regulations, including the release of diseased fish into the wild (sparing the expense of proper disposal) and the improper dumping of diseased carcasses (in one case use of an open trench enabled scavengers to provide a route for the disease into the food chain).

The Legislature has a constitutional mandate to manage natural resources for the maximum benefit of Alaskans. To gamble with these resources at public expense is simply irresponsible. Our stewardship of Alaska's natural resources, her lands, her waters, and her fisheries, involves both development and conservation. The public interest would be best served by our unfailing commitment to managing Alaska's fisheries resources according to sustained yield principles, maximizing returns through controlled harvest and enhancement, providing incentives for shore-based processing, continuing marketing and quality assurance campaigns, and protecting the marine environment from pollution.

The moratorium on fish farming now in place will expire in July of this year. Proposed legislation has been introduced which would ban commercial finfish farming in Alaska. Legislative committees are now taking public testimony on this issue. If the Legislature lives up to its constitutional mandate, Alaska will refuse to flirt with the potential catastrophe which could be brought about by fish farming.

#

[Sen. Dick Eliason represents District B in the Alaska State Legislature. He is Chairman of the Senate Labor and Commerce Committee, and a member of the Senate Resources Committee.]

FISH FARMING IN ALASKA:
GAMBLING WITH RESOURCES AT PUBLIC EXPENSE

BY
SENATOR DICK ELIASON

SB397
HB432

Alaska should move now to ban commercial finfish farming in the state. Development of a fish farming industry could jeopardize our natural resources, our sport and subsistence fisheries, and our billion-dollar commercial fishing industry.

Stewardship of common property resources is one of the most challenging responsibilities with which Alaska's government is charged. Our state Constitution (Art.VIII, Sec.2) provides, "The legislature shall provide for the utilization, development, and conservation of all natural resources belonging to the State...for the maximum benefit of its people." As a member of the legislature for nineteen years I can assure you that implementing this policy so that everyone is happy is an impossible task, but it is nonetheless essential to strive for the greatest common good.

The mandate to manage natural resources for the public good is, in itself, ample reason for the legislature to ban fish farming. Even fish farm advocates agree that risks to wild stocks can be minimized but not eliminated, and that the current economic potential for fishfarming is bleak. How can we justify spending public funds to help establish an industry which could bring catastrophe to natural resources and to the state's largest private sector employer?

The small group of individuals pushing for fish farming in Alaska is quick to point out that many countries around the globe are ardently pursuing mariculture, and that Alaska should jump on the bandwagon. Does any one of these other countries boast natural fishery resources on a par with

Alaska's? On the contrary. In most cases, they've either never had significant natural stocks or their fisheries have been decimated by poor management. These countries have little to lose by experimenting with fish farming.

The development of the world's finfish farming industry has been marked by an initial period of very rapid growth, and more recently by severe economic woes including many bankruptcies and the dumping of large quantities of farmed fish on the market at a loss. Farm operations have been established long enough in many places for us to see that the industry is plagued by problems Alaska does not have now, and and does not want.

Critical areas of concern include water quality, siting, and hazards to natural stocks. The degradation of water quality seems impossible for fish farms to avoid. According to a state report done in Washington, one typical fish farm using net-pens produces pollutants "equivalent to untreated sewage from approximately 10,000 persons." Pollutants are also laced with hormones and antibiotics given to the fish; these are believed to pose a serious threat to the public health by producing antibiotic-resistant bacteria in the human food chain. Over time, in a single site, tons of oxygen-demanding waste are produced. Complaints about pollution from salmon farms are cropping up in Ireland, Norway and Canada. Fish farms contributed to the pollution which likely was a key factor in the frightening killer-algae-bloom which destroyed all marine life in its path when it swept

through the North Sea in 1988. Maintaining the quality of the marine environment along our coasts is something in which most Alaskans have a stake.

The location of fish farms has sparked bitter public debate in places like Puget Sound. Even in Alaska a limited number of sites possess the features desirable for fish farms: accessibility, protection from heavy wave action, good flushing action, availability of a fresh water source, a good distance from anadromous fish streams, and so on. Many of these same attributes are desired for other uses: shellfish farms, hatcheries, recreation, boat moorage, residential development, etc. Conflict over siting is inevitable.

Perhaps the most unsettling of the potential dangers of fish farming center around the problems of fish disease, accidental escapement, and genetic intermingling.

These are serious concerns even in Norway, where mariculture is "state of the art" and fish farmers have access to extensive subsidized technical expertise. Fish escaping from pens pose a threat even if the renegade fish are free of disease. Renegade salmon may compete for space in a river inhabited by natural stocks, and inbreeding can weaken the qualities which suit a fish to life in the wild (such as the ability to migrate).

In Norway the escapement of large numbers of fish infected with a deadly disease has threatened wild stocks. Fish biologists there have concluded that disease in farms can lead to higher rates of infection in the vicinity of the net

pens, even if the disease itself already exists in natural stocks. When an exotic disease breaks out in a river inhabited by natural stocks, the entire river must be poisoned to eradicate it; this has happened in the U.S. and in Norway.

Recently the deadly VHS disease erupted again at a hatchery in Washington, and was also detected in wild salmon. The source of VHS is a mystery. But the fact that it never appeared in the U.S. until shortly after the establishment of fish farming, and that two of the three hatchery outbreaks of the disease in Washington have occurred within ten miles of major salmon farms, seems to lead to an apparent connection.

Those advocating fish farming in Alaska claim that all these risks can be minimized with the proper controls, siting guidelines and, of course, adequate funding. Indeed, to allow ANY fish farming, funding would be required for a whole new layer of bureaucracy spanning four departments (DEC, DNR, Fish and Game, and Public Safety), including lab space, state fish pathologists, biologists, and protection officers as well as office personnel.

But no amount of regulation can be effective if enforcement can't be guaranteed -- a costly and virtually impossible task when fish farms would be located in remote places and monitored sporadically. For example how can we prevent a farmer in some isolated bay from releasing diseased fish into the wild to save the huge expense of proper disposal? (Such actions are alleged to be taking place in Norway).

More than 70,000 people are employed seasonally in Alaska's seafood industry. They depend on the state to manage fisheries resources for a sustained yield. An average of only 3 people are needed to run the average fish farm. Fish farming has been touted as a fine "Mom & Pop" operation, a family business -- well, maybe if you're a member of the Rockefeller family, because it takes about \$1,000,000 to get started and it's a minimum of two years before you can expect any return on your investment! Financing for ventures in Alaska would likely come from out of state and foreign investors, so even if the industry were able to reap a profit, much of it would not benefit Alaskans. A much better "Mom & Pop" operation is shellfish farming, which has the legislature's full support (and mine), and which is now developing in various parts of Alaska.

Economic diversification and development deserve our support, but it should not be blind support of "anything at any cost." Potential benefits must always be weighed against potential harm. I concur that within human limitations, damage can be minimized in fish farming, but I doubt that adequate adherence to protective measures can be achieved, and I can't see a reason to take any risks when potential benefits are so minuscule.

We can best serve Alaska by responsibly managing our fisheries resources according to sustained yield principles, maximizing returns by controlled harvest and through enhancement efforts, continuing to support the "Americanizing"

and "Alaskanizing" of our fisheries, increasing incentives for shore-based processing, strengthening our marketing and quality assurance/education efforts, and by overall efforts to maintain a healthy marine environment.

The legislature recently received the final recommendations of the Finfish Farming Task Force appointed by Governor Cowper. The report confirms that the potential negative impacts of fish farming on natural stocks cannot to be eliminated, and does not present any evidence that Alaska stands to gain enough to justify taking the risks involved. The report recommends that the legislature act this session to resolve this issue.

To this end I have introduced Senate Bill 397, which would ban commercial finfish farming in Alaska. The current moratorium on fish farming will expire this July, unless action is taken. I hope that the members of the public will make their views known to their elected representatives in Juneau so that the legislature can resolve this issue once and for all.

for private profit?

By John de Young
P.I. Columnist

Consider these things about floating fish farms:
■ A typical net-pen fish farming operation on Puget Sound produces pollutants "equivalent to untreated sewage from approximately 10,000 persons." That's what a state report says. The pollution comes from fish feces, urine and food pellets deposited in the water and on the bottom of the Sound.

■ There are 13 commercial pens now operating over 60 acres of aquatic lands leased from the state. These 13 operations daily deposit to the bottom of Puget Sound nearly six times as much oxygen-demanding fecal matter and other wastes than does Metro's Renton Waste Water Treatment Plant, which serves 430,000 people. Materials that deplete oxygen can radically change or kill off the life forms in an unpolluted environment.

■ Siting 27 more fish farms, now delayed by opposition from upland property holders, environmentalists and county officials, would add a pollution load to Puget Sound equal to that from building four new cities the size of Everett.

■ The "proper siting of 100 farms would not have significant impact on the aquatic environment." So says the state's just-issued environmental impact statement on floating net pens.

Those 100 fish farms would produce 55 metric tons of oxygen-demanding waste per day. That's 18 more tons a day than Metro's Renton and West Point treatment plants together produce from the sewage of 1 million people.

Analysis

The environmental impact statement was prepared by three private organizations that supply fish-farm companies with paid expert witnesses.

Under Gov. Booth Gardner, state policy is to hasten any increase of fish farming in the state's waters and to downplay environmental problems that aquaculture may bring.

The official evangelist is the Department of Agriculture's Dr. John Pitts, veterinarian and former Jefferson County commissioner who appears at meetings and hearings — in one case, as a paid witness for a net-pen applicant — to pooh-pooh environmental objections raised by net-pen opponents.

Opponents are not just those who own shoreline property, who howl against a net pen being erected in their aquatic front yard. They've been fired up by what the state's environmental impact statement confirms: A new, nearby fish farm can give view property a one-time, financial knock.

Opponents include environmentalists like David Ortmann of Friends of the Earth, who says: "Why should we be happy about fish farms that dump tons of fish poop every day into Puget Sound?"

They include commercial fishermen like the Puget Sound Gillnetters, who know something that has largely escaped the notice of sport anglers.

Atlantic salmon, not a salmon but a sea-run trout of the Atlantic seaboard, have escaped by the thousands from net pens here and in British Columbia. The B.C. government booms fish farms with a gusto exceeding even the ta-ra-boom-deys from Gardner's men and from Brian Boyle, the separately elected head of the Department of Natural Resources, which manages shore bottoms and other public lands.

What's more, hundreds of thousands of Pacific salmon have also escaped from the pens, especially in British Columbia.

So what does that mean?
The state environmental impact statement points out that escaped exotic fish like the Atlantic salmon "could establish self-sustaining populations and compete with indigenous fish," such as steelhead trout.

That may not be far off.
In the North Puget Sound last year, commercial and sports fishermen caught hundreds, probably thousands, of Atlantic salmon weighing up to 10 pounds.

More dangerous by far is that for the first time ever at least three sexually mature Atlantic salmon showed up miles from the sea in the Nooksack River last year, near Bellingham, and one in the Nisqually, near Olympia. Rumor has a fourth Atlantic nested in the Skagit River at Sedro-Woolley.

What's the worry about four fish, though they may be forerunners of thousands to come?

The environmental impact statement warns that accidental importation of "exotic" fish diseases associated with fish farms in Europe could devastate existing salmon and trout runs in state rivers.

Just in the past two weeks the public has learned that such a disease, viral hemorrhagic septicemia or VHS, has shown up at two hatcheries in state waters. It is the first time ever that VHS has been found in North America.

VHS, state fish-disease experts say, has never been found to occur naturally in Atlantic salmon. They say that the chance that Atlantic salmon in pens here are the source of the disease is "virtually zero." The disease was found in chinook and coho salmon, species raised extensively at federal, state and tribal hatcheries and at commercial net-pen operations.

The impact statement does not dwell on what has happened in Norway, where other diseases associated with that country's extensive net-pen industry have ravaged wild Atlantic salmon runs in 32 rivers. The government was forced to poison some streams, set up a salmon sperm bank to preserve wild genes and consider banning any new net pen within 12 miles of a river mouth, an obvious rule not yet under consideration here.

Nor does the statement dwell on the possibility of migrating wild fish: catching indigenous fish diseases from net pens here or of net-pen escapes spreading such diseases into our river systems.

Fish farmers themselves helped call state attention to fecal build-up beneath pens, a build-up that kills clams, oysters and other bottom dwellers and can release poisonous hydrogen sulfide gas, which



DUANE HOFFMANN/PI

can kill all fish in a pen in minutes.

In 1966 Commissioner of Public Lands Boyle limited new net pens to sites where the water is at least 40 feet deep at low tide, a mile away from other pens and with enough current to flush away food and fecal deposits. He also limited the surface area of new pens to two acres or less.

These requirements ended up in "Recommended Interim Guidelines" written for the departments of Agriculture, Ecology, Natural Resources and Fisheries, which share regulation of the fish-farm industry, with Agriculture and Pitts calling most of the shots.

With no force of law and offered to help county commissioners site pens under state law, the guidelines deliberately do not talk about navigation problems, use conflicts and, most important, esthetics.



If the two sides could stop feuding and start talking about necessary standards, we could have a safe, considerable industry.

—Peter Katz,
fish farmer

Commissioners have learned that if they turn down a net-pen proposal, the applicant will seek a full rehearing before the state's Shorelines Hearings Board, with Pitts certain to show up to put the stamp of Gardner's administration on having the permit granted.

Dorain Colby, an Island County commissioner, put the matter thus in a 1987 letter:

"While there may be legitimate reasons for denying a permit to locate a salmon net pen, local government has been placed in the position of being able to say 'yes' to such a proposal but not 'no'."

Under Gardner, the Department of Ecology has refused to require net pen operators to get pollution-limiting discharge permits under the federal Clean Water Act.

The Sierra Club Legal Defense Fund has announced it will sue the U.S. Environmental Protection Agency if necessary to force EPA to force Ecology to force every net pen operator have such a permit.

The state's draft environmental impact statement declares that the major impacts of net pens can be cured by "proper farm siting to assure dispersion of wastes, flushing of the site and protection of sensitive areas."

It's a view that one can come to easily while talking to such eloquent fish farmers as Peter Katz, a marine architect running the Paradise Bay Co. net farm at Port Townsend, and John Forster, a Ph.D. in aquaculture running Sea Farm Washington's similar

operations at Port Angeles.

Both pen systems, clean, low in the water, quiet, full of fat, bright Pacific and Atlantic salmon, are barely noticeable in the working harbors that contain them.

But that's quite different than siting a pen in Frenchman's Cove on the west side of Hood Canal, as International Marine Farms Inc. proposes.

Or siting a pen, as Tailfin Inc. proposes, in a main salmon and trout-fishing cove between East Point and Bell's Beach on the west side of Wudway Island, where from her home Margaret Jorgensen looks out across Saratoga Passage to Camano Island. She heads the Marine Environmental Consortium, made up of 20 citizen organizations that oppose fish and other floating farms.

Katz argues for having the state set standards for siting and operating net pens, to ensure that the pens do not harm the environment and to give the net-pen operators a clear but flexible regulatory framework to live with. But Katz feels the industry is getting a bad rap from people like Johnston, who, he says, simply don't want a net pen in their aqueous front yard.

"If the two sides could stop feuding and start talking about necessary standards, we could have a safe, considerable industry," he says. "But we're years away from that."

Forster, president of the Washington Fish Growers Association, dismisses esthetic revulsion as the main drive behind the opposition to what he characterizes as a clean, beneficial industry with vast prospects.

"It's more than esthetics. It's an intrusion into a life style that they don't like and they're using environmental problems as a smokescreen. Because of that, the debate is dishonest at the moment, terribly dishonest."

Johnston, at a gathering in her home with other members of the Marine Environmental Consortium, characterizes such comments as unworthy.

"The net pen issue raises a fundamental issue of public policy that involves more than us, though the environmental questions are real and cannot be brushed aside by the industry or the state. The big question is: Should the public waters of Washington State be turned over to a few corporations for private profit?"

That's a proper question for us all to ask. It must be answered by political action. Gardner's administration has already answered: Yes.

To me it seems stupid to site more pens in pristine salt and fresh waters (yes, an application is pending in Eastern Washington) until we have better, more extensive scientific information about siting them, what the draft environmental impact statement supplies.

Until we know if pens can be sited safely anywhere, we would be blind to commit ourselves to putting major sources of pollution in our unpolluted waterways and on waterways we are trying to clean up.

The tragedy of Norway's rivers demonstrates that

Norway sees mounting disease, pollution threat from fish farms

The deadly salmon disease furunculosis, previously unknown in Norwegian waters, is breaking out of fish farms and threatening beleaguered wild stocks, says a top government official.

Svein Aage Mehli, head of the division of Norway's Directorate for Nature Management which is charged with protection of wild salmon, told a Washington State regulatory hearing Nov. 14 that 5,000 farmed salmon infected with the disease escaped this summer into Hjørundfjorden near Molde.

Despite an intensive fishery to catch the fish and a system of net barricades at the mouths of salmon rivers, an infected fish was found in fresh water, he testified.

"If the disease spreads to natural stocks, the situation may be out of control in Norway," Mehli said.

"I feel we are on a sharp edge with diseases. If we have (the parasite) *Gyrodactylus salaris* in more rivers we may just accept our wild salmon is extinct."

Furunculosis is present in B.C. waters and leads to loss of appetite, fluid retention, ulcers and eventually death in up to 50 percent of affected stocks. It had not been found in Norway until smolt transfers from outside the country were undertaken. *Gyrodactylus* also has been linked to fish farming and is treated by killing all host fish with rotenone.)

Mehli was qualified as an expert witness at a hearing in Lacey, Wash., of the Shoreline Hearings Board, which is hearing an appeal of a Skagit County decision to reject a fish farm in the mouth of the Skagit.

The fish farm proponents, a tribal group, are appealing the refusal of the Skagit County commissioners to issue permits for the farm on the basis that it threatens Skagit salmon and could pollute the sensitive estuary.

Proponents have denied there is any evidence of a disease threat to wild stocks from farmed salmon.

As a result, the appeal hearing has turned into a deep investigation of the environmental impact of salmon farms on wild stocks. Mehli was flown from Norway to testify on behalf of county commissioners, who backed up their decision by referring to the Suzuki Foundation report on Norway called *Journey to the Future*.



• Svein Aage Mehli, of Norway's environmental agency, testified last month to a Washington State regulatory agency.

Mehli responded angrily to suggestions by fish farm proponents that there is "no conclusive evidence" of disease spreading to wild stocks from farms.

"We are very concerned," he said. "It is not right to ask for conclusive evidence at such an early stage."

Furunculosis imported on smolts destined for salmon farms broke out two years ago and authorities felt they had eradicated it, he said.

This year's outbreak was a shock, as was the continued spread of bacterial kidney disease (BKD), which is very difficult to treat even with antibiotics.

"BKD poses a problem for natural stocks because it was diagnosed for the first time in 1980 and previously did not exist in nature," Mehli said. "It is very easy to see a connection between BKD (in salmon farms) and wild stocks in the river."

"It's reasonable to conclude" BKD spread from farms, he said, and Norwegian scientists "see logic in such a connection." BKD is diagnosed or suspected in 100 netpen operations and hatcheries.

Antibiotic use on Norwegian fish farms climbed to 48 tonnes last year, equal to the requirements for human use and animal husbandry combined.

"If you see the first diagnosis of redmouth disease in Norway just two years ago, it's impossible to ask what happened in such a case," Mehli continued. "Veteri-

narians underline the seriousness of that situation, that net pen operations have an impact."

Mehli said redmouth now is present in 300 facilities but was unknown until 1985.

"Net pen operations may function as a multiplying station for disease," Mehli said. "They will give greater disease pressure on natural stocks that we didn't see before netpen operations."

Mehli said further studies on the straying of farmed fish into rivers show a sharp increase in the presence of farmed fish. A year ago, 18 percent of the fish found in the rivers studied were of farm origin. In 1988, the figure rose to 40 percent. The origin was confirmed by scale samples and electrophoresis.

Asked if strong regulations could control disease, Mehli agreed they could "minimize problems if they go far enough. Norway has not gone far enough."

Norway is proposing a ban on the transfer of eggs and smolts between regions of the country, he said, and considering a ban on all imports of sexual products like eggs and milt.

Even though existing regulations list diseases which must not be present in imported eggs, the list is limited and "in Norwegian cage culture we know other diseases are knocking at the door."

In theory, he said, fish farmers "want to get rid of disease, but if they see profit in the short term they may react in a different way."

Mehli also confirmed fears of negative genetic effects of farmed fish on wild stocks if they interbreed. "We are very afraid it could affect their ability to migrate."

Netpen salmon have undergone careful selection for size and growth rate, he said, but researchers may have inadvertently selected other characteristics which could have a negative impact if reintroduced into wild stocks.

"First there is a genetic problem and second an environmental problem. If Atlantic salmon (escaping in Pacific waters) have the same requirements as coho or steelhead trout — and we know that salmon escape in great numbers — then you will have competition for space in the rivers."

As to their ability to spawn, "we see them in rivers, they are mature, ready to spawn and we are very worried of what will happen."

New zoning regulations now being implemented in Norway will ban farms within 20 kilometres of salmon rivers and close entire fjords to farming where salmon are present.

West Coast Shake-out

Supply and demand tremors rattle B.C. growers.

by Peter Chettleburgh

THE SHAKE-OUT has begun. Sagging salmon prices, excessive debt, high interest rates and a worldwide glut of salmon have triggered a period of consolidation in the west coast salmon farming industry. On the East Coast where prices are firmer and farmers have been more conservative in their approach there is still a margin of profit, but it too is narrowing as prices continue to slide in the face of skyrocketing worldwide production (220,000 tonnes in '89).

Everyone said it would happen, but no one really wanted to believe it. On the west coast, where prices have been hovering at or below production levels for most of the summer, reality has struck home with a vengeance. The need for cash flow has caused many farmers to sell a lot of small pre-market fish for ridiculously low prices - 90¢ a pound was one figure this writer heard mentioned earlier this summer.

Since May we have heard of at least four west coast farms that have been put into receivership, another two that have been sold at fire sale prices and at least a dozen more which are in desperate need of working capital. Everyone else is holding on, praying for higher prices in the fall.

One of the big ones that went into receivership is the Fremstad Group which has four farms, a hatchery and processing plant in the vicinity of Campbell River. It's being handled by the accounting firm of Coopers

and Lybrand which was looking for a buyer as we went to press in August.

Triangel Resources near Tofino on the west coast of Vancouver Island found itself in trouble earlier this spring and was taken over by General Sea Harvest, an affiliate of the Finnish conglomerate, Cultor Ltd. (formerly Finnish Sugar Co.), the parent company of Ewos Canada. General Sea and B.C. Packers were also looking at the assets of Ross Passage Salmon Farm, another west coast operation which found itself in trouble earlier this spring.

One other company that is known to be in receivership is Seagrow Industries Inc. (400 tonne capacity) with two sites in Jervis Inlet. The receiver, Coopers and Lybrand, was still looking for a buyer as we went to press.

There were also some amalgamations before the current shake-up began. For instance, within the last year Five Fishes (Sechelt) and Nordic Ventures (Quadra Island) were purchased by B.C. Packers, the large west coast fishing company-cum-processor owned by Westons. Apparently B.C. Packers is on the lookout for other expansion prospects, but doesn't plan to walk into a situation unless all the biological criteria, etc. are just right.

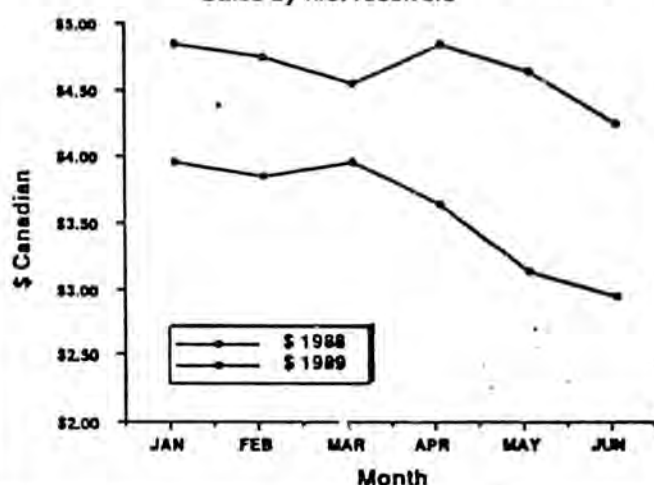
As a general comment, it can be said that the farms with some of the worst financial problems are in the Sechelt area. This is where the goldrush started in 1984

and it is the area that received a lot of the initial debt financing from Norway. Now the Norwegian financing has all but dried up and few investors are prepared to put additional

salmon farms at about \$250 million. And this does not include an additional investment of at least \$50 million in the supply and services sector (cages, feed, nets, etc). Of this total in-

Fresh B.C. Salmon Prices 4-6 lbs.

Sales by first receivers



The graph above tells the story. The top line shows prices for B.C. farmed salmon (4-6 lbs.) during the first six months of 1988, while the lower line shows prices for the first six months of 1989. Prices are FOB Vancouver (Source BCSFA).

money into the farms because of their current debt structure. Adding to their woes are the growing conditions which many in the industry agree are not as good as those north of Campbell River or on the west coast of Vancouver Island. Indeed, some of the salmon farm sites may end up in the hands of oyster growers who are already lining up for a chance at leases that will probably turn out to be better for shellfish than salmon.

\$250 million investment

A recent estimate puts the total investment in B.C.

vestment, at least \$85 million has come in through Norwegian banks, much of which is now exposed to major losses, according to a recent report in a Norwegian newspaper.

Even for the smaller farms, those with debt in the neighbourhood of \$2-3 million, the debt servicing costs of 15-18% will skim off between \$300,000 and \$400,000 a year. That's a lot of fish, and a lot of debt relative to inventory, assets and equity, particularly in an industry that has yet to establish a solid production base.

> > >

Although the depressed prices are toughest on the farmers, the suppliers behind the scenes are also hit hard. Scantech Resources of Sechart folded in July after becoming one of B.C.'s major suppliers of fish farm equipment in just four years. President Clark Hamilton says that he lost everything in the failure but is still a strong believer in the future of the industry in British Columbia.

Another supplier which was hard hit was Powell River Net Loft which ceased doing any further work for the fish farming industry in June. The suppliers that are the most exposed are the companies which specialize solely in fish farming equipment and services for the B.C. market. They don't have the flexibility of companies that serve other industries or those that have national distribution.

It's small consolation that salmon farmers around the world are facing the same problems of overproduction and falling prices. Indeed, both the Scots and

Norwegian smolt producing sector.

In British Columbia the problems seem even worse. Excessive debt financing, high jacking rates and high

rived late in the world growth curve of farmed salmon production.

Glutted markets

As if this weren't enough, world markets are currently glutted with high inventories of frozen Pacifics, a legacy of an oversupply last year and ample reserves of fresh and frozen farmed Atlantics on world markets this year. Farmed Atlantics now take preference in most European and some North American markets, areas that were once dominated by wild Pacifics. Consequently, the price for both farmed and wild Pacifics has seen a dramatic fall since last December with farm gate prices for farmed chinook (6-9 lb.) dropping more than \$1.50 per pound to \$2.50 and lower for a while early this summer. (New Brunswick Atlantics (6-9 lb.) were wholesaling for about \$1.25 more per

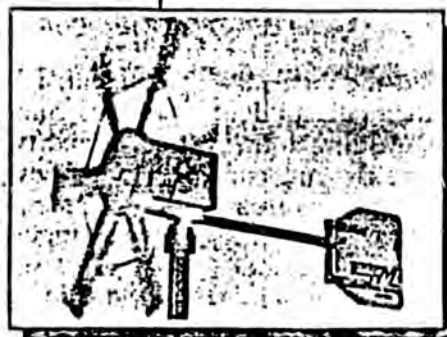
"At the end of the day salmon farming will end up like other producing sectors with only the low-cost producers surviving."

Norwegians are taking a serious beating in Europe where production continues to grow at about 50% per year while demand is at about 25%. In Norway the Fish Farmers Sales Organization (FOS) has recommended holding the number of smolts going into the sea at about 50 million this season. This is to reduce production and maintain prices in the years ahead. One of the consequences, however, will be

mortalities from algal blooms and BKD have continued to chip away at profit margins. B.C. growers have also had to cope with a relatively new and untamed culture species, chinook. It doesn't have the 20 year track record of the Atlantic species which the Norwegians and Scots have been able to use to their advantage on both the production and marketing sides. It's taken extra time and money for west coast

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of the same size mid-summer, while Norwegian Atlantics were about 50¢/lb less than the New Brunswick product.).

The depressed market conditions came at a particularly awkward time for B.C. growers. The 60 or so companies that started operations within the last four years are at a stage of maximum investment, everything's out on the line, but as yet they haven't had a good chance to make any major earnings and reduce their debt. And now, with salmon prices the way they are, you can be sure that any fish under 4 pounds is being sold below the break-even point.

The worst part is that there aren't any major miracles expected in the near future. Though there should be a modest price rise when the wild-catch season ends this fall, a significant jump in farm gate

World's shrimp producers face same problems

Shrimp producers in southeast Asia are facing the same slide in prices that hit salmon farmers this year. According to a recent article in *Aquaculture Digest* (July 25, 1989) the pond-side price for giant tiger shrimp fell from \$8.50 to \$4.40 per kilo in Taiwan last spring and only recovered slightly during the summer. Taiwanese production costs are about \$5.00 per kilo.

Once again the main culprit is a hyper-active production sector trying to sell product into already-glutted markets. According to *Aquaculture Digest* the winners in the shrimp game are likely to be the low-cost producers in China and Indonesia while the losers are going to be the high-cost, intensive shrimp farmers of Taiwan, the Philippines, Thailand and the rest of the world. Commercial shrimp fishermen will also have problems remaining competitive in the years ahead, the article adds.

prices is not likely since the ever-increasing supply of farmed product from Norway, Scotland, Chile and Ireland is flooding markets in Europe and Japan, and making serious inroads into adjacent turf in the United States. It's a classic case of supply and demand

theory in action and will only be stabilized by market expansion, strong promotional efforts, more efficient production techniques and well organized selling.

Who will survive?

The farms in the best position are those with the

ciency and deepest pockets, all linked to an efficient means of selling their product. The big integrated national and multinational companies are in a strong position. They can benefit from profits in several segments of the production, processing and distribution chain.

But there is also a future for independent farms if they can maintain a low cost of production. To do so they must run a lean operation, maximizing growth rates, while keeping feed wastage and equipment purchases to the minimum. They will want to have the least expenses possible and get the best prices they can for their product by pursuing niche markets.

Production costs are hard to pin down, but estimates run between \$2.50 and \$3.50 a pound farm gate depending on the site and

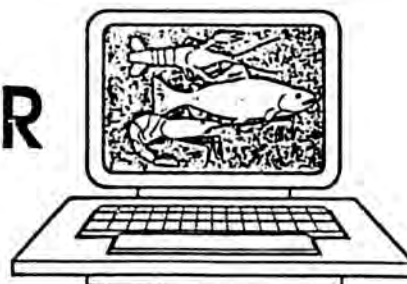
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what costs are included. This means that in mid August, with farm gate prices hovering at about \$3.00 per pound, B.C. farmers could make a modest profit if they were operating on the lean side or could be losing up to 50¢ a pound if they were on the high side. Unfortunately, for many of them there was no choice but to sell chinook and coho that were starting to mature. A couple of farmers were seriously looking into the possibility of establishing U-catch'em pens catering to wealthy U.S. yachtsmen.

Key to success

One of the most important keys to success in the years ahead will be management. As aquaculture consultant Ted Needham pointed out in a recent issue of UK-based *Fish Farmer* magazine "... every farmer has to find out what his rearing costs really are. ... he can only do this if he works to proper budgets with monthly cash flows projected over two years and updated at least quarterly. All forecasts of fish growth should be based on what has been achieved to date

improvements." Needham's advice is as sound here in Canada as it is in Scotland. The margin for sloppy record keeping slipped away sometime last winter.

What is the outlook?

Is there any light at the end of the tunnel? Depends on who you talk to, but with another 50,000 tonnes projected to come onto world markets next year (275,000 tonnes total) there's not much hope that prices will again reach 1988 levels.

Who are the consumers?

Who's going to eat all this fine, fresh fish? The European market is nearing saturation and what's left will probably go to Scottish and Norwegian producers. The Japanese market is still available but it takes work to penetrate and, once again, the canny Norwegians are already in there, picking up what the Japanese can't produce for themselves (domestic farmed salmon production for Japan is estimated at about 25,000 tonnes of coho this year). The most accessible market left is our big, convenient neighbor to the south and there's still lots of opportunity there

in the U.S. market. Marketing and distribution are pivotal. It will take a concentrated, cooperative effort on the part of all Canadian producers of both wild and farmed fish.

At the end of the day salmon farming will end up like other producing sectors with only the truly low-cost producers surviving. They will sell their fish in a well disciplined market where demand will determine the production that is planned and financed. But at this point not even a prophet could say how long the restructuring will take and who the survivors will be. Ω

FRANK SIMON

Continued from page 42

The intense competition in the salmon business doesn't worry Simon either. "There is always room for a producer who's doing things right," he says. "We want to differentiate ourselves on the basis of quality. We believe that if we do everything right, we'll have a prominent position in the market." Ω

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MIX AND MIS-MATCH

Genetic pollution is the most invidious consequence of the escape of farmed salmon, argues Richard Douthwaite, who fears that the mating of farmed with wild fish may eventually eliminate our native stocks

On 9 February 1988 a storm of unusual ferocity hit the west coast of Ireland and swept across the country, leaving a trail of destruction in its wake. In Clew Bay on the Atlantic coast winds were so severe that farmers went down to the beaches the next day with their tractors and collected large quantities of dead fish. It was no surprise that two salmon cages moored in the bay broke up, releasing more than 30,000 fish into the open sea.

It is not always the weather which is to blame for fish farm escapes. One moonless night a few months before the storm, two men in a rowing boat cut the nets of 12 salmon cages moored in Mulroy Bay in Donegal. Almost 10,000 fish, worth £100,000, got away and the farm recaptured less than a quarter of them. The raiders' motive was to catch the escapees in their drift nets and then sell them.

Only recently has concern been expressed about the effects that these escapees might have on wild

salmon stocks. Perhaps the matter should have been addressed earlier. The first Scottish attempts to rear salmon in cages were made in the late 1960s and it was as long ago as 1981 that Scotland's output of farmed salmon exceeded its wild catch, with Ireland reaching that position about four years later.

Today the problem is so large it cannot be ignored. Scottish farmed output is expected to be 54,000 tonnes in 1991, about fifty times the size of the wild catch, and Ireland hopes to produce 15,000 tonnes that year. There is so much salmon in cages at sea that if only two or three per cent break free in any year, they will substantially outnumber the native stock.

Escapes would not matter if the freed fish were genetically identical to those born in the rivers up which they swim. However, this is rarely the case. The salmon in each river – even sometimes in the carrier streams – are unique strains which have evolved in the ten thousand

years since the ice sheets retreated. In most cases escapees will not be of that strain. There are 400 distinct stocks of wild salmon in Scotland, according to a report produced last year by the Scottish Wildlife and Country Link. It also states that wild salmon transferred from one river to another perform less well and have harmful effects on the native stock.

Farmed fish are increasingly being bred, like pigs and cattle, for characteristics which suit life in captivity rather than in the wild. Consequently, if escapees enter a river and mate with wild fish, they will pass on genes which tend towards placid behaviour, late sexual development and more rapid growth. Cross-bred young are therefore less likely than pure-bred natives to survive in the sea and return to the river as adults.

Even if farmed fish turn up in a river but mate with each other rather than with the wild fish, the effects are still adverse. They will

Genetic pollution is not the only threat which fish farming poses to the survival of wild salmon. Disease organisms and parasites multiply rapidly in the confined conditions of a salmon cage and from there they can easily migrate to affect other fish. It is for this reason that salmon farmers become wary if another farm establishes cages within a few miles of his own, which is why whole lochs in Scotland are allocated to one firm.

Now it does appear in farmed salmon all over the world. Pancreas disease was first reported in Ireland in 1984

after occurring first in Scotland in 1976. Seventeen of the 21 farms in Ireland now have it and output is consequently down by 25 per cent because of deaths or stunted growth.

The most worrying disease appeared only last year, in Norway: Salmon Anaemia Syndrome kills 80-90 per cent of young fish. Again, its cause is completely unknown.

In spite of the threat that diseases present both to their own and to the wild stock, some fish farms are their own worst enemy. In Scotland dead diseased salmon are

known to have been dumped at sea rather than incinerated on land, spreading pathogens far and wide.

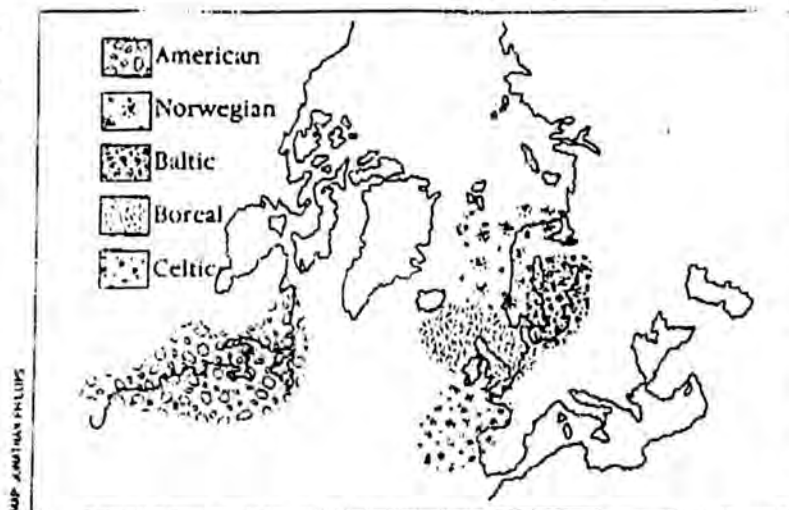
There are also two dangerous parasites. One is a tape worm which uses the edible mussel as an intermediate host, then moves on to affect wild fish. The worm weakens wild salmon, rather than killing them directly, lessening their ability to return up turbulent rivers to their spawning grounds and also making them more vulnerable to disease.

The second parasite is a flatworm, *Gyrodactylus salaris*, which has completely wiped out stocks of

wild salmon in 28 rivers in Norway. It was accidentally introduced when farmed fish were imported from infected hatcheries and put out into freshwater cages. The pest attacks parr – young salmon which have not yet developed the physical features that allow them to live in the sea. 'It is the most serious threat to Atlantic salmon in Norway today,' says Rear Admiral D.J. Mackenzie, director of the Atlantic Salmon Trust, Pitlochry. The only cure so far is a drastic one – to poison any remaining salmon in the river and then restock with uninfected fish.



Previous page: grilse from the Spey.
Above: fish jostle for food in the confinement of the cages. Right: distribution of the main races of Atlantic salmon



Although fishermen have known for hundreds of years that salmon stocks differ from river to river, scientists have only confirmed this belief within the last 20 years. Using a technique called electrophoresis they can analyse the proteins with which each fish is made up with great precision.

The first finding revealed by this technique was that there are five main races of Atlantic salmon, four of which share a common feeding ground off western Greenland. The Baltic salmon is the exception, feeding as an adult in the sea which gives it its name.

The second finding was that salmon vary genetically to a surprising extent from river to river, even within the same race. Dr Tom Cross, now of

University College, Cork, examined fish from the Bandon and Munster Blackwater rivers in the south of Ireland and found significant differences in their liver enzymes even though they were both of the Celtic race and the river mouths only 80 miles apart. Dr Cross repeated his tests with Boreal fish from the Moy and Carrowiskey in north-west Ireland and found the Carrowiskey fish very different again.

The situation is so serious that regular escapes from farms could eventually wipe out all native salmon. Research in Norway, where salmon have been farmed for much longer than in Scotland or Ireland, shows that in some rivers up to two-thirds of the fish are already of the farmed variety. 'If genetic pollution continues at its present rate, the hereditary variations of some of the river species will be halved within seven years,' says Professor Harald Skjervold whose research findings in this field all point to this alarming conclusion.

Any experienced salmon fisherman will confirm that salmon stocks vary from river to river.

salmon enter in the spring," says leading salmon geneticist Professor Noel Wilkins of University College, Galway. "Other rivers have significant runs only in late summer, when the returning fish are smaller and younger. Some rivers are noted for the fine shape of their fish, others are not."

Andrew Young, who managed the fisheries of the Duke of Sutherland more than 130 years ago, knew why this was: "Each river has its own peculiar race of fish," he wrote. "We have now shown that salmon undoubtedly return to the river where they have spawned and where they belong to the race of fish that inhabit that particular river." Professor Wilkins agrees: "Salmon return to their own river with amazing accuracy and mating occurs predominantly between individuals who were born in the same river system."

It is this inbreeding which has allowed the different strains to develop. In some rivers a higher proportion of fish come back after two or more winters at sea than after one year as grilse. Thus, if all the smolt are killed by disease or pollution one year, others are left to return to the river the following year to spawn, giving a chance for numbers to recover.

Fish farmers are deliberately trying to eliminate this characteristic: what they want are fish with a low grilse rate, because it is more profitable to produce bigger fish which spend two winters in the sea than smaller fish which spend one. Norwegian salmon fit this bill and consequently their eggs have been widely used in Scottish and Irish hatcheries instead of the native strains. Farmers also want their hatched fish to be ready to go to sea after one year in fresh water - it is obviously uneconomical to keep them in freshwater cages for an extra season. But again, in the wild, a stock in which some fish go to sea after one year and some after two has a better chance of surviving than one which does not.

Then there is the question of homing. Tagging experiments have shown that a higher proportion of wild fish return to their native rivers from the sea than do hatchery-bred fish released as fry into streams other than those from which their parents came. However, if any introduced fish which do return are caught and mated, their young will show a better return rate, which will

University College, Cork, examined fish from the Bandon and Munster Blackwater rivers in the south of Ireland and found significant differences in their liver enzymes even though they were both of the Celtic race and the river mouths only 80 miles apart. Dr Cross repeated his tests with Boreal fish from the Moy and Carrowiskey in north-west Ireland and found the Carrowiskey fish very different again.

The differences that exist between salmon from different rivers, says Dr Cross, are due to the small population sizes and the fact that they have been apart for 5,000 years. How important the differences are to survival, we cannot say. I think we ought at least to keep the different races apart."

• Contrary to claims by B.C. salmon farmers that salmon egg transfers pose little threat to wild stocks, an Atlantic salmon advisory body has advised extreme caution to avoid disease and genetic problems.

Report sees genetic threat

"None of the benefits of transfer of young Atlantic salmon and salmon eggs into Canadian waters outweigh the threats to native stocks," says a top body of Canadian fisheries scientists.

Fish farmers, the B.C. government and the federal fisheries department have allowed major imports of Atlantic salmon to Pacific waters, claiming they pose a minimal threat to wild stocks. The imports are scheduled to end in 1989.

But a review of egg imports by the Canadian Atlantic Fisheries Scientific Advisory Committee in 1986 warned that "there are unpredictable genetic risks associated with transferring European salmon stocks to North America and the potential benefits to Canadian aquaculture interests may be low."

CAFSAC is a top scientific advisory group which provides background information for Canadian representatives on international bodies studying conservation of Atlantic salmon.

Its conclusions go a long way to support the call issued by the UFAWU in May demanding a halt on any movement of salmon eggs and smolts, particularly Atlantics, until protection of wild stocks can be assured.

The CAFSAC scientists concluded that most of the benefits of imports accrued to the aquaculture industry because "it could allow the industry to expand as quickly as possible (and) it could be cheaper than purchasing local seedstocks."

In the long run, they said, it would "encourage the multinational nature of the aquaculture industry by allowing surplus seedstock in one country to be moved to another country."

But the imports carry the risk of disease, they warned, pointing to the Norwegian experience with the parasite *Gyrodactylus salaris*.

"Although the Canadian Fish

Health Protection Regulations are considered among the best fish disease control mechanisms in the world," they wrote, "they are not infallible, a fact which, along with the large number of potential pathogenic organisms that are not considered under the Canadian regulations, makes the likelihood of an unwanted pathogen or strain of pathogen entering the country with fish from a certified (disease-free) source a very real possibility."

The CAFSAC report is part of a longer study by the North Atlantic Salmon Conservation Organization, a Scotland-based body supported by Atlantic salmon-producing nations.

B.C. salmon farmers have been enraged by UFAWU calls for controls to avert genetic pollution of wild stocks by farmed fish, claiming such pollution is unknown or unlikely to occur.

But NASCO warns that importation of European Atlantics to Atlantic Canada "provide risks of undesirable impacts on North American Atlantic salmon stocks."

"There are new disease or strains of diseases which may be introduced, also hybridization with North American stocks could result in loss of genetic diversity and reduced productivity."

NASCO concluded there is "an urgent need to develop new techniques to study the effects of hybridization, e.g. potential impacts of genetic impoverishment resulting from 'domesticated' or genetically engineered Atlantic salmon stocks (cultured salmon) spawning with wild stocks and hybridization of different strains of wild stock."

NASCO recommends that until definitive measures are in place to protect the genetic integrity of wild stocks, aquaculture projects should:

• use stocks originating as closely as possible to the project area,

• use sterile fish,

• establish "river preserves where no transfers or hatchery stocks is allowed in order to maintain the genetic integrity of some wild stocks; and

• manage stocks to ensure they are not reduced below a minimum size.

The Fisherman 7-15-88

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Alaska fishermen's concerns over genetic pollution and disease problems associated with escaped pen-farmed salmon are not unwarranted. Some 13% to 20% of all farmed fish escape, as documented by Norwegian scientists and European countries.

Also, verily large numbers of fish occasionally escape from pens. Their scientific studies show that the escapees do spawn in rivers up to a proven distance of 20 kilometers from their net pens. As a consequence of this research, and with great concern for the genetic integrity and survival of their wild salmon stocks, Norway has just imposed a series of new regulations on the pen-farmed salmon industry.

No salmon farms will be located within 20 kilometers of salmon rivers, and entire fjords will be closed to farming where salmon rivers are present.

This past December in Jarvis Inlet, B.C., 300,000 pen-farmed salmon escaped in winter storms that hit Canada. Floating net pens were found for miles up and down the coast.

Norway, in the salmon farming business for 20 years, has found itself combatting new diseases in net pens every year. Last spring, fish farmers requested that the government hire 100 new fish disease specialists (adding to their 60 disease specialists and nearly 150 fish veterinarians) before allowing any new permits to be issued in their country. A group of farmers who have lost tons of their farmed salmon due to a deadly salmon disease called *furunculosis* and government controls is suing the Norwegian government for \$25 million. Last summer 5,000 fish infected with *furunculosis* escaped in Norway. Despite intensive efforts to capture the diseased fish, an infected fish was found in a freshwater stream.

In order to control disease in pens, Norway's use of antibiotics in pen farming has risen 170% in the past two years to reach a level of 48 tons, more than the use in animal husbandry and human use combined. With the present focus on health and nutrition, how does this

Other View

reliance on antibiotics fit our view of pen-farmed salmon as a healthy addition to our diets?

Norway's most severe threat to their wild salmon stocks is from a parasite called *gyrodactylus salaris* that is responsible for wiping out 30 wild-salmon rivers. The *gyrodactylus salaris* parasite entered Norway via imported salmon eggs from Sweden. Importing eggs was prohibited by regulation, but those regulations were lifted as the result of pressure by farmers with economic concerns. The only control for the fatal parasite is by treating the rivers with a chemical called rotenone; unfortunately, rotenone kills everything in the rivers, not just the parasite, hence the loss of wild salmon by the tons in Norway.

Ownership of the pen-farming industry continues to be an issue. In Washington state, a local fish farmer is suing foreign corporations, primarily Norwegian, for attempting to monopolize the industry. Who would own the farms in Alaska?

The Alaska State Legislature should fund the Mariculture Task Force, a forum where these concerns and others need to be researched.

SONYA CORAZZA of Homer heads the Mariculture Committee of the United Fishermen of Alaska. This article came "signed" by United Fishermen of Alaska, as follows: Alaska Crab Coalition, Alaska Independent Fishermen's Marketing Association, Alaska Longline Fishermen's Association, Alaska Trollers Association, Bering Sea Fishermen's Association, Bristol Bay Drift-netters Association, Concerned Area M Fishermen, Cook Inlet Aquaculture Association, Copper River Fishermen's Cooperative, Cordova District Fisheries United, Kenai Peninsula Fishermen's Association, North Pacific Fisheries Association, Northern Southeast Regional Aquaculture Association, Peninsula Marketing Association, Petersburg Vessel Owners Association, Prince William Sound Aquaculture Corp., Prince William Sound Seiners Association, Seafood Producers Cooperative, Southeast Alaska Seiners, Southern Southeast Regional Aquaculture Association, United Cook Inlet Drift Association, United Southeast Alaska Gillnetters, Western Alaska Cooperative Marketing Association, and at-large delegates, Bill Hall, Ruel Holmberg Sr. and Bob Honkola.

is just part of their market, since seafood producers have turned to an increasing degree to foreign suppliers. The reason is that the cost of local packaging has risen to 20-40% more than that of imported products.

Spokesmen for Kassagerd Reykjavikur and Plastprent, two of the main manufacturers, said demand was always subject to fluctuation and that no massive change had yet taken place. Eggert Hauks-son, Plastprent's managing direc-

tor of the company's production, the position had never been so tight, with so little tolerance of price increases on the market. Bjarni Lúdvíksson, managing director at Icelandic Freezing Plants Corporation, said that as yet only a fraction of the corporation's packaging needs had been supplied from abroad. "Obviously we have to hold our own costs down, and while the dollar is so weak we must use the opportunity. If the króna is devalued, everything will change overnight."

NEWSNET

PROCEEDINGS against Mike Ikenze, the former Icelandic Consul in Nigeria who acted as an intermediary in attempts to sell stockfish from a group of Icelandic producers in 1984, have been dropped following his agreement to repay one-quarter of the GBP300,000 which he received for use in landing sales contracts.

SHRIMP CATCHES around Eldey off the southwest of the country are likely to be banned for some time following poor results of trial catches in the area. Only 20kg were caught in a two-hour trial haul recently. Closure of the area could have serious results for

local fishermen, who have in many cases filled their quotas for other species.

LUMPFISH CATCHES this season have been very poor, and production of lumpfish caviar is expected to amount to only about 9,000 barrels, against 27,000 last year.

A NEW EXPORTING enterprise has begun in Sandgerdi, a village in the southwest of the country, where two local residents, Thorbjörn Danielsson and Eiríkur H. Sigurgeirsson, have been assisted by chef Sigmar B. Hauksson in marketing whelk and crab in Sweden and France. Sales to a Swedish restaurant have already been agreed, and exports to France are to start in the autumn. The Swiss market is also being considered.

JUNE CATCH FIGURES



In tons	June		Jan-June	
	1988	(1987)	1988	(1987)
Cod	80 624	89 489	311 592	400 500



Hopes high for capelin

The capelin season began on 10 July, with 49 Icelandic vessels sharing a provisional quota of 398,000 tons. With the prices for meal and oil rising because of poor soya harvests in the USA and growing demand in the Far East, hopes are high for a successful season. The quota is to be revised in November.

News from Iceland August 1988

Salmon fishing:

Problems posed by sea-cage escapees

Salmon fishermen trying their luck this season in the Ellidaár rivers, which flow through the eastern part of Reykjavík and are popular with local residents, are complaining that large numbers of the salmon they are landing are "escapees" from aquaculture stations and are consequently smaller and less attractive than the wild types.

According to biologists studying the problem, the fish are fairly easy to recognize. They generally have damaged fins and are shorter and

fatter than the true natives of the river. In many cases they weigh only about one pound.

Biologists are concerned about the effects of the presence of the cultivated fish in rivers. A survey made two years ago estimated that 60-70 cultivated salmon had entered Ellidaár, a significant number in terms of the genetic effect on the local stock. Studies from Norway show that up to 10% of the fish in rivers near large aquaculture stations can be "escapees."



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Fish Farming Still draws opposition

By DAVID FOSTER
The Associated Press

RICH PASSAGE, Wash. — The history of salmon-fishing in the stormy North Pacific is filled with tales of brave fishermen riding the wild seas, but its future is being shaped in calmer waters.

Thousands of salmon in this sheltered arm of Puget Sound are captives in sunken pens the size of basketball courts. Crowded fin to fin, they swim endless laps, gobbling feed pellets and being fattened toward the day they'll be scooped up and whisked to market.

Yet while the crenulated coastline and pristine waters that stretch from Washington's Puget Sound to southeastern Alaska might be ideal for fish farming, the political climate is not so welcoming.

In Alaska, where commercial fishermen are a powerful

Please see Back Page, FISH FARMING

Anchorage
Daily News
2-20-90

FISH FARMING: Young industry has run into resistance

Continued from Page A-1

lobby, bumper stickers in fishing towns proclaim "Real Fish Don't Eat Pellets," and the legislature is considering a permanent ban on fish farms when a two-year moratorium expires in July.

In Washington state, salmon farmers have the official blessing of the legislature, but that has helped little in the face of challenges from fishermen and environmental groups, which have defeated several proposed farms.

The fish waste produced by a two-acre salmon farm is equivalent to the sewage produced by a town of 5,000 people, claims a Washington citizens group called the Marine Environmental Consortium.

Environmentalists also fear introduced species such as Atlantic salmon — favored because they fetch a higher price and are more docile than Pacific salmon — will corrupt the local gene pool and spread disease. Wealthy owners of shoreside homes, meanwhile, don't want fish farms spoiling their views.

Promoters call fish farming an efficient way to help meet the world's growing appetite for fish. Not only does it provide a year-round supply of fresh salmon to supplement the seasonal wild catch, they say, it also creates jobs free of the hazards of commercial fishing, one of the nation's most dangerous occupations.

They also contend salmon-farming provides an economic incentive to preserve clean water.

"We're the best environmentalists of all, because we're dependent on it," said Jerry Polley, site manager for Global Aqua, the nation's largest salmon farm. "If something's wrong with the water quality, we're going to be the first to complain."

Production of farm-raised salmon, here and abroad, has boomed in five years, flooding markets traditionally held by wild salmon and driving down prices.

"For the first couple of years, as more salmon was around on a year-round basis, the farmed fish seemed to help the wild market," said commercial fisherman Randy Babich. "Now it's a battle at the retail counter."

Fish farming, or aquaculture, is hardly a new concept. For years, farmers have raised oysters in the Northwest, rainbow trout in Idaho and catfish in the Southeast. But techniques have developed more slowly in domesticating salmon, the mainstay of fisheries off Oregon, Washington, British Columbia and Alaska.

For years, it was practiced only by the Norwegians, forced into salmon farming by their declining wild fish populations. But interest has spread quickly since 1985, after Norway refined methods to raise salmon cheaply enough to compete with the wild catch.

In 1983, world production of farm-raised salmon was 23,500 metric tons, just 3 percent of the 670,000-ton wild salmon catch. By last year, farm-raised salmon production had soared to an estimated 202,000 tons, or 30 percent of the relatively constant wild catch.

Norway still leads the pack, producing about 75 percent of the world's farm-raised salmon, but other places, including Scotland, Chile, Canada and Iceland, are catching up.



Daily News file photo

Alaska Department of Fish and Game technician feeds penned salmon at Little Port, Walters in southeast Alaska.

The United States, with 50 fish farms in Washington state and Maine, lags far behind, producing 1 percent of the total.

Many of the U.S. salmon farms are run by Norwegian companies, including Global Aqua's four-acre operation in Rich Passage, 10 miles west of Seattle.

Global Aqua's farm is fairly typical: a huge raft anchored offshore holds 40 pens, each lined with a net holding as much as 15 tons of fish, which range from finger-size smolt to fat-bellied salmon 2 feet long.

A half-dozen workers tend the pens from metal walk ways, filling automatic feeders and mending nets. At harvest, workers herd fish into one end of the pens, scoop them out with an oversize dipnet and load them onto a boat. The salmon are still kicking when they reach a Seattle processing plant 30 minutes away.

In the three years it takes to raise salmon to harvest farmers contend with prowling otters, hungry sea lions and diseases that can wipe out whole farms if left unchecked.

Aquaculturists say their operations will never be a major blot on the coastline.

"It would take just 40 acres of farms to produce all of the salmon that was imported into the United States in 1988," said Chris Gibson of Sea Farm Washington in Port Angeles. "The industry does not need a lot of space."

It may need even less space in coming months. Worldwide growth of salmon farming and recent overproduction in Norway have glutted the market with fish. Prices have plunged, and many farms are selling below cost just to keep cash flowing.

In British Columbia, lax regulation and a surge of Norwegian investment capital helped the number of fish farms soar from five to 135 in the past six years. But now many are in trouble. Nineteen have filed for receivership in the past year, and small businesses are being bought out by large investors better able to outlast the lull in prices.

Aquaculture boosters profess confidence in their long-term place in the salmon trade.

n

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The Fisherman (B.C.) Dec 188

Fish farm use of antibiotics poses threat

The widespread use of antibiotics in fish culture poses a serious potential threat to public health, says a Washington State zoologist, and should be strictly controlled.

Arthur Whiteley, a zoologist with a long-standing interest in microbiology, told a Washington State Shorelines Hearing Board inquiry Nov. 14 that antibiotic use on fish farms will produce antibiotic resistant bacteria in the human food chain.

If these resistant bacteria occur in humans, "the diseases caused by that organism could not be medically treated."

"It would eliminate from the tools of the physician those he would want to control disease."

Whiteley was qualified as an expert witness in the hearing, which was set up to hear an appeal against a decision by Skagit County to deny permits for a fish farm near the mouth of the Skagit River.

Whiteley produced a pile of scientific studies which show that "in almost every case resistant bacteria is selected by the use of antibiotics in fish culture."

In other words, use of antibiotics to treat bacteria causing fish disease kill all but the bacteria which is resistant to the medication.

Studies have proved that this

resistance can be transferred from one type of bacteria to another, Whiteley said, and can create resistance to several types of antibiotic.

Whiteley said this type of transference has been documented in the case of a vibrio bacteria which causes disease in fish. In a laboratory, this resistance was transferred to different bacteria which exist in the North Pacific food chain and are pathogenic to humans.

"This has not been observed in the wild," he said, "but there is a probability it could occur. Experiments indicate the genetic mechanism is in place ... and we can predict it will occur in nature under certain conditions."

The Centre for Disease Control in Atlanta has found the same phenomenon in beef and poultry, he said, and blame it for a dramatic increase in salmonella.

The only solution, he said, is to ban the use of antibiotics in fish culture which are used in human treatment.

In B.C., both oxytetracycline and erythromycin are used in fish culture even though they also are used in human medicine. There is no inspection to determine whether or not this transference of resistance is occurring in B.C. or whether fish sold to consumers is free of antibiotics.

HEAWI loses close vote

Farms offer 'surplus' chinook

Surplus chinook smolts offered to the fisheries department by the B.C. Salmon Farmers Association should be destroyed, says the UFAWU, rather than released in a makeshift enhancement scheme.

At least eight farms offered the smolts for sale earlier this month, suggesting that some kind of technological breakthrough led to survival rates above their forecast.

In fact, the proposal to sell the "surplus" chinook to the Salmonid Enhancement Program is a bid for a bail-out by an industry facing collapsing prices, said the UFAWU May 10.

"Prices for farmed salmon have tumbled a dollar a pound in the past few months," said union spokesman Geoff Meggs. "They simply can't afford to feed these fish and are hoping the taxpayer will bail them out."

Fisheries department spokesman Ted Perry said at least six

million fish were available in farms and hatcheries from Duncan to Powell River. He said DFO would not buy any fish, nor accept donations of fish that were not genetically pure Big Qualicum or Robertson Creek stock.

The fish would be released by DFO into the wild.

At press time, the farmers were insisting on selling the fish, which will starve unless fed by mid-June.

"Release of these fish poses a disease threat to wild stocks and would open the door to private ocean ranching," Meggs said. "Fish farmers have resisted every effort to win appropriate govern-

ment regulations, but they're not shy about asking for government money when times get tight."

Uncontrolled growth of the industry has seen farm fish harvests rise to 6,000 tonnes last year from 387 tonnes in 1986. Prices have crashed from an average annual farm gate value of \$3.17 to \$2.27, according to B.C. provincial statistics.

"Spending on salmonid enhancement has been frozen," Meggs said, "but apparently money may be found for this boondoggle. It's a slap in the face to SEP volunteers who have donated thousands of hours and faced steady funding cuts to even to consider this kind of scheme."

Consumer group urges farm salmon controls

Both levels of government should step up their regulation of the fish farming industry, says the Consumers' Association of Canada (CAC), to protect the consumer and wild salmon stocks.

In a comprehensive task force report released April 11, the CAC says that "the industry is not in the public interest." The report also says that "the industry has sold out its own interests" and "the industry is beginning to lose its industry."

In the task force recommendations:

- stepped-up provincial government monitoring and regulation of the aquaculture industry;
- public sector testing of fish for market to determine levels of residues;
- monitoring of environmental impacts and prosecution of regulatory violations; and
- consumer labelling to distinguish farmed and wild fish and to report harvest dates.

The report also urges the B.C. Salmon Farmers Association to rejoin the Canadian General Standards Board committees on feed and feed additives to seek ways to reduce residues and contaminants.

The task force expressed concern about colorants, drugs and other medication used in aquaculture "which may remain in the product at the point of consumption."

Antibiotics are a very real problem, the report says, because "long-term consumption of sub-clinical dosages of antibiotics by humans (for example, by consuming antibiotic-containing fish) can lead to the development of resistant strains of bacteria in the body system."

Treatment of infection in humans can be undermined by such doses, the report notes and "there is a potential for allergic reactions by individuals sensitive to antibiotic traces."

(The farm industry has established a Quality Assurance program with spot-checking which it says will control this problem. Fish must be held 42 days after drug treatment before going to market. The provincial government is recommending at least double that time.)

The task force recommends much tighter controls and monitoring of antibiotic use, including certification of farmed staff handling drugs.

The CAC proposes an industry commitment to "produce, catch and process fish without negative impact to the environment."

All types of fish, farmed and wild, should be checked for chemical residues, PCBs and pesticides.

Consumers should insist on protection of wild stocks, the CAC concludes. "A fish farm industry at the expense of the wild stock would, in fact, reduce the choices of fish for the consumer."

Algae, disease, low prices hammer B.C. salmon farmers

British Columbia's fish farming industry, wracked by collapsing prices, disease, algae blooms and bankruptcies, is facing a major corporate shakedown.

Despite continued assurances by industry leaders that all is well, signs of trouble include:

- ★ a rash of receiverships affecting about 12 farms and three companies;

- ★ devastating algae blooms throughout the Strait of Georgia which have wiped out some farms and crippled others;

- ★ industry agreement that the Sunshine Coast, the scene of a salmon farming goldrush only three years ago, may see an exodus of operations to colder, algae-free waters; and

- ★ continued low prices which are driving down wild salmon prices and forcing more producers to the wall.

The most visible problem has been the algae blooms, which sweep in on hot, calm days and suffocate salmon in their pens within hours. Persistent low levels of algae are believed to contribute to stress and disease.

Losses to various diseases continues to be high on many B.C. farms, according to industry publications.

According to the *Sechelt Press*, a plankton bloom during the Labor Day weekend wiped out five farms, severely damaged five others and destroyed 300 tons of salmon worth about \$2 million. The regional dump, which was to be closed to farm waste Oct. 20, was opened especially to handle the emergency.

Farms in Agamemnon Channel took the brunt of the assault, but the entire

region was affected. Local fishermen heard radio chatter from farmers seeking some place to dispose of the sudden large volumes of dead fish.

Professor Larry Albright of Simon Fraser University told a public meeting on the impact of fish farms later that month that the entire Strait of Georgia is so infested with the algae that farms will be removed from the area completely.

Meanwhile, prices continue to drop, heading below \$1 a pound according to some market reports. The break-even point is estimated to be around \$2.25 to \$2.50 a pound level.

The crunch of falling prices, provoked in part by aggressive marketing by Norwegian producers, is hitting farms hard in many areas.

Coopers and Lybrand, receiver for three firms put into receivership by secured creditors, reports continued financial problems for farms in the Campbell River area.

Eric van Soeren, receiver for North American Salmon Corp., operator of six sites around Quadra Island, and Sea

Grow, with operations at Nelson Island, said Sept. 19 that new buyers had not been found.

But both firms were thrown into receivership by Norwegian banks seeking to slow their losses on loans to B.C. producers. Now van Soeren is seeking a buyer for Atwood Bay farm near Desolation Sound and expects a busy fall with other troubled firms. He would not disclose who is buying the farm.

As a result of the chaos, the normally boosterish industry is shying away from an optimistic DFO analysis of the industry which predicts production could hit 80,000 to 100,000 metric tons by the year 2000.

Product of 50,000 tons is very realistic, the Price Waterhouse report claims. But industry spokesmen believe that disease and other problems will keep them in the low-growth range of about 20,000 tons until the turn of the century.

(Ed: The above article was reprinted with permission from *The Fisherman*, Geoff Meggs, Editor)

Fish farmer sues foreigners

A Washington state fish farmer and his corporation have sued in U.S. District Court alleging that foreign national interests have attempted to monopolize the commercial fish farming industry in his state. Lee A. Holley III of Lopez Island in northern Puget Sound alleges in his suit that foreign business interests, primarily

Norwegian, operated through American national fronts to destroy competition in the industry, remove local control and violate antitrust laws.

Holley, owner of Northern Nights Fish Farms Inc., is suing several Norwegian corporations that have either sole or partial ownership of farms in Puget Sound. Also named in the suit are state officials and other individuals who allegedly contributed to illegal activity. Holley charges that large financial contributions were made to state political campaigns by the foreign interests, which, he says, also assisted in defeating a moratorium proposed against new businesses in San Juan County, where Holley lives.

Comments from the Norwegian companies and state officials were being withheld pending litigation, according to several reached by telephone.

— Brad Matsen

The Fisherman January 25, 1989

Fish farm drug hits wild stock

Fishermen harvesting shellfish off Scotland say a chemical used by salmon farmers is killing marine life.

Scientists at Aberdeen University have linked the chemical with increasing numbers of wild salmon going blind.

The controversy has erupted over Nuvan 500, which farmers use to control pests. Its byproduct, dichlorvos, is listed by the 1987 North Sea Conference as one of 26 most dangerous chemicals in waterways.

The debate highlights the severe problems salmon farming disease treatment can pose for

the marine environment and other marine life.

According to the *London Observer*, in a report on its wire service Jan. 11, scientists at Norway's Institute of Marine Research in Bergen have found the chemical could be damaging sensitive lobster and crab larvae around the farms. Mussel and oysters also absorb the chemical.

Nuvan is strictly controlled on land, but salmon farmers have easy access because they are not subject to the same regulations.

Fishermen and environmentalists are demanding a ban on Nuvan, but farmers say they will

be decimated by sea lice if Nuvan is taken from their arsenal. They favour voluntary controls.

Nuvan is not registered for use in Canada, meaning it is unavailable. Valery Brooks, of the B.C. Salmon Farmers Association, said sea lice are not a problem in this province, but a special session on lice is scheduled for an aquaculture conference in Dartmouth next month.

Scientists there have concluded that sea lice threaten the viability of salmon farming in Atlantic waters and 96 percent of farms must use treatments to control the parasite.

A new problem for fish farmers

Foes of Puget Sound pens make an issue out of virus new to Northwest

By Jane Hadley
P-I Reporter

An exotic virus that caused fisheries officials to order almost 4 million fish and eggs destroyed at two hatcheries last week has given new ammunition to foe of fish-raising pens in Puget Sound.

Opponents of the net pens said yesterday they plan to make an issue of the virus at hearings tomorrow and Thursday on a state Department of Fisheries environmental impact statement on net pen fish farming.

But proponents of expanded fish farming on Puget Sound say it would be irresponsible to speculate on the source of the virus. They said there is no evidence pointing to Atlantic salmon or net pens as the cause, as some opponents charge.

But, Jerry C. Grover, of the U.S. Fish and

Wildlife Service said logic pointed to the Atlantic salmon.

There are 13 existing net pen operations in the state, most of which grow the Atlantic salmon. Close to 20 other net pens have been proposed.

The virus, known as viral hemorrhagic septicaemia or "VHS," was found in cell cultures in two hatcheries in December and positively identified Feb. 17. It has never before been reported in North America. It has caused substantial fish losses in Denmark and other European countries.

No fish reportedly have died of the disease in Northwest waters to date.

The virus was found in cell cultures at the Fish and Wildlife Service's Makah Hatchery near Neah Bay and a joint state-private hatchery at Glenwood Springs on Orcas Island.

"From the conversations I've heard, everyone's

looking at the net pen aquaculture industry in Puget Sound and Canada," said Grover, fisheries associate manager for the U.S. Fish and Wildlife Service regional office in Portland.

Grover said it's important "not to be finger-pointing because we don't know" and labeled such a guess as "speculation."

He added, "It doesn't take too much gray matter to put two and two together. You have to ask how the thing leap-frogs from Europe to Puget Sound. The common denominator would be Atlantic salmon. That's what the scientists are talking about."

The state Department of Fisheries, several scientists and an industry spokesman immediately jumped on Grover's comments.

"I'm certain this issue will be thrown at the

See FISH, Page B4

Fish: Virus origin to be probed

Page B1

try, when, in fact, I think it's endless," said Anne Kirske, executive director of the Washington State Fish Growers Association.

But environmentalists were just as indignant yesterday and accused the state Fisheries Department of being a "booster" of net pen farming.

"This is really a terribly threatening thing," said L. Joe Miller, president of the Marine Environmental Consortium, a coalition of numerous local groups fighting proposed net pen operations around Puget Sound.

"It's the kind of thing environment groups we work with have been anticipating and dreading and, now, here it is," he said. "The state and industry have said, no, this is not a realistic concern. They've said we're only worried about our views. Now they say this (virus) has come in on somebody's boot, which is really an

insulting suggestion."

Grover discounted the "boot" theory and some other suggested sources. He said it's "kind of far-fetched, even impossible" to believe that somebody who traveled in Europe brought the virus in on his or her boot. The virus can survive only a short time outside living tissue, he said.

Grover said his agency, the state Fisheries Department, the Wildlife Department, and Indian tribes are launching a massive testing program to try to track down where the virus might have spread. The U.S. Fish and Wildlife Agency, for example, will test the 35 miles of the Sooes River and its tributaries that are upstream of the Makah Hatchery.

The current theory, he said, is that Sooes River fish shed the virus and it got into the hatchery through its water intake.

The Fisheries Department will test saltwater around Glenwood Springs as well as some net pen operations. He said test results

should be available in late March.

Grover and Dr. Marsha Landholt, a fish pathologist at the University of Washington, said the rainbow trout is the most susceptible species of fish to get the disease from the virus. Coho salmon can carry the virus and pass it on without getting sick. But fisheries experts are worried about steelhead, because they are a type of rainbow trout.

Several weeks ago, Washington state rainbow trout were injected with the VHS virus in a federal laboratory and suffered "a high incidence of mortality," said Peck of the Fisheries Department. Landholt said VHS may seem "like a scourge to us because it's a new disease. But if you talk to people in Denmark and Europe that have VHS, they don't seem to worry to the degree we are. They seem to manage around it."

Landholt said they disinfect and destroy all fish in all infected hatcheries as well as those downstream.

Seattle Post-Intelligencer

February 22, 1989

Puget Sound anglers hooking Atlantic salmon

by Brad O'Connor
Times staff reporter



Steve Loop caused quite a stir in June when he showed up at Seacrest Boathouse in West Seattle with a 5½-pound Atlantic salmon he'd caught while fishing for blackmouth near the Southworth Ferry landing.

Atlantics are not supposed to be swimming around Puget Sound and it was only the second Dave Nelson, Seacrest manager, had seen in his 17

years at the boathouse.

Atlantics — 1 million or more of them — are in the Sound, but all are supposed to be confined to net pens where they are reared by private growers for markets mostly in the south, the East Coast and California.

Loops' Atlantic was an escapee.

Since June, Nelson has weighed about a dozen others, all caught on hook and line, which is remarkable. While Atlantics provide some of the world's greatest freshwater sports fishing, they rarely are caught on sports gear in salt water.

"Ponder this," said Nelson, "if we've seen a dozen here, there must be many, many more swimming around out there."

He's correct. There are more.

Will Sandoval, biologist for the Muckleshoot Tribe, said his tribal fishermen have told of netting several Atlantics during summer and fall salmon seasons.

"Some told of catching three or four a day," he said.

Three that Sandoval checked during a state and tribal test fishery for sockeye in July were approaching sexually maturity.

"What concerns me is that they may have been looking for somewhere to spawn. Even if they can't spawn successfully, there's a risk they could be carrying some exotic disease."

Decades ago, attempts were made to establish spawning runs of Atlantics in Washington and British Columbia. All failed and the belief among some fisheries scientists is that further attempts to establish Atlantic runs on the West Coast also would fail.

In fact, most fisheries managers nowadays shudder at the thought of Atlantics spawning in any West Coast stream — not only because of the risk of disease, but because of increased competition for food and space with native trout and salmon.

Reports of Atlantic catches are funneled to Lee Hoines, a Department of Fisheries biologist at Olympia. Of the 203 reported to him last year, most were caught by commercial fishermen in the Bellingham area and around the San Juans.

However, two were caught in fresh water, including one last October near the mouth of the

on the Nooksack River and another in July in Cedar Creek, a tributary of the Nisqually.

What if they did spawn successfully?

"My assumption is that they can't. I can't say that absolutely is the case, but I hope they don't," said Tim Flint, another WDF biologist.

De Yonge was right on fish-farm perils

By Arthur H. Whiteley, John W. Brookbank and Annamarie K. Johnstone

In his article (P-I Op-Ed, March 29), State Land Commissioner Brian Boyle took severe exception to John de Yonge's March 5 Focus Section article on fish farms.

We believe that de Yonge's pithy comments were right on target.

Boyle argues against relating fish-farm pollutants to untreated human sewage. In terms of organic sludge whose decomposition consumes dissolved oxygen from the water, and loading of the water with various nitrogen compounds and phosphate which act as fertilizers, the two pollutants are essentially alike.

The question of dilution of these discharges is relevant.

Metro's West Point Wastewater Treatment Plant dumps its soluble discharge into the main channel of Puget Sound at considerable depth, permitting dispersion. Fish-pen wastes are deposited on the site as feed pellets and feces, which settle as sediment and dissolved components that enter the water column. The sites are channels or embayments with restricted water flow, not rivers, with a one-way flow that flushes things away. Tides flow and ebb and currents in bays create eddies, leading to retention and accumulation of the pen wastes.

Metro sewage must undergo treatment, at substantial and justified expense to our citizens who create this waste. Discharge is monitored by a permit, mandated by federal Clean Water Act. The fish-pen solid waste enters the bay raw, untreated, without disinfection — and free to the fish farmer. Washington's pens have avoided the federal discharge permits, although the Sierra Club Legal Defense Fund threatens the state with legal action if this requirement is not enforced.

real, just as it has been in Norway.

Boyle's understanding of the *Gyrodactylus salaris* issue in Norway is at variance with reports from Dag Dolmen of the Directorate for Nature Management in Trondheim. This trematode parasite has been introduced into Norway, according to Dolmen's analysis, "through stocking with salmon parr from infected hatcheries/fish farms." Johnson and Jensen report that total salmon catches in infested Norwegian rivers (1970 to 1984) dropped to 16 percent of levels in uninfested rivers. These were mostly wild fish, which have been nearly decimated by a parasite spread through "hatchery/fish farm" stockings. The smolts that are stocked in salt water fish farms are reared as fry in fresh water hatcheries.

In November, Svein Mehli, head of the division of the Directorate for Nature Management concerned with protection of wild salmon in Norway, testified for Skagit County before the State Shorelines Hearing Board. Mehli reported the escape into Norway waters of thousands of pen-reared salmon carrying furunculosis, the appearance of bacterial kidney disease in farmed stock, the presence of redmouth disease in 300 salmon pens — a disease previously unknown in Norway — and of his concern about "other diseases knocking at the door." Given these facts, we disagree with Boyle's position that "environmental arguments against fish farms are essentially specious."

Boyle objected to de Yonge's extrapolation of the targeted 100 fish pens to the sewage equivalent of Seattle's sewage outfall — as "scientifically absurd." But Boyle can find a graph on pages 133 and 134 of the draft Programmatic Environmental Impact Statement to which he referred that shows that 100 pens will load Puget Sound with biological oxygen demand (organic sludge) 150 percent higher than that of the West Point plant, and add an amount of dissolved nitrogen to the embayments equal to that from this sewage plant. We think de Yonge stated things correctly.

In Norway, which has much smaller farms than are permitted here, pens are moved every couple of years, to try to mitigate environmental problems. Moreover, they are located closer to the open water at the mouth of fjords. In some regions, alternate fjords are kept free of pens to create security zones between sites.

Atlantic salmon can become diseased in their pens and they do escape. This year commercial fishermen have recorded many Atlantics caught along with native salmon south of San Juan Island and between Bellingham and Point Roberts. Escaped Atlantics have been picked up in the Nooksack, Skagit and Nisqually rivers. These are adult fish, apparently ready to breed. We feel that there remains a possibility that they will breed, that they will become established and that they will compete on the breeding grounds with native salmonids — how successfully neither we nor Boyle knows yet. The presence of potentially diseased pen escapees among breeding natives poses a danger that in our opinions is

Boyle must be well aware of the current concern about appearance of viral hemorrhagic septicemia (VHS) in resident salmonids and doubtless has seen the U.S. Fish and Wildlife Service summary of March 3, 1989, which reports that this virus is confirmed in yearling coho and steelhead trout and fall chinook salmon fry from the Makah hatchery. We assume that he is aware of the opinion from the U. S. Fish and Wildlife Service that the logical, though not proved, avenue for entry of this new disease is via Atlantic net-pen culture. If these are proved to be "specious arguments," then we can drop them.

Is it fair for "the working stiff" on the gillnet boats, purse seiners and reef boats — white and Indian alike — to be crowded off their fishing grounds, or worse, to have their resource diminished? Should clam growers, who have husbanded their rich resource for three generations, be forced to contend with pollution from a fish pen?

In order to generate new jobs and revenue, a wiser course for our state would be to accept the mitigation measure in the draft EIS — to culture salmon in tank farms. These should be on privately owned land with effluent monitored and regulated by permit and then discharged into deep water. In this way the negative impacts of floating mariculture — navigation hazards, storm-caused breakup of pens, dissemination of disease, release of untreated wastes, difficulties with antibiotics and impairment of aesthetics — would be eliminated. Lastly, land-based fin-fish culture would place the costs of this industry on those who profit from it.

■ Dr. Arthur H. Whiteley is professor emeritus of zoology at the University of Washington; Dr. John W. Brookbank is professor emeritus of microbiology and cell biology at the University of Florida; Dr. Annamarie K. Johnstone is a marine microbiologist. Soapbox columns are contributed by readers.

Senator Eliason

Juneau Empire
2-20-90

Japanese buying up Norwegian fish

Surplus of pen-reared fish threatens Alaska's seafood markets in Japan

THE ASSOCIATED PRESS

ANCHORAGE — Norwegian fish farmers are attempting to sell a huge surplus of pen-reared salmon in Japan, long the main market of Alaska seafood processors.

The 88 million pounds of frozen fish could add to an already glutted Japanese salmon market, and drag down prices for this summer's Alaska salmon harvest, according to a U.S. embassy cable from Japan.

More than 80 percent of Alaska's salmon goes to Japan, most of it frozen.

The Norwegians so far have been unable to sell most of their frozen fish, but may cut prices in order to move it, according to the cable released by the U.S. International Trade Administration. If that happens, the Norwegian salmon "will be a threat to U.S. frozen, chum, coho and sockeye salmon," the cable said.

"If they dump it on the market, that would create one hell of a mess," said Roger Dahlke, market-

ing manager for Trident Seafood, a Seattle processor with plants in Bristol Bay and the Aleutians.

Dahlke said Trident is currently trying to sell a lot of Alaska salmon in Japan. But the company is making little headway in a market swamped with both fresh farm-raised fish and frozen fish left over from last season.

As of December, wholesale prices for sockeye salmon had dropped by more than a third from summertime levels, according to Pacific Fishing Magazine. Prices haven't moved much since then, according to industry officials.

Bill Atkinson, publisher of a seafood newsletter that tracks Japanese markets, doubts the Norwegians will be willing to drop their price low enough to compete on the glutted frozen market.

"The Norwegians are not really interested at selling at a loss," Atkinson said. "And the Japanese are not going to accept a high price for them when there are all the other less ex-

pensive fish available."

But one unnamed importer cited in the embassy cable said at least 44 million pounds of the frozen Norwegian fish probably will end up in Japan, knocking down salmon prices just as Alaska's annual harvest begins.

"This scenario, if true, is very critical for U.S. salmon fishermen," embassy officials said. Japanese buyers might import Norwegian salmon in an attempt to force down Alaska salmon prices during pre-season negotiations, the cable said.

"With this type of volume they could start eroding traditional (Alaska) sockeye markets," said Gary Ervin, president of the Kenai Peninsula-based Seafoods From Alaska.

Pen-reared salmon production has been expanding rapidly since the Norwegians pioneered the aquaculture technology in the early 1980s. Salmon farming has been banned in Alaska but is legal in Europe, South America, the South Pacific, Canada and the Pacific Northwest.

Farmers feed the salmon until they reach market size. They offer the fish fresh on a year-round basis. Most Alaska salmon is sold frozen or canned.

Within the past five years, farm-raised salmon have taken over most of the European market, as well as much of the East Coast market, according to a report by the state-funded Alaska Finfish Farming Task Force Force.

Last year Norway produced more than 330 million pounds of salmon, a nearly 60 percent increase from 1988, and farmers have been unable to sell all that fish.

That production, combined with a record Alaska salmon harvest and a strong Japanese chum harvest, created a huge glut on the worldwide market. The amount of unsold fish is estimated by the state finfish task force at more than 200 million pounds. That equals the entire 1989 export of Alaska salmon to Japan.

When Norwegian fish farmers could not sell all their fish, they froze large amounts and began pushing it toward Japanese markets long claimed by Alaska.

"I think the impact of farm-reared salmon on traditional Alaska markets is profound, and simply going to accelerate," said Chuck Becker, Anchorage district director of the U.S. Commerce Department's International Trade Administration.

Additives to the Environment of Net-Pen Reared Fish
Pacific Marine Fisheries Commission 42nd Annual Meeting
Seattle, Washington, October 16-18, 1989

PHD Arthur H. Whiteley and Annamarie Johnstone

We have been asked to address our remarks to the matter of additives to the environment of net-pen reared fish. In this particular forum, we assume the emphasis should be on additives that may have an impact on humans when these fish come to market, rather than the impact on the plant and animal communities in the natural environment, though these are not wholly separable.

By its very nature, net-pen rearing of salmon requires the use of numerous chemicals, sometimes in large amounts, some used in the fresh water hatcheries to produce the fry and smolts, some used in the grow-out period in the marine pens, and others used during processing of the fish for the market. Partial lists are shown in Table 1, compiled from Austin and Austin, 1987, from a 1988 report for the Nature Conservancy Council by the University of Stirling, and from other sources.

The lists include chemicals used in salmon and in other forms of fish culture, both in this country and in foreign countries. Inasmuch as farmed fish are imported from some of these other countries, inclusion of these chemicals in the lists may be relevant to the matter of seafood surveillance in the United States marketplace.

Chemotherapeutics. The most relevant additives for present purposes are antibiotics and therapeutants used to control bacterial diseases. Because of stress, disease may cause losses of 30-40%, sometimes higher. Diseases in salmon farms include *Vibrio anguillarum* (vibriosis), *Aeromonas salmonicida* (furunculosis), *Aeromonas hydrophila* (hemorrhagic septicemia), *Yersenia ruckeri* (red mouth), *Vibrio salmonicida* (Hitra disease), *Renibacterium salmonarum* (bacterial kidney disease). To combat these diseases, medicated food containing antibiotics is supplied. In Washington, the FDA approved antibiotics and therapeutants are oxytetracycline (OTC), Romet 30 (sulfadimethoxine and orhomoprim) and sulfamerazine. In addition, Tribissen (sulfadiazine and trimethoprim) is used in Norway and Scotland, and in British Columbia erythromycin is used to control BKD. In Japanese fish culture a wide variety of antibiotics has been used, but has recently restricted the use of chemotherapeutics in cultured fish (Aoki, 1988, pers. comm).

In the US, Norway, BC and Scotland, doses of drugs are as indicated in Table 1B. It is anecdotal, however, that additional amounts of antibiotics are used by farmers, who may mix the drugs with feed and binders. Control of use of antibiotics in Norway and Scotland is regulated by veterinarians, and this is supposed to be the case in B.C. In the British Isles it is apparently easy to find legal loopholes to permit other antibiotics and doses to be used (Austin and Austin, 1987). In Washington fish farmers are supposed to notify the Department of Fisheries if they use antibiotics, but veterinarian supervision is not required. Generally approval exists for only therapeutic use of these

drugs. Nonetheless they often are used prophylactically inasmuch as sick fish may not take the medicated food.

There appears to be no medical or public health supervision or regulation here, or in the other fish farming countries, on the use of antibiotics and chemotherapeutics other than the requirement of FDA approval of the three drugs and their dosages. There appears to be no monitoring by agencies of the use of these drugs or their persistence in marketed fish.

The amounts of drugs used are enormous. In Norway last year, 48 metric tons (105,000 lbs) of OTC alone were used - more than in animal husbandry and human health uses combined (Mehli, 1988, pers. comm. and press accounts). This figure has grown from 13,691 lbs in 1984 (Midtlying, 1985). The 1984 figure for Tribissen, nitrofurazolidon and sulfamerazine is 30,204 lbs (Midtlying, 1985). Comparable figures for British Columbia and Washington are not at hand. Assuming the dosages cited earlier for the 13 Washington pens, calculation leads to a first approximation of about one ton of OTC, a figure similar to that given by a Washington fish pen operator (Dr. A. Bill, 1989, pers. comm.).

The relevant issue here is "Do these uses affect man?" Consumers clearly would be exposed to residual antibiotics in the fish meat. Because of the potential for these residues producing a serious problem in public health, Japan has recently restricted the use of chemotherapeutics, and does not allow cultured fish to move to market if residual drugs can be detected in fish meat (Aoki, 1988, pers. comm.). The potential for adverse effects has been emphasized by Austin (1988, conference in Vancouver, B.C.; Austin and Austin, 1987). The current regulations for control of such residues are based on admittedly minimal research. The FDA requires a 21 day withdrawal period after the last medicated feeding of OTC and 42 days for Romet 30 before slaughtering for the market. In B.C. the withdrawal period is 42 days, and in Norway 61 days. Very few data exist for measurement of persistence of these drugs in fish flesh after feeding. McCracken et al (1976) measured the presence of trimethoprim in trout muscle 77 days after medication; Salte and Liestøl (1983) calculated that the withholding period for trout receiving OTC should be 100 days at winter temperatures, and for Romet 30 they recommended withdrawal periods of 60 days, above 10°C. All authors emphasize that temperature is a seriously complicating factor - residues of Romet 30 persisted for several months in fish at colder temperatures, leading Salte and Liestøl to recommend using the component drugs only in summer. Clearly these limited data do not support the FDA regulation of 21 days. New, more refined measurements of drug residues in salmon coming to market clearly are needed - a recurrent theme of the Austins. Some of these measurements are being made now at the University of British Columbia by McErlane et al. (1989), and Grondel et al. (1987) have published a pharmacokinetic analysis of OTC distribution in carp. In the absence of more detailed studies, humans ingesting farmed salmon may be receiving subtherapeutic doses of antibiotics. One would like to see regulations established for testing the product, by agencies, as it comes to market to ensure the absence of detectable residues. Methods used should be such as those approved by the National Committee for Clinical Laboratory Standards

used by the Clinical Laboratories, Laboratory Medicine, University Hospital, University of Washington.

The issue extends beyond the limits of the penned salmon. Much of the antibiotic fed escapes into the fluid environment and, notably, into the sediments that accumulate beneath the pens (Jacobsen and Berglund, 1988), where it may be exposed to native fish, shellfish, and other indigenous species, thus providing another avenue to humans who may catch and consume these forms.

The medical consequences of the mis-administration of antibiotics are numerous, and are well discussed in such modern treatises as Goodman and Gilman (1985) and Kucers and Bennett (1987). A number of them are antigenic and elicit immunological hypersensitivity responses; some have toxic effects in various tissues varying with the physiological and health state of the person; some particularly should be avoided during pregnancy; tetracyclines lead to discoloration of infants' teeth and may interfere with bone growth; some, notably the tetracyclines, may lead to the development of superinfections by resistant strains of bacteria; they may interfere with the normal immune response; and the breakdown products of antibiotics, including OTC, can be toxic particularly in individuals with compromised livers. Basically, it is poor medical practice to ingest unneeded antibiotics or deteriorating antibiotics.

Another cluster of problems associated with use and misuse of antibiotics is the generation of strains of pathogenic bacteria that have resistance to the drugs. Such strains have now appeared in essentially all fish culture communities that have been adequately tested. Mostly the resistance factors are carried on R plasmids, which also usually are found to carry resistance determinants for 1 to 8 additional antibiotics, thus showing multiple drug resistance. In high proportions, these R plasmids are transferable to other bacteria, and thus drug-resistance may be disseminated to other ecosystems. Studies at the Centers for Disease Control have shown that outbreaks of salmonellosis could be traced to drug-resistant *Salmonella* derived through the foodchain back to land farms associated with agricultural antimicrobial use (Cohen and Tauxe, 1986). It is prudent to evaluate the possibility for a similar generation of R plasmids in fish farms and their dissemination to human populations in the marketplace. When drug-sensitive populations of pathogens are replaced by drug-resistant populations, then treatment of the affected fish becomes ineffective, and, if the R plasmids are in human pathogens, treatment of patients would be adversely affected. Particularly, it is a general principle that medically important antibiotics, including oxytetracycline, the sulfas and erythromycin, should be restricted in their nonmedical uses to minimize R plasmid selection and transmission.

When antimicrobials are used in fish farms near commercial or recreational shellfish beds, there is the further potential for drug-resistant organisms to be concentrated by the shellfish, through filtration, and thus enter human populations.

Food additives. The dry pellets, fed to the penned fish in the marine environment, contain fish meal, grains, fish oils and carbohydrates, supplemented by minerals and vitamins as indicated in Table 2. While these additives have no direct human import, it is reported that planktonic blooms of

the ichthyotoxic dinoflagellate, *Gyrodinium aureolum*, were enhanced by the biotin in fish farm wastes (Turner et al., 1984). These blooms cause mortalities to cultured fish, and, unfortunately, to wild fish as well (Bullock et al., 1985).

Pigment is added to the feed to produce a colored flesh in farmed salmon, inasmuch as the color of wild salmon flesh is derived from natural food organisms. In Great Britain, the carotenoid canthaxanthin, an analog of astaxanthin common in natural food organisms, is used in the form of carophyll red. It is stated in a report from the University of Stirling that this use is banned in the US because of possible carcinogenic properties of canthaxanthin (NCC Report, 1988). To date a petition for its use has not been submitted to the FDA (FDA, Seattle Office, 1989). A petition is presently under consideration for use of astaxanthin as a colorant. A main local supplier adds canthaxanthin as a colorant. There clearly are gray areas here where research and regulation is sorely needed.

Many wild fish are rich in omega 3, polyunsaturated fatty acids. A higher ratio of omega 3/omega 6 fatty acids is believed favorable for maintaining low cholesterol levels in humans. Cultured fish and other sea foods, because of their artificial diets, may have low levels of omega 3 fatty acids, and thus unfavorable ratios of omega 3/omega 6 (Suzuki et al., 1986; Chanmugam et al., 1986). Consequently, individuals eating farmed salmon in the expectation of gaining this supplement will typically be erring, unless the farmer has specifically added it as a dietary supplement and indicated this in marketing. The dry pellets supplied locally generally do not have omega 3 acids added as a supplement (Moore-Clark Co., 1989, pers. comm.) because these are contained in the fish oils of the fish meal used.

Moist pellets, which are more commonly fed during the hatchery phases of salmon farming, are derived from fish meal that is pasteurized, combined with additives, and frozen. However, moist pellets used in some fish farms in Puget Sound contained *Salmonella* spp. (Draft PEIS, WDF, p. 116, 1989). Moist pellets used in British Columbia have been found to contain *Salmonella* (Kelly, 1988, pers. comm.; Babink, 1988, pers. comm.). In these cases it is unclear whether the pathogens had survived the pasteurization, or had appeared subsequently. These pathogens can persist for a period of time in marine waters, are harbored by fish in polluted waters, without harm to them (Buttiaux, 1963). Marine shellfish can concentrate *Salmonella* and transmit them to humans. There is, therefore, a potential for fish culture to join animal husbandry as a mode for affecting humans in the manner described by Cohen and Tauxe (1986).

Hormones. At this time, hormones are being used in B.C., experimentally and perhaps to an extent in actual culture, to control the sex, size and behavior of penned salmon, both *Oncorhynchus* spp. and *Salmo salar*. Gonadotropin, gonadotropin releasing factor and analogs, and antiestrogens have been used in adult females to modify spawning. Androgens and estrogens are used to cause feminization, and, in combination with other techniques, to produce triploid and tetraploid stocks for production of sterile salmon. A review is provided by Donaldson (1986).

In general, these treatments are used on egg-producing females or on eggs and sperm, and the likelihood of carry-over of hormones to adult, marketable fish is tiny. Anabolic steroids including methyl testosterone,

thyroid hormones, somatotropins, certain pituitary hormones can be used to accelerate growth in juveniles and the timing of smoltification (Donaldson, 1986). If these hormones, or androgens and estrogens, were used for growth acceleration or other effects on near-harvest adults, then there would be cause for concern to human consumers.

Pesticides. A remarkable list of agents are or have been used in salmon culture. Examples are: formalin, malachite green, acriflavin, Nuvan, Neguvon, Chloramine T, MS222, copper sulfate, tributyltin, diquat, in addition to the chemotherapeutics. Some are used in Scotland and Norway which apparently are not used, or not permitted, in the U.S. and B.C. Lists are incorporated into Table 1 of this presentation.

Treatment of salmon lice (*Lepeophtherius salmonis*). These copepod ectoparasites pose a severe problem for adult penned fish in Scotland and Norway. In Europe, organophosphate pesticides (Nuvan^R (dichlorvos; Scotland) and Neguvon^R (trichlorfon which forms dichlorvos; Norway) are primarily used. Fish are treated by immersion in a concentration of 1 ppm for 1 hr, as needed. In 1984 39,600 lbs of Neguvon were used in Norway (Midtlyng, 1985). They are inhibitors of acetylcholinesterase activity in the cholinergic nervous system. These agents not only kill fish lice, but other crustacea in the environment as well, including commercially important species such as crabs, lobsters and mussels (Egidius and Moster, 1987), and they cause potentially serious problems to the treated fish (Davies and McKie, 1987; NCC Report, 1988). These agents are restricted by the EPA in the U.S. (Seattle EPA Office, 1989). In Washington, the carbamate Sevin^R (carbaryl) has been suggested for use for treatment of salmon lice, and it is used in oyster culture for controlling ghost shrimp. Sevin, also, is an inhibitor of acetylcholinesterase. Sevin has recently been restricted in parts of the United States, and its discharge is regulated by an NPDES permit. BRAVO (chlorothalonil), a fungicide has been suggested for and used recently on fishpen nets, a use banned by EPA because it is a class B carcinogen (EPA, Seattle, 1989).

Disinfectants and Antifoulants. Formalin and malachite green have been used for control of ectoparasites and fungi, usually in the fresh water phases of farming. Malachite green, a potential teratogen (NCC Report, 1988), is now banned. MS-222 is used under certain conditions for anaesthesia, but with a 21-day withdrawal period for clearance from tissues. Hatchery ponds are sterilized with chlorine.

To prevent fouling of nets by growth of algae and encrusting invertebrates, fish farmers have treated nets and pen structures with the antifouling agent, tributyltin (TBT). This substance, at exceedingly low concentrations, has a variety of adverse effects on marine invertebrates and perhaps on vertebrates (Bailey, D.S., 1987). When, in 1987, farmed salmon appeared in the Seattle markets carrying substantial amounts of TBT in their flesh, the state enacted a law prohibiting this use and partially eliminating it from use on boats. A similar law exists in the national statutes, in Great Britain and other parts of Europe. Despite this ban, a Canadian Governmental memorandum on August 11, 1988, titled "Private Salmon Hatcheries and Netpen Facilities, Some Serious Concerns" indicates that 25% of BC pens are still treated with unregistered boat hull paints, sometimes including TBT, which liberate

large quantities of particulate paint into the water, sometimes onto oyster beds, thus creating potential hazards for two kinds of aquacultured products.

If antifoulant is used on nets now, usually it is copper-based. Copper and other heavy metals are highly toxic to many marine invertebrates. Standards for permissible amounts of copper in farmed fish flesh appear to be lacking.

Summary. There are a number of chemicals and additives used in net pen culture now that have the potential for adverse human impact. Often these are used at the discretion only of the user, and with little or no external monitoring. There appears to be little or no input into this regulation by public health agencies.

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Table 1
Chemicals Used in Net Pen Culture of Fish
(From Austin and Austin, 1986; The Nature Conservancy
Report, Scotland, 1988; and other sources)

Chemotherapeutics

Oxytetracycline	Streptomycin
Romet 30 ^R (sulfadimethoxine and . orthomeprim)	Sulfisoxazole
Sulfamerazine	Kanamycin
Tribrissen ^R (trimethoprim	Fumequine
Erythromycin	Chloramphenicol
Penicillin G	Chloramine T
Oxolinic acid	Acriflavin
Minocycline	Acetic acid
Clindamycin	Formalin
Kitasamycin	Malachite green
Rifampicin	Iodine
Hyamine 3500	Iodophor
Copper sulfate	Benzalkonium
	Nitrofurantoin

Pesticides

Dichlorvos (Nuvan^R, an organophosphate)
Trichlorfon (Neguvon^R, an organophosphate)
Carbaryl (Sevin, a carbamate; used in oyster culture)
Diquat

Antifoulants and Disinfectants

Tributyl tin - now banned
Copper paint
Bitumen
Chlorine
Chlorothalonil

Anaesthetics

MS-222 (tricaine methane-sulfonate)
Benzocaine
Carbon dioxide

Food additives

Colorants-canthaxanthin
Minerals
Vitamins
Omega 3 fatty acids

Table 1B
Doses of Antimicrobials Commonly Used in Salmon Net-pen Culture

Antimicrobial	Dose, mg/kg of fish/day	Days of Treatment
Oxytetracycline	75	10
Romet 30	50	5
Sulfamerazine	220	14
Tribrissen	30	10
Erythromycin	10-25, or unspecified	4-21

These regimens are repeated 2 or 3 times a year

Table 2
Mineral and Vitamin Food Additives
in Salmon Pellets
(Data from Nature Conservancy Council Report 1988, and
Moore-Clark Analysis)

Minerals

Calcium phosphate
Magnesium sulfate
Sodium Chloride
Potassium chloride
Iron sulfate
Zinc sulfate
Copper sulfate
Manganese sulfate
Cobalt sulfate
Chromium chloride
Ethylenediamine dihydroiodide
Selenium

Vitamins

Thiamine hydrochloride
Riboflavin
Calcium pantothenate
Niacin
Pyridoxine hydrochloride
Biotin
Folic acid
Cyanocobalamin
Inositol
Ascorbic acid
Choline chorlide
Menadione
alpha tocopherol acetate
p-aminobenzoic acid
Retinol acetate
Vitamin A
Vitamin B12
Vitamin D3
BHA-BHT, antioxidant

Alaska Water Resources Board
Resolution No. 89-22

Possible Impacts of Fish Farming

WHEREAS: A strong market for fresh salmon and therefore a demand for rearing areas exists for pen reared salmonid fin fish.

WHEREAS: The State of Alaska has an abundance of salt and fresh water environments ideally suited for this economic activity.

WHEREAS: There is a persistent and ever growing clamor on the part of fin fish growers to have Alaskan water resources made available to them.

WHEREAS: The State of Alaska has a very large, extremely valuable wild fish population distributed throughout the state upon which very valuable commercial, subsistence and recreational fisheries are also dependent.

WHEREAS: After an initial period of very rapid growth and expansion into lucrative markets for their product the fin fish industry elsewhere in the world is now beset with problems of disease, parasitic infestations and escapement of penned stocks leading to the degradation of wild salmon stocks.

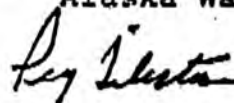
WHEREAS: There are among the so far identified dangerous diseases and infestations those that are demonstrably able to be transported from country to country and from continent to continent under present conditions.

WHEREAS: Among these afflictions there are disease infestations for which there is no known treatment and parasitic infestations which once established would require the roetinine treatment of entire river systems to eradicate.

NOW THEREFORE BE IT RESOLVED: The Alaska Water Resources Board recommends that there be no fin fish farming of salmon or trout in Alaska until it can be established that the disastrous consequences of inadequately regulated fin fish farming now being experienced in other parts of the world will not occur here; and

NOW THEREFORE: The Board further recommends that the Fin Fish Task Force created but not funded by the 15th Alaska Legislature be reactivated, funded and charged with the task of assembling the necessary information to assure that fin fish farming, if allowed, will not constitute a deadly hazard to our wild stocks.

Adopted this 9th day of March, 1989
Alaska Water Resources Board



Peg Tileston, Chairwoman
Alaska Water Resources Board

The Fisherman (B.C.) Dec '88

Norway sees mounting disease, pollution threat from fish farms

The deadly salmon disease furunculosis, previously unknown in Norwegian waters, is breaking out of fish farms and threatening beleaguered wild stocks, says a top government official.

Svein Aage Mehli, head of the division of Norway's Directorate for Nature Management which is charged with protection of wild salmon, told a Washington State regulatory hearing Nov. 14 that 5,000 farmed salmon infected with the disease escaped this summer into Hjørundfjorden near Molde.

Despite an intensive fishery to catch the fish and a system of net barricades at the mouths of salmon rivers, an infected fish was found in fresh water, he testified.

"If the disease spreads to natural stocks, the situation may be out of control in Norway," Mehli said.

"I feel we are on a sharp edge with diseases. If we have (the parasite) *Gyrodactylus salaris* in more rivers we may just accept our wild salmon is extinct."

Furunculosis is present in B.C. waters and leads to loss of appetite, fluid retention, ulcers and eventually death in up to 60 percent of affected stocks. It had not been found in Norway until smolt transfers from outside the country were undertaken. *Gyrodactylus* also has been linked to fish farming and is treated by killing all host fish with rotenone.)

Mehli was qualified as an expert witness at a hearing in Lacey, Wash., of the Shoreline Hearings Board, which is hearing an appeal of a Skagit County decision to reject a fish farm in the mouth of the Skagit.

The fish farm proponents, a tribal group, are appealing the refusal of the Skagit County commissioners to issue permits for the farm on the basis that it threatens Skagit salmon and could pollute the sensitive estuary.

Proponents have denied there is any evidence of a disease threat to wild stocks from farmed salmon.

As a result, the appeal hearing has turned into a deep investigation of the environmental impact of salmon farms on wild stocks. Mehli was flown from Norway to testify on behalf of county commissioners, who backed up their decision by referring to the Suzuki Foundation report on Norway called *Journey to the Future*.



Svein Aage Mehli, of Norway's environmental agency, testified last month to a Washington State regulatory agency.

Mehli responded angrily to suggestions by fish farm proponents that there is "no conclusive evidence" of disease spreading to wild stocks from farms.

"We are very concerned," he said. "It is not right to ask for conclusive evidence at such an early stage."

Furunculosis imported on smolts destined for salmon farms broke out two years ago and authorities felt they had eradicated it, he said.

This year's outbreak was a shock, as was the continued spread of bacterial kidney disease (BKD), which is very difficult to treat even with antibiotics.

"BKD poses a problem for natural stocks because it was diagnosed for the first time in 1980 and previously did not exist in nature," Mehli said. "It is very easy to see a connection between BKD (in salmon farms) and wild stocks in the river."

"It's reasonable to conclude" BKD spread from farms, he said, and Norwegian scientists "see logic in such a connection." BKD is diagnosed or suspected in 100 netpen operations and hatcheries.

Antibiotic use on Norwegian fish farms climbed to 48 tonnes last year, equal to the requirements for human use and animal husbandry combined.

"If you see the first diagnosis of redmouth disease in Norway just two years ago, it's impossible to ask what happened in such a case," Mehli continued. "Veteri-

narians underline the seriousness of that situation, that net pen operations have an impact."

Mehli said redmouth now is present in 300 facilities but was unknown until 1985.

"Net pen operations may function as a multiplying station for disease," Mehli said. "They will give greater disease pressure on natural stocks that we didn't see before netpen operations."

Mehli said further studies on the straying of farmed fish into rivers show a sharp increase in the presence of farmed fish. A year ago, 18 percent of the fish found in the rivers studied were of farm origin. In 1988, the figure rose to 40 percent. The origin was confirmed by scale samples and electrophoresis.

Asked if strong regulations could control disease, Mehli agreed they could "minimize problems if they go far enough. Norway has not gone far enough."

Norway is proposing a ban on the transfer of eggs and smolts between regions of the country, he said, and considering a ban on all imports of sexual products like eggs and milt.

Even though existing regulations list diseases which must not be present in imported eggs, the list is limited and "in Norwegian cage culture we know other diseases are knocking at the door."

In theory, he said, fish farmers "want to get rid of disease, but if they see profit in the short term they may react in a different way."

Mehli also confirmed fears of negative genetic effects of farmed fish on wild stocks if they interbreed. "We are very afraid it could affect their ability to migrate."

Netpen salmon have undergone careful selection for size and growth rate, he said, but researchers may have inadvertently selected other characteristics which could have a negative impact if reintroduced into wild stocks.

"First there is a genetic problem and second an environmental problem. If Atlantic salmon (escaping in Pacific waters) have the same requirements as coho or steelhead trout — and we know that salmon escape in great numbers — then you will have competition for space in the rivers."

As to their ability to spawn, "we see them in rivers, they are mature, ready to spawn and we are very worried of what will happen."

New zoning regulations now being implemented in Norway will ban farms within 20 kilometres of salmon rivers and close entire fjords to farming where

Should corporations use public waters for private profit?

By John de Vange
P.I. Columnist

Consider these things about floating fish farms:

■ A typical net-pen fish farming operation on Puget Sound produces pollutants "equivalent to untreated sewage from approximately 10,000 persons." That's what a state report says. The pollution comes from fish feces, urine and food pellets deposited in the water and on the bottom of the Sound.

■ There are 13 commercial pens now operating over 80 acres of aquatic lands leased from the state. These 13 operations daily deposit to the bottom of Puget Sound nearly six times as much oxygen-demanding fecal matter and other wastes than does Metro's Renton Waste Water Treatment Plant, which serves 430,000 people. Materials that deplete oxygen can radically change or kill off the life forms in an unpolluted environment.

■ Siting 27 more fish farms, now delayed by opposition from upland property holders, environmentalists and county officials, would add a pollution load to Puget Sound equal to that from building four new cities the size of Everett.

■ The "proper siting of 100 farms would not have significant impact on the aquatic environment." So says the state's just-issued environmental impact statement on floating net pens.

Those 100 fish farms would produce 55 metric tons of oxygen-demanding waste per day. That's 18 more tons a day than Metro's Renton and West Point treatment plants together produce from the sewage of 1 million people.

Analysis

The environmental impact statement was prepared by three private organizations that supply fish-farm companies with paid expert witnesses.

Under Gov. Booth Gardner, state policy is to outlaw any increase of fish farming in the state's waters and to downplay environmental problems that aquaculture may bring.

The official evangelist is the Department of Agriculture's Dr. John Pitts, veterinarian and former Jefferson County commissioner who appears at meetings and hearings — in one case, as a paid witness for a net-pen applicant — to psych-out environmental objections raised by net-pen opponents.

Opponents are not just those who own shoreline property, who howl against a net pen being erected in their aquatic front yard. They've been fired up by what the state's environmental impact statement confirms: A new, nearby fish farm can give view property a one-time, financial knock.

Opponents include environmentalists like David Orman of Friends of the Earth, who says: "Why should we be happy about fish farms that dump tons of fish poop every day into Puget Sound?"

They include commercial fishermen like the Puget Sound Gillnetters, who know something that has largely escaped the notice of sport anglers:

Atlantic salmon, not a salmon but a sea-run trout of the Atlantic seaboard, have escaped by the thousands from net pens here and in British Columbia. The B.C. government booms fish farms with a gusto exceeding even the la-ra-ra-boom-de-ays from Gardner's men and from Brian Boyle, the separately elected head of the Department of Natural Resources, which manages shore bottoms and other public lands.

What's more, hundreds of thousands of Pacific salmon have also escaped from the pens, especially in British Columbia.

So what does that mean? The state environmental impact statement points out that escaped exotic fish like the Atlantic salmon "could establish self-sustaining populations and compete with indigenous fish," such as steelhead trout.

That may not be far off. In the North Puget Sound last year, commercial and sports fishermen caught hundreds, probably thousands, of Atlantic salmon weighing up to 10 pounds.

More dangerous by far is that for the first time ever at least three sexually mature Atlantic salmon showed up miles from the sea in the Nooksack River last year, near Bellingham, and one in the Nisqually, near Olympia. Rumor has a fourth Atlantic netted in the Skagit River at Sedro-Woolley.

What's the worry about four fish, though they may be forerunners of thousands to come?

The environmental impact statement warns that accidental importation of "exotic" fish diseases associated with fish farms in Europe could devastate existing salmon and trout runs in state rivers.

Just in the past two weeks the public has learned that such a disease, viral hemorrhagic septicaemia or VHS, has shown up at two hatcheries in state waters. It is the first time ever that VHS has been found in North America.

VHS, state fish-disease experts say, has never been found to occur naturally in Atlantic salmon. They say that the chance that Atlantic salmon in pens here are the source of the disease is "virtually zero." The disease was found in chinook and coho salmon, species raised extensively at federal, state and tribal hatcheries and at commercial net-pen operations.

The impact statement does not dwell on what has happened in Norway, where other diseases associated with that country's extensive net-pen industry have ravaged wild Atlantic salmon runs in 32 rivers. The government was forced to poison some streams, set up a salmon sperm bank to preserve wild genes and consider banning any new net pen within 12 miles of a river mouth, an obvious rule not yet under consideration here.

Nor does the statement dwell on the possibility of migrating wild fish catching indigenous fish diseases from net pens here or of net pens recapturing spreading such diseases into our river systems.

Fish farmers themselves helped call state attention to fiscal build-up beneath pens, a build-up that kills crabs, mussels and other bottom dwellers and can release poisonous hydrogen sulfide gas, which



can kill all fish in a pen in minutes.

In 1986 Commissioner of Public Lands Boyle limited new net pens to sites where the water is at least 40 feet deep at low tide, a mile away from other pens and with enough current to flush away food and fecal deposits. He also limited the surface area of new pens to two acres or less.

These requirements ended up in "Recommended Interim Guidelines" written for the departments of Agriculture, Ecology, Natural Resources and Fisheries, which share regulation of the fish-farm industry, with Agriculture and Pitts calling most of the shots.

With no force of law and offered to help county commissioners site pens under state law, the guidelines deliberately do not talk about navigation problems, use conflicts and, most important, esthetics.

If the two sides could stop feuding and start talking about necessary standards, we could have a safe, considerable industry.

—Peter Katz,
fish farmer

Commissioners have learned that if they turn down a net-pen proposal, the applicant will seek a full rehearing before the state's Shorelines Hearings Board, with Pitts certain to show up to put the stamp of Gardner's administration on having the permit granted.

Dusan Coffey, an Island County commissioner, put the matter thus in a 1987 letter:

"While there may be legitimate reasons for denying a permit to locate a salmon net pen, local government has been placed in the position of being able to say 'yes' to such a proposal but not 'no'."

Under Gardner, the Department of Ecology has refused to require net pen operators to get pollution-discharge permits under the federal Clean Water Act.

The Sierra Club Legal Defense Fund has announced it will sue the U.S. Environmental Protection Agency if necessary to force EPA to force Ecology to force every net pen operator have such a permit.

The state's draft environmental impact statement declares that the major impacts of net pens can be cured by "proper farm siting to assure dispersion of wastes, flushing of the site and protection of sensitive areas."

It's a view that one can come to easily while talking to such eloquent fish farmers as Peter Katz, a marine architect running the Paradise Bay Co. net farm at Port Townsend, and John Forster, a Ph.D. in aquaculture running Sea Farm Washington's similar

operations at Port Angeles.

Both pen systems, clean, low in the water, quiet, full of fat, bright Pacific and Atlantic salmon, are barely noticeable in the working harbors that contain them.

But that's quite different than siting a pen in Frenchman's Cove on the west side of Hood Canal, as International Marine Farms Inc. proposes.

Or siting a pen, as Tailfin Inc. proposes, in a main salmon and trout-fishing cove between East Point and Bella Beach on the west side of Whidbey Island, where from her home Margaret Jorgensen looks out across Saratoga Passage to Camano Island. She heads the Marine Environmental Consortium, made up of 20 citizen organizations that oppose fish and other floating farms.

Katz argues for having the state set standards for siting and operating net pens, to ensure that the pens do not harm the environment and to give the net-pen operators a clear but flexible regulatory framework to live with. But Katz feels the industry is getting a bad rap from people like Johnston, who, he says, simply don't want a net pen in their aqueous front yard.

"If the two sides could stop feuding and start talking about necessary standards, we could have a safe, considerable industry," he says. "But we're years away from that."

Forster, president of the Washington Fish Growers Association, dismisses esthetic revulsion as the main drive behind the opposition to what he characterizes as a clean, beneficial industry with vast prospects.

"It's more than esthetics. It's an intrusion into a life style that they don't like and they're using environmental problems as a smokescreen. Because of that, the debate is dishonest at the moment, terribly dishonest."

Johnston, at a gathering in her home with other members of the Marine Environmental Consortium, characterizes such comments as unwelcome.

"The net pen issue raises a fundamental issue of public policy that involves more than us, though the environmental questions are real and cannot be brushed aside by the industry or the state. The key question is: Should the public waters of Washington State be turned over to a few corporations for private profit?"

That's a proper question for us all to ask. It must be answered by political action. Gardner's administration has already answered: Yes.

To me it seems stupid to site more pens in pristine salt and fresh waters, yes, an application is pending in Eastern Washington until we have better, more extensive scientific information about siting than what the draft environmental impact statement supplies.

Until we know if pens can be sited safely anywhere, we would be blind to commit ourselves to putting major sources of pollution in our unpolluted waterways and in waterways we are trying to clean up.

The greediness of Norway's rivers demonstrates that

West Coast Shake-out

Supply and demand tremors rattle B.C. growers.

by Peter Chettleburgh

THE SHAKE-OUT has begun. Sagging salmon prices, excessive debt, high interest rates and a worldwide glut of salmon have triggered a period of consolidation in the west coast salmon farming industry. On the East Coast where prices are firmer and farmers have been more conservative in their approach there is still a margin of profit, but it too is narrowing as prices continue to slide in the face of skyrocketing worldwide production (220,000 tonnes in '89).

Everyone said it would happen, but no one really wanted to believe it. On the west coast, where prices have been hovering at or below production levels for most of the summer, reality has struck home with a vengeance. The need for cash flow has caused many farmers to sell a lot of small pre-market fish for ridiculously low prices - 90¢ a pound was one figure this writer heard mentioned earlier this summer.

Since May we have heard of at least four west coast farms that have been put into receivership, another two that have been sold at fire sale prices and at least a dozen more which are in desperate need of working capital. Everyone else is holding on, praying for higher prices in the fall.

One of the big ones that went into receivership is the Fremstad Group which has four farms, a hatchery and processing plant in the vicinity of Campbell River. It's being handled by the accounting firm of Coopers

and Lybrand which was looking for a buyer as we went to press in August.

Triangel Resources near Tofino on the west coast of Vancouver Island found itself in trouble earlier this spring and was taken over by General Sea Harvest, an affiliate of the Finnish conglomerate, Cultor Ltd. (formerly Finnish Sugar Co.), the parent company of Ewos Canada. General Sea and B.C. Packers were also looking at the assets of Ross Passage Salmon Farm, another west coast operation which found itself in trouble earlier this spring.

One other company that is known to be in receivership is Seagrow Industries Inc. (400 tonne capacity) with two sites in Jervis Inlet. The receiver, Coopers and Lybrand, was still looking for a buyer as we went to press.

There were also some amalgamations before the current shake-up began. For instance, within the last year Five Fishes (Sechelt) and Nordic Ventures (Quadra Island) were purchased by B.C. Packers, the large west coast fishing company-cum-processor owned by Westons. Apparently B.C. Packers is on the lookout for other expansion prospects, but doesn't plan to walk into a situation unless all the biological criteria, etc. are just right.

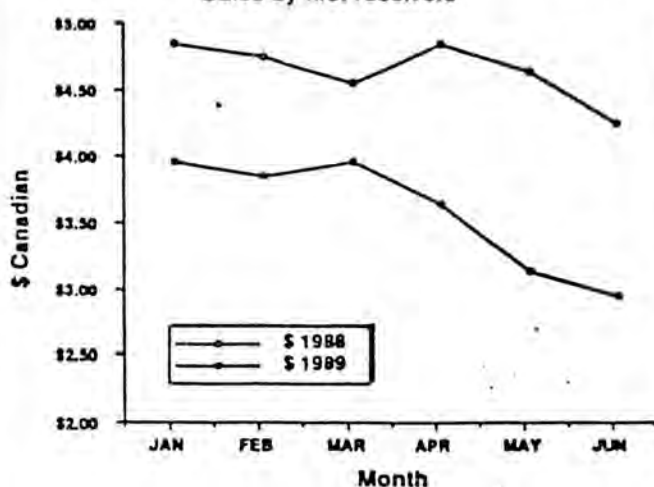
As a general comment, it can be said that the farms with some of the worst financial problems are in the Sechelt area. This is where the goldrush started in 1984

and it is the area that received a lot of the initial debt financing from Norway. Now the Norwegian financing has all but dried up and few investors are prepared to put additional

salmon farms at about \$250 million. And this does not include an additional investment of at least \$50 million in the supply and services sector (cages, feed, nets, etc). Of this total in-

Fresh B.C. Salmon Prices 4-6 lbs.

Sales by first receivers



The graph above tells the story. The top line shows prices for B.C. farmed salmon (4-6 lbs.) during the first six months of 1988, while the lower line shows prices for the first six months of 1989. Prices are FOB Vancouver (Source BCSFA).

money into the farms because of their current debt structure. Adding to their woes are the growing conditions which many in the industry agree are not as good as those north of Campbell River or on the west coast of Vancouver Island. Indeed, some of the salmon farm sites may end up in the hands of oyster growers who are already lining up for a chance at leases that will probably turn out to be better for shellfish than salmon.

\$250 million investment

A recent estimate puts the total investment in C.

vestment, at least \$85 million has come in through Norwegian banks, much of which is now exposed to major losses, according to a recent report in a Norwegian newspaper.

Even for the smaller farms, those with debt in the neighbourhood of \$2-3 million, the debt servicing costs of 15-18% will skim off between \$300,000 and \$400,000 a year. That's a lot of fish, and a lot of debt relative to inventory, assets and equity, particularly in an industry that has yet to establish a solid production base.

>>>>

Problems for suppliers

Although the depressed prices are toughest on the farmers, the suppliers behind the scenes are also hit hard. Scantech Resources of Sechart folded in July after becoming one of B.C.'s major suppliers of fish farm equipment in just four years. President Clark Hamilton says that he lost everything in the failure but is still a strong believer in the future of the industry in British Columbia.

Another supplier which was hard hit was Powell River Net Loft which ceased doing any further work for the fish farming industry in June. The suppliers that are the most exposed are the companies which specialize solely in fish farming equipment and services for the B.C. market. They don't have the flexibility of companies that serve other industries or those that have national distribution.

What went wrong

It's small consolation that salmon farmers around the world are facing the same problems of overproduction and falling prices. Indeed, both the Scots and

a continued shakeout in the Norwegian smolt producing sector.

In British Columbia the problems seem even worse. Excessive debt financing, high jacking rates and high

"At the end of the day salmon farming will end up like other producing sectors with only the low-cost producers surviving."

Norwegians are taking a serious beating in Europe where production continues to grow at about 50% per year while demand is at about 25%. In Norway the Fish Farmers Sales Organization (FOS) has recommended holding the number of smolts going into the sea at about 50 million this season. This is to reduce production and maintain prices in the years ahead. One of the consequences, however, will be

mortalities from algal blooms and BKD have continued to chip away at profit margins. B.C. growers have also had to cope with a relatively new and untried culture species, chinook. It doesn't have the 20 year track record of the Atlantic species which the Norwegians and Scots have been able to use to their advantage on both the production and marketing sides. It's taken extra time and money for west coast

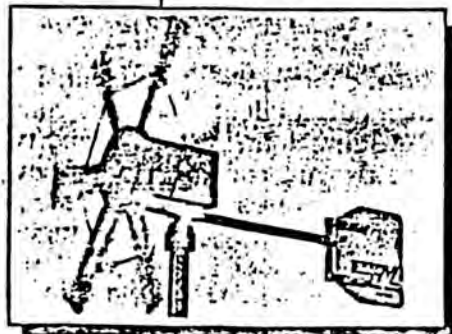
producers who already arrived late in the world growth curve of farmed salmon production.

Glutted markets

As if this weren't enough, world markets are currently glutted with high inventories of frozen Pacifics, a legacy of an oversupply last year and ample reserves of fresh and frozen farmed Atlantics on world markets this year. Farmed Atlantics now take preference in most European and some North American markets, areas that were once dominated by wild Pacifics. Consequently, the price for both farmed and wild Pacifics has seen a dramatic fall since last December with farm gate prices for farmed chinook (6-9 lb.) dropping more than \$1.50 per pound to \$2.50 and lower for a while early this summer. (New Brunswick Atlantics (6-9 lb.) were wholesaling for about \$1.25 more per

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pound than B.C. chinooks of the same size mid-summer, while Norwegian Atlantics were about 50¢/lb less than the New Brunswick product.).

The depressed market conditions came at a particularly awkward time for B.C. growers. The 60 or so companies that started operations within the last four years are at a stage of maximum investment, everything's out on the line, but as yet they haven't had a good chance to make any major earnings and reduce their debt. And now, with salmon prices the way they are, you can be sure that any fish under 4 pounds is being sold below the break-even point.

The worst part is that there aren't any major miracles expected in the near future. Though there should be a modest price rise when the wild-catch season ends this fall, a significant jump in farm gate

World's shrimp producers face same problems

Shrimp producers in southeast Asia are facing the same slide in prices that hit salmon farmers this year. According to a recent article in *Aquaculture Digest* (July 25, 1989) the pond-side price for giant tiger shrimp fell from \$8.50 to \$4.40 per kilo in Taiwan last spring and only recovered slightly during the summer. Taiwanese production costs are about \$5.00 per kilo.

Once again the main culprit is a hyper-active production sector trying to sell product into already-glutted markets. According to *Aquaculture Digest* the winners in the shrimp game are likely to be the low-cost producers in China and Indonesia while the losers are going to be the high-cost, intensive shrimp farmers of Taiwan, the Philippines, Thailand and the rest of the world. Commercial shrimp fishermen will also have problems remaining competitive in the years ahead, the article adds.

prices is not likely since the ever-increasing supply of farmed product from Norway, Scotland, Chile and Ireland is flooding markets in Europe and Japan, and making serious inroads into adjacent turf in the United States. It's a classic case of supply and demand

theory in action and will only be stabilized by market expansion, strong promotional efforts, more efficient production techniques and well organized selling.

Who will survive?

The farms in the best position are those with the

least debt, highest efficiency and deepest pockets, all linked to an efficient means of selling their product. The big integrated national and multinational companies are in a strong position. They can benefit from profits in several segments of the production, processing and distribution chain.

But there is also a future for independent farms if they can maintain a low cost of production. To do so they must run a lean operation, maximizing growth rates, while keeping feed wastage and equipment purchases to the minimum. They will want to have the least expenses possible and get the best prices they can for their product by pursuing niche markets.

Production costs are hard to pin down, but estimates run between \$2.50 and \$3.50 a pound farm gate depending on the site and

... Please turn to page 48

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W. C. SHAKE-OUT

Continued from page 23

what costs are included. This means that in mid August, with farm gate prices hovering at about \$3.00 per pound, B.C. farmers could make a modest profit if they were operating on the lean side or could be losing up to 50¢ a pound if they were on the high side. Unfortunately, for many of them there was no choice but to sell chinook and coho that were starting to mature. A couple of farmers were seriously looking into the possibility of establishing U-catch'em pens catering to wealthy U.S. yachtsmen.

Key to success

One of the most important keys to success in the years ahead will be management. As aquaculture consultant Ted Needham pointed out in a recent issue of UK-based *Fish Farmer* magazine "... every farmer has to find out what his rearing costs really are. ... he can only do this if he works to proper budgets with monthly cash flows projected over two years and updated at least quarterly. All forecasts of fish growth should be based on what has been achieved to date

rather than on some hoped-for improvements." Needham's advice is as sound here in Canada as it is in Scotland. The margin for sloppy record keeping slipped away sometime last winter.

What is the outlook?

Is there any light at the end of the tunnel? Depends on who you talk to, but with another 50,000 tonnes projected to come onto world markets next year (275,000 tonnes total) there's not much hope that prices will again reach 1988 levels.

Who are the consumers?

Who's going to eat all this fine, fresh fish? The European market is nearing saturation and what's left will probably go to Scottish and Norwegian producers. The Japanese market is still available but it takes work to penetrate and, once again, the canny Norwegians are already in there, picking up what the Japanese can't produce for themselves (domestic farmed salmon production for Japan is estimated at about 25,000 tonnes of coho this year). The most accessible market left is our big, convenient neighbor to the south and there's still lots of opportunity there

if the Canadians will make a serious effort to go after it. Marketing and distribution are pivotal. It will take a concentrated, cooperative effort on the part of all Canadian producers of both wild and farmed fish.

At the end of the day salmon farming will end up like other producing sectors with only the truly low-cost producers surviving. They will sell their fish in a well disciplined market where demand will determine the production that is planned and financed. But at this point not even a prophet could say how long the restructuring will take and who the survivors will be. Ω

FRANK SIMON

Continued from page 42

The intense competition in the salmon business doesn't worry Simon either. "There is always room for a producer who's doing things right," he says. "We want to differentiate ourselves on the basis of quality. We believe that if we do everything right, we'll have a prominent position in the market." Ω

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MIX AND MIS-MATCH

Genetic pollution is the most invidious consequence of the escape of farmed salmon, argues Richard Douthwaite, who fears that the mating of farmed with wild fish may eventually eliminate our native stocks

On 9 February 1988 a storm of unusual ferocity hit the west coast of Ireland and swept across the country, leaving a trail of destruction in its wake. In Clew Bay on the Atlantic coast winds were so severe that farmers went down to the beaches the next day with their tractors and collected large quantities of dead fish. It was no surprise that two salmon cages moored in the bay broke up, releasing more than 30,000 fish into the open sea.

It is not always the weather which is to blame for fish farm escapes. One moonless night a few months before the storm, two men in a rowing boat cut the nets of 12 salmon cages moored in Mulroy Bay in Donegal. Almost 10,000 fish, worth £100,000, got away and the farm recaptured less than a quarter of them. The raiders' motive was to catch the escapees in their drift nets and then sell them.

Only recently has concern been expressed about the effects that these escapees might have on wild

salmon stocks. Perhaps the matter should have been addressed earlier. The first Scottish attempts to rear salmon in cages were made in the late 1960s and it was as long ago as 1981 that Scotland's output of farmed salmon exceeded its wild catch, with Ireland reaching that position about four years later.

Today the problem is so large it cannot be ignored. Scottish farmed output is expected to be 54,000 tonnes in 1991, about fifty times the size of the wild catch, and Ireland hopes to produce 15,000 tonnes that year. There is so much salmon in cages at sea that if only two or three per cent break free in any year, they will substantially outnumber the native stock.

Escapes would not matter if the freed fish were genetically identical to those born in the rivers up which they swim. However, this is rarely the case. The salmon in each river—even sometimes in the carrier streams—are unique strains which have evolved in the ten thousand

years since the ice sheets retreated. In most cases escapees will not be of that strain. There are 400 distinct stocks of wild salmon in Scotland, according to a report produced last year by the Scottish Wildlife and Country Link. It also states that wild salmon transferred from one river to another perform less well and have harmful effects on the native stock.

Farmed fish are increasingly being bred, like pigs and cattle, for characteristics which suit life in captivity rather than in the wild. Consequently, if escapees enter a river and mate with wild fish, they will pass on genes which tend towards placid behaviour, late sexual development and more rapid growth. Cross-bred young are therefore less likely than pure-bred natives to survive in the sea and return to the river as adults.

Even if farmed fish turn up in a river but mate with each other rather than with the wild fish, the effects are still adverse. They will

Genetic pollution is not the only threat which fish farming poses to the survival of wild salmon. Disease organisms and parasites multiply rapidly in the confined conditions of a salmon cage and from there they can easily migrate to affect other fish. It is for this reason that salmon farmers become wary if another farm establishes cages within a few miles of its own which is why whole lochs in Scotland are allocated to one farm.

Now if disease appear in farmed salmon, very year Pancreas disease are in Ireland in 1984

after occurring first in Scotland in 1976. Seventeen of the 21 farms in Ireland now have it and output is consequently down by 25 per cent because of deaths or stunted growth.

The most worrying disease appeared only last year, in Norway: Salmon Anaemia Syndrome kills 80-90 per cent of young fish. Again, its cause is completely unknown.

In spite of the threat that diseases present both to their own and to the wild stock, some fish farms are their own worst enemy. In Scotland dead diseased salmon are

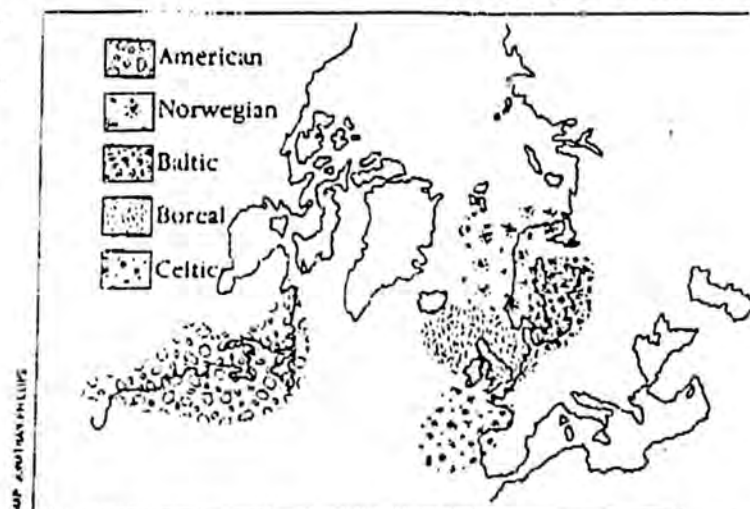
known to have been dumped at sea rather than incinerated on land, spreading pathogens far and wide. There are also two dangerous parasites. One is a tape worm which uses the edible mussel as an intermediate host, then moves on to affect wild fish. The worm weakens wild salmon, rather than killing them directly, lessening their ability to return up turbulent rivers to their spawning grounds and also making them more vulnerable to disease.

The second parasite is a flatworm, *Gyrodactylus salaris*, which has completely wiped out stocks of

wild salmon in 28 rivers in Norway. It was accidentally introduced when farmed fish were imported from infected hatcheries and put out into freshwater cages. The pest attacks parr— young salmon which have not yet developed the physical features that allow them to live in the sea. It is the most serious threat to Atlantic salmon in Norway today, says Rear Admiral D.J. Mackenzie, director of the Atlantic Salmon Trust, Pitlochry. The only cure so far is a drastic one—to poison any remaining salmon in the river and then restock with uninfected fish.



Previous page: grilse from the Spey.
Above: fish jostle for food in the confinement of the cages. Right: distribution of the main races of Atlantic salmon



Although fishermen have known for hundreds of years that salmon stocks differ from river to river, scientists have only confirmed this belief within the last 20 years. Using a technique called electrophoresis they can analyse the proteins with which each fish is made up with great precision.

The first finding revealed by this technique was that there are five main races of Atlantic salmon, four of which share a common feeding ground off western Greenland. The Baltic salmon is the exception, feeding as an adult in the sea which gives it its name.

The second finding was that salmon vary genetically to a surprising extent from river to river, even within the same race. Dr Tom Cross, now of

University College, Cork, examined fish from the Bandon and Munster Blackwater rivers in the south of Ireland and found significant differences in their liver enzymes even though they were both of the Celtic race and the river mouths only 80 miles apart. Dr Cross repeated his tests with Boreal fish from the Moy and Carrowiskey in north-west Ireland and found the Carrowiskey fish very different again.

The differences that exist between salmon from different rivers, says Dr Cross, 'are due to the small population sizes and the fact that they have been apart for 5,000 years. How important the differences are to survival, we cannot say. I think we ought at least to keep the different races apart.'

Any experienced salmon fisherman will confirm that salmon stocks vary from river to river.

'Some are early rivers where large salmon enter in the spring,' says leading salmon geneticist Professor Noel Wilkins of University College, Galway. 'Other rivers have significant runs only in late summer, when the returning fish are smaller and younger. Some rivers are noted for the fine shape of their fish, others are not.'

Andrew Young, who managed the fisheries of the Duke of Sutherland more than 130 years ago, knew why this was: 'Each river has its own peculiar race of fish,' he wrote. 'We have now shown that salmon undoubtedly return to the river where they have spawned and where they belong to the race of fish that inhabit that particular river.' Professor Wilkins agrees: 'Salmon return to their own river with amazing accuracy and mating occurs predominantly between individuals who were born in the same river system.'

It is this inbreeding which has allowed the different strains to develop. In some rivers a higher proportion of fish come back after two or more winters at sea than after one year as grilse. Thus, if all the smolt are killed by disease or pollution one year, others are left to return to the river the following year to spawn, giving a chance for numbers to recover.

Fish farmers are deliberately trying to eliminate this characteristic: what they want are fish with a low grilse rate, because it is more profitable to produce bigger fish which spend two winters in the sea than smaller fish which spend one. Norwegian salmon fit this bill and consequently their eggs have been widely used in Scottish and Irish hatcheries instead of the native strains. Farmers also want their hatched fish to be ready to go to sea after one year in fresh water - it is obviously uneconomical to keep them in freshwater cages for an extra season. But again, in the wild, a stock in which some fish go to sea after one year and some after two has a better chance of surviving than one which does not.

Then there is the question of homing. Tagging experiments have shown that a higher proportion of wild fish return to their native rivers from the sea than do hatchery-bred fish released as fry into streams other than those from which their parents came. However, if any introduced fish which do return are caught and mated, their young will show a better return rate, which will

• Contrary to claims by B.C. salmon farmers that salmon egg transfers pose little threat to wild stocks, an Atlantic salmon advisory body has advised extreme caution to avoid disease and genetic problems.

Report sees genetic threat

"None of the benefits of transfer of young Atlantic salmon and salmon eggs into Canadian waters outweigh the threats to native stocks," says a top body of Canadian fisheries scientists.

Fish farmers, the B.C. government and the federal fisheries department have allowed major imports of Atlantic salmon to Pacific waters, claiming they pose a minimal threat to wild stocks. The imports are scheduled to end in 1989.

But a review of egg imports by the Canadian Atlantic Fisheries Scientific Advisory Committee in 1986 warned that "there are unpredictable genetic risks associated with transferring European salmon stocks to North America and the potential benefits to Canadian aquaculture interests may be low."

CAFSAC is a top scientific advisory group which provides background information for Canadian representatives on international bodies studying conservation of Atlantic salmon.

Its conclusions go a long way to support the call issued by the UFAWU in May demanding a halt on any movement of salmon eggs and smolts, particularly Atlantics, until protection of wild stocks can be assured.

The CAFSAC scientists concluded that most of the benefits of imports accrued to the aquaculture industry because "it could allow the industry to expand as quickly as possible (and) it could be cheaper than purchasing local seedstocks."

In the long run, they said, it would "encourage the multinational nature of the aquaculture industry by allowing surplus seedstock in one country to be moved to another country."

But the imports carry the risk of disease, they warned, pointing to the Norwegian experience with the parasite *Gyrodactylus salaris*.

"Although the Canadian Fish

Health Protection Regulations are considered among the best fish disease control mechanisms in the world," they wrote. "they are not infallible, a fact which, along with the large number of potential pathogenic organisms that are not considered under the Canadian regulations, makes the likelihood of an unwanted pathogen or strain of pathogen entering the country with fish from a certified (disease-free) source a very real possibility."

The CAFSAC report is part of a longer study by the North Atlantic Salmon Conservation Organization, a Scotland-based body supported by Atlantic salmon-producing nations.

B.C. salmon farmers have been enraged by UFAWU calls for controls to avert genetic pollution of wild stocks by farmed fish, claiming such pollution is unknown or unlikely to occur.

But NASCO warns that importation of European Atlantics to Atlantic Canada "provide risks of undesirable impacts on North American Atlantic salmon stocks."

"There are new disease or strains of diseases which may be introduced, also hybridization with North American stocks could result in loss of genetic diversity and reduced productivity."

NASCO concluded there is "an urgent need to develop new techniques to study the effects of hybridization, e.g. potential impacts of genetic impoverishment resulting from 'domesticated' or genetically engineered Atlantic salmon stocks (cultured salmon) spawning with wild stocks and hybridization of different strains of wild stock."

NASCO recommends that until definitive measures are in place to protect the genetic integrity of wild stocks, aquaculture projects should:

• use stocks originating as closely as possible to the project area,

• use sterile fish,

• establish "river preserves where no transfers or hatchery stocks is allowed in order to maintain the genetic integrity of some wild stocks; and

• manage stocks to ensure they are not reduced below a minimum size.

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Genetic fears of pen salmon are real

□ By SONJA CORAZZA

Alaska fishermen's concerns over genetic pollution and disease problems associated with escaped pen-farmed salmon are not unwarranted. Some 13% to 20% of all farmed fish escape, as documented by Norwegian scientists and European countries.

Also, verily large numbers of fish occasionally escape from pens. Their scientific studies show that the escapees do spawn in rivers up to a proven distance of 20 kilometers from their net pens. As a consequence of this research, and with great concern for the genetic integrity and survival of their wild salmon stocks, Norway has just imposed a series of new regulations on the pen-farmed salmon industry.

No salmon farms will be located within 20 kilometers of salmon rivers, and entire fjords will be closed to farming where salmon rivers are present.

This past December in Jarvis Inlet, B.C., 300,000 pen-farmed salmon escaped in winter storms that hit Canada. Floating net pens were found for miles up and down the coast.

Norway, in the salmon farming business for 20 years, has found itself combatting new diseases in net pens every year. Last spring, fish farmers requested that the government hire 100 new fish disease specialists (adding to their 60 disease specialists and nearly 150 fish veterinarians) before allowing any new permits to be issued in their country. A group of farmers who have lost tons of their farmed salmon due to a deadly salmon disease called *furunculosis* and government controls is suing the Norwegian government for \$25 million. Last summer 5,000 fish infected with *furunculosis* escaped in Norway. Despite intensive efforts to capture the diseased fish, an infected fish was found in a freshwater stream.

In order to control disease in pens, Norway's use of antibiotics in pen farming has risen 170% in the past two years to reach a level of 48 tons, more than the use in animal husbandry and human use combined. With the present focus on health and nutrition, how does this

Page 4 February 27, 1988 Peninsula Clarion

Other View

reliance on antibiotics fit our view of pen-farmed salmon as a healthy addition to our diets?

Norway's most severe threat to their wild salmon stocks is from a parasite called *gyrodactylus salaris* that is responsible for wiping out 30 wild-salmon rivers. The *gyrodactylus salaris* parasite entered Norway via imported salmon eggs from Sweden. Importing eggs was prohibited by regulation, but those regulations were lifted as the result of pressure by farmers with economic concerns. The only control for the fatal parasite is by treating the rivers with a chemical called rotenone; unfortunately, rotenone kills everything in the rivers, not just the parasite, hence the loss of wild salmon by the tons in Norway.

Ownership of the pen-farming industry continues to be an issue. In Washington state, a local fish farmer is suing foreign corporations, primarily Norwegian, for attempting to monopolize the industry. Who would own the farms in Alaska?

The Alaska State Legislature should fund the Mariculture Task Force, a forum where these concerns and others need to be researched.

SONYA CORAZZA of Homer heads the Mariculture Committee of the United Fishermen of Alaska. This article came "signed" by United Fishermen of Alaska, as follows: Alaska Crab Coalition, Alaska Independent Fishermen's Marketing Association, Alaska Longline Fishermen's Association, Alaska Trollers Association, Bering Sea Fishermen's Association, Bristol Bay Drift-netters Association, Concerned Area M Fishermen, Cook Inlet Aquaculture Association, Copper River Fishermen's Cooperative, Cordova District Fisheries United, Kenai Peninsula Fishermen's Association, North Pacific Fisheries Association, Northern Southeast Regional Aquaculture Association, Peninsula Marketing Association, Petersburg Vessel Owners Association, Prince William Sound Aquaculture Corp., Prince William Sound Seiners Association, Seafood Producers Cooperative, Southeast Alaska Seiners, Southern Southeast Regional Aquaculture Association, United Cook Inlet Drift Association, United Southeast Alaska Gillnetters, Western Alaska Cooperative Marketing Association, and at-large delegates, Bill Hall, Ruel Holmberg Sr. and Bob Honkola.

seafood producers have turned to an increasing degree to foreign suppliers. The reason is that the cost of local packaging has risen to 20-40% more than that of imported products.

Spokesmen for Kassagerd Reykjavikur and Plastprent, two of the main manufacturers, said demand was always subject to fluctuation and that no massive change had yet taken place. Eggert Hauks-son, Plastprent's managing direc-

tion had never been so tight, with so little tolerance of price in-creases on the market. Bjarni Lúdviksson, managing director at Ice-landic Freezing Plants Corporation, said that as yet only a fraction of the corporation's packaging needs had been supplied from abroad. "Obviously we have to hold our own costs down, and while the dollar is so weak we must use the opportuni-ty. If the króna is devalued, every-thing will change overnight."

NEWSNET

PROCEEDINGS against Mike Ikenze, the former Icelandic Consul in Nigeria who acted as an inter-mediary in attempts to sell stock-fish from a group of Icelandic pro-ducers in 1984, have been dropped following his agreement to repay one-quarter of the GBP300,000 which he received for use in landing sales contracts.

SHRIMP CATCHES around Eldey off the southwest of the country are likely to be banned for some time following poor results of trial catches in the area. Only 20kg were caught in a two-hour trial haul recently. Closure of the area could have serious results for

local fishermen, who have in many cases filled their quotas for other species.

LUMPFISH CATCHES this season have been very poor, and production of lumpfish caviar is expected to amount to only about 9,000 barrels, against 27,000 last year.

A NEW EXPORTING enterprise has begun in Sandgerdi, a village in the southwest of the country, where two local residents, Thor-björn Danielsson and Eiríkur H. Sigurgeirsson, have been assisted by chef Sigmar B. Hauksson in marketing whelk and crab in Swe-den and France. Sales to a Swedish restaurant have already been agreed, and exports to France are to start in the autumn. The Swiss market is also being considered.

JUNE CATCH FIGURES



In tons	June		Jan-June	
	1988	(1987)	1988	(1987)
Cod	80 624	(89 489)	311 590	(350 500)



Hopes high for capelin

The capelin season began on 10 July, with 49 Icelandic vessels sharing a provisional quota of 398,000 tons. With the prices for meal and oil rising because of poor soya harvests in the USA and growing demand in the Far East, hopes are high for a successful season. The quota is to be revised in November.

News from Iceland August 1988

Salmon fishing:

Problems posed by sea-cage escapees

Salmon fishermen trying their luck this season in the Ellidaár riv-ers, which flow through the eastern part of Reykjavik and are popular with local residents, are complain-ing that large numbers of the salm-on they are landing are "escapees" from aquaculture stations and are consequently smaller and less at-tractive than the wild types.

According to biologists studying the problem, the fish are fairly easy to recognize. They generally have damaged fins and are shorter and

fatter than the true natives of the river. In many cases they weigh only about one pound.

Biologists are concerned about the effects of the presence of the cultivated fish in rivers. A survey made two years ago estimated that 60-70 cultivated salmon had en-tered Ellidaár, a significant number in terms of the genetic effect on the local stock. Studies from Nor-way show that up to 10% of the fish in rivers near large aquaculture stations can be "escapees."



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Fish farming still draws opposition

By DAVID FOSTER
The Associated Press

RICH PASSAGE, Wash. — The history of salmon-fishing in the stormy North Pacific is filled with tales of brave fishermen riding the wild seas, but its future is being shaped in calmer waters.

Thousands of salmon in this sheltered arm of Puget Sound are captives in sunken pens the size of basketball courts. Crowded fin to fin, they swim endless laps, gobbling feed pellets and being fattened toward the day they'll be scooped up and whisked to market.

Yet while the crenulated coastline and pristine waters that stretch from Washington's Puget Sound to southeastern Alaska might be ideal for fish farming, the political climate is not so welcoming.

In Alaska, where commercial fishermen are a powerful

Please see Back Page, FISH FARMING

Anchorage
Daily News
2-20-90

FISH FARMING: Young industry has run into resistance

Continued from Page A-1

lobby, bumper stickers in fishing towns proclaim "Real Fish Don't Eat Pellets," and the legislature is considering a permanent ban on fish farms when a two-year moratorium expires in July.

In Washington state, salmon farmers have the official blessing of the legislature, but that has helped little in the face of challenges from fishermen and environmental groups, which have defeated several proposed farms.

The fish waste produced by a two-acre salmon farm is equivalent to the sewage produced by a town of 5,000 people, claims a Washington citizens group called the Marine Environmental Consortium.

Environmentalists also fear introduced species such as Atlantic salmon — favored because they fetch a higher price and are more docile than Pacific salmon — will corrupt the local gene pool and spread disease. Wealthy owners of shoreside homes, meanwhile, don't want fish farms spoiling their views.

Promoters call fish farming an efficient way to help meet the world's growing appetite for fish. Not only does it provide a year-round supply of fresh salmon to supplement the seasonal wild catch, they say, it also creates jobs free of the hazards of commercial fishing, one of the nation's most dangerous occupations.

They also contend salmon-farming provides an economic incentive to preserve clean water.

"We're the best environmentalists of all, because we're dependent on it," said Jerry Polley, site manager for Global Aqua, the nation's largest salmon farm. "If something's wrong with the water quality, we're going to be the first to complain."

Production of farm-raised salmon, here and abroad, has boomed in five years, flooding markets traditionally held by wild salmon and driving down prices.

"For the first couple of years, as more salmon was around on a year-round basis, the farmed fish seemed to help the wild market," said commercial fisherman Randy Babich. "Now it's a battle at the retail counter."

Fish farming, or aquaculture, is hardly a new concept. For years, farmers have raised oysters in the Northwest, rainbow trout in Idaho and catfish in the Southeast. But techniques have developed more slowly in domesticating salmon, the mainstay of fisheries off Oregon, Washington, British Columbia and Alaska.

For years, it was practiced only by the Norwegians, forced into salmon farming by their declining wild fish populations. But interest has spread quickly since 1985, after Norway refined methods to raise salmon cheaply enough to compete with the wild catch.

In 1983, world production of farm-raised salmon was 23,500 metric tons, just 3 percent of the 670,000-ton wild salmon catch. By last year, farm-raised salmon production had soared to an estimated 202,000 tons, or 30 percent of the relatively constant wild catch.

Norway still leads the pack, producing about 75 percent of the world's farm-raised salmon, but other places, including Scotland, Chile, Canada and Ireland, are catching up.



Daily News file photo

Alaska Department of Fish and Game technician feeds penned salmon at Little Port, Walters in southeast Alaska.

The United States, with 50 fish farms in Washington state and Maine, lags far behind, producing 1 percent of the total.

Many of the U.S. salmon farms are run by Norwegian companies, including Global Aqua's four-acre operation in Rich Passage, 10 miles west of Seattle.

Global Aqua's farm is fairly typical: a huge raft anchored offshore holds 40 pens, each lined with a net holding as much as 15 tons of fish, which range from finger-size smolt to fat-bellied salmon 2 feet long.

A half-dozen workers tend the pens from metal walkways, filling automatic feeders and mending nets. A harvest, workers herd fish into one end of the pens, scoop them out with an oversize dipnet and load them onto a boat. The salmon are still kicking when they reach a Seattle processing plant 30 minutes away.

In the three years it takes to raise salmon to harvest, farmers contend with prowling otters, hungry sea lions and diseases that can wipe out whole farms if left unchecked.

Aquaculturists say their operations will never be a major blot on the coastline.

"It would take just 40 acres of farms to produce all of the salmon that was imported into the United States in 1988," said Chris Gibson of Sea Farm Washington in Port Angeles. "The industry does not need a lot of space."

It may need even less space in coming months. Worldwide growth of salmon farming and recent overproduction in Norway have glutted the market with fish. Prices have plunged, and many farms are selling below cost just to keep cash flowing.

In British Columbia, lax regulation and a surge of Norwegian investment capital helped the number of fish farms soar from five to 135 in the past six years. But now many are in trouble. Nineteen have filed for receivership in the past year, and small businesses are being bought out by large investors better able to outlast the lull in prices.

Aquaculture boosters profess confidence in the

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The Fisherman (B.C.) Dec 188

Fish farm use of antibiotics poses threat

The widespread use of antibiotics in fish culture poses a serious potential threat to public health, says a Washington State zoologist, and should be strictly controlled.

Arthur Whiteley, a zoologist with a long-standing interest in microbiology, told a Washington State Shorelines Hearing Board inquiry Nov. 14 that antibiotic use on fish farms will produce antibiotic resistant bacteria in the human food chain.

If these resistant bacteria occur in humans, "the diseases caused by that organism could not be medically treated."

"It would eliminate from the tools of the physician those he would want to control disease."

Whiteley was qualified as an expert witness in the hearing, which was set up to hear an appeal against a decision by Skagit County to deny permits for a fish farm near the mouth of the Skagit River.

Whiteley produced a pile of scientific studies which show that "in almost every case resistant bacteria is selected by the use of antibiotics in fish culture."

In other words, use of antibiotics to treat bacteria causing fish disease kill all but the bacteria which is resistant to the medication.

Studies have proved that this

resistance can be transferred from one type of bacteria to another, Whiteley said, and can create resistance to several types of antibiotic.

Whiteley said this type of transference has been documented in the case of a vibrio bacteria which causes disease in fish. In a laboratory, this resistance was transferred to different bacteria which exist in the North Pacific food chain and are pathogenic to humans.

"This has not been observed in the wild," he said, "but there is a probability it could occur. Experiments indicate the genetic mechanism is in place . . . and we can predict it will occur in nature under certain conditions."

The Centre for Disease Control in Atlanta has found the same phenomenon in beef and poultry, he said, and blame it for a dramatic increase in salmonella.

The only solution, he said, is to ban the use of antibiotics in fish culture which are used in human treatment.

In B.C., both oxytetracycline and erythromycin are used in fish culture even though they also are used in human medicine. There is no inspection to determine whether or not this transference of resistance is occurring in B.C. or whether fish sold to consumers is free of antibiotics.

HEAWI I loses close vote

Farms offer 'surplus' chinook

Surplus chinook smolts offered to the fisheries department by the B.C. Salmon Farmers Association should be destroyed, says the UFAWU, rather than released in a makeshift enhancement scheme.

At least eight farms offered the smolts for sale earlier this month, suggesting that some kind of technological breakthrough led to survival rates above their forecast.

In fact, the proposal to sell the "surplus" chinook to the Salmonid Enhancement Program is a bid for a bail-out by an industry facing collapsing prices, said the UFAWU May 10. Prices for farmed salmon have tumbled a dollar a pound in the past few months, said union spokesman Geoff Meggs. "They simply can't afford to feed these fish and are hoping the taxpayer will bail them out."

Fisheries department spokesman Ted Perry said at least six

million fish were available in farms and hatcheries from Duncan to Powell River. He said DFO would not buy any fish, nor accept donations of fish that were not genetically pure Big Qualicum or Robertson Creek stock.

The fish would be released by DFO into the wild.

At press time, the farmers were insisting on selling the fish, which will starve unless fed by mid-June.

"Release of these fish poses a disease threat to wild stocks and would open the door to private ocean ranching," Meggs said. "Fish farmers have resisted every effort to win appropriate govern-

ment regulations, but they're not shy about asking for government money when times get tight."

Uncontrolled growth of the industry has seen farm fish harvests rise to 6,000 tonnes last year from 387 tonnes in 1986. Prices have crashed from an average annual farm gate value of \$3.17 to \$2.27, according to B.C. provincial statistics.

"Spending on salmonid enhancement has been frozen," Meggs said, "but apparently money may be found for this boondoggle. It's a slap in the face to SEP volunteers who have donated thousands of hours and faced steady funding cuts to even to consider this kind of scheme."

Consumer group urges farm salmon controls

Both levels of government should step up their regulation of the fish farming industry, says the Consumers' Association of Canada (CAC), to protect the consumer and wild salmon stocks.

In a comprehensive task force report on the industry released April 17, the CAC declares that "a self-regulated industry is not in the consumer's best interest."

Farmed fish is being sold "without specific regulations since pre-existing legislation is being used to govern a new industry," the report says.

In particular, the task force recommends:

- stepped-up provincial government monitoring and regulation of the aquaculture industry;
- public sector testing of fish for market to determine levels of residues;
- monitoring of environmental impacts and prosecution of regulatory violations; and
- consumer labelling to distinguish farmed and wild fish and to report harvest dates.

The report also urges the B.C. Salmon Farmers Association to rejoin the Canadian General Standards Board committees on feed and feed additives to seek ways to reduce residues and contaminants.

The task force expressed concern about colorants, drugs and other medication used in aquaculture "which may remain in the product at the point of consumption."

Antibiotics are a very real problem, the report says, because "long-term consumption of sub-clinical dosages of antibiotics by humans (for example, by consuming antibiotic-containing fish) can lead to the development of resistant strains of bacteria in the body system."

Treatment of infection in humans can be undermined by such doses, the report notes and "there is a potential for allergic reactions by individuals sensitive to antibiotic traces."

(The farm industry has established a Quality Assurance program with spot-checking which it says will control this problem. Fish must be held 42 days after drug treatment before going to market. The provincial government is recommending at least double that time.)

The task force recommends much tighter controls and monitoring of antibiotic use, including certification of farmed staff handling drugs.

The CAC proposes an industry commitment to "produce, catch and process fish without negative impact to the environment."

All types of fish, farmed and wild, should be checked for chemical residues, PCBs and pesticides.

Consumers should insist on protection of wild stocks, the CAC concludes. "A fish farm industry at the expense of the wild stock would, in fact, reduce the choices of fish for the consumer."

Algae, disease, low prices hammer B.C. salmon farmers

British Columbia's fish farming industry, wracked by collapsing prices, disease, algae blooms and bankruptcies, is facing a major corporate shakedown.

Despite continued assurances by industry leaders that all is well, signs of trouble include:

- ★ a rash of receiverships affecting about 12 farms and three companies;

- ★ devastating algae blooms throughout the Strait of Georgia which have wiped out some farms and crippled others;

- ★ industry agreement that the Sunshine Coast, the scene of a salmon farming goldrush only three years ago, may see an exodus of operations to colder, algae-free waters; and

- ★ continued low prices which are driving down wild salmon prices and forcing more producers to the wall.

The most visible problem has been the algae blooms, which sweep in on hot, calm days and suffocate salmon in their pens within hours. Persistent low levels of algae are believed to contribute to stress and disease.

Losses to various diseases continues to be high on many B.C. farms, according to industry publications.

According to the *Sechelt Press*, a plankton bloom during the Labor Day weekend wiped out five farms, severely damaged five others and destroyed 300 tons of salmon worth about \$2 million. The regional dump, which was to be closed to farm waste Oct. 20, was opened especially to handle the emergency.

Farms in Agamemnon Channel took the brunt of the assault, but the entire

region was affected. Local fishermen heard radio chatter from farmers seeking some place to dispose of the sudden large volumes of dead fish.

Professor Larry Albright of Simon Fraser University told a public meeting on the impact of fish farms later that month that the entire Strait of Georgia is so infested with the algae that farms will be removed from the area completely.

Meanwhile, prices continue to drop, heading below \$1 a pound according to some market reports. The break-even point is estimated to be around \$2.25 to \$2.50 a pound level.

The crunch of falling prices, provoked in part by aggressive marketing by Norwegian producers, is hitting farms hard in many areas.

Coopers and Lybrand, receiver for three firms put into receivership by secured creditors, reports continued financial problems for farms in the Campbell River area.

Eric van Soeren, receiver for North American Salmon Corp., operator of six sites around Quadra Island, and Sea

Grow, with operations at Nelson Island, said Sept. 19 that new buyers had not been found.

But both firms were thrown into receivership by Norwegian banks seeking to slow their losses on loans to B.C. producers. Now van Soeren is seeking a buyer for Atwood Bay farm near Desolation Sound and expects a busy fall with other troubled firms. He would not disclose who is buying the farm.

As a result of the chaos, the normally boosterish industry is shying away from an optimistic DFO analysis of the industry which predicts production could hit 80,000 to 100,000 metric tons by the year 2000.

Product of 50,000 tons is very realistic, the Price Waterhouse report claims. But industry spokesmen believe that disease and other problems will keep them in the low-growth range of about 20,000 tons until the turn of the century.

(Ed: The above article was reprinted with permission from *The Fisherman*, Geoff Meggs, Editor)

Fish farmer sues foreigners

A Washington state fish farmer and his corporation have sued in U.S. District Court alleging that foreign national interests have attempted to monopolize the commercial fish farming industry in his state. Lee A. Holley III of Lopez Island in northern Puget Sound alleges in his suit that foreign business interests, primarily

Norwegian, operated through American national fronts to destroy competition in the industry, remove local control and violate antitrust laws.

Holley, owner of Northern Nights Fish Farms Inc., is suing several Norwegian corporations that have either sole or partial ownership of farms in Puget Sound. Also named in the suit are state officials and other individuals who allegedly contributed to illegal activity. Holley charges that large financial contributions were made to state political campaigns by the foreign interests, which, he says, also assisted in defeating a moratorium proposed against new businesses in San Juan County, where Holley lives.

Comments from the Norwegian companies and state officials were being withheld pending litigation, according to several reached by telephone.

— Brad Matsen

The Fisherman January 25, 1989

Fish farm drug hits wild stock

Fishermen harvesting shellfish off Scotland say a chemical used by salmon farmers is killing marine life.

Scientists at Aberdeen University have linked the chemical with increasing numbers of wild salmon going blind.

The controversy has erupted over Nuvar 500, which farmers use to control pests. Its byproduct, dichlorvos, is listed by the 1987 North Sea Conference as one of 26 most dangerous chemicals in waterways.

The debate highlights the severe problems salmon farming disease treatment can pose for

the marine environment and other marine life.

According to the *London Observer*, in a report on its wire service Jan. 11, scientists at Norway's Institute of Marine Research in Bergen have found the chemical could be damaging sensitive lobster and crab larvae around the farms. Mussel and oysters also absorb the chemical.

Nuvar is strictly controlled on land, but salmon farmers have easy access because they are not subject to the same regulations.

Fishermen and environmentalists are demanding a ban on Nuvar, but farmers say they will

be decimated by sea lice if Nuvar is taken from their arsenal. They favour voluntary controls.

Nuvar is not registered for use in Canada, meaning it is unavailable. Valery Brooks, of the B.C. Salmon Farmers Association, said sea lice are not a problem in this province, but a special session on lice is scheduled for an aquaculture conference in Dartmouth next month.

Scientists there have concluded that sea lice threaten the viability of salmon farming in Atlantic waters and 96 percent of farms must use treatments to control the parasite.

A new problem for fish farmers

Foes of Puget Sound pens make an issue out of virus new to Northwest

By Jane Hadley
P-I Reporter

An exotic virus that caused fisheries officials to order almost 4 million fish and eggs destroyed at two hatcheries last week has given new ammunition to foe of fish-raising pens in Puget Sound.

Opponents of the net pens said yesterday they plan to make an issue of the virus at hearings tomorrow and Thursday on a state Department of Fisheries environmental impact statement on net pen fish farming.

But proponents of expanded fish farming on Puget Sound say it would be irresponsible to speculate on the source of the virus. They said there is no evidence pointing to Atlantic salmon or net pens as the cause, as some opponents charge.

But, Jerry C. Grover, of the U.S. Fish and

Wildlife Service said logic pointed to the Atlantic salmon.

There are 13 existing net pen operations in the state, most of which grow the Atlantic salmon. Close to 20 other net pens have been proposed.

The virus, known as viral hemorrhagic septicemia or "VHS," was found in cell cultures in two hatcheries in December and positively identified Feb. 17. It has never before been reported in North America. It has caused substantial fish losses in Denmark and other European countries.

No fish reportedly have died of the disease in Northwest waters to date.

The virus was found in cell cultures at the Fish and Wildlife Service's Makah Hatchery near Neah Bay and a joint state-private hatchery at Glenwood Springs on Orcas Island.

"From the conversations I've heard, everyone's

looking at the net pen aquaculture industry in Puget Sound and Canada," said Grover, fisheries associate manager for the U.S. Fish and Wildlife Service regional office in Portland.

Grover said it's important "not to be finger-pointing because we don't know" and labeled such a guess as "speculation."

He added, "It doesn't take too much gray matter to put two and two together. You have to ask how the thing leap-frogs from Europe to Puget Sound. The common denominator would be Atlantic salmon. That's what the scientists are talking about."

The state Department of Fisheries, several scientists and an industry spokesman immediately jumped on Grover's comments.

"I'm certain this issue will be thrown at the

See FISH, Page B4

Fish: Virus origin to be probed

From Page B1

industry, when, in fact, I think it's groundless," said Anne Kirske, executive director of the Washington State Fish Growers Association.

But environmentalists were just as indignant yesterday and accused the state Fisheries Department of being a "booster" of net pen farming.

"This is really a terribly threatening thing," said L. Joe Miller, president of the Marine Environmental Consortium, a coalition of numerous local groups fighting proposed net pen operations around Puget Sound.

"It's the kind of thing environment groups we work with have been anticipating and dreading and, now, here it is," he said. "The state and industry have said, no, this is not a realistic concern. They've said we're only worried about our views. Now they say this (virus) has come in on somebody's boot, which is really an

insulting suggestion."

Grover discounted the "boot" theory and some other suggested sources. He said it's "kind of far-fetched, even impossible" to believe that somebody who traveled in Europe brought the virus in on his or her boot. The virus can survive only a short time outside living tissue, he said.

Grover said his agency, the state Fisheries Department, the Wildlife Department, and Indian tribes are launching a massive testing program to try to track down where the virus might have spread. The U.S. Fish and Wildlife Agency, for example, will test the 35 miles of the Sooes River and its tributaries that are upstream of the Makah Hatchery.

The current theory, he said, is that Sooes River fish shed the virus and it got into the hatchery through its water intake.

The Fisheries Department will test saltwater around Glenwood Springs as well as some net pen operations. He said test results

should be available in late March.

Grover and Dr. Marsha Landholt, a fish pathologist at the University of Washington, said the rainbow trout is the most susceptible species of fish to get the disease from the virus. Coho salmon can carry the virus and pass it on without getting sick. But fisheries experts are worried about steelhead, because they are a type of rainbow trout.

Several weeks ago, Washington state rainbow trout were injected with the VHS virus in a federal laboratory and suffered "a high incidence of mortality," said Peck of the Fisheries Department. Landholt said VHS may seem "like a scourge to us because it's a new disease. But if you talk to people in Denmark and Europe that have VHS, they don't seem to worry to the degree we are. They seem to manage around it."

Landholt said they disinfect and destroy all fish in all infected hatcheries as well as those downstream.

Seattle Post-Intelligencer

February 22, 1987

Puget Sound anglers hooking Atlantic salmon

by Brad O'Connor
Times staff reporter



Steve Loop caused quite a stir in June when he showed up at Seacrest Boathouse in West Seattle with a 5½-pound Atlantic salmon he'd caught while fishing for blackmouth near the Southworth Ferry landing.

Atlantics are not supposed to be swimming around Puget Sound and it was only the second Dave Nelson, Seacrest manager, had seen in his 17

years at the boathouse.

Atlantics — 1 million or more of them — are in the Sound, but all are supposed to be confined to net pens where they are reared by private growers for markets mostly in the south, the East Coast and California.

Loops' Atlantic was an escapee.

Since June, Nelson has weighed about a dozen others, all caught on hook and line, which is remarkable. While Atlantics provide some of the world's greatest freshwater sports fishing, they rarely are caught on sports gear in salt water.

"Ponder this," said Nelson, "if we've seen a dozen here, there must be many, many more swimming around out there."

He's correct. There are more.

Will Sandoval, biologist for the Muckleshoot Tribe, said his tribal fishermen have told of netting several Atlantics during summer and fall salmon seasons.

"Some told of catching three or four a day," he said.

Three that Sandoval checked during a state and tribal test fishery for sockeye in July were approaching sexual maturity.

"What concerns me is that they may have been looking for somewhere to spawn. Even if they can't spawn successfully, there's a risk they could be carrying some exotic disease."

Decades ago, attempts were made to establish spawning runs of Atlantics in Washington and British Columbia. All failed and the belief among some fisheries scientists is that further attempts to establish Atlantic runs on the West Coast also would fail.

In fact, most fisheries managers nowadays shudder at the thought of Atlantics spawning in any West Coast stream — not only because of the risk of disease, but because of increased competition for food and space with native trout and salmon.

Reports of Atlantic catches are funneled to Lee Hoines, a Department of Fisheries biologist at Olympia. Of the 203 reported to him last year, most were caught by commercial fishermen in the Bellingham area and around the San Juans.

However, two were caught in fresh water, including one last October near the

on the Nooksack River and another in July in Cedar Creek, a tributary of the Nisqually.

What if they did spawn successfully?

"My assumption is that they can't. I can't say that absolutely is the case, but I hope they don't," said Tim Flint, another WDF biologist.

De Yonge was right on fish-farm perils

By Arthur H. Whiteley, John W. Brookbank and Annamarie K. Johnstone

In his article (P-I Op-Ed, March 29), State Land Commissioner Brian Boyle took severe exception to John de Yonge's March 5 Focus Section article on fish farms.

We believe that de Yonge's pithy comments were right on target.

Boyle argues against relating fish-farm pollutants to untreated human sewage. In terms of organic sludge whose combustion consumes dissolved oxygen from the water, and loading of the water with various nitrogen compounds and phosphate which act as fertilizers, the two pollutants are essentially alike.

The question of dilution of these discharges is relevant.

Metro's West Point Wastewater Treatment Plant dumps its soluble discharge into the main channel of Puget Sound at considerable depth, permitting dispersion. Fish-pen wastes are deposited on the site as feed pellets and feces, which settle as sediment and dissolved components that enter the water column. The sites are channels or embayments with restricted water flow, not rivers, with a one-way flow that flushes things away. Tides flow and ebb and currents in bays create eddies, leading to retention and accumulation of the pen wastes.

Metro sewage must undergo treatment, at substantial and justified expense to our citizens who create this waste. Discharge is monitored by a permit, mandated by federal Clean Water Act.

The fish-pen solid waste enters the bay raw, untreated, without disinfection and free to the fish farmer. Washington's pens have avoided the federal discharge permits, although the Sierra Club Legal Defense Fund threatens the state with legal action if this requirement is not enforced.

real, just as it has been in Norway.

Boyle's understanding of the *Gyrodactylus salaris* issue in Norway is at variance with reports from Dag Dolmen of the Directorate for Nature Management in Trondheim. This trematode parasite has been introduced into Norway, according to Dolmen's analysis, "through stocking with salmon parr from infected hatcheries/fish farms." Johnson and Jensen report that total salmon catches in infested Norwegian rivers (1970 to 1984) dropped to 16 percent of levels in uninfested rivers. These were mostly wild fish, which have been nearly decimated by a parasite spread through "hatchery/fish farm" stockings. The smolts that are stocked in salt water fish farms are reared as fry in fresh water hatcheries.

In November, Svein Mehli, head of the division of the Directorate for Nature Management concerned with protection of wild salmon in Norway, testified for Skagit County before the State Shorelines Hearing Board. Mehli reported the escape into Norway waters of thousands of pen-reared salmon carrying furunculosis, the appearance of bacterial kidney disease in farmed stock, the presence of redmouth disease in 300 salmon pens — a disease previously unknown in Norway — and of his concern about "other diseases knocking at the door." Given these facts, we disagree with Boyle's position that "environmental arguments against fish farms are essentially specious."

Boyle objected to de Yonge's extrapolation of the targeted 100 fish pens to the sewage equivalent of Seattle's sewage outfall — as "scientifically absurd." But Boyle can find a graph on pages 133 and 134 of the draft Programmatic Environmental Impact Statement to which he referred that shows that 100 pens will load Puget Sound with biological oxygen demand (organic sludge) 150 percent higher than that of the West Point plant, and add an amount of dissolved nitrogen to the embayments equal to that from this sewage plant. We think de Yonge stated things correctly.

In Norway, which has much smaller farms than are permitted here, pens are moved every couple of years, to try to mitigate environmental problems. Moreover, they are located closer to the open water at the mouth of fjords. In some regions, alternate fjords are kept free of pens to create security zones between sites.

Atlantic salmon can become diseased in their pens and they do escape. This year commercial fishermen have recorded many Atlantics caught along with native salmon south of San Juan Island and between Bellingham and Point Roberts. Escaped Atlantics have been picked up in the Nooksack, Skagit and Nisqually rivers. These are adult fish, apparently ready to breed. We feel that there remains a possibility that they will breed, that they will become established and that they will compete on the breeding grounds with native salmonids — how successfully neither we nor Boyle knows yet. The presence of potentially diseased pen escapees among breeding natives poses a danger that in our opinions is

Boyle must be well aware of the current concern about appearance of viral hemorrhagic septicemia (VHS) in resident salmonids and doubtless has seen the U.S. Fish and Wildlife Service summary of March 3, 1989, which reports that this virus is confirmed in yearling coho and steelhead trout and fall chinook salmon fry from the Makah hatchery. We assume that he is aware of the opinion from the U. S. Fish and Wildlife Service that the logical, though not proved, avenue for entry of this new disease is via Atlantic net-pen culture. If these are proved to be "specious arguments," then we can drop them.

Is it fair for "the working stiffs" on the gillnet boats, purse seiners and reef boats — white and Indian alike — to be crowded off their fishing grounds, or worse, to have their resource diminished? Should clam growers, who have husbanded their rich resource for three generations, be forced to contend with pollution from a fish pen?

In order to generate new jobs and revenue, a wiser course for our state would be to accept the mitigation measure in the draft EIS — to culture salmon in tank farms. These should be on privately owned land with effluent monitored and regulated by permit and then discharged into deep water. In this way the negative impacts of floating mariculture — navigation hazards, storm-caused breakup of pens, dissemination of disease, release of untreated wastes, difficulties with antibiotics and impairment of aesthetics — would be eliminated. Lastly, land-based fin-fish culture would place the costs of this industry on those who profit from it.

■ Dr. Arthur H. Whiteley is professor emeritus of zoology at the University of Washington; Dr. John W. Brookbank is professor emeritus of microbiology and cell biology at the University of Florida; Dr. Annamarie K. Johnstone is a marine microbiologist. Soapbox columns are contributed by readers.

Senator P. L. ...

Juneau Empire
2-20-90

Japanese buying up Norwegian fish

Surplus of pen-reared fish threatens Alaska's seafood markets in Japan

THE ASSOCIATED PRESS

ANCHORAGE — Norwegian fish farmers are attempting to sell a huge surplus of pen-reared salmon in Japan, long the main market of Alaska seafood processors.

The 88 million pounds of frozen fish could add to an already glutted Japanese salmon market, and drag down prices for this summer's Alaska salmon harvest, according to a U.S. embassy cable from Japan.

More than 80 percent of Alaska's salmon goes to Japan, most of it frozen.

The Norwegians so far have been unable to sell most of their frozen fish, but may cut prices in order to move it, according to the cable released by the U.S. International Trade Administration. If that happens, the Norwegian salmon "will be a threat to U.S. frozen, chum, coho and sockeye salmon," the cable said.

"If they dump it on the market, that would create one hell of a mess," said Roger Dahlke, market-

ing manager for Trident Seafood, a Seattle processor with plants in Bristol Bay and the Aleutians.

Dahlke said Trident is currently trying to sell a lot of Alaska salmon in Japan. But the company is making little headway in a market swamped with both fresh farm-raised fish and frozen fish left over from last season.

As of December, wholesale prices for sockeye salmon had dropped by more than a third from summertime levels, according to Pacific Fishing Magazine. Prices haven't moved much since then, according to industry officials.

Bill Atkinson, publisher of a seafood newsletter that tracks Japanese markets, doubts the Norwegians will be willing to drop their price low enough to compete on the glutted frozen market.

"The Norwegians are not really interested at selling at a loss," Atkinson said. "And the Japanese are not going to accept a high price for them when there are all the other less ex-

pensive fish available."

But one unnamed importer cited in the embassy cable said at least 44 million pounds of the frozen Norwegian fish probably will end up in Japan, knocking down salmon prices just as Alaska's annual harvest begins.

"This scenario, if true, is very critical for U.S. salmon fishermen," embassy officials said. Japanese buyers might import Norwegian salmon in an attempt to force down Alaska salmon prices during pre-season negotiations, the cable said.

"With this type of volume they could start eroding traditional (Alaska) sockeye markets," said Gary Ervin, president of the Kenai Peninsula-based Seafoods From Alaska.

Pen-reared salmon production has been expanding rapidly since the Norwegians pioneered the aquaculture technology in the early 1980s. Salmon farming has been banned in Alaska but is legal in Europe, South America, the South Pacific, Canada and the Pacific Northwest.

Farmers feed the salmon until they reach market size. They offer the fish fresh on a year-round basis. Most Alaska salmon is sold frozen or canned.

Within the past five years, farm-raised salmon have taken over most of the European market, as well as much of the East Coast market, according to a report by the state-funded Alaska Finfish Farming Task Force Force.

Last year Norway produced more than 330 million pounds of salmon, a nearly 60 percent increase from 1988, and farmers have been unable to sell all that fish.

That production, combined with a record Alaska salmon harvest and a strong Japanese chum harvest, created a huge glut on the worldwide market. The amount of unsold fish is estimated by the state finfish task force at more than 200 million pounds. That equals the entire 1989 export of Alaska salmon to Japan.

When Norwegian fish farmers could not sell all their fish, they froze large amounts and began pushing it toward Japanese markets long aimed by Alaska.

"I think the impact of farm-reared salmon on traditional Alaska markets is profound, and simply going to accelerate," said Chuck Becker, Anchorage district director of the U.S. Commerce Department's International Trade Administration.

Additives to the Environment of Net-Pen Reared Fish
Pacific Marine Fisheries Commission 42nd Annual Meeting
Seattle, Washington, October 16-18, 1989

PHD Arthur H. Whiteley and Annamarie Johnstone

We have been asked to address our remarks to the matter of additives to the environment of net-pen reared fish. In this particular forum, we assume the emphasis should be on additives that may have an impact on humans when these fish come to market, rather than the impact on the plant and animal communities in the natural environment, though these are not wholly separable.

By its very nature, net-pen rearing of salmon requires the use of numerous chemicals, sometimes in large amounts, some used in the fresh water hatcheries to produce the fry and smolts, some used in the grow-out period in the marine pens, and others used during processing of the fish for the market. Partial lists are shown in Table 1, compiled from Austin and Austin, 1987, from a 1988 report for the Nature Conservancy Council by the University of Stirling, and from other sources.

The lists include chemicals used in salmon and in other forms of fish culture, both in this country and in foreign countries. Inasmuch as farmed fish are imported from some of these other countries, inclusion of these chemicals in the lists may be relevant to the matter of seafood surveillance in the United States marketplace.

Chemotherapeutics. The most relevant additives for present purposes are antibiotics and therapeutants used to control bacterial diseases. Because of stress, disease may cause losses of 30-40%, sometimes higher. Diseases in salmon farms include *Vibrio anguillarum* (vibriosis), *Aeromonas salmonicida* (furunculosis), *Aeromonas hydrophila* (hemorrhagic septicemia), *Yersenia ruckeri* (red mouth), *Vibrio salmonicida* (Hitra disease), *Renibacterium salmonarum* (bacterial kidney disease). To combat these diseases, medicated food containing antibiotics is supplied. In Washington, the FDA approved antibiotics and therapeutants are oxytetracycline (OTC), Romet 30 (sulfadimethoxine and orhomprim) and sulfamerazine. In addition, Tribissen (sulfadiazine and trimethoprim) is used in Norway and Scotland, and in British Columbia erythromycin is used to control BKD. In Japanese fish culture a wide variety of antibiotics has been used, but has recently restricted the use of chemotherapeutics in cultured fish (Aoki, 1988, pers. comm).

In the US, Norway, BC and Scotland, doses of drugs are as indicated in Table 1B. It is anecdotal, however, that additional amounts of antibiotics are used by farmers, who may mix the drugs with feed and binders. Control of use of antibiotics in Norway and Scotland is regulated by veterinarians, and this is supposed to be the case in B.C. In the British Isles it is apparently easy to find legal loopholes to permit other antibiotics and doses to be used (Austin and Austin, 1987). In Washington fish farmers are supposed to notify the Department of Fisheries if they use antibiotics, but veterinarian supervision is not required. Generally approval exists for only therapeutic use of these

drugs. Nonetheless they often are used prophylactically inasmuch as sick fish may not take the medicated food.

There appears to be no medical or public health supervision or regulation here, or in the other fish farming countries, on the use of antibiotics and chemotherapeutics other than the requirement of FDA approval of the three drugs and their dosages. There appears to be no monitoring by agencies of the use of these drugs or their persistence in marketed fish.

The amounts of drugs used are enormous. In Norway last year, 48 metric tons (105,000 lbs) of OTC alone were used - more than in animal husbandry and human health uses combined (Mehli, 1988, pers. comm. and press accounts). This figure has grown from 13,691 lbs in 1984 (Middtying, 1985). The 1984 figure for Tribissen, nitrofurazolidon and sulfamerazine is 30,204 lbs (Middtying, 1985). Comparable figures for British Columbia and Washington are not at hand. Assuming the dosages cited earlier for the 13 Washington pens, calculation leads to a first approximation of about one ton of OTC, a figure similar to that given by a Washington fish pen operator (Dr. A. Bill, 1989, pers. comm.).

The relevant issue here is "Do these uses affect man?" Consumers clearly would be exposed to residual antibiotics in the fish meat. Because of the potential for these residues producing a serious problem in public health, Japan has recently restricted the use of chemotherapeutics, and does not allow cultured fish to move to market if residual drugs can be detected in fish meat (Aoki, 1988, pers. comm.). The potential for adverse effects has been emphasized by Austin (1988, conference in Vancouver, B.C.; Austin and Austin, 1987). The current regulations for control of such residues are based on admittedly minimal research. The FDA requires a 21 day withdrawal period after the last medicated feeding of OTC and 42 days for Romet 30 before slaughtering for the market. In B.C. the withdrawal period is 42 days, and in Norway 61 days. Very few data exist for measurement of persistence of these drugs in fish flesh after feeding. McCracken et al (1976) measured the presence of trimethoprim in trout muscle 77 days after medication; Salte and Liestøl (1983) calculated that the withholding period for trout receiving OTC should be 100 days at winter temperatures, and for Romet 30 they recommended withdrawal periods of 60 days, above 10°C. All authors emphasize that temperature is a seriously complicating factor - residues of Romet 30 persisted for several months in fish at colder temperatures, leading Salte and Liestøl to recommend using the component drugs only in summer. Clearly these limited data do not support the FDA regulation of 21 days. New, more refined measurements of drug residues in salmon coming to market clearly are needed - a recurrent theme of the Austins. Some of these measurements are being made now at the University of British Columbia by McErlane et al. (1989), and Grondel et al. (1987) have published a pharmacokinetic analysis of OTC distribution in carp. In the absence of more detailed studies, humans ingesting farmed salmon may be receiving subtherapeutic doses of antibiotics. One would like to see regulations established for testing the product, by agencies, as it comes to market to ensure the absence of detectable residues. Methods used should be such as those approved by the National Committee for Clinical Laboratory Standards

used by the Clinical Laboratories, Laboratory Medicine, University Hospital, University of Washington.

The issue extends beyond the limits of the penned salmon. Much of the antibiotic fed escapes into the fluid environment and, notably, into the sediments that accumulate beneath the pens (Jacobsen and Berglund, 1988), where it may be exposed to native fish, shellfish, and other indigenous species, thus providing another avenue to humans who may catch and consume these forms.

The medical consequences of the mis-administration of antibiotics are numerous, and are well discussed in such modern treatises as Goodman and Gilman (1985) and Kucers and Bennett (1987). A number of them are antigenic and elicit immunological hypersensitivity responses; some have toxic effects in various tissues varying with the physiological and health state of the person; some particularly should be avoided during pregnancy; tetracyclines lead to discoloration of infants' teeth and may interfere with bone growth; some, notably the tetracyclines, may lead to the development of superinfections by resistant strains of bacteria; they may interfere with the normal immune response; and the breakdown products of antibiotics, including OTC, can be toxic particularly in individuals with compromised livers. Basically, it is poor medical practice to ingest unneeded antibiotics or deteriorating antibiotics.

Another cluster of problems associated with use and misuse of antibiotics is the generation of strains of pathogenic bacteria that have resistance to the drugs. Such strains have now appeared in essentially all fish culture communities that have been adequately tested. Mostly the resistance factors are carried on R plasmids, which also usually are found to carry resistance determinants for 1 to 8 additional antibiotics, thus showing multiple drug resistance. In high proportions, these R plasmids are transferable to other bacteria, and thus drug-resistance may be disseminated to other ecosystems. Studies at the Centers for Disease Control have shown that outbreaks of salmonellosis could be traced to drug-resistant *Salmonella* derived through the foodchain back to land farms associated with agricultural antimicrobial use (Cohen and Tauxe, 1986). It is prudent to evaluate the possibility for a similar generation of R plasmids in fish farms and their dissemination to human populations in the marketplace. When drug-sensitive populations of pathogens are replaced by drug-resistant populations, then treatment of the affected fish becomes ineffective, and, if the R plasmids are in human pathogens, treatment of patients would be adversely affected. Particularly, it is a general principle that medically important antibiotics, including oxytetracycline, the sulfas and erythromycin, should be restricted in their nonmedical uses to minimize R plasmid selection and transmission.

When antimicrobials are used in fish farms near commercial or recreational shellfish beds, there is the further potential for drug-resistant organisms to be concentrated by the shellfish, through filtration, and thus enter human populations.

Food additives. The dry pellets, fed to the penned fish in the marine environment, contain fish meal, grains, fish oils and carbohydrates, supplemented by minerals and vitamins as indicated in Table 2. While these additives have no direct human import, it is reported that planktonic blooms of

the ichthyotoxic dinoflagellate, *Gyrodinium aureolum*, were enhanced by the biotin in fish farm wastes (Turner et al., 1984). These blooms cause mortalities to cultured fish, and, unfortunately, to wild fish as well (Bullock et al., 1985).

Pigment is added to the feed to produce a colored flesh in farmed salmon, inasmuch as the color of wild salmon flesh is derived from natural food organisms. In Great Britain, the carotenoid canthaxanthin, an analog of astaxanthin common in natural food organisms, is used in the form of carophyll red. It is stated in a report from the University of Stirling that this use is banned in the US because of possible carcinogenic properties of canthaxanthin (NCC Report, 1988). To date a petition for its use has not been submitted to the FDA (FDA, Seattle Office, 1989). A petition is presently under consideration for use of astaxanthin as a colorant. A main local supplier adds canthaxanthin as a colorant. There clearly are gray areas here where research and regulation is sorely needed.

Many wild fish are rich in omega 3, polyunsaturated fatty acids. A higher ratio of omega 3/omega 6 fatty acids is believed favorable for maintaining low cholesterol levels in humans. Cultured fish and other sea foods, because of their artificial diets, may have low levels of omega 3 fatty acids, and thus unfavorable ratios of omega 3/omega 6 (Suzuki et al., 1986; Chanmugam et al., 1986). Consequently, individuals eating farmed salmon in the expectation of gaining this supplement will typically be erring, unless the farmer has specifically added it as a dietary supplement and indicated this in marketing. The dry pellets supplied locally generally do not have omega 3 acids added as a supplement (Moore-Clark Co., 1989, pers. comm.) because these are contained in the fish oils of the fish meal used.

Moist pellets, which are more commonly fed during the hatchery phases of salmon farming, are derived from fish meal that is pasteurized, combined with additives, and frozen. However, moist pellets used in some fish farms in Puget Sound contained *Salmonella* spp. (Draft PEIS, WDF, p. 116, 1989). Moist pellets used in British Columbia have been found to contain *Salmonella* (Kelly, 1988, pers. comm.; Sabink, 1988, pers. comm.). In these cases it is unclear whether the pathogens had survived the pasteurization, or had appeared subsequently. These pathogens can persist for a period of time in marine waters, are harbored by fish in polluted waters, without harm to them (Buttiaux, 1963). Marine shellfish can concentrate *Salmonella* and transmit them to humans. There is, therefore, a potential for fish culture to join animal husbandry as a mode for affecting humans in the manner described by Cohen and Tauxe (1986).

Hormones. At this time, hormones are being used in B.C., experimentally and perhaps to an extent in actual culture, to control the sex, size and behavior of penned salmon, both *Oncorhynchus* spp. and *Salmo salar*. Gonadotropin, gonadotropin releasing factor and analogs, and antiestrogens have been used in adult females to modify spawning. Androgens and estrogens are used to cause feminization, and, in combination with other techniques, to produce triploid and tetraploid stocks for production of sterile salmon. A review is provided by Donaldson (1986).

In general, these treatments are used on egg-producing females or on eggs and sperm, and the likelihood of carry-over of hormones to adult, marketable fish is tiny. Anabolic steroids including methyl testosterone,

thyroid hormones, somatotropins, certain pituitary hormones can be used to accelerate growth in juveniles and the timing of smoltification (Donaldson, 1986). If these hormones, or androgens and estrogens, were used for growth acceleration or other effects on near-harvest adults, then there would be cause for concern to human consumers.

Pesticides. A remarkable list of agents are or have been used in salmon culture. Examples are: formalin, malachite green, acriflavin, Nuvan, Neguvon, Chloramine T, MS222, copper sulfate, tributyltin, diquat. In addition to the chemotherapeutics. Some are used in Scotland and Norway which apparently are not used, or not permitted, in the U.S. and B.C. Lists are incorporated into Table 1 of this presentation.

Treatment of salmon lice (*Lepeophtheirus salmonis*). These copepod ectoparasites pose a severe problem for adult penned fish in Scotland and Norway. In Europe, organophosphate pesticides (Nuvan^R (dichlorvos; Scotland) and Neguvon^R (trichlorfon which forms dichlorvos; Norway) are primarily used. Fish are treated by immersion in a concentration of 1 ppm for 1 hr, as needed. In 1984 39,600 lbs of Neguvon were used in Norway (Midtlyng, 1985). They are inhibitors of acetylcholinesterase activity in the cholinergic nervous system. These agents not only kill fish lice, but other crustacea in the environment as well, including commercially important species such as crabs, lobsters and mussels (Egidius and Moster, 1987), and they cause potentially serious problems to the treated fish (Davies and McKie, 1987; NCC Report, 1988). These agents are restricted by the EPA in the U.S. (Seattle EPA Office, 1989). In Washington, the carbamate Sevin^R (carbaryl) has been suggested for use for treatment of salmon lice, and it is used in oyster culture for controlling ghost shrimp. Sevin, also, is an inhibitor of acetylcholinesterase. Sevin has recently been restricted in parts of the United States, and its discharge is regulated by an NPDES permit. BRAVO (chlorothalonil), a fungicide has been suggested for and used recently on fishpen nets, a use banned by EPA because it is a class B carcinogen (EPA, Seattle, 1989).

Disinfectants and Antifoulants. Formalin and malachite green have been used for control of ectoparasites and fungi, usually in the fresh water phases of farming. Malachite green, a potential teratogen (NCC Report, 1988), is now banned. MS-222 is used under certain conditions for anaesthesia, but with a 21-day withdrawal period for clearance from tissues. Hatchery ponds are sterilized with chlorine.

To prevent fouling of nets by growth of algae and encrusting invertebrates, fish farmers have treated nets and pen structures with the antifouling agent, tributyltin (TBT). This substance, at exceedingly low concentrations, has a variety of adverse effects on marine invertebrates and perhaps on vertebrates (Bailey, D.S., 1987). When, in 1987, farmed salmon appeared in the Seattle markets carrying substantial amounts of TBT in their flesh, the state enacted a law prohibiting this use and partially eliminating it from use on boats. A similar law exists in the national statutes, in Great Britain and other parts of Europe. Despite this ban, a Canadian Governmental memorandum on August 11, 1988, titled "Private Salmon Hatcheries and Netpen Facilities, Some Serious Concerns" indicates that 25% of BC pens are still treated with unregistered boat hull paints, sometimes including TBT, which liberate

large quantities of particulate paint into the water, sometimes onto oyster beds, thus creating potential hazards for two kinds of aquacultured products.

If antifoulant is used on nets now, usually it is copper-based. Copper and other heavy metals are highly toxic to many marine invertebrates. Standards for permissible amounts of copper in farmed fish flesh appear to be lacking.

Summary. There are a number of chemicals and additives used in net pen culture now that have the potential for adverse human impact. Often these are used at the discretion only of the user, and with little or no external monitoring. There appears to be little or no input into this regulation by public health agencies.

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Table 1
Chemicals Used in Net Pen Culture of Fish
 (From Austin and Austin, 1986; The Nature Conservancy
 Report, Scotland, 1988; and other sources)

Chemotherapeutics

Oxytetracycline	Streptomycin
Romet 30 ^R (sulfadimethoxine and orhomoprim)	Sulfisoxazole
Sulfamerazine	Kanamycin
Tribrissen ^R (trimethoprim)	Fumequine
Erythromycin	Chloramphenicol
Penicillin G	Chloramine T
Oxolinic acid	Acriflavin
Minocycline	Acetic acid
Clindamycin	Formalin
Kitasamycin	Malachite green
Rifampicin	Iodine
Hyamine 3500	Iodophor
Copper sulfate	Benzalkonium
	Nitrofurantoin

Pesticides

Dichlorvos (Nuvan^R, an organophosphate)
 Trichlorfon (Neguvon^R, an organophosphate)
 Carbaryl (Sevin, a carbamate; used in oyster culture)
 Diquat

Antifoulants and Disinfectants

Tributyl tin - now banned
 Copper paint
 Bitumen
 Chlorine
 Chlorothalonil

Anaesthetics

MS-222 (tricaine methane-sulfonate)
 Benzocaine
 Carbon dioxide

Food additives

Colorants-canthaxanthin
 Minerals
 Vitamins
 Omega 3 fatty acids

Table 1B
Doses of Antimicrobials Commonly Used in Salmon Net-pen Culture

Antimicrobial	Dose, mg/kg of fish/day	Days of Treatment
Oxytetracycline	75	10
Romet 30	50	5
Sulfamerazine	220	14
Tribrissen	30	10
Erythromycin	10-25, or unspecified	4-21

These regimens are repeated 2 or 3 times a year

Table 2
Mineral and Vitamin Food Additives
in Salmon Pellets
(Data from Nature Conservancy Council Report 1988, and
Moore-Clark Analysis)

Minerals

- Calcium phosphate
- Magnesium sulfate
- Sodium Chloride
- Potassium chloride
- Iron sulfate
- Zinc sulfate
- Copper sulfate
- Manganese sulfate
- Cobalt sulfate
- Chromium chloride
- Ethylenediamine dihydroiodide
- Selenium

Vitamins

- Thiamine hydrochloride
- Riboflavin
- Calcium pantothenate
- Niacin
- Pyridoxine hydrochloride
- Biotin
- Folic acid
- Cyanocobalamin
- Inositol
- Ascorbic acid
- Choline chorlide
- Menadione
- alpha tocopherol acetate
- p-aminobenzoic acid
- Retinol acetate
- Vitamin A
- Vitamin B12
- Vitamin D3
- BHA-BHT, antioxidant

Alaska Water Resources Board
Resolution No. 89-22

Possible Impacts of Fish Farming

WHEREAS: A strong market for fresh salmon and therefore a demand for rearing areas exists for pen reared salmonid fin fish.

WHEREAS: The State of Alaska has an abundance of salt and fresh water environments ideally suited for this economic activity.

WHEREAS: There is a persistent and ever growing clamor on the part of fin fish growers to have Alaskan water resources made available to them.

WHEREAS: The State of Alaska has a very large, extremely valuable wild fish population distributed throughout the state upon which very valuable commercial, subsistence and recreational fisheries are also dependent.

WHEREAS: After an initial period of very rapid growth and expansion into lucrative markets for their product the fin fish industry elsewhere in the world is now beset with problems of disease, parasitic infestations and escapement of penned stocks leading to the degradation of wild salmon stocks.

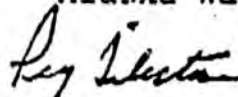
WHEREAS: There are among the so far identified dangerous diseases and infestations those that are demonstrably able to be transported from country to country and from continent to continent under present conditions.

WHEREAS: Among these afflictions there are disease infestations for which there is no known treatment and parasitic infestations which once established would require the roetinine treatment of entire river systems to eradicate.

NOW THEREFORE BE IT RESOLVED: The Alaska Water Resources Board recommends that there be no fin fish farming of salmon or trout in Alaska until it can be established that the disastrous consequences of inadequately regulated fin fish farming now being experienced in other parts of the world will not occur here; and

NOW THEREFORE: The Board further recommends that the Fin Fish Task Force created but not funded by the 15th Alaska Legislature be reactivated, funded and charged with the task of assembling the necessary information to assure that fin fish farming, if allowed, will not constitute a deadly hazard to our wild stocks.

Adopted this 9th day of March, 1989
Alaska Water Resources Board



Peg Tileston, Chairwoman
Alaska Water Resources Board

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

SOUTHEAST REGIONAL OFFICE DIVISION OF LAND AND WATER MANAGEMENT

STEVE COWPER, GOVERNOR

400 WILLOUGHBY AVENUE
SUITE 400
JUNEAU, ALASKA 99801-1063
PHONE: (907) 465-3400

March 23, 1990

Re: Thorne Ferguson

Honorable Richard I. Eliason
c/o Pouch V
Juneau, Alaska 99811

Dear Senator Eliason:

Research of our records indicates that T. Ferguson Construction, Inc. did purchase U.S. Mineral Survey 419B, known as the Maine, Monterey and San Francisco claims from Georgia-Pacific Corporation, (Warranty Deed, 1984). The property is located at Copper Harbor, Hetta Inlet, on the west side of Prince of Wales Island. In 1985 In 1985 Mr. Ferguson submitted applications intended to obtain approval of what appeared to be a multi-stage development. According to one of the cover letters, the initial stage of construction (development of a seasonal resort for hunting as well as fresh and salt water fishing) was intended to support the second stage (the development of a hatchery and fish farm); see ADL lease application 104488.

In September of 1987 the applicant indicated to DNR they had received a Army Corps of Engineers permit dated in June of 1986. Proposed construction under the Corps permit consisted of a lodge, barge ramp, and docks to be constructed in conjunction with the proposed private fish hatchery. The permit stated that the lodge and docks would supported by approximately 100 piles, and the barge ramp would consist of a timber crib bulkhead placed at M.L>L>W. and back-filled with approximately 1,800 cubic yards of shot rock fill (see Army Corps of Engineers Public Notice of Application for Permit Hetta Inlet 7, dated September 3, 1985).

However, contrary to the lease application and corps notices, a letter from the State Office of Management and Budget dated August 22, 1985 appears to indicate that the applicant dropped the hatchery portion of its proposal at that time. Mr. Menzies letter of June 2, 1986 appears to furnish the reason. The OMB consistency determination of May 9, 1986 purposely dropped consideration of the hatchery and hydroelectric plant.

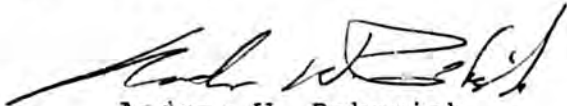
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The 1986 Army Corps of Engineer Permit is the only document that appears to still imply a remaining interest in a hatchery. None of the State approvals, including Water Use Applications LAS 6089 and 6090 involve the hatchery proposal directly.

It appears clear from the file that the applicant was never assured of being able to develop a hatchery. That although it is something that he wanted to do, he decided to proceed with the lodge with no guarantees that he would be able to construct the hatchery. It is possible that the \$500,000 figure thrown around would include the \$370,000 initial purchase price.

Please let me know if there is anything else I can do.

Sincerely,



Andrew W. Pekovich
Regional Manager, SERO

CC: Larry Ostrovsky
Gary Gustafson
Janet Burleson