

ALASKA LEGISLATURE SPECIAL COMMITTEE/SUBJECT FILE 8672
1900 SCOMM 75: MARICULTURE (FISH FARMING), 1987-1990

Legal Status--The legal status of mariculture in Alaska is unclear. While there is recognition of sea farming in statutes, clear regulatory processes are not available to guide individuals wishing to engage in many mariculture activities.

The Department of Law has said that technically the only species for which an applicant can presently receive a fish farming permit is oysters, a non-indigenous shellfish. However, there are mechanisms that allow individuals to harvest some undersized species and hold the animals in a farming environment until they reach salable size.

Specific regulations must be passed by the Board of Fisheries and Department of Fish and Game before sea farmers can obtain permits to collect and hold most native species of shellfish and finfish. Current statutes do not allow state or nonprofit salmon hatcheries to sell or transfer surplus eggs to private farmers.

Siting--The environmental impacts of mariculture operations are site- and species-specific. When siting mariculture facilities, it is important to consider the water circulation in the area and flushing action in the immediate vicinity. Concerns that water quality would be degraded beyond the immediate vicinity of mariculture operations are generally unwarranted. Such conditions would exist only in areas of extremely limited flushing or if culture density was very great.

Mariculture is one of many potential uses of Alaska's tidelands and adjacent uplands. The current decision-making process for these land use decisions involves weighing mariculture against a host of other potential uses.

Permitting--Mariculture is likely to become a significant use of Alaska's tidelands and adjacent uplands. This has prompted the Department of Natural Resources to work on a new tideland permitting process for shellfish operations that would require permittees to meet certain benchmarks to ensure project viability. The new permitting process also provides the mariculture developer greater security than the present system.

Disease and Genetics--Alaska's existing disease and genetics policies appear to provide adequate safeguards for the protection of native and cultured stocks. Endemic disease agents are ubiquitous in wild stocks and the marine environment. Many are opportunistic, causing disease in fish primarily when they are crowded or stressed. Although it is possible for such disease to be transmitted from cultured to wild stocks, catastrophic mortalities from indigenous pathogens would not be expected because of the lack of stress factors in the receiving populations and the wide environmental dispersion of host animals. Mariculture would produce no further risk to wild stocks than the current salmon ranching program provided state disease and genetic policies are followed.

Public Health--Growth of a mariculture industry presents no special public health concerns as existing state regulatory programs governing sanitary practices and seafood product wholesomeness appear to be adequate to provide proper protections.

I. SITING

A. Species Requirement Criteria

Each species of cultured plant or animal has a unique and specific set of environmental needs. Consideration of the environmental requirements of the species targeted for a sea farm will help assure that the site will be suitable for the proposed operation. Conditions, such as salinity, temperature, flushing action, depth of water at the site and other factors may vary from species to species. For example, oysters are tolerant of salinity changes and exposure to air, while scallops are quite sensitive to those factors.

This procedure could allow for evaluation of permit applications to assure that the site is suitable for the proposed farming operation.

B. Requirements for Aquatic Environmental Protection

Mariculture facilities have several possible environmental impacts on areas adjacent to their location. These effects include changes in water current circulation, an increase in sedimentation and various changes in water quality. These environmental impacts are species- and site-specific, depending on the size of the operation.

When siting mariculture facilities, it is important to consider the water circulation in the area and flushing ability in the immediate vicinity. The placement of mariculture facilities in the water (either rafts with suspended mesh bags or trays for shellfish, or net pens for finfish) will alter the water-current patterns. These structures will decrease water movement which may in turn result in an increase in sedimentation from food particles, feces, and shell debris. The concentration of ammonia-related compounds generated from decomposing organic material may increase, and the amount of dissolved oxygen may decrease. All of these factors may combine to effect the quality of the seafood product being cultured.

Generally, floating facilities have less problems with sedimentation than bottom-culture operations. One way to alleviate a water circulation problem is to place multiple net pens or rafts in a line parallel to the direction of water flow. Proper spacing between nets or rafts should be maintained to allow adequate water circulation. Choosing a site with adequate flushing capabilities will eliminate much of the sedimentation problem. The culture structure should be far enough off of the bottom to allow normal water flow beneath it.

CORRECTION

**THIS DOCUMENT
HAS BEEN REPHOTOGRAPHED
TO ASSURE LEGIBILITY**

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Public Health--Growth of a mariculture industry presents no special public health concerns as existing state regulatory programs governing sanitary practices and seafood product wholesomeness appear to be adequate to provide proper protections.

Brood Stocks--The availability of brood and seed sources will be a major factor in shaping the initial growth of a mariculture industry in Alaska. Orderly development of mariculture would be enhanced by a policy of allowing access to necessary seed and brood sources from wild stocks, but sea farmers should develop captive brood sources for many species over a period of time. Acquisition of brood stocks for salmon and some other fully allocated species may require changes in statutes and regulations. Proper protection of Alaska's wild fisheries resources will require the cautious development of mariculture brood sources. Brood stock programs for captive culture populations should follow appropriate policy guidelines for disease, genetic and exotic species issues.

Research and Development--The success of mariculture throughout the world is largely due to government research in disease prevention and control, broodstock development, and nutritional requirements, including use of local fish meals. The industry is likely to look at government to continue fulfilling these functions.

Training and Education--One of the best methods for the State of Alaska to encourage a strong resident involvement in mariculture is through training, education and extension service programs. Particularly important to local involvement in mariculture operations is the availability of these programs to residents of rural areas. Education and training programs should (1) provide a novice with enough knowledge to allow him or her to start a mariculture business with a reasonable chance of success and (2) train Alaskans to work as technicians at sea farms or hatchery operations.

Taxes--The Department of Revenue was seeking at the time of this report legal clarification of the applicability of the Fisheries Business Tax on cultured seafood. This issue also is important to municipalities, however, since half of the tax is shared with local governments.

Investment Incentives--There appears to be a number of strategies available to the State of Alaska to encourage mariculture development or to influence the composition of the industry. A clear state policy supportive of mariculture is perceived to be a vital factor, while incentives such as credits on the Fisheries Business Tax may influence growth. Resident participation in mariculture could be encouraged through state loans and other non-conventional financing.

Market Development--Although overall consumer demand for high quality seafood is strong and growing, a critical factor to development of a strong mariculture industry is establishment of specific market channels. Early development could help farmers avoid holding products for which there are no markets. It would be helpful to gather market information in an easily accessible format.

Policy and Administration--Selection of a lead state agency has been recommended by a leading mariculture expert, but much more important is development of a strong and clearly articulated state policy regarding mariculture.

I. SITING

A. Species Requirement Criteria

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This procedure could allow for evaluation of permit applications to assure that the site is suitable for the proposed farming operation.

B. Requirements for Aquatic Environmental Protection

Mariculture facilities have several possible environmental impacts on areas adjacent to their location. These effects include changes in water current circulation, an increase in sedimentation and various changes in water quality. These environmental impacts are species- and site-specific, depending on the size of the operation.

When siting mariculture facilities, it is important to consider the water circulation in the area and flushing ability in the immediate vicinity. The placement of mariculture facilities in the water (either rafts with suspended mesh bags or trays for shellfish, or net pens for finfish) will alter the water-current patterns. These structures will decrease water movement which may in turn result in an increase in sedimentation from food particles, feces, and shell debris. The concentration of ammonia-related compounds generated from decomposing organic material may increase, and the amount of dissolved oxygen may decrease. All of these factors may combine to effect the quality of the seafood product being cultured.

Generally, floating facilities have less problems with sedimentation than bottom-culture operations. One way to alleviate a water circulation problem is to place multiple net pens or rafts in a line parallel to the direction of water flow. Proper spacing between nets or rafts should be maintained to allow adequate water circulation. Choosing a site with adequate flushing capabilities will eliminate much of the sedimentation problem. The culture structure should be far enough off of the bottom to allow normal water flow beneath it.

The effects of finfish culture and shellfish culture on water quality of surrounding areas are quite different. Shellfish cultures feed on indigenous phytoplankton and so do not introduce any 'new' nutrients into the area. As much as 40% of the total nutrients can be removed from the water column by these shellfish. Shellfish excrete relatively small amounts of ammonia and related compounds. Finfish cultures may increase the concentrations of ammonia, organic and total nitrogen, phosphate, and total phosphorous and Biological Oxygen Demand (BOD) in the surrounding area. Surrounding concentrations of dissolved oxygen may decrease. Generally, this phenomena is not a problem in culture areas with good water circulation because the metabolic wastes are diluted over a short distance.

The culture of finfish and shellfish results in the release of nutrients and the consumption of dissolved oxygen. A net increase in environmental nutrient levels may be expected in salmonid culture because of nutrient input in the form of feed. Culturing molluscs requires no addition of feed, so no input of "new" nutrients to the marine ecosystem results. However, molluscs do enhance the recycling of nutrients in the water column as they ingest phytoplankton and return a portion of the nutrients to the water column and sediments, making those nutrients available to primary producers again. The filter-feeding activities of the molluscs also serve to concentrate nutrients from a wide area into the area of the sea farm.

Concerns that water quality would be degraded beyond the immediate vicinity of mariculture operations are generally unwarranted. Such conditions would be anticipated only in areas of extremely limited flushing or if culture density was very great. In the few cases where measurable water-quality changes have been noted, the effects have been largely confined within the culture structure.

C. Site-Use Determination

Mariculture is one potential use among many of Alaska's tidelands and the uplands. The current decision-making process for these land-use decisions involve weighing mariculture against a host of other potential uses, including recreation, subsistence, personal use, log transfer sites, commercial fishing, and wilderness, as well as social, political, and economic factors associated with these uses. The most logical procedure to determine site usage is to have potential mariculture locations identified (using a set of predetermined, proven site criteria) and then included in the State Land Use Plans, such as the Prince of Wales Island area and

the Prince William Sound area plan. These plans attempt to balance many disparate and sometimes competing interests. If the potential mariculture sites were included in such a plan, site decisions would be straightforward and timely. While these area plans would be developing mariculture policies within the planning areas, statewide mariculture policies could result from these efforts. Another option is the development of a new plan similar to the ones generated by the Private Nonprofit Hatchery Program, which are presently working quite well. The development of a new plan does not seem currently possible because of the time and resources needed to develop such a plan. The inclusion of potential sites into state plans also seems unlikely due to the present lack of state funding for future plans. Thus, it seems that the present and future basis for the site decision making will be made on a case-by-case basis by all state and federal agencies involved with either permitting or resource review. These decisions will involve, for example, on federal public lands, wilderness capability analyses using the Alaska National Interest Lands Conservation Act (ANILCA) Sections 507(a) and 1315(b and d), and subsistence evaluations using ANILCA Section 810. Subsistence, as defined by ANILCA, provides for the customary and traditional consumptive uses of fish, wildlife, and other wild renewable resources by rural Alaska residents on federal public lands. It does not preclude the use of other resources but requires that an evaluation of effects be made. In Section 804, the nonwasteful subsistence uses of fish and wildlife shall be accorded a priority over the taking of fish and wildlife on public lands for other purposes. Another determination, which may be and probably will be required, is a cumulative effects analysis. This determination will probably be the result of legal actions and the expected large number of mariculture sites. These two determinations, and especially the case-by-case determinations, will necessitate more work by all the agencies involved as well as time delays for the applicants.

II. PERMITTING

A. Statutory/Regulatory Status

The legal status of mariculture in Alaska is unclear. While there is legal recognition of sea farming in statute, clear regulatory processes are not available for applicants to engage in many mariculture activities. Unclear are issues such as the ability of individuals to gather brood stock in limited fisheries, use of gear not authorized in the commercial fishery, and the harvesting of juveniles for culturing in fisheries with size limitations.

The Department of Law has determined that private, for-profit mariculture is covered by existing statutes. However, the department said, the Board of Fisheries and ADF&G must enact specific regulations before sea farmers can obtain permits to hold live fish or shellfish. To date the board has approved the farming of a non-indigenous species--oysters. Current statutes do not allow state or private nonprofit hatcheries to sell surplus salmon eggs to private salmon farmers.

There is no clear regulatory structure supportive of the development of a mariculture industry, although there are mechanisms to allow some activities. For instance, it is legally possible to obtain a permit to commercially harvest some undersized species and to hold the animals in a farming environment until they reach salable size. This method would appear to be most suitable in fisheries where there are no size and sex restrictions and little competition for the resource, such as mussels. There also is provision in law (AS 16.05.050 (11)) under which the Commissioner of ADF&G can authorize interim-use permit holders to engage in the experimental taking of fisheries resources. This statute may be a vehicle to allow the collection of brood stock for farming purposes in some fisheries.

ADF&G and the Department of Commerce and Economic Development are conducting a joint project with Japan to test the feasibility of culturing scallops in Kodiak. Local "cooperators" participating in the experiment have been issued scientific/educational permits for the collection of spat, and will be allowed to hold scallops for experimental purposes. However, the cooperators are not allowed to engage in "commercial" activities such as the sale of spat, juvenile or adult scallops.

B. Agency Coordination

Oyster farmers follow the established permitting path for use of state tidelands, and production and sale of shellfish products. The most critical permitting process is physical aquatic siting. This generally involves the Departments of Natural Resources, Fish and Game, and Environmental Conservation, the Army Corps of Engineers, and the Environmental Protection Agency. Permits for uplands usage at individual sites may require the additional involvement of the U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management, National Park Service, or other federal agencies.

Coordination of state and federal agency responses to the physical siting process is handled by the Division of Governmental Coordination (DGC) in the Office of Management and Budget. The DGC's review process is designed to

coordinate federal, state, and local review of projects in the coastal areas of the state. It is oriented to address any land management or resource regulatory issue related to physical siting and design of proposed projects. A key component of the process is review of the "consistency" of the proposed project with the standards of the Alaska Coastal Management Plan. Mariculture projects will be reviewed for their consistency with recreation, subsistence, habitat, and with air, land, and water quality standards. Applications for mariculture projects are reviewed on a 50-day schedule, which means the DGC will complete its review within 50 days unless non-consistency or other problems are raised.

New permitting systems required for mariculture development should fit within the existing DGC review process and timetable.

C. Project Development

Based on the growing interest in sea farming, mariculture is likely to become a significant use of Alaska's tidelands and adjacent uplands. As such, land managers and upland owners are interested in ensuring that sites are utilized for permitted activities and do not result in speculation. At the same time, these land managers have interest in developing a system that responds to the needs of the individual grower and results in a strong, diverse mariculture industry. ADNR currently is working on a new tidelands permitting process for shellfish operations that would require permittees to meet certain benchmarks to ensure project viability, while providing greater security for the mariculture developer than the present permitting system.

The characteristics and the scope of a mariculture project will be determined during the permit process. The applicant's development plan will become a part of the permits and they will describe: (1) what species will be raised; (2) size and location of the project; (3) type of structures used for growing; (4) whether upland support facilities will be allowed; (5) environmental safeguards that will be implemented; and (6) a timetable that will be used to monitor the progress during construction and development.

During the early stages of development, ADNR will be using these permits and develop a plan to monitor the progress of a project. ADNR will be emphasizing the need to use the land for its intended purpose within a specified period of time. The intent of this monitoring is to ensure the land speculation is not occurring and that approved sites are available to create a land base large enough to support a self-sustaining industry.

As the project gets into the production phase, the monitoring by ADNR will become less important and the roles of ADF&G and ADEC will become more important in regulating water quality, protecting public health, and certifying brood sources.

To ensure mariculture develops into a self-sustaining industry, ADNR is considering modification of land-use permits and leases to meet the need of a grower. At the present time, there is no guarantee for the grower that starts out with a land-use permit and then requests a lease with a term of more than ten years. The site will be put up for bid at a public auction and the grower may lose the site if he is outbid. A lease term of less than ten years may be negotiated if the director finds it in the best interest of the state.

III. FIN/SHELLFISH HEALTH AND GENETICS

A. Fin/Shellfish Health

1. Importation of exotic diseases

Current regulations (5AAC 41.070) prohibit importation of exotic finfish or shellfish species into Alaska except Pacific Northwest-cultured, Japanese oysters and ornamental fish for non-release only. Oysters can be imported only after disease certification by the ADF&G, Division of Fisheries Rehabilitation, Enhancement and Development's Fish Pathology Section and only after the importing party obtains a Fish Transport Permit (5AAC 41.005), which must also be evaluated by the Fish Pathology Section. Adequate control to prevent importation of exotic diseases is in effect.

2. Potential dissemination of indigenous aquatic animal diseases within the State of Alaska by movement of mariculture species

Possession or transport of any live fish or gametes thereof requires a Fish Transport Permit, as above, the application of which is evaluated regarding various concerns, including finfish or shellfish disease within the stock or brood source on which the permit is approved or denied (5AAC 41.020; 41.030). The definition of a fish includes all invertebrates and amphibians (AS 16.05.940). In addition, disease control is required at hatchery or rearing facilities (5AAC 41.080) through disinfection procedures and yearly hatchery inspections by a qualified fish pathologist. Disease outbreaks must be reported to the Fish Pathology Section which is governed by these

regulations in recommending to the Commissioner the disposition of said diseased fish. Current regulations appear adequate to control movement of finfish and shellfish diseases affecting mariculture practices.

3. Transmission of diseases from cultured finfish or shellfish species to wild stocks

Future mariculture practices would produce no further risk to wild stocks than practices currently employed. Certain disease agents are already ubiquitous in the environment and opportunistic, infecting fish only when they are crowded or stressed artificially by aquaculture practices. Other disease agents which are obligate pathogens could possibly transmit from cultured finfish/shellfish to wild stocks. Although this would be undesirable, most generally clinical disease or catastrophic mortalities do not result in the receiving wild populations due to the lack of stress factors and wide environmental dispersion of host animals.

Although some risk is present now and will be present in future mariculture endeavors, there are adequate, current regulations cited previously for monitoring cultured fish/shellfish stocks for disease, and control of such diseases to protect both wild and other cultured stocks.

4. Environmental contamination by therapeutic drugs or chemicals used in mariculture practices

There are no data on which to evaluate this possibility. However, certain premises suggest that this is an unlikely concern: (1) The great magnitude of dilution of such drugs in the water column would make the final exposure concentration so far below efficacious levels that natural fauna and flora should be unaffected; (2) the infrequency of use would prevent chronic exposure of natural flora; (3) in most instances, a systemic chemotherapeutant is the only practical method to treat a disease affecting thousands of captive fish. Consequently, the drug is administered in the diet and metabolized with very little of the medicated feed left to allow leaching of the drug into ambient water.

Circumstantial information suggests that drugs used in mariculture operations present a negligible risk to the environment.

5. The increasing demand on state pathology laboratories to conduct disease surveillance for private enterprise

will incur additional costs that must be borne by the state in order to maintain control of disease occurrence within cultured and wild stocks of finfish and shellfish.

B. Genetics

ADF&G has a detailed policy statement developed dealing with the issue of genetics, including transportation of stocks and importation of non-indigenous species. Exceptions to this genetics policy will be made on a case-by-case basis. While it appears that there is considerable opportunity for genetic engineering as part of mariculture activities, that field is largely unknown.

IV. PUBLIC HEALTH

The Alaska Department of Environmental Conservation (ADEC) is responsible for ensuring sanitary control and product wholesomeness of all phases of the seafood industry. This responsibility is addressed in 18 AAC 34, the Fish Inspection Regulations.

With regard to the shellfish industry, ADEC certifies all shellfish waters for harvesting on the basis of sanitary quality and public health safety, regulates the harvesting of shellfish, makes laboratory examinations of shellfish and shellfish waters, and restricts the harvesting of shellfish from particular areas in public health emergencies.

Processing of other mariculture products also would be dealt with through existing ADEC regulations to protect the sanitary quality and public health safety of the particular mariculture product.

A. Water Quality

Water quality of a shellfish growing area must meet minimum standards established by the federal Food and Drug Administration, "National Shellfish Sanitation Program (NSSP)." Prior to harvesting a shellfish growing area, ADEC conducts a sanitary and biological survey of the area before approving it to allow shellfish harvesting for sale for human consumption.

The examination is verified by laboratory findings when needed to indicate that pathogenic microorganisms, radionuclides, pesticide chemicals, harmful industrial wastes, and sewage wastes do not reach the area in dangerous concentrations and do not pollute the shellfish in the area.

Laboratory water samples from the sanitary survey are analyzed by the ADEC Palmer Laboratory to ensure that the samples do not exceed standards established by the NSSP.

Factors which may affect water quality are location of nearby pollutant sources, other users of the growing site, vessel traffic, freshwater streams, float houses, human habitation, and point source pollution.

The use of nets treated with tri-n-butyl tin (TBT) has been extensive in Norway and other countries involved in sea farming. This compound is used as an antifoulant to reduce labor costs associated with cleaning nets. Public health concerns have been raised over the use of TBT, a heavy metal.

However, the use of TBT in connection with mariculture in Alaska is not likely to be a problem since the ADEC presently is not approving permit applications for aquaculture operations using TBT-treated nets.

For information on requirements of the "National Shellfish Sanitation Program", refer to the program's Manual of Operations, Part 1. Sanitation of Shellfish Growing Areas, U.S. Department of Health and Human Services, Food and Drug Administration, 1986 Revision.

B. Food Quality of Mariculture Products

ADEC is responsible for ensuring that all seafood products intended for human consumption are wholesome and uncontaminated.

Shellfish (clams, mussels, and oysters) possess the ability to filter and concentrate pathogenic microorganisms and toxic substances from the water. Furthermore, shellfish are packed whole and alive and are often consumed raw or lightly cooked. For these reasons, the public health significance of consuming shellfish for food is very important.

Other mariculture products intended for sale for human consumption would need to be evaluated and protected from potential contamination or adulteration that could result from pathogenic microorganisms and toxic substances.

1. Paralytic shellfish poisoning

Paralytic shellfish poisoning, or "PSP", is a very serious illness caused by poisons concentrated in some varieties of dinoflagellates, a kind of microorganism. Since shellfish feed on these organisms, they can absorb and store the PSP toxin. The presence of PSP in Alaska has been well documented, and shellfish intended for commercial markets must be quarantined and tested for the toxin before being released for sale for human consumption.

Currently, testing for PSP is done through the ADEC laboratory in Palmer. The only test currently certified by the Food and Drug Administration is a mouse bioassay. Research is ongoing at several universities to establish other testing methods for PSP, but none have been certified to date.

2. Coliform testing

The National Shellfish Sanitation Program has minimum coliform standards for shellfish meat that must be met before shellfish can be commercially marketed. The need for actual coliform testing of the meat is determined by an ADEC review of the sanitary survey to see if actual or potential pollution may be present.

3. Sanitation

Harvesting and processing areas must meet state and federal regulations currently in existence to guarantee proper sanitation and product wholesomeness. This includes, for example, separation of raw and finished product, transporting under refrigeration, and holding shellfish during PSP and/or bacterial testing.

V. BROOD STOCKS

Development of dependable, high quality brood stock sources in sufficient quantity to meet initial and long-term needs will be a critical step in providing a strong foundation for mariculture. During the initial phases of growth, general availability of brood and seed sources will likely be a major factor in deciding which species are developed and where development occurs.

Proper protection of Alaska's wild fisheries resources will require the cautious development of mariculture brood sources. Brood stock programs for captive culture for profit populations should follow specific policy guidelines for disease, genetic, indigenous and non-indigenous species issues.

Orderly development of mariculture would be enhanced by adoption of a policy by the State of Alaska to assist in initial access to necessary seed and brood sources from appropriate wild stocks. Over the long term, however, sea farmers should develop captive brood sources for many species. This will be particularly important in brood sources secured from fully allocated common property resources.

Acquisition of brood stocks and seeds also may require changes in statutes and regulations. For instance, the sale of surplus eggs from existing hatcheries to private farmers appears to be prohibited by state law. Legal issues also are raised by the capture of under-sized juveniles, use of gear not authorized in the commercial fishery, captures when the commercial fishery is closed and ability to capture wild brood sources in limited fisheries.

A. Salmon

Most interest in salmon farming in Alaska revolves around chinook and coho stocks. Alaska now has well developed public and private hatchery programs releasing large numbers of smolts of these species. Many of these programs achieve large enough returns to satisfy brood needs, provide catches to common property fisheries and allow terminal area cost recovery harvests. Present performance and estimates of survival rates and other factors suggest that these hatchery programs could provide large enough surpluses of chinook and coho eggs to satisfy the initial needs of a salmon farming industry in Alaska.

The food quality of returning hatchery salmon deteriorates rapidly, and many fish harvested in terminal areas for cost recovery would be more valuable as egg sources for salmon farming. A higher value for cost recovery catches could mean more fish are made available to the common property fisheries. It is estimated that 10 to 20 million surplus chinook and coho eggs per year could be made available for farming purposes under a strategy of allowing cost recovery

egg sales. Statutes would have to be amended to allow surplus egg sales from private or public hatcheries for salmon farming.

B. Trout, Char, Steelhead

There are no current brood stock surpluses in Alaska's hatchery programs for these species. Farming brood stock development for these species probably would be modeled after the conservative, carefully controlled egg take schedules from wild stocks taken already for our existing salmon ranching programs. These salmon egg takes are conducted on the healthiest wild stocks on varied schedules to ensure protection to the donor populations.

C. Non-indigenous Salmonids

Atlantic salmon is the most intensely farmed salmonid in the world. Some British Columbia and Washington State farms are now growing Atlantic salmon, partially because of limited sources of Pacific salmon brood stocks. The State of Alaska's disease and genetics policies and regulations currently prohibit the importation of live salmon or eggs.

D. Black Cod

Present interest in black cod (sablefish) farming is based upon the concept of capturing early life-stage juveniles from wild populations, and growing the fish to marketable size. Farming of black cod is being conducted on an experimental basis in British Columbia. High market prices have created strong competition for Alaska's black cod, and the state's only in-shore fishery already has been limited. Knowledge of this species is somewhat limited, suggesting that black cod farming should proceed cautiously.

E. Oysters

Several oyster farms are presently operating in Southeast with seed spat being imported primarily from Washington. Logistical problems in importing this spat have resulted in significant losses to many operators and remain a primary concern of existing farmers. While it may be necessary to develop an oyster seed hatchery in Alaska to ensure continuous dependable supplies, present sources of spat appear adequate to meet foreseeable demand.

F. Mussels

Mussel farming is based upon the collection of wild spat. In this case, Alaska has an abundant, widely distributed and unutilized resource, and there does not appear to be any biological need for constraints upon collection of wild spat.

G. Scallops

Interest in scallop farming has grown rapidly, particularly in the Kodiak area where a feasibility study is being conducted on collection of weathervane scallop spat using Japanese techniques. The distribution of natural populations is limited, but scallops produce enormous quantities of gametes and continuous collection of wild spat for farming probably won't pose biological or allocation problems.

H. Abalone

Abalone farming in Alaska probably would follow the development of culturing programs in Japan and California where hatcheries are used to produce spat for brood purposes. Competition is strong for Alaska's relatively small abalone resource open to commercial harvest.

VI. RESEARCH AND DEVELOPMENT

The success of mariculture is largely due to progress in three areas: (1) controlled breeding of domesticated broodstock; (2) understanding of the nutritional requirements of cultured organisms; and (3) control and prevention of disease. All three elements are involved in development of any mariculture operation, including shellfish, finfish and sea vegetables. Even if mariculture development is industry-driven in Alaska, there's a major role for government to play in research and development.

A. Broodstock Development

The biggest initial problem facing shellfish farmers in Alaska is location of dependable sources of spat. Indeed, the collection of spat is a major concern of established shellfish farming industries throughout the world. For the short term, the farming of indigeneous shellfish probably will rely upon the capture of wild spat or juvenile animals. Hatchery production of shellfish spat is an option for development of dependable sources for farming operations, but technical obstacles must first be overcome for some species.

The Norwegian success in salmon farming can be partially linked to the establishment of an experimental government genetics laboratory. A variety of salmon stocks were tested for growth characteristics, food conversion, fecundity, disease resistance, maturity schedules and other desired characteristics. The few stocks selected form the basis of an ongoing selection program. The University of British Columbia is undertaking a similar broodstock development program for Canadian farmers using coho hatchery stocks.

Development of salmon farming in Alaska would pose similar needs involving chinook and coho. Broodstock development using hatchery stocks would help guide farmers to the most suitable brood stock sources. Selection of the right broodstock could be critical to the success of fish farming.

B. Fish Nutrition and Dietary Requirements

Since about 60 percent of the production cost of farmed fish is procurement of food and feeding, a successful fish farming industry creates a demand for local production of food. An important research need is experimental work to develop the proper diet for Alaska conditions using ingredients that can be procured locally. While there is substantial agreement to the ratio of fish meal, dry ingredients and the fresh fish components of a diet, it is desirable to utilize stocks of local fish which aren't currently harvested in a commercial fishery. This would create new fishing opportunities and provide raw product to feed mills at low cost. Some waste products from processing plants also can be utilized in fish food.

C. Experimental Facility

A variety of fisheries research programs exist in Alaska, but no single agency has the resources to undertake the research outlined in this document. One potential solution is a coordinated approach to mariculture research involving a number of state and federal programs, resulting in a pooling of talent and financial resources under a single program. An important potential source of operating funds for such an experimental facility could be proprietary research for individuals and companies.

D. Database

Orderly development of a mariculture industry will be assisted by the gathering and organization of solid statistical data on the growth and performance of the industry. This database will be particularly helpful in market development and the growth of in-state support industries. The state could incorporate reporting requirements for quantities of brood or seed, production and product on hand into licensing programs.

VII. TRAINING AND EDUCATION

One of the best methods available to the State of Alaska to encourage a strong resident involvement in mariculture is through education, training and extension service programs. A special effort should be undertaken to make these programs available to residents of coastal communities to ensure local involvement.

Education and training programs should focus on two separate objectives: (1) provide a novice with enough knowledge to allow him or her to embark upon a mariculture business with a reasonable chance of success; and (2) train Alaskans to work as technicians at sea farms or hatchery operations.

A. Components of a Comprehensive Program

The most effective program would provide education and training at all levels: high school, post-secondary, vocational and extension services. High school technical training will serve to inform young Alaskans about jobs and career opportunities in mariculture. Post-secondary mariculture education helps ensure a resident pool of expertise, while vocational-technical courses provide focused education aimed at providing local residents with operational job skills needed by the industry. Extension services are particularly important to residents desiring to develop small scale mariculture operations and support services.

B. Coordination

Components of this comprehensive program are likely to be located throughout Alaska's diverse educational system, including local school districts, University of Alaska, Marine Advisory Program, community colleges, private institutions (Sheldon Jackson College), vocational education programs, and services offered by various governmental agencies (Office of Commercial Fisheries Development, FRED Division). Coordination of these programs could help avoid duplications and identify gaps in programs.

C. Training Areas

Education and training should cover the spectrum of planning, operational and regulatory concerns, including but not limited to physical operations, biological operations, economics, regulatory programs and technology.

1. Physical operations--site selection, physical plant design, equipment, utilities, support services, chemicals, transportation, processing, product quality
2. Biological operations--brood stock acquisition and development, disease management, nutrition, environmental quality
3. Economics--business management, operational costs, supply and demand, marketing, cash flow, financing, short- and long-term financial and operational planning
4. Regulatory--explanation of the regulatory process involving training and applicant manuals, helpful agencies and nonprofit organizations

5. Technology--dispersal of information regarding technological advances in equipment, nutrition, disease and other operational concerns

VIII. TAXES

Development of a clear and stable taxing policy is an important ingredient of governmental response to a developing industry such as mariculture. While municipal taxing authority over locally raised mariculture products appears clear, the applicability of existing food taxes levied by the state is uncertain. Clarification of this issue will be important to the state, local governments and prospective farmers alike.

A. Fisheries Business Tax

The Fisheries Business Tax currently imposed on commercially processed or exported seafoods ranges from one to six per cent of the product value at its first point of sale or export. Except for limited circumstances, the tax is based upon the amount paid a harvester by a processing company or broker. If mariculture products were to be taxed under the current structure, most mariculture farmers would be taxed at three per cent of the export product value. In-state sales of fresh product probably would not be taxed.

After studying the statutes and regulations, the Department of Revenue decided it should seek a legal advice from the Department of Law concerning the applicability of the Fisheries Business Tax on mariculture products. The Department is uncertain whether the tax was designed as a severance or product tax. Since state law provides municipalities with 50 percent of the collections of the Fisheries Business Tax within their jurisdiction, the issue is important to local governments.

B. Local Taxing Authority

Recent revisions to Title 29 broadened the taxing authority of local governments. All municipalities appear to have the authority to impose local sales taxes on seafood products purchased or sold within their taxing jurisdictions. Several local governments currently levy such taxes ranging from one to three percent of the initial purchase value.

C. Seafood Marketing Assessment

The Alaska Seafood Marketing Institute is partially funded through the Seafood Marketing Assessment which is a tax applied to processing operations and round fish exports or in limited cases to seafood brokers or distributors. This tax currently is fixed at .2 percent of the initial purchase

or export value. It appears to be applicable to mariculture products.

IX. INVESTMENT INCENTIVES

There appear to be a number of strategies available to the State of Alaska to encourage mariculture investments or influence the composition of the industry. In crafting these strategies, social and economic objectives should be carefully weighed. For instance, local employment and resident ownership may be achieved through divergent policies, and economic stability may come through involvement of a blend of corporate and family farming operations.

Large corporations or companies desiring to develop mariculture operations generally have access to venture capital through existing collateral bases or established relationships with financial institutions. These investors also can afford to hire experienced professionals to craft a financial prospectus, deal with difficult regulatory processes or manage a farm. Individual Alaskans interested in small to moderate farms generally lack the collateral base, trust of financial institutions and operational experience. These competitive disadvantages can be partially offset through non-conventional financing and other incentives designed to encourage resident investment.

Important to note is that other countries with developed mariculture industries have used combinations of incentives and regulatory devices to achieve socio-economic goals. Examples can be found in Norway where the government has restricted production size of salmon farms and extended licensing preference to local residents to encourage small operations in rural locations. These policies are directed at reversing population migrations to urban areas. The Japanese government has actively encouraged the development of cooperative farms involving local residents of fishing communities who often combine fishing and farming activities.

Regulatory/Political Climate

A clear policy supporting and encouraging mariculture development throughout the state's regulatory structure is perceived to be extremely vital to the growth of sea farming. A strong governmental policy supporting salmon farming has been critical to the rapid development of pen-rearing operations in British Columbia. This also has been true in Hawaii, Japan and Norway. Conversely, the growth of salmon farming in Washington State has been hampered by confusing and conflicting policies between various state agencies and county governments.

B. Taxes

A major attraction to venture capital in the British Columbia salmon farming industry has been a government program allowing tax-free profits up to \$500,000 (Canadian currency) from qualified farming investments. This policy helped attract millions of dollars in investment capital. This avenue would be open to the State of Alaska through amendments to its corporate tax laws.

If the Fisheries Business Tax is applied to mariculture products, another potential incentive available to the state would be tax credits or a temporary moratorium on Fisheries Business Taxes on new facilities. A model for a tax credit program could be found in legislation approved by the 1986 Legislature. The legislation (House Bill 58) was designed to encourage the building of new shore-based processing facilities, expansion of existing plants, diversification of product lines, and improvement of product quality. This incentive also could be accomplished by a moratorium on the Fisheries Business Tax during the first years of production of a new farming operation.

C. Non-conventional Financing

The state could encourage resident involvement in mariculture through establishment of a state loan program or loan guarantee fund. These non-conventional financing arrangements could be geared toward small to medium sized projects to qualified Alaskans. This program could potentially be targeted to assist residents of economically depressed rural communities. Non-conventional financing could be particularly important to family-sized mariculture operations.

Another option could be to focus on amendments to national agricultural loan funds to include financing for small-scale mariculture projects.

D. Non-cash Incentives

Another method to entice investment capital is through long term tideland leases, water rights and lease or grants of state-owned uplands for staging facilities. These non-cash incentives and tax advantages could be offered to firms which meet certain state objectives, such as employment of residents from areas of high unemployment or with commercial fishing backgrounds, or providing equity participation by Alaskans.

X. MARKET DEVELOPMENT

Although overall consumer demand for high quality seafood is

strong and growing, a critical factor to development of a strong, diversified mariculture industry is establishment of specific market channels. This market development ideally occurs before farms reach the production stage, so farmers don't end up with products at the marketing stage that cannot be sold. Failure rates in mariculture can be affected by the early establishment of market development programs.

A. Market Information

A large body of knowledge exists concerning seafood quality and marketing of Alaska products. While most is directed at products of wild origin, much of the information also will be applicable to cultured seafood. The information has not been gathered in an easily accessible format that could benefit prospective sellers of cultured--or wild--seafood products. Consequently, each interested individual must invest significant amounts of time and energy into essentially duplicative research.

B. Market Research

A good market research program would focus on development of specific market-related information on target species prior to commercial production. Critical market problems and opportunities should be identified for each species on a priority basis.

C. Alternative Markets

Cultured seafood products may not follow existing marketing channels, forcing farmers to focus on development of specialty or select markets. In analogous situations this need has led to the creation of private marketing entities conducting common promotion and assuming direct involvement in the sales process.

D. Quality

A primary benefit of cultured seafood is the relative ease of providing consistently high quality products. The early development of minimum and target quality standards for each product would benefit pioneering farmers and prevent problems as the industry grows and operational patterns are developed.

E. Transportation

The cost of moving product to market will play a significant role in siting of farms and market price of the finished product. Concentration of Alaska's mariculture activities or development of innovative transportation systems will help allow economies of scale in shipping and make Alaska cultured seafood price competitive.

F. Generic Promotion

The Alaska Seafood Marketing Institute's programs are designed to promote the benefits of all Alaska seafood products and do not make such distinctions as "troll-caught" or "net-caught," and "wild" or "cultured." However, some differentiations are possible under ASMI's enabling statutes but must not create competitive advantages for specific companies or regions of the state. ASMI promotions are determined by its industry board of directors which generally allocates the promotional budget in proportion to the value of Alaska's seafood production sold in U.S. markets. These amounts are adjusted to reflect market conditions and other factors.

XI. POLICY AND ADMINISTRATION

As outlined in this report, government will play a major role in the development of Alaska mariculture industry. The specific roles of various agencies in that process will be determined through consultation from the governor and legislature. One key policy decision will be the determination of how various agencies involved should interact, and whether a lead agency for mariculture should be designated. In determining the appropriate governmental structure, it might be useful to view the primary functions of agencies in terms of development advocacy and regulatory functions.

A. Lead Agency

A leading U.S. aquaculture law specialist brought to Alaska in early 1986 to discuss mariculture development strongly recommended the designation of a lead agency. The lead agency should be a development advocate with the ability to pull together state, local, federal and private resources to ensure success. The goal for this lead agency would be to streamline the permitting process and strengthen advocacy programs, while the objective would be to put Alaskans to work and create new wealth with the sale of a finished product.

While this concept is sound, the present structure of state agencies do not easily facilitate a lead agency with both advocacy and regulatory functions. The Department of Commerce and Economic Development has a strong advocacy program, but lacks regulatory jurisdiction and staffing. This also is the case with the Department of Community and Regional Affairs. At the same time, the resource agencies (DNR, ADEC and ADF&G) and the Division of Governmental Coordination in the Office of Management and Budget have strong regulatory and permitting functions but lack economic development staffs.

The present structure of state government might be more easily adapted to a cooperative approach with lead advocacy and permitting agencies. This concept would have prospective farmers making initial contacts at the lead advocacy agency which would in turn provide permitting road maps directing applicants to the proper lead permitting agency.

B. Policy Development

Regardless of which agency is considered lead, the parade should be led by a strong, clearly articulated state policy regarding mariculture development. This policy should give clear guidance to the agencies for making such value judgments as:

- (1) The balance between creation of jobs and the maximum amount of industrial capital.
- (2) Balance of environmental protection and economic development.
- (3) The importance of mariculture as a use of state tidelands and uplands.
- (4) Role of mariculture in efforts to diversify Alaska's economy.
- (5) Weight of specific social objectives (local employment, Alaska equity, tax revenues, etc.).
- (6) Recovery of private wealth created from common property resources.

Alaska Mariculture Report

Published by the
Alaska Mariculture Association

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Vol. 1, Number 2

The Alaska Mariculture Report is published monthly by the Alaska Mariculture Association (AMA). The newsletter is designed to provide information relating to mariculture development in Alaska, as well as to report on AMA activities. We encourage readers to submit articles for publication or suggest newsletter items. Write: Alaska Mariculture Association, P.O. Box 020704, Juneau, AK 99802-0704.

AMA Asks Policymakers to Promote Mariculture

The Alaska Mariculture Association (AMA) has called upon state policy-makers to adopt legislation promoting mariculture.

AMA issued the request following a recent meeting of its board of directors in Juneau. AMA concluded that the introduction of legislation is the best way to clarify ambiguous statutes and regulations and clearly articulate a policy on sea farming.

"The growing consumer interest in seafood has combined with a static level of commercial harvests to produce a very positive market climate for cultured seafood," said Paul Fuhs, AMA president. "We believe Alaska may miss these favorable market conditions if it fails to enact a clear state policy on mariculture. This emerging industry is becoming ensnared in red tape, and we're asking the governor and legislature to help us get free."

Research by the Department of Law indicates the only commercial form of mariculture specifically sanctioned under current law and regulations is oyster farming--a non-indigenous species. Meanwhile, the farming of native stocks, such as scallops and mussels, have no established permitting process except for scientific or educational projects.

"Our examination of the legal status of mariculture has revealed a confusing patchwork of often conflicting laws and regulations that results in barriers to applicants," Fuhs said. "While present state law recognizes the legal status of mariculture, there are legal and regulatory uncertainties stifling investments."

"One enterprising Alaskan has found a route around these roadblocks by obtaining a permit to commercially harvest wild juvenile mussels and growing them in captivity to a marketable size. But this path has been torturously difficult, requiring a tremendous investment in time and energy by an individual who is familiar enough the permitting process to find what may be best characterized as a loophole."

The shortcomings of the current legal situation are very apparent to aspiring scallop farmers in Kodiak who are participating in an experimental project sponsored jointly by the State of Alaska and Japan. These "cooperators" have been issued special science/educational permits to gather and hold wild scallop spat.

Several of these "cooperators" are expressing interest in proceeding with some independent commercial applications. However, the "sci/ed" permits are very restrictive and the state has had to caution the individuals to refrain from any commercial activities.

"The Department of Fish and Game has responded to these requests and is working on a permit to allow the commercial gathering of wild scallop spat," Fuhs said. "How we get from the hunting and gathering phase to actual cultivation isn't clear, however, as the proposed permits won't authorize the growing or farming of the scallops."

"We're calling upon Governor Cowper and legislators to develop a clear state policy on mariculture that will promote the industry and result in a simplified, straight-forward permitting process," Fuhs said. "Mariculture offers the promise of adding thousands of year-round jobs in Alaska's coastal communities and creating many economic spinoffs in service centers and transportation hubs such as Anchorage."

Study Finds Small Environmental Risk from Mariculture

A scientific study conducted for the University of Washington has found that mariculture poses no clear environmental risks when located in areas with adequate water circulation.

The UW study assesses "the probable magnitude of environmental changes that may result from mariculture operations in Puget Sound" and discusses the range of environmental issues raised by shellfish and salmon farming. Following are excerpts from the report:

Water Circulation--"A culture structure placed in the marine environment will reduce current velocity in the surrounding area, particularly in the downcurrent direction. However, this effect is not likely to be significant except in cases of intensive culturing in an area with very restricted natural circulation."

Water Quality--"Field studies have typically observed little or no changes in water quality outside the culture structure in well-flushed areas. Adverse effects would be anticipated only in

areas of extremely limited flushing or very intensive culturing activity."

Phytoplankton--"Floating mariculture is unlikely to have a measurable effect on phytoplankton standing stock or productivity in most of Puget Sound. A localized and measurable effect on productivity would be expected only in highly stratified and poorly flushed areas in which the water passing through a culture structure could maintain its integrity with minimal dilution."

Sedimentation--"Floating mariculture generates large amounts of solid wastes in the form of feces and unutilized feed (salmon culture) or feces, pseudofeces and shell debris (shellfish culture)...While there are profound effects on sediment chemistry, and consequently the sediment biota, these effects are very localized. Visible accumulation of solids and alteration of sediment chemistry typically extends no more than 30 meters from the culture structure...The depth of this accumulation depends for the most part upon water depth and current velocity."

Fish and Megafauna--"Accumulation of organic material in the vicinity of a mariculture operation may result in the loss of nonmotile megafauna (e.g. geoducks) living in intimate contact with the sediments. However, fish and motile megafauna (e.g. crabs) living on or above the sediment surface are typically found in higher densities around floating mariculture structures than in the surrounding area."

Introduction of Exotic Species--"If culture operations require the importation of live material into the state, the potential introduction of exotic species probably represents the greatest environmental threat posed by mariculture. Introduced species may establish self-sustaining wild populations, potentially becoming pests or eliminating native species. While there appears to be little risk of this occurring for those species currently being deliberately introduced for culture in Puget Sound, requests for future introductions should be carefully evaluated in this regard."

Diseases--"There is a fear that the disease organism may proliferate among the cultured fish, become more virulent, and reinfect the wild stocks. However, there is no evidence to indicate that this scenario has ever occurred...While fish held in culture are likely to show more frequent appearance of disease than wild fish, disease does not appear to be transmitted to wild populations."

Genetic Effects--"The potential consequences of the interbreeding of escaped and wild organisms, if at all, are unclear. However, for salmonids at least, the potential magnitude of the problem would seem minimal."

Toxicants--"Salmon net-pen culture in Puget Sound requires the occasional usage of antibiotics, most frequently oxytetracycline. The potential environmental effects of this usage are minimized by the high water solubility of the compound, rapid dilution with the surrounding water and the infrequency of its use."

The August 1986 report was conducted by Donald Weston of Science Applications International Corporation who now is working on a comprehensive environmental impact statement for salmon farming in Washington. The report is entitled: "The Environmental Effects of Floating Mariculture in Puget Sound." (College of Ocean and Fishery Sciences, University of Washington, Seattle, WA 98195.)

Scallop Farming in Alaska--A Farmer's Perspective

by Timothy Ward

Central Kodiak Archipelago Scallop Farming Project

The potential for scallop farming in Kodiak Island waters is excellent because of the good density and high growth rate of the natural population of the weathervane scallop (Patinopecten caurinus). These natural stocks coupled with the Japanese success in culturing a similar species (P. yessoensis) has sparked a major effort to master techniques for scallop farming in Kodiak.

An island-wide effort was mounted this year to negotiate the first hurdle of scallop farming--collection of spat. Although the three groups--State of Alaska, Kodiak Area Native Association and Central Kodiak Archipelago Scallop Farming Project (CKASFP)--were unsuccessful in capturing weathervane spat in trial efforts, other scallops, clams, mussels, cockles and snails were gathered. The real test of the spat gathering phase of the project will come next year when the collecting gear is pulled and examined.

CKASFP set weathervane scallop collecting gear in mid-May and July in four widely separated areas of high potential. The timing was based on the belief that Kodiak weathervane scallops spawn in June and July. The sites were selected in protected areas with good tidal action, no fresh water and adjacent scallop beds. The gear was set in 10 fathoms of water; it is now believed 30-50 fathoms is preferable.

The collecting gear is a vertical line buoyed at the top and anchored at the bottom. Monofilament web-filled onion bags are attached to the line. The mesh of the onion bags is large enough to let the scallop larvae enter, while the web provides a surface on which the larvae will attach and grow into a juvenile scallop. The scallops eventually detach from the web to fall to the ocean floor, but are too large to fit through the mesh of the onion bag.

(Next Issue: Transfer of seedlings and the grow-out phase.)

Kodiak Area Native Association Scallop Project

by Bill Osborne, KANA Mariculture Coordinator

The Kodiak Area Native Association (KANA) approached the State of Alaska in 1985 for assistance in establishing new marine-based businesses to promote economic growth. The result was an agreement with a Japanese development agency--Overseas Fisheries Cooperation Foundation--to test the feasibility of farming scallops on Kodiak Island.

Meanwhile, KANA obtained federal funding to assist in a scallop mariculture demonstration project. The goals of the KANA project are to establish a stable, income-producing enterprise for Kodiak villages, and to develop scallop mariculture techniques for application in other areas of Alaska.

Dr. Mike Kaill, mariculture specialist with the Alaska Department of Fish and Game (ADFG), and I studied scallop mariculture techniques in Japan last summer, while trial collection efforts began in several locations around Kodiak Island by private "cooperators" and ADFG staff. Strong support for the project was provided by Junzo Abe, a Japanese aquaculture specialist temporarily working with the Marine Advisory Program.

The initial spat collection effort yielded a variety of scallops, including the pink scallop (Chlamys sp.), but, unfortunately, no weathervanes. Japanese experts believe the design of the collectors may have contributed to the failure to gather weathervane spat, and say the successful collection of other scallops is a good sign.

The next collection effort will begin with a training workshop in Kodiak for project participants. OFCF will send Japanese technicians to work with ADFG, KANA and other "cooperators" at six collection sites. Work also will proceed in Kodiak to predict the timing and location of scallop spat settlement, analyze plankton and spat samples, and provide other technical support.

We're looking forward to 1987 being the year of the scallop in Kodiak.

TBT Correction

An article in our last newsletter misinterpreted research conducted by the National Marine Fisheries Service's Auke Bay Fisheries Laboratory on the use of tri-n-butyl tin (TBT) as an antifoulant treatment for marine nets.

The article said NMFS research show TBT-treated nets "appear to cause significant mortalities in open-reared chinook." Frank Thrower of NMFS explains: "Although TBT has caused significant mortalities of pen-reared chinook salmon on some occasions at our research station, we have never said or implied that rearing chinook in TBT-treated nets will always result in significant mortalities. With proper caution, chinook can be reared in TBT-treated nets without significant mortalities."

Thrower also clarified that TBT has not been demonstrated to be a "suspected carcinogenic compound" as stated in the article. As a heavy metal, TBT raises health concerns similar to those associated with human consumption of mercury. TBT currently is classified as a pesticide by the federal government, although that classification currently is under review.

Mariculture News Notes

The Mariculture Technical Work Group, composed of representatives from state and federal agencies and formed at the invitation of AMA, is nearly complete with its review of issues associated with the development of a mariculture industry in Alaska. The group's final report will be discussed in the January issue of the Alaska Mariculture Report.

Support for mariculture development in Alaska is growing, if adoption of recent policy statements by municipal governments is a reliable indication. A statement supporting mariculture was adopted at the annual meeting of the Alaska Municipal League in November, and a similar policy position was adopted at the initial meeting of an informal coastal alliance formed by representatives of municipal governments from Bristol Bay to Ketchikan. Resolutions urging the legislature to adopt pro-mariculture policies also have been adopted by the Southeast Conference and Kodiak Island Borough.

The "bible" of Alaska's beginning oyster farmers is the Alaska Oyster Grower's Manual, produced jointly by the Office of Commercial Fisheries Development and Marine Advisory Program. The manual covers the spectrum of concerns of fledgling farmers from site selection and permitting to contacts for purchase of spat and culturing techniques. This valuable manual is now being revised for a third edition. The updated version should be available after April 1, 1987. Meanwhile, a handful of copies of the second edition are available by writing: Mr. Bill Paulick, Office of Commercial Fisheries Development, Department of Commerce and Economic Development, Pouch D, Juneau, AK 99811.

The Fisheries Rehabilitation, Enhancement and Development (FRED) staff of Alaska Department of Fish and Game in Kodiak has prepared a scallop mariculture field manual providing basic technical information on scallop spat collection and culturing. The manual, which is designed to be updated as new information becomes available, also contains an explanation of the permitting process. Mariculture Field Manual. Alaska Department of Fish and Game, FRED Division, 211 Mission Road, Kodiak, AK 99615.

The market penetration achieved by Norway in selling farmed salmon is demonstrated by the retail sale of Atlantic salmon in Juneau. While a selling price of \$9.69 is unlikely to result in much product movement, the arrival of pen-reared salmon at retail counters so close to Alaska's only source of off-season fresh salmon is significant. The store--Fred Meyers--had no fresh troll-caught salmon available.

ALASKA MARICULTURE ASSOCIATION

P.O. Box 020704
Juneau, AK 99802-0704

Mariculture Technical Work Group

Where: Hendrickson Building, Room 205
University of Alaska, Juneau
(See Attached Map)

When: 8:30 a.m., Thursday, October 30, 1986

- I. Introduction
8:30-8:45 a.m.
Rodger Painter--Alaska Mariculture Association
- II. Subcommittee Assignments/Coffee
8:45-9:15 a.m.
- III. Mariculture Overview: Worldwide Trends/Alaska Feasibility
9:15-10:45 a.m.
Bill Heard--National Marine Fisheries Service
Mike Kaill--Alaska Department of Fish and Game
- IV. Questions and Answers/Discussion
11:00-Noon
- V. Lunch
- VI. Subcommittee Discussions
1:00-5:00 p.m.

ALASKA MARICULTURE ASSOCIATION

M E M O R A N D U M

TO: Mariculture Technical Work Group

FROM: Rodger Painter
Alaska Mariculture Association

DATE: October 23, 1986

Thank you for your participation in the Mariculture Technical Work Group. Response to the letters of invitation indicates that 15-20 people will attend the first meeting. Attached is an agenda.

You also will find a description of subcommittees. You will be asked to select a subcommittee at the beginning of the meeting. This decision will be critical since most of the work will take place in the subcommittees.

We hope to schedule a concluding session of the work group for mid-November. That meeting will consist of descriptions of the subcommittee deliberations and recommendations by the subcommittee chairs, and a discussion of work group recommendations.

The subcommittees may require additional meetings to complete the discussions and recommendations. These meeting will be left at the discretion of the subcommittees.

AMA wants to keep the discussions focused on the more technical considerations of mariculture development. The socio-economic issues are best dealt with in other forums.

The Mariculture Technical Work Group recommendations will be presented to the legislature and to the new governor when he or she takes office in December. The recommendations should prove valuable to both industry and government officials as Alaska shapes a state policy for mariculture development.

Mariculture Technical Work Group Subcommittees

Siting and Operational Criteria

Permitting process, siting criteria, sedimentation, genetic effects of escapements, water quality

Subcommittee Chairs:

Bill Heard--NMFS

Mike Kaill--ADFG

Disease and Public Health

Disease management programs, use of antibiotics, non-indigenous species, movement of brood stock, PSP testing, quality assurance

Subcommittee Chairs:

Ted Meyers--ADFG

Doug Donegan--ADEC

Development and Research

Developmental programs, dietary requirements, brood stock availability, research needs, marketing, taxes

Subcommittee Chairs:

Bill Paulick--Commerce

Ole Mathisen--UAJ

ALASKA MARICULTURE ASSOCIATION

P.O. Box 020704
Juneau, Alaska 99802-0704

(907) 586-2032

October 13, 1986

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

Dear Commissioner Collinsworth:

The Alaska Mariculture Association (AMA) was formed recently by a group of individuals and companies interested in the development of a sound, year-round mariculture industry in Alaska. Attached is a press release which outlines some of the organization's initial goals.

We are strongly committed to the development of an industry which is compatible with Alaska's abundant wild sea resources, unpolluted coastline, and existing seafood industry. We believe this goal is possible and, because of the current problems with the state's economy, highly desirable.

AMA is interested in addressing the spectrum of issues which have been raised regarding mariculture, ranging from promotion of the industry to environmental safeguards and protection of public welfare. Timely review is necessary since the Legislature will likely be considering mariculture development in the next session.

An important first step in the process is for us to receive advice from the state and federal agencies which may have some involvement or responsibilities regulating mariculture. We would greatly appreciate the involvement of the Alaska Department of Fish and Game in a Mariculture Technical Work Group to identify issues and develop potential governmental responses.

Also invited to participate in the Mariculture Technical Work Group have been: Departments of Commerce & Economic Development, Environmental Conservation, Revenue and Natural Resources; University of Alaska, Juneau; National Marine Fisheries Service; Environmental Protection Agency; U.S. Forest Service and U.S. Fish and Wildlife Service. We have received very positive feedback from agency representatives contacted to date.

If possible, we would appreciate the involvement of the following individuals from your department: Mike Kaill (FRED); Ted Meyers (FRED); and Bob Clasby (Commercial Fisheries). We hope to hold an initial meeting of the advisory work group during the last week in October at the UAJ School of Fisheries. I will be in touch to firm up this date.

We have identified the following concerns which we would like the Mariculture Technical Work Group to address:

- Disease Management
- Water Quality
- Sedimentation
- Importation of Non-indigenous Species
- Escapes of Cultured Species and Genetic Implications for Wild Species
- Guidelines for the use of Antibiotics
- Brood Stock Sources and Allocations of Wild Stocks for Brood Stock
- Product Wholesomeness and Testing for PSP
- Site Competition
- Tax Structure
- State and Federal Business Development Services
- Research Priorities

AMA believes many of these issues can be addressed through present state and federal regulatory and planning processes with little or no modification. Others may require both statutory and regulatory changes.

The Mariculture Technical Work Group recommendations are needed by the end of November. It will be difficult but very possible to complete this process in one month. Many of the individuals we hope to have involved in the work group are very familiar with mariculture issues, and the agencies certainly have expertise in dealing with the permitting and regulatory process.

Attached is a document which addresses many of the concerns raised about mariculture development. This study by the University of Washington represents one of the most comprehensive examinations of environmental and health concerns about mariculture. We will be providing additional background materials to your representatives.

The Mariculture Technical Work Group process could be greatly expedited if your agency representatives have the opportunity to study the list of issues raised and come into the first meeting with some preliminary thoughts on how to approach the issues under--or potentially under--your jurisdiction.

Please contact me with any questions you or others may have concerning the Mariculture Technical Work Group. Thank you for your cooperation and assistance.

Sincerely,

Rodger Painter

Mariculture. 'worst case' could cost fisheries \$36 million

Continued from page G-1

bia. The firms also would be interested in investing in Alaska, he said.

However, Meyer sees some disadvantages in Alaska.

"Alaska does not have a good track record of building infrastructure for any kind of industry. It's somewhat disorganized for any newcomer," he said.

Legislators will end up at the pivot point, choosing between constituents who fear competition and social impact and an industry promising all the things they campaigned to bring home.

"My mind is still open," Juneau's Duncan said. "The bottom line is what will be our economic benefit and impact on fisheries."

"We want to make sure we're not harming a part of the state economy," Duncan said. "My fishing constituents are not very enthralled with the idea."

"I know who I represent," Sen. Lloyd Jones, R-Ketchikan, said. "Commercial fishermen are not in favor of it; consequently, I have to make sure I don't hurt their cause."

Legislators like Anchorage Rep. Johnny Ellis and Kodiak Sen. Fred Zharoff cite Alaska's geographic advantages and the economic potential to support mariculture development.

The already substantial market share of farmed salmon and the predicted growth buoys the proponents' arguments. A sampler of statistics:

- In 1986, approximately 59,200 metric tons of farmed salmon were produced worldwide. In three years, that's expected to increase to between 107,000 and 140,000 metric tons.

- The 1986 wild salmon harvest was 657,000 metric tons. Fore-

casts for 1990 predict the world harvest stabilizing at about 677,000 metric tons.

- About 43 percent of world salmon production and 90 percent of U.S. salmon comes from Alaska commercial fishermen. The 1986 harvest in state was 268,000 metric tons.

- Between 1983 and 1985, fresh farmed salmon imports into the United States grew from 4 million pounds to 16 million pounds, with the value growing from \$13 million to \$52 million.

"If this state does allow salmon farming, it appears that even a very modest development will result in thousands of jobs, and over \$100 million in sales when both direct and indirect effects are considered," according

'It doesn't matter if Alaska is involved, the impact is there . . . Farmed salmon is not going away.'

— Rick Harris
Sealaska vice president

to a report prepared by Robert Logan, a University of Alaska-Fairbanks professor, and by John Weddleton, an Anchorage consultant.

A study conducted by Sealaska Corp., the regional native corporation for Southeast Alaska, found mariculture could be profitable in urban, rural and remote sites.

"It doesn't matter if Alaska is involved, the impact is there," Rick Harris, vice president of resource planning and administration for Sealaska, said.

"Thirteen countries are producing farmed salmon. The market shows no inclination to stop growing," Harris said. "Farmed salmon is not going away."

The growing farm production is expected to cause a \$5 million

to \$36 million loss in revenue to the Alaska fishing industry by 1990, according to the House Research Agency.

"In relative terms, prices for Alaska salmon are expected to fall by about 9 percent as a result of world farmed salmon production, and an additional 1 percent if Alaska were to develop a 20,000 metric ton industry," the agency reports.

The market for fish, both fresh and frozen, has grown tremendously.

How long the expansion can continue is uncertain, however: Commercial fishermen see a glut of salmon in about four years, while mariculture proponents see new markets opening when fresh salmon is available

throughout the year.

Americans are eating more seafood than ever, with consumption growing from 12.3 pounds per person in 1982 to 14.7 pounds per person in 1986, Painter said. Nationally, that's an "increase over five years of 692 million pounds," he said.

"There was a tremendous increase in consumption at a time when the U.S. commercial fishery production was extremely static," Painter said. "What the figures really show is some important long-term trends in changes and patterns in world seafood market."

"The United States . . . is moving toward tremendously increased reliance on foreign-produced products. All the wonderful gains in seafood consumption

do not really benefit our seafood industry but are primarily benefiting foreign producers."

In Logan and Weddleton's report, a 20,000 metric ton Alaska industry was predicted to provide direct farm employment of 1,200 jobs. Depending on the value of sales, farm size and location variables, the industry employment predictions ranged from 2,000 to 6,300 jobs.

The "worst case" effect on the traditional fishery was estimated at \$36 million in losses from farmed salmon.

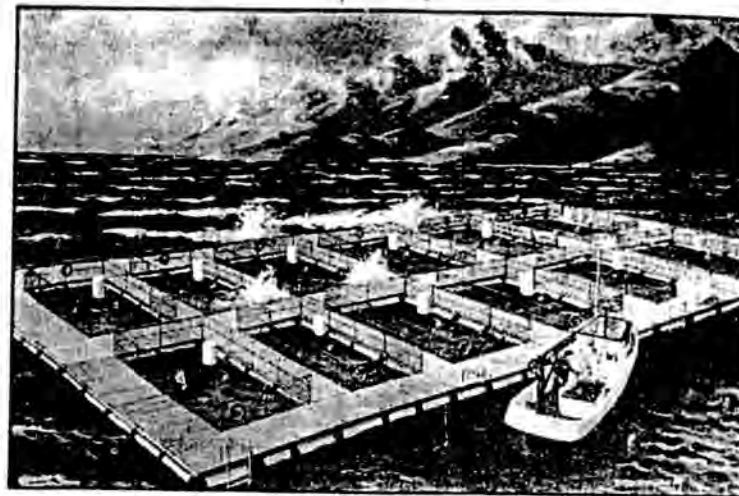
"An incremental Alaskan production of 20,000 metric tons causes an additional \$4 million in losses," they wrote. "This compares to a 'best case' scenario of \$5 million in losses from world salmon farming, but in absence of Alaskan salmon farming."

"Recall that the positive impact of a 20,000 metric ton salmon farming industry was in excess of \$100 million in terms of direct sales," Logan and Weddleton wrote.

"It would be difficult to argue that salmon farming is unjustified in Alaska on purely economic grounds. It would have to be on the grounds of social concerns such as environmental hazards," they wrote.

Krygier said the latter concern should be no small matter to Alaskans who have the world's best wild stock fishery.

He said the farms must be kept well stocked with food for the growing salmon. The nutrient-rich water also is a boon to disease-causing organisms. Net pens would be attractive too to



An artist's rendering shows a salmon farming facility.

other salmon, kings and cohos that winter in Southeast rather than in the North Pacific. That would expose wild stocks to disease, and could allow stocks to mix, Krygier said.

"We fish our wild populations," Krygier said. "That's not like Norway, which had no natural populations to damage."

"The value of our natural stocks are so great we can't risk bringing in a potential disease-creating situation like this," he said.

Such risks must not be overlooked but should not necessarily rule out mariculture in Alaska, according to Painter.

"Certainly the environment needs to be protected, and wild fishery resources are vital to the state economy," Painter said. "They can be protected with a good regulatory approach."

"Or it can go way overboard so that nothing will happen. It's always difficult to find the balance," he said.

Disease and genetic research has been going on for several years in Norway, and federal agencies have test programs in Alaska and Washington.

Sen. Arliss Sturgulewski suggested there was "a major role for the University of Alaska to play" in determining what would make a quality operation.

Marine research has been underfunded and spread over the university system with little cohesion, Sturgulewski charged.

What the state should not become, she said, is a banker.

Painter said the association was not lobbying for loan programs or financial backing. There is private financing available, he said.

"Foreign capital coming into the state is not a bad idea," Sealaska's Harris said. "We need to ensure that Alaskans are part of the industry, so we don't see people in Kake sitting on the beach while the Norwegians fish."

ATA Notes on Pierce paper presented to AFS meeting in Juneau 11-15-88

It is our belief that Brad's paper takes a highly promotional (advocacy) position. The fact that this gentleman is located just four doors down the corridor, and he knew we had a lot of knowledge on this issue - yet never even come in to get us to shoot his ideas down - straw dog to strengthen paper - shows the level of bias. His extreme advocacy reminds me of a Rodger convert who has economic stars in their eyes - seeing only the promised land of salmon farming. This paper does not answer our concerns over disease and genetics; water and land use conflicts; foreign or corporate ownership; market impacts; or competition for funding.

Brad stated that Alaska has seen its market share drop from 97% of quality species to 53%. That most economists see prices falling by 20 - 30% by 1995. Hatchery contribution to harvest was 18% in 1988 season. Alaska has spent 80 million on ocean ranching since its inception. ASMI receives only 1/8th of the money that the fish farming marketing associations in foreign countries receive. We are being out spent and will lose market share. Its interesting that last year promoters of salmon farming were claiming that they wouldn't impact our markets. Now they are arguing the other side of the coin - but saying because of impacts we must do it.

To stop this loss in market share the paper proposes that Alaska do the following:

- 1) Increase quality of product through state wide regulation program. eg. mandatory fish hold inspections - grading.
- 2) Entice more private money into the ocean ranching program.

The paper emphasized that there needs to be more capital investment in the hatchery program to remain competitive; a sign of the competitiveness of an industry is its capital investment expenditures. Since there will be few public dollars available he feels that private money needs to be used more. In fact the paper advocated private for profit ocean ranching.

- 3) Allow pen-rearing to make up for supply shortages during off season.
- 4) Start making fish meal from waste materials produced from current fish processing.

The question should be - Do we need more market share if we sell all we catch now? I believe the issue - touched on by him and argued by us for a long time - is that we can increase our market share by increasing quality and market forms of our existing resource. Our fishing industry was analogized to the General Motors of the late 70's, to interested in short term profits while large portions of the market were being lost to Japanese imports, the result of which was economic protection legislation. While we do seek protection through legislation it is not for a particular group that it is sought. The

fishing community seeks protection of our (every citizen of the state) public resource, wild and enhanced runs of salmon. Protection of this resource from the possible genetic and disease effects of pen-rearing effect all the people of the state not just commercial fishermen.

He forgets our argument that the high quality species, mostly kings and coho, are only about 70,000 to 80,000 metric tons; and the addition of 225,700 mt by 1990 leads to saturation of the "high priced spread".

Yes, the market can expand slowly after initial hard marketing; but remember that Fish Farming International warned that "production may exceed demand by 23,000 tons". The fact that he projects a 20-30 % decline in average prices by 1995 should make his Alaska adventure even less likely to succeed.

Subsidy is used when the Fisheries Enhancement Loan Fund is mentioned. This is not, and has never been, a subsidy. The citizens of this state, through the legislature, have taken the role of bankers investing in enhancing our natural resource by loaning money to enhance the welfare of the state and are not funding or providing a subsidy for a special interest group.

The paper also states that fishermen have a problem with the state selling fish on the open market and competing with their product. But this statement is used in a paragraph which is talking exclusively about the sale of excess chinook eggs to B.C. Fishermen do have a problem with the state competing through cost recovery in their markets - there is no doubt who will lose if private fishermen are to compete with the state. But the real issue is genetics when there is the transfer of eggs from Alaska to B.C. salmon farmers, and not that fishermen don't like the competition.

He stated that fisherman did not buy off on any of the proposals to reduce general fund expenditures on the FRED budget, when in fact we did after much testimony.

Brad also is pretty nasty to commercial fisherman. He makes his point as if the only beneficiaries to enhanced fish were the commercial fisherman. He forgets that many of the hatcheries around the state are directed at sportfisherman. The benefits to the state in the form of more sports catch benefits tourism and the subsistence life styles of the people of the state. Additionally, he says that "the State provides massive support to the commercial fishing industry, ..." He misses the fact that we pay license fees and raw fish tax to the tune of 47.5 million dollars in 1987, while ADF&G's budget was about 43 million (minus DJ & PR Federal funds).

We do agree on the need for quality and some of his arguments hold water. The concept of buy back is well supported by us, though he would have benefited by discussing this with us. All in all - this is a damn bias paper.

Policy Implications of Recent Studies on "Costs of Production for Pen-Reared Salmon in Alaska" and "World Markets for Farmed Salmon"
By Brad Pierce

As a legislative analyst for the House Research Agency, I have been asked to study a number of fisheries and aquaculture issues for the legislature during the past few years. Presenting this paper today gives me the opportunity to gather some of the threads of my observations and conclusions in an attempt to weave them into a more or less coherent view of Alaska's competitive position in future salmon markets. I have to stress that the opinions expressed in this paper are entirely my own and do not in any way reflect the position of House Research or the legislature.

Alaska's commercial salmon fisheries presently account for almost one-half of the world's 550,000 metric ton (mt) catch of Pacific salmon and 90 percent of U.S. commercial landings.¹ Worldwide, seafood markets are expanding and the most important development in domestic and international salmon markets in recent years has been the introduction of large quantities of premium quality fresh farmed salmon. You are probably all aware of the projections for worldwide farmed salmon production, so I will keep the numbers to a minimum and focus on their meaning for Alaska. According to the National Marine Fisheries Service (NMFS), farmed salmon production is expected to more than double during the next few years, from 97,879 mt in 1987 to 225,700 mt in 1990.²

To place this in perspective, consider that preliminary data for the 1988 season put the Alaska harvest of premium species at 155,593 mt (all but pinks are considered premium species).³ In other words, current worldwide farmed production is probably on the same order as Alaska's combined catch of premium species. About one-third of Alaska's harvest of premium species is chum salmon, which occupy a somewhat lower market tier than other premium species--chinook, coho, sockeye and Atlantic salmon. The Food and Agriculture Organization (FAO) of the United Nations predicts that by the turn of the century, farmed salmon may account for one-half of worldwide production.⁴

Something over 90 percent of Alaska's production of premium salmon species is sold in frozen form. A recent study by the Seafare Group showed that the percentage of U.S. fresh/frozen salmon consumption attributable to imports increased from 10 to 48 percent between 1981 and 1987. During the same period, Alaska's contribution to domestic salmon supplies declined from 97 to 53 percent. Recent harvest fluctuations account for some of this change, but the underlying decline in Alaska's market share is clear. The same is true in export markets. In 1985, Norway displaced the U.S. as the largest supplier of fresh/frozen salmon to Europe and last year became the leading exporter of fresh salmon to Japan.⁵ Obviously, a very serious erosion of Alaska's dominant position in its major salmon markets has occurred.

A study of domestic salmon markets by James Anderson, of the University of Rhode Island, describes an enormous unfulfilled domestic demand in retail and restaurant markets for the attributes of farmed salmon that are not shared by wild fish from Alaska--freshness, consistently high quality and year-round availability.⁶ This is particularly true on the East Coast,

Alaska's Ocean Ranching Investment

The state has invested heavily in salmon ocean ranching production during the past 12 years. Capital investments in public hatchery projects total about \$80 million and about \$52 million has been loaned for private nonprofit hatcheries. Public hatcheries were initially financed via \$56 million in bond issues passed by the voters of the state. The fisheries enhancement loan fund that finances the private nonprofit hatchery system offers a subsidy of about \$32 million. Combined public and private nonprofit hatchery systems are projected to generate economic activity in excess of public costs over the useful life of the various facilities.⁷

In FY 86 and 87, the Fisheries Rehabilitation Enhancement and Development (FRED) Division, which manages the state's public and private nonprofit hatchery systems, suffered significant budget cuts. This placed the operation of several public hatchery facilities in jeopardy. In the intent language of the FY 88 FRED budget, the legislature stated that it wanted the agency to reduce its dependency on state general funds and generate increased program receipts to make the public hatchery system more self-sustaining. A working group of FRED staff, representatives of the regional aquaculture associations and myself attempted to come to grips with this funding crisis.

To date, commercial salmon fishermen have rejected all proposals for generating increased program receipts or shouldering a larger share of the financial burden of public hatchery production, except for assuming the operation of four of the state's most productive (commercial species oriented) hatchery facilities through their regional associations. The FRED Division saves about \$2.5 million in annual operating expenses by transferring operations of these facilities to the private sector and commercial fishermen continue to receive the direct economic benefits from hatchery returns at no extra cost to themselves, at least individually.⁸ To me, these operating agreements raise some public policy questions about what the general public who bonded to build the facilities receives from the deal, but that discussion is beyond the scope of this paper.

Rationalization of the state's ocean ranching program to reflect fiscal reality is absolutely necessary. Prudhoe Bay oil production begins to decline next year with nothing on the economic horizon to replace the revenues the state receives from it. We have seen only the beginning of what is likely to be many more state budget reductions. The transfer of public hatchery facilities to the private sector can increase economic efficiency in the ocean ranching program and is an important first step in improving the competitiveness of aquaculture in Alaska. To avoid potential political problems, it is also important that the general public receive some economic rent in the form of additional general fund revenues from the commercial fishing industry as repayment for their initial investment.

While growth in Alaska's ocean ranching program has run into a public financing barrier, the provincial government of British Columbia reports that over \$100 million in private capital has been invested in new production capacity in the B.C. salmon farming industry during the past four years. This level of private investment is expected to double next year. Capital investment today is one indicator of market competitiveness in the future. Alaska law does not presently allow private for profit aquaculture or salmon farming; as long as this situation persists, the state will be at a competitive disadvantage in world salmon markets.

Ocean Ranching

The FRED Division is changing emphasis from hatchery production to research, development and technology transfer. The financial burden of enhancement activities that primarily benefit commercial fishermen will, of necessity, be shifted from the state to the fishermen themselves in the future. The focus of commercial species production in the public hatchery system is moving toward producing much larger quantities of sockeye and chum salmon.

Alaska has a natural comparative advantage in having most of the world's premier sockeye habitat combined with state-of-the-art enhancement techniques. To date, sockeye have not been successfully farmed. The FRED Division is working on shortening the freshwater rearing phase of hatchery sockeye, which could greatly reduce the cost of production. This type of high-risk development of improved fish husbandry techniques could pay off in commercial fisheries of the future and is an excellent example of the technology transfer role state government can play in economic development.

Chum salmon are cheap to raise and Alaska's hatchery programs are very successful at producing large volumes. In domestic restaurant and retail markets, chum salmon occupy a lower-priced niche than other premium species and market studies have shown that high volumes in frozen portioned form can compete very well on price. Chum roe or "sujiko" is also highly prized in Japan. New hatchery techniques that control the sex of juveniles could be applied to chum production that would increase the ratio of female to male returns in terminal fisheries at hatchery sites. This could add significant value to chum production and reduce the broodstock requirement.¹⁰ Most of Alaska's public and private nonprofit hatcheries are now reaching design capacity in chum production and substantial increases in returns can be expected during the next few years.

State budget constraints may force changes in the financing of chinook and coho hatchery production in the near future. These species are expensive to rear. To the extent that there is federal funding under U.S.-Canada treaty obligations and for sportfish enhancement programs, traditional ocean ranching of chinook and coho is economical. Without some means to offset costs (e.g., selling surplus eggs and/or smolts to salmon farmers), it may become necessary to charge a royalty on the commercial catch of hatchery returns and a fee (e.g., tag, punchcard or license) to sport fishermen in the future to help pay for increased public production of these species.

Salmon Marketing Strategy

As long as the state provides massive support to the commercial fishing industry, government has a right to ensure that the maximum value is extracted from the public resource. This can be encouraged by close policy coordination between the government agencies that regulate and support the industry. A fresh product commands the highest value, which means that management strategies need to be oriented toward allowing harvesters to "fish to the market." The Division of Commercial Fish has been fairly successful at this by spacing season openings of short duration over as extended a time period as possible. Within basic biological constraints, ensuring an even flow of fresh salmon to the marketplace over the entire harvest season should be a management priority.

CORRECTION

**THIS DOCUMENT
HAS BEEN REPHOTOGRAPHED
TO ASSURE LEGIBILITY**

Policy Implications of Recent Studies on "Costs of Production for Pen-Reared Salmon in Alaska" and "World Markets for Farmed Salmon"
By Brad Pierce

As a legislative analyst for the House Research Agency, I have been asked to study a number of fisheries and aquaculture issues for the legislature during the past few years. Presenting this paper today gives me the opportunity to gather some of the threads of my observations and conclusions in an attempt to weave them into a more or less coherent view of Alaska's competitive position in future salmon markets. I have to stress that the opinions expressed in this paper are entirely my own and do not in any way reflect the position of House Research or the legislature.

Alaska's commercial salmon fisheries presently account for almost one-half of the world's 550,000 metric ton (mt) catch of Pacific salmon and 90 percent of U.S. commercial landings.¹ Worldwide, seafood markets are expanding and the most important development in domestic and international salmon markets in recent years has been the introduction of large quantities of premium quality fresh farmed salmon. You are probably all aware of the projections for worldwide farmed salmon production, so I will keep the numbers to a minimum and focus on their meaning for Alaska. According to the National Marine Fisheries Service (NMFS), farmed salmon production is expected to more than double during the next few years, from 97,879 mt in 1987 to 225,700 mt in 1990.²

To place this in perspective, consider that preliminary data for the 1988 season put the Alaska harvest of premium species at 155,593 mt (all but pinks are considered premium species).³ In other words, current worldwide farmed production is probably on the same order as Alaska's combined catch of premium species. About one-third of Alaska's harvest of premium species is chum salmon, which occupy a somewhat lower market tier than other premium species--chinook, coho, sockeye and Atlantic salmon. The Food and Agriculture Organization (FAO) of the United Nations predicts that by the turn of the century, farmed salmon may account for one-half of worldwide production.⁴

Something over 90 percent of Alaska's production of premium salmon species is sold in frozen form. A recent study by the Seafare Group showed that the percentage of U.S. fresh/frozen salmon consumption attributable to imports increased from 10 to 48 percent between 1981 and 1987. During the same period, Alaska's contribution to domestic salmon supplies declined from 97 to 53 percent. Recent harvest fluctuations account for some of this change, but the underlying decline in Alaska's market share is clear. The same is true in export markets. In 1985, Norway displaced the U.S. as the largest supplier of fresh/frozen salmon to Europe and last year became the leading exporter of fresh salmon to Japan.⁵ Obviously, a very serious erosion of Alaska's dominant position in its major salmon markets has occurred.

A study of domestic salmon markets by James Anderson, of the University of Rhode Island, describes an enormous unfulfilled domestic demand in retail and restaurant markets for the attributes of farmed salmon that are not shared by wild fish from Alaska--freshness, consistently high quality and year-round availability.⁶ This is particularly true on the East Coast,

where consumers are not particular as to species, method of catch, or flesh color. Pacific Northwest consumers have a strong preference for the bright red flesh of troll-caught wild chinook and coho and the Japanese are partial to frozen sockeye; but these are knowledgeable consumers to whom the Pacific salmon species are familiar and readily available. This consumer preference probably does not exist in most of the U.S. In restaurant and retail markets nationwide, the most highly prized attributes of salmon are high quality and freshness, though it is likely that few consumers could tell the difference in taste between fresh and frozen fish.

Due to the level of unfulfilled demand in domestic salmon markets and a cheap dollar overseas, prices are presently at all time highs. At some point however, the huge increases in farmed salmon production forecast for the future will catch up with demand and begin to affect the price of all premium species. The few economists willing to venture a forecast in such a volatile market situation seem to agree that a 20-30 percent decline in average real (inflation adjusted) prices is likely by 1995. Given projections of available supplies of farmed fish, current domestic restaurant consumption (43,100 mt) and retail consumption (25,700 mt) of premium salmon is expected to double by 1995.

So what does this mean for Alaska? All recent studies of world salmon markets assume that production of wild Pacific salmon is currently at maximum sustainable levels and further incremental increases will be generated by ocean ranching programs, which enhance coastal water fisheries. The most economically successful ocean ranching programs have been with species that require minimal time in a hatchery facility, i.e., pink and chum salmon.

In economic terms, Alaska's commercial salmon fisheries are mature. Limited entry has placed a cap on the number of participants in the harvest and any growth in the natural resource base will come as aquaculturally produced fish from the state's ocean ranching program. Hatchery returns now account for about 18 percent of the total harvest. Projected increases in the state harvest of premium species by 1995 as a result of hatchery returns will not come close to meeting anticipated domestic restaurant demand, let alone growth in domestic retail and international markets (see table below). Thus, the erosion of Alaska's market share is likely to continue unless aquaculture production of premium species is substantially increased.

Alaska's Statewide Hatchery Returns of Premium Species 1987 and 1995

	1987	1995
Chinook	665 mt	1,613 mt
Coho	2,098 "	1,779 "
Chum	6,931 "	29,364 "
Sockeye	3,390 "	7,342 "
Total	13,084 mt	41,712 mt

Sources: Computed from the "FY 88 FRED Division Annual Report" and information supplied by Jeff Hartman, Economist, FRED Division, July 1988.

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To date, commercial salmon fishermen have rejected all proposals for generating increased program receipts or shouldering a larger share of the financial burden of public hatchery production, except for assuming the operation of four of the state's most productive (commercial species oriented) hatchery facilities through their regional associations. The FRED Division saves about \$2.5 million in annual operating expenses by transferring operations of these facilities to the private sector and commercial fishermen continue to receive the direct economic benefits from hatchery returns at no extra cost to themselves, at least individually.⁸ To me, these operating agreements raise some public policy questions about what the general public who bonded to build the facilities receives from the deal, but that discussion is beyond the scope of this paper.

Rationalization of the state's ocean ranching program to reflect fiscal reality is absolutely necessary. Prudhoe Bay oil production begins to decline next year with nothing on the economic horizon to replace the revenues the state receives from it. We have seen only the beginning of what is likely to be many more state budget reductions. The transfer of public hatchery facilities to the private sector can increase economic efficiency in the ocean ranching program and is an important first step in improving the competitiveness of aquaculture in Alaska. To avoid potential political problems, it is also important that the general public receive some economic rent in the form of additional general fund revenues from the commercial fishing industry as repayment for their initial investment.

While growth in Alaska's ocean ranching program has run into a public financing barrier, the provincial government of British Columbia reports that over \$100 million in private capital has been invested in new production capacity in the B.C. salmon farming industry during the past four years. This level of private investment is expected to double next year. Capital investment today is one indicator of market competitiveness in the future. Alaska law does not presently allow private for profit aquaculture or salmon farming; as long as this situation persists, the state will be at a competitive disadvantage in world salmon markets.

Commercial fishermen in Alaska perceive salmon farming as a threat to their livelihoods and have used their political influence to block its development. By doing so, they have shut themselves out of an opportunity to invest in farming capacity (through their cooperatives and regional associations) to augment their wild catch in the off season and gain a better competitive position in growing fresh salmon markets. A recent study by the DPA group has shown that farm raised salmon from Alaska can be competitive on a delivered cost basis, particularly in West Coast and Asian markets.⁹

A salmon farming industry in Alaska could allow public and private nonprofit hatchery operations to generate increased revenues through sales of eggs and smolts, which in turn could help pay for expansion of the ocean ranching program. Last summer, the ADF&G was offered \$2 million by the B.C. Salmon Farmer's Association for surplus chinook eggs at the Little Port Walter hatchery, which could have helped fund the \$14.7 million FY 89 FRED Division budget. Due to regulatory constraints and political considerations, the department found itself unable to respond to this proposal. In fact, because of opposition from commercial fishermen, the FRED Division has found it nearly impossible to harvest and sell surplus fish returning to state hatchery sites in order to generate program receipts and recover operating costs. Fishermen have made their position very clear; they do not want the state selling fish in "their" markets.

At least fifteen countries and perhaps a dozen states have developed regulatory regimes to accomodate salmon farming. Many have had to overcome the same sort of political opposition that exists in Alaska. No other government has allowed special interests to exercise veto power over aquaculture development, however. There are many legitimate concerns about salmon farming, but economic protectionism is not one of them. It won't work. The market forces described in recent studies are inexorable and the consequences of ignoring them are a loss of market share and potential revenue to the fishing industry and to the economy of the state.

One reason that British Columbia, Chile and other countries have become so competitive in markets previously dominated by Alaska is that they have encouraged outside private investment from any source and have not had to rely on public capital. Now that Alaska's salmon ocean ranching program has become firmly established and production of commercial species is being assumed by fishermen through their regional associations, the most economically rational course of action for the legislature to take with respect to salmon aquaculture development would be to introduce more private sector initiative. This could be done opening up the Title 16 statutes to allow private-for-profit hatchery operations and salmon farms. However, politics will almost certainly prevent this in the immediate future.

Absent any fundamental change in its approach to private investment in salmon aquaculture, there are a few actions state government can do to improve Alaska's competitive position in future salmon markets. From existing research, the following policy implications have been drawn: 1) orient the state's ocean ranching program to reflect present fiscal and future market reality, 2) develop a state salmon marketing strategy that places greater emphasis on quality, 3) increase economic efficiency in the harvesting sector, and 4) study the feasibility and economies of scale of a fish meal industry in Alaska. Each of these is discussed briefly below.

Ocean Ranching

The FRED Division is changing emphasis from hatchery production to research, development and technology transfer. The financial burden of enhancement activities that primarily benefit commercial fishermen will, of necessity, be shifted from the state to the fishermen themselves in the future. The focus of commercial species production in the public hatchery system is moving toward producing much larger quantities of sockeye and chum salmon.

Alaska has a natural comparative advantage in having most of the world's premier sockeye habitat combined with state-of-the-art enhancement techniques. To date, sockeye have not been successfully farmed. The FRED Division is working on shortening the freshwater rearing phase of hatchery sockeye, which could greatly reduce the cost of production. This type of high-risk development of improved fish husbandry techniques could pay off in commercial fisheries of the future and is an excellent example of the technology transfer role state government can play in economic development.

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State budget constraints may force changes in the financing of chinook and coho hatchery production in the near future. These species are expensive to rear. To the extent that there is federal funding under U.S.-Canada treaty obligations and for sportfish enhancement programs, traditional ocean ranching of chinook and coho is economical. Without some means to offset costs (e.g., selling surplus eggs and/or smolts to salmon farmers), it may become necessary to charge a royalty on the commercial catch of hatchery returns and a fee (e.g., tag, punchcard or license) to sport fishermen in the future to help pay for increased public production of these species.

Salmon Marketing Strategy

As long as the state provides massive support to the commercial fishing industry, government has a right to ensure that the maximum value is extracted from the public resource. This can be encouraged by close policy coordination between the government agencies that regulate and support the industry. A fresh product commands the highest value, which means that management strategies need to be oriented toward allowing harvesters to "fish to the market." The Division of Commercial Fish has been fairly successful at this by spacing season openings of short duration over as extended a time period as possible. Within basic biological constraints, ensuring an even flow of fresh salmon to the marketplace over the entire harvest season should be a management priority.

Compared to fresh farmed fish, frozen salmon from Alaska are widely perceived to be of inconsistent or inferior quality. One answer to the fresh vs. frozen perception problem is to promote the qualities of frozen salmon as the Alaska Seafood Marketing Institute (ASMI) has with its "Premium Quality" program, which places labels on top grade fish. Currently, the program is on a very small scale, involving only 40,000 lbs. of troll-caught cohos during 1987 and less during 1988 because of poor returns. The program is scheduled to be expanded to net-caught fish next year. As the Seafare Group noted in their study, a few Northwest fishermen (notably Bruce Gore) are producing "frozen at sea" salmon that command exceptional prices in the restaurant trade. If ASMI is going to promote frozen wild salmon that can compete with fresh farmed fish, a long-term strategy might be to explore the market opportunities for frozen at sea salmon products from Alaska.

The British Columbia government has been fairly successful at raising the overall quality of salmon delivered by fishermen to processors through their vessel hold inspection program, which has been in place for the past six years. Under this program, all fishing vessels must be inspected and meet specific standards prior to obtaining or renewing their operating licenses. In Alaska, certain processors have fish hold standards, but there is no organized attempt by the state to impose requirements. One idea would be for the Marine Advisory Program to develop fishery specific hold standards, perhaps combined with a one-time Commercial Fisheries Loan program to finance upgrading of vessels. The long-term goal should be for all fishing vessels in Alaska (except those used in skiff fisheries) to have properly insulated, sanitary fish holds and for all new vessels to employ some form of refrigeration or freezing capability. Price differentials paid by processors can encourage investment in refrigeration equipment, but it is up to state government to ensure that overall quality is raised to competitive standards.

The Quality Assurance Program--developed by ASMI and the Department of Environmental Conservation (DEC) during the past three years--could be greatly expanded, with processors assuming the financial burden of producing quality products that measure up to world standards. Uniform statewide dockside grading standards could be included in the program, which would give buyers a better idea of what to expect when placing orders for fresh fish with unfamiliar Alaska processors.

Even though processing facilities in Alaska receive regular sanitation inspections, fresh and frozen products shipped from the state are not subject to the rigorous inspection standards that competing products from Norway and other countries are. (A few processors who sell to the government employ federal inspectors.) It is likely that some form of mandatory federal product inspection standards will be imposed on the seafood industry within the next several years. Alaska has more to gain from a mandatory product inspection program than any other state and could take the national lead with a rigorous state program. As Ken Talley of Seafood Trends says, "This is a job for government. The industry has shown itself to be incapable of developing a meaningful product inspection program."

Another area in which the salmon processing industry in Alaska has fallen behind farmed salmon producers is marketing and promotional support. The salmon farming industry in Norway charges a 1.25 percent of gross product value marketing assessment to both producers and purchasers/exporters. This cumulative (2.5 percent) assessment is over eight times the 0.3

percent marketing assessment charged to partially fund ASMI. Thus, it appears that even with \$ 4.4 million in FY 89 Targeted Export Assistance (TEA) funding from the federal government, ASMI is being heavily outspent by the competition.

Harvesting Efficiency

Another measure to enhance Alaska's long-term competitiveness is to increase the efficiency and professionalism of the harvesting sector. The most practical means to achieve this is to amend existing buy back provisions in the limited entry statutes to make them workable.¹¹ Under a buy back program, an agent enters the limited entry permit market, buys up permits and retires them from the particular fishery. This reduces the number of fishermen that share the gross harvest value. Implementation of a buy back program would have to be approved and financed by the participants in a specific fishery via an assessment on the gross value of their catch. To date, this powerful management tool has lain dormant. Because the buy back concept is somewhat controversial, no legislator has been willing to introduce appropriate legislation, though several gear groups have expressed interest in the idea as a means to provide economic stability in their fisheries.

Given the long-term price outlook for premium salmon markets, fishermen may need the option of a workable buy back program to protect their investment. Ideally, the time for fishermen to tax themselves to finance a buy back program is now, while product prices and gross revenues are very high in many salmon fisheries. However, it is probably unrealistic to expect fishermen to give up present earnings for unsubstantiated worries about the future. One idea would be for the legislature to create a state buy back loan fund that permit holders in a fishery could use to implement a program, which could be repaid to the state with interest.

As a complement to a buy back program, the legislature might direct the Division of Commercial Fisheries and the Commercial Fisheries Entry Commission (CFEC) to review the management and economic impacts of regulatory restrictions (e.g., vessel and gear limitations) to see which, if any, might be relaxed by the Board of Fisheries. There is little likelihood that this type of long-range economic planning will gain any immediate legislative support, however. Our political system tends to respond best to crises, so until a price crash occurs in future salmon markets, the most realistic option is for the CFEC to have workable legislation drafted and ready to introduce should it be needed.

Fish Meal Production

One final area that has received only passing mention in recent studies is Alaska's potential as a producer of fish meal and oil. Processing plants in the state currently produce about 263,340 mt of fish waste annually, from which about 150,000 mt of fish meal could potentially be recovered.¹² With the recent explosion in aquaculture production of numerous species worldwide, Alaska could become a major source of fish meal, which is the primary ingredient in most fish feeds. Only two locations--Kodiak and Dutch Harbor--currently have a sufficient concentration of year round processing facilities to support development of full-scale meal plants, though the Seward Fisheries plant has been producing dry fish feed on a smaller scale for several years. The Alaska

Fisheries Development Foundation (AFDF) is conducting a pilot project to assist Kodiak Reduction, Inc. in upgrading its equipment to produce a larger volume and higher quality meal product that will be competitive in Far East markets.

Much of the fish waste in Alaska is produced seasonally from salmon processing operations. Currently these wastes are ground up and discharged into coastal waters. Aside from causing marine pollution, these wastes also contain whatever pathogens the processed fish carried. The technology for producing quality silage and liquefied fish paste (to be later converted to meal or mixed with dry feed) from seasonally operated plants is still in its infancy, but offers great promise. The economics of scale need to be studied carefully to determine its application in Alaska. Paste made from salmon wastes is not generally fed to other salmon due to bioaccumulation of toxins, but it can be fed to other fish or shellfish and there are rapidly expanding markets in Asia.

Another marketable byproduct is salmon oil, which can be used as a nutritional supplement or cooking oil. North Pacific Processors in Cordova is presently distributing samples of salmon head oil to potential customers in an attempt to create new markets.¹³ There are some federal regulatory hurdles that must be overcome before salmon oil can be widely used for human consumption. Since development of these products could add value to Alaska's salmon production and alleviate marine pollution problems, the legislature may want to assist with research funding.

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In conclusion, Alaska's competitive position in future premium salmon markets ultimately depends on producing products that are in demand and meet world class standards. Current high prices and escalating limited entry permit values are obscuring a dramatic decline in Alaska's dominant position in domestic and international salmon markets. Farmed salmon producers have set new competitive standards that must be met or much of the state's premium species production will not command the highest prices in future markets. Aside from getting tough on the quality issue, which has little political appeal, much of what state government can do to enhance Alaska's competitive position is already being done. Private investment (or the lack of it) in salmon aquaculture is likely to be a key element in determining future market competitiveness. Farmed salmon producers are monitoring the market situation very carefully and have factored lower prices into their long-range business plans; policymakers in Alaska should do the same.

We all remember how, in the early 1970s, Detroit automakers ignored the underlying trends in the marketplace in favor of short-term profits. Finally they lost so much of their domestic market share to higher quality Japanese imports they were forced to seek protection from the federal government through import quotas. Alaska is the General Motors of salmon producers, and by not taking advantage of the salmon farming opportunity, the commercial fishing industry is in danger of becoming a victim of its own political power.

¹Sea Fare Group, "World Markets for Salmon: Pen-Reared Salmon Impacts," April 1988, p. 74.

²"Aquaculture and Capture Fisheries: Impacts in U.S. Seafood Markets," NMFS, April 1988, p. 17.

³"Preliminary Review of the 1988 Alaska Commercial Salmon Fishery," ADF&G, Division of Commercial Fisheries, October 17, 1988.

⁴As reported in "Worldwide Farmed Salmon Forecasts to the Year 2000," DPA Group, Inc., 1988.

⁵"Request of the Alaska Seafood Marketing Institute for FY 1988 Targeted Export Assistance, Alaska Seafood Marketing Institute, July 20, 1988, p. 11.

⁶James L. Anderson, "Analysis of the U.S. Market for Fresh and Frozen Salmon," Staff Paper Series, University of Rhode Island, College of Resource Development, May 1988.

⁷Jeff Hartman, "An Analysis of the Net Benefits of Existing and Proposed Enhancement Projects for the State of Alaska," ADF&G, FRED Division, April 1986.

⁸"FRED 1988 Report to the Alaska State Legislature on the Funding of the Fishery Enhancement Program."

⁹DPA Group, Inc., "Cost of Production Model for Pen-Rearing of Salmon in Alaska and Currently Producing Regions," March 1988, p. 5.

¹⁰Jim Seeb, "Economic Evaluation of the Culture of All-Female Pacific Salmon," Proceedings of the Fourth Alaska Aquaculture Conference, Sitka Alaska, November 1987, University of Alaska, Alaska Sea Grant Report No. 88-4, September 1988, p. 157.

¹¹Ben Muse and Kurt Schelle, "Investments in Fleet Reductions: Suggestions for Revisions of Alaska's Buy Back Statute," CFEC Policy Discussion Draft 86-2, June 17, 1986.

¹²"Waste Watching: Conference was a Primer on Turning Dross into Dollars," Lodestar, Alaska Fisheries Development Foundation, Spring 1988.

¹³Lodestar, AFDF, October 30, 1988.

Public Report No. 15

JACULTURE

**Administration of
Resources in
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December 1988

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report highlights
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to mariculture



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Public Report No. 15

**AQUACULTURE
and the Administration of
Coastal Resources in
British Columbia**

December 1988

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ombudsman

Fairness for all in British Columbia

Public Report No. 15

AQUACULTURE

and the Administration of
Coastal Resources in
British Columbia

December 1988



OVERVIEW

December, 1988

The dramatic increase in aquaculture activity along the B.C. coast in the past few years has brought with it the promise of greater economic growth and stability for many coastal communities; it has also underlined the potential for conflict among the many legitimate and sometimes competing users of coastal resources. This has resulted in a number of complaints to the Ombudsman's office representing a variety of personal, public and commercial interests, and focusing on concerns such as resource use planning, the tenure granting process, environmental safety and conflict resolution. These concerns have caused the Ombudsman's office to prepare this systems study of the regulation of aquaculture in B.C. This report deals with principles of administrative fairness and not with the technical or political aspects of aquaculture, which are beyond the mandate of this office.

Three levels of government are interested in this development: local government is concerned with zoning and planning, the Federal government with navigable waters and fish spawning grounds, and the Provincial government variously with waste management, economic development, and land and resource allocation. Private interests include those of coastal property owners, aquaculture entrepreneurs, sport fishermen and recreational boaters, the tourist industry, coastal forest company operations, and commercial fishing companies and their unions.

The administrative practices and consensual initiatives discussed in this report are intended to assist resource management while avoiding conflict and litigation. Aquaculture is but one use of coastal resources and the rapid growth of the industry has provided the context for a case study of more general resource management principles. Environmental quality is as important to entrepreneurs investing in a vulnerable stock as to conservationists concerned with a vulnerable wilderness; broad and meaningful participation in long-range planning at once satisfies community and individual interests in protecting property, government concern that decisions are based on complete information, and business dependence on a certain and stable investment climate. Integrated management of abundant but finite coastal resources can put different areas to the appropriate and optimum use of each distinct interest, and revitalized coastal economies will help to finance the preservation and enhancement of other interests.

This report concludes with three major recommendations which address the statutory authority for the administration of aquaculture, the integrated management of coastal resources and activities, and the consensual resolution of related public interest disputes.

Stephen Owen
Ombudsman

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THE ADMINISTRATION OF AQUACULTURE AS A COASTAL RESOURCE IN BRITISH COLUMBIA

Background

Aquaculture as an industry has experienced rapid growth on the coast of British Columbia since the mid-1980s. While the term aquaculture is all-encompassing, and may refer to the raising of plants or animals in fresh or salt water, in British Columbia it has become popularly associated primarily with the rearing of salmon in net-pen facilities anchored in salt water near the shore. It is the rapid, and in some instances, unexpected appearance of these facilities which has caused concerns for a number of individuals living in or involved with the coastal areas of the province. Concerns received by the Ombudsman's Office have had at their foundation the issue of public involvement in aquaculture administration and decision making. While many individuals who lodged complaints with this office had obvious vested interests, such as ownership of a family home in or near the same location as the "fish farm", their concerns also reflected broader interests in the welfare of the general coastal environment and its inhabitants, human or otherwise. For the most part, complainants' frustrations appear to have stemmed from the lack - or at least a perceived lack - of a meaningful voice in the regulatory process. While there is no shortage of policies and policy requirements, both provincial and federal, the feeling remained that these policies were not known or readily available to the general public, nor were they effectively binding in a consistent manner on the Ministry, or Ministries at all times during which discretion was being exercised.

The physical or geographic characteristics of the British Columbia coast which make it suitable for salmon farming, or long-line oyster culture, also make it attractive and desirable to other potential users of the coast, including recreational, residential, commercial, and industrial users. The conflicts which have arisen with the rapid appearance of net-pen facilities have not disappeared or dissipated over time. Coastal communities, in their efforts either to attract or control the development of the aquaculture industry, find themselves embroiled in passionate disputes concerning appropriate use of coastal

resources. For many communities, the fact that they possessed power to control development through zoning measures and the creation of official community plans was cold comfort, as in some instances the industry had arrived before the planning and public participation process could be completed, or commenced. This is, of course, a problem common to all matters of zoning within the context of disputes about development.

This systems study makes recommendations for enhancing the mechanisms for public participation in aquaculture administration and decision making. It also addresses issues relating to the furtherance of the overall goal of administrative fairness through the application of principles of integrated coastal resource planning and management. A major aspect of this paper deals with a proposal for the resolution of conflicts through the establishment of contemporary consensual dispute resolution strategies and techniques. Finally, this study addresses related issues of environmental impact and health considerations, insofar as issues of administrative fairness arise within the context of these highly technical matters.

The administration of aquaculture presents challenges which are inherently inter-disciplinary in nature. This office does not address matters which are, in substance, technical. The recommendations contained within this paper have as their collective goal the enhancement of the fairness of the administration of coastal land tenures and aquaculture practice, to the benefit of those who will use, share, or allocate coastal lands and waters.

It is important to state at this point that this office recognizes the inherently evolutionary nature of regulatory programs. Flexibility and discretion are valuable in the developmental stages; as experience is accumulated, however, it is appropriate to provide a greater degree of structure to the program requirements, and to the discretion which is exercised.

This structuring is best accomplished through legislation, with accompanying regulation passed pursuant to the authority of the statute. Aquaculture development, in the opinion of this office, is reaching the stage where a legislative framework for regulation is both necessary and appropriate.

The Practice of Aquaculture

Oceanographer Jacques Cousteau has observed that for man, the future lies in doing in an ocean environment that which he has already done for thousands of years on land - namely, the controlled rearing of animals within a contained area for the purpose of food production.¹ In countries such as Norway, Sweden, Scotland, Chile, and Japan, aquaculture is firmly established as a valuable industry for the production of seafood for both domestic use and export. A combination of offshore interest in the aquaculture potential of the B.C. coast from countries such as Norway, combined with expanding market opportunities for salmon products has resulted since 1984 in a dramatic growth in the demand for aquaculture land tenures. (See Appendix 10 for charts illustrating tenure distribution and industry composition). These tenures, which take the legal form of either a long-term lease or licence, are issued by the Ministry of Crown Lands (formerly Ministry of Forests and Lands) operating under the authority of the Land Act.²

Because salmon farms are floating, often self-contained, light industrial - or, more accurately, agricultural - structures which are fixed usually within 100 metres of the low tide water mark, they represent a somewhat novel introduction to the shore line environment: Appendix 1 shows a typical net-pen facility with walkways supported by floats. The floats may be hollow fibreglass, foam, or lightweight concrete. Two nets can be seen: an outer net to deter predators such as dogfish and sea lions, and an inner net which contains the fish stock. Feed in the form of pellets is distributed in the net-pen at intervals determined by the operator. Feed which is not consumed as it drifts downward will usually pass through the net and, along with fish feces, be deposited on the seabed in a manner determined by the depth, current flow, and tidal action at the net-pen site. Impact of the solid waste will vary from severe in a poorly flushed, inappropriate site to negligible at a site with excellent current, depth, and flushing.

Because of the tendency of the inner nets, with their relatively fine mesh, to become blocked or fouled with marine organisms such as mussels, kelp, or various types of seaweed, some operators have their nets dipped before installation in an anti-foulant compound. TBT, or Tributyltin, a highly toxic tin-based substance, was at one time used by a number of farms, but was banned for use

on nets by the Salmon Farmers' Association, and by the Federal Government. A copper-based anti-foulant (cuprous oxide) is now employed by a number of farms, with cost-benefit analyses being conducted by some facilities to determine its overall usefulness. Anti-foulant usage has been the focus of concern expressed to this office by certain individuals who fear a cumulative biological impact.

It will be noted that net-pen facilities bear some resemblance to a marina in that the submerged nets which contain the fish are suspended and linked by a series of walkways, usually assembled in a geometric pattern. However, they exist for what is primarily an industrial purpose, to benefit the owner of the fish farm. Apart from providing boat moorage as a public courtesy, as some fish farms do, they do not directly serve the general public. In this respect, they are similar to coastal log dumps which exist to serve the needs of the forest industry. Again, however, unlike log dumps or booming grounds, fish farms have not been a part of the province's history to the extent that their environmental impacts are well known, their general economic contributions are recognized, and their visual impact is assimilated into the consciousness of other coastal users.

Many individuals have economic interests in the aquaculture industry, directly or indirectly. Or they may simply wish to see an improvement in the employment picture for coastal communities. There appear to be few individuals within rural coastal communities who are neutral on the subject of fish farming. Opponents of the fish farm concept are greatly concerned at the ease with which a net-pen facility, which has the portability of a log boom, can be floated into a bay and anchored, transforming an area overnight. They fear the environmental impact of the farm, with tens or hundreds of thousands of fish in an confined environment doing what all organisms do - ingesting nutrients (in this case processed by man) and excreting waste products into a relatively limited area. (For an illustration detailing the various aspects of this interaction, see Appendix 12: "Possible impacts of a salmon farm upon the marine environment"). Pleasure boaters see favourite anchorages being occupied by large net-pen facilities. Scuba divers and tourists see the face of uninhabited areas being changed through a permanent industrial presence. Traditional fishermen see fish farms as a biological threat to wild stock. The industry as a whole claims that

it is a perfect, environmentally sound way to exploit the riches of B.C.'s coastal waters, and it is with each passing month developing new fish-rearing technology aimed at enhancing operational productivity and reducing adverse environmental effects which may be caused by the farm (excess waste), or suffered by the farm (e.g. plankton blooms). Opponents will often concede the potential value of the industry, but "not in my backyard".

As the industry attempts to advance its interests in establishing itself as a viable and important element of the British Columbia economy, it must at the same time fight a continual battle with those who believe with similar sincerity that the widespread growth of the industry will produce long term costs for the province far in excess of any benefits conferred. And both opponent and proponent are forced to deal with the fact that (as with some other resource uses) no one governmental agency has exclusive jurisdiction over the enterprise. (See Appendix 2, Aquaculture Licencing and Approval Flowchart) The Ministry of Crown Lands allocates parcels of aquatic land beneath the high tide line; the Ministry of Agriculture and Fisheries reviews and approves development plans and provides technical assistance to fish farmers; the Ministry of Environment may consider waste management and alleged pollution issues; the Ministry of Municipal Affairs may be involved in related by-law matters; and the Ministry of Health may have concerns specific to site operation and waste disposal. Both the fish farmer and the coastal resident or resource user find that, although there are many policies and procedural requirements for fish farmers to observe, there is little in the way of regulations, and virtually no statute law created to deal directly with the aquaculture industry. With no expert, independent, and binding appeal tribunal to adjudicate competing claims, opponent and proponent may utilize every political, legal, or economic weapon at their disposal to advance their respective interests, the result often being that no one's interests are well served.

As was stated in Public Report #11 produced by the Ombudsman's office entitled, Pesticide Regulation in B.C., "It is necessary for government to develop procedures which identify and attempt to balance these competing interests in environmental management". This study examines the present administration of aquaculture, focusing upon the reality of its existence as an application of coastal resources in the province. Recommendations are made for enhanced administrative fairness in all aspects of coastal land allocation, the

process which usually provides the basis for the conflicts which presently exist. Central to fair and effective (i.e. maximum benefit and minimum detriment to all parties) resource utilization is the concept of integrated planning and management; the report describes models which have been proposed or applied, and makes recommendations for the institution of appropriate planning and management mechanisms. The report also proposes the use of specific approaches to creative conflict resolution, whether the conflicts are matters of inherently subjective concern, or technical expertise.

Jurisdiction

The Ombudsman Act, s. 10,³ authorizes investigation of a decision, recommendation, act, omission, or procedure used by an authority (Ministries and agencies of the Province) "that aggrieves or may aggrieve a person". S. 22 of the Act sets out a code of administrative fairness by which the elements referred to in s. 10 can be measured. S. 22 is a guide for the broad assessment of government acts or omissions; in specific instances, the principles of administrative law and practice must be applied, within the context of thorough investigation, the consideration of all perspectives, and reasonableness. These principles may include the need for a clear statutory foundation from which administrative policy is derived; a structured framework for the exercise of discretion to ensure consistency and certainty; a process for the meaningful participation of interested parties in decision making that affects vital interests; internal quality control mechanisms; and external review procedures which respect the requirements of due process.

It should be noted that, in addition to the authority exercised by provincial ministries mentioned previously, the shore areas most often occupied by aquaculturists are also the subject of federal jurisdiction, primarily for the purposes of fisheries habitat protection (Department of Fisheries and Oceans, administering the federal Fisheries Act)⁴ and navigation (the Coast Guard, administering the provisions of the federal Navigable Waters Protection Act)⁵. While recommendations made by this office may have some impact on procedures employed as between the British Columbia and Federal governments, the matters of major concern which are addressed in this report are matters within (by law or by convention) Provincial authority. The Ministries of government which make administrative decisions relevant to the subject of this paper come within the Ombudsman's jurisdiction. This

jurisdiction includes the authority to examine the merits of such decisions, and not merely the procedures followed in reaching them. It also includes the responsibility to recommend statutory change, where existing legislation or procedures create the potential for unfairness.

Scope of Study

The Ombudsman's office is perhaps in a unique position to deal with inter-ministerial issues such as aquaculture administration. This office does not take a position for or against aquaculture; rather, the mandate of the Office of the Ombudsman is to be an advocate of fairness, and to ensure that aquaculture policy is administered in a manner which is fair to all individuals whose interests are affected.

This study was commenced on the initiative of the Ombudsman as a result of complaints received concerning aquaculture regulation in B.C. The common thread running through the complaints received was a dissatisfaction with the manner in which aquaculture is regulated. Such concerns ranged from an apprehension concerning the apparent lack of legislation or regulations, to the manner and degree in which public information is received and acted upon. Ten operating or proposed finfish net-pen facilities were identified specifically by complainants; for certain facilities, a number of complaints were received, and some of these were representative in nature, incorporating petitions of protest signed by local residents. It should be noted that in matters addressed publicly by this office, a common principle is followed: the concerns revealed by complaints are generally held to be of greater significance than the number of complaints.

What became apparent to this office early in the study was that some of the existing problems had their origin in the lack of a well-defined, integrated, and inter-disciplinary system for the management of British Columbia's coastal resources. The border between land and ocean constitutes an area highly prized by a diverse range of human interests, ranging from residential and recreational to industrial and international trade. Many areas of the coast are sensitive to excess waste loading, and their sometimes delicate ecologies may be considered a non-renewable resource.

The nature of this topic demanded a special approach from the Office of the Ombudsman. In addition to consultation with representatives of the various ministries involved,

this office also produced a discussion paper, which was primarily an information gathering tool. Questions distilled from a preliminary examination of available literature and analysis of the complainants' concerns were incorporated into the discussion paper under three headings: land allocation, conflict resolution, and environmental and health impact. Almost 100 copies of the discussion paper were distributed to a broad range of interested individuals and organizations. These included both individuals whose interests were confined primarily to environmental aspects, and members of the aquaculture industry. In addition, contact was made with representatives of the State governments of Alaska, Washington, Oregon, and Hawaii, for the purpose of studying their coastal resource management systems and their attitudes toward and experience with aquaculture. Contact was also made with representatives of Canadian Maritime provinces where aquaculture legislation is in place, as well as the governments of Norway and Sweden, who provided valuable information on both the law and practice of fish farming. This office also had useful contact with the Natural Resources Management Program at Simon Fraser University, and the Westwater Research Centre at the University of British Columbia.

No study of the current administration of Aquaculture in B.C. would be complete without a detailed review of the Report of the 1986 Public Inquiry into Finfish Aquaculture in British Columbia ("The Gillespie Report"). In response to concerns about the growth of the aquaculture industry advanced by the United Fishermen and Allied Workers Union (UFAWU) the Province of British Columbia instituted a moratorium on finfish aquaculture tenure issuance commencing October 31, 1986. At the same time, a commission of inquiry under the Chairmanship of Kamloops lawyer David Gillespie was established with a thirty-day mandate to investigate, report and make recommendations on the following aspects of marine finfish aquaculture operations:

- (a) impact on commercial fishery operation, markets, and localized production - related facilities;
- (b) potential and environmental impacts and effect on wild fish stocks;
- (c) impact and involvement of local government and interest groups;
- (d) government approval and monitoring procedures.

This office is not attempting to duplicate matters that were the subject of the 1986 Gillespie Report. However, implementation of the recommendations of that inquiry, which has been completed to the considerable credit of all Ministries involved, does not affect the appropriateness of further examination by the Office of the Ombudsman. This office has the relatively narrow focus of administrative fairness, while the Gillespie Report was more broadly directed to include social and economic policy concerns. Above all, the Ombudsman's Office seeks to be constructive in its involvement. It also notes the considerable and impressive dedication of Ministry personnel in applying their expertise, within the limits imposed by the institutional framework, toward achieving an equitable balance of interests in the regulation of this new and formidable industry.

Legislative and Statutory Framework

What makes net-pen aquaculture relatively unique is the process, both legal and physical, by which a private use is created of resources which have historically been treated as public. To understand the basis for this, it is necessary to review both the legal and physical aspects of the shore zone (see Appendix 3.). The upland zone (above the high-water line) remains primarily within the exclusive jurisdiction of the Province. Exceptions to this rule of ownership concern land which, by virtue of an overriding national interest, as expressed either in the Constitution Act 1867 (formerly known as the British North America Act) or decisions of the Court, is vested in the Federal Crown. Examples of lands under federal control are airport facilities, military bases, and subaquatic lands underlying offshore waters.

Title to the foreshore (that area between the high and low water line which is exposed at low tide) is vested in the province. No private ownership of the foreshore exists except in the case of a special Crown grant, or proof of a previous title that would predate the Province's entry into Confederation. However, private use of the foreshore can be granted as part of the legal rights conferred with a lease of aquatic land, which will by its nature include a right of possession extending to the high water mark.

It has long been established that, independent of Crown disposition by way of lease, the public has a right to pass on-foot without hindrance along the foreshore, and to navigate in ships over the foreshore when it is submerged

at high tide. At the same time, private owners of upland property possess what are known as "riparian rights". "Riparian" technically refers to inland bodies of waters such as lakes or streams, and the term "littoral" is used to refer to the equivalent rights attaching to ownership of property which abuts on a sea or ocean shore. However, Canadian courts have used the term "riparian" in both contexts, and it is used in such a fashion as well by the Ministry of Crown Lands. For the purpose of this report, the most important riparian right is the right of access from the upland property to "navigable water" at each and every point along the junction between the foreshore and upland property.

The submerged or sub-aquatic land beneath the low tide mark is known as the "solum" and was originally treated as the property of the federal Crown. This notion arose in Canada first as a result of the English legal tradition that all seabed is vested in and under the control of the Crown, for reasons of national security. A further reason was the fact that the Canadian Constitution provided that public harbours, international trade and shipping, and offshore fisheries would be the subject of control by the federal Crown. Federal - Provincial concerns over ownership of the seabed or its resources did not arise until late twentieth century technology made it an issue. To some extent, the legal issue remains unsettled. However, as it is relevant to the practice of coastal aquaculture, this much appears clear:

- (a) A decision by the Supreme Court of Canada in 1984⁶ settled the dispute over "internal waters" and the seabed between the Mainland and Vancouver Island, by confirming jurisdiction of the province over the management and sale of all resources in this area.
- (b) This does not mean that the federal government is without jurisdiction in the area classified as "internal waters". Jurisdiction remains over certain enumerated and significant public harbour areas and for the purposes of enforcing the Navigable Waters Protection Act and the Fisheries Act.

The primary function of the Department of Fisheries and Oceans in administering the provisions of the Fisheries Act is to prevent destruction of fish habitat, which includes critical spawning areas for salmon and other aquatic life. The Fisheries Act also prohibits the

dumping or placement in any other fashion of "deleterious substances" which would have the effect of harming fish habitat or wild fish stocks.

The Coast Guard, as a component of the federal Ministry of Transport, enforces the provisions of the Navigable Waters Protection Act to ensure that any structures, whether erected from the seabed or in the form of a floating structure fixed with anchors, do not pose a threat or restriction on the right of free and safe navigation.

Currently, the federal Department of Fisheries and Oceans (DFO) requires fish farmers to possess a valid licence under Section 7 of the Fisheries Act. It has been argued, - although no fish farmers have to date sought to follow this point up - that the Department of Fisheries and Oceans has no constitutional right to insist upon such a licence. The Provincial Ministries of Crown Lands and Agriculture and Fisheries do not recognize the DFO requirement as a licence binding upon the Province; rather, DFO is treated as a referral agency, and its comments are carefully reviewed.

The Coast Guard establishes itself in the regulatory framework by requiring that fish farms of the floating net-pen variety, as well as long-line shellfish farms or any other aquaculture facility which would fix structures at a point on the surface of the water, obtain a certificate of exemption under the Navigable Waters Protection Act; this certificate declares that the installation design and location has been examined and found not to pose a restriction or hazard to coastal navigation.

From the above discussion, it can be ascertained that, because of the manner in which net-pen facilities are located, in reasonable proximity to the foreshore, the primary jurisdictional and regulatory functions fall to the provincial government. It is worth noting that on September 6, 1988, the Government of British Columbia signed a significant memorandum of understanding on aquaculture development with the Government of Canada. The agreement, amongs its other functions, formalizes the jurisdiction of the Provincial Government to licence, develop, manage and regulate the aquaculture industry in B.C.

Primary among the aquaculture regulators is the Provincial Ministry of Crown Lands, allocating aquatic Crown land under the authority of the Land Act. However, the Land

Act does not mention aquaculture and there are, to date, no Land Act regulations directed specifically at aquaculture. The Ministry of Crown Lands dictates procedures by way of guidelines set out in the Land Administration Manual. These guidelines govern grants of aquatic Crown Land by way of licence or long-term lease; current Ministry policy is to provide for lease terms of up to 30 years. The guidelines do not have the force of legislation.

Because of the overlapping jurisdiction of other Ministries to control certain aspects of aquaculture, the Ministry of Crown Lands utilizes a referral process by which details of proposed salmon farming operations are relayed to other ministries and levels of government for comment. The referral process can be seen, through directives from the Land Division, to be undergoing continual refinement; certain interest groups are now among the referral agencies.

The Provincial Ministry of Agriculture and Fisheries has been formally designated lead Ministry and has responsibility for reviewing and approving fish farm development plans. The title "lead Ministry" indicates that it has been given responsibility for development, coordination, and implementation of strategies dealing with aquaculture. It also provides technical information on the subject, and has undertaken a number of initiatives aimed at the promotion of orderly growth of the aquaculture industry.

Information received by this office from the Ministry of Agriculture and Fisheries indicates that both general and specific strategies are being formulated to assist in this aim. Proposals of interest to this office include:

- (a) recognition of competing demands for coastal resources;
- (b) streamlining of regulatory and reporting procedures;
- (c) establishment of a provincial aquaculture permit or registration requirement; and,
- (d) specific aquaculture legislation.

The Ministry also administers the provincial Fisheries Act⁷. As has been pointed out: "This Act deals not so much with the regulation and preservation of the wild

fishery, as does its federal counterpart, but with those activities which are ancillary to the wild fishery, and more closely approximate matters of Property and Civil Rights in the province [reserved to the provinces by the Constitution Act 1867]"⁸.

The Provincial Fisheries Act restricts its ambit to matters relating to licensing of fish processing operations and fish buying stations, and dovetails with companion legislation, the Fish Inspection Act⁹, which provides for the maintenance of health and product quality standards in fish processing plants. From the beginning, the Ministry of Agriculture and Fisheries has been treated by the Ministry of Crown Lands as a primary referral Ministry; other referral agencies include the Ministry of Environment, local governments, and, to a lesser degree, the Ministries of Municipal Affairs, Regional Development (formerly the Ministry of Economic Development), and Health.

Apparently, no provincial agency other than the Ministry of Crown Lands has direct power to disallow an application for a coastal land tenure. Comments by Federal referral agencies are given considerable weight. The Coast Guard has the closest to an absolute veto by its power to declare a proposed floating structure to be a potential hazard to coastal navigation under the Navigable Waters Protection Act. It should be noted that restrictions imposed by other agencies do not affect the power of the Ministry of Crown Lands to issue a tenure. However, such tenure is granted subject to development restrictions or other laws which may be imposed by Federal, Provincial, or local authorities. One of the ostensible purposes of the present referral system is to identify locations in which such restrictions will be imposed and to advise the applicant accordingly, to prevent wasted effort.

Local governments have power to prohibit or regulate the siting of aquaculture facilities through their powers of local zoning (where their boundaries cross a water area, zoning will also apply to the surface of the water within that area under Section 963 of the Municipal Act). Development may also be subject to certain conditions. This may be done through official community plans and development permit requirements enacted under sections 945 and 980 of the Municipal Act.

Out of this inter-jurisdictional maze, one clear fact appears: no single level of government - local, Provincial, or Federal - emerges as having total jurisdiction.

The fragmented jurisdiction among local, Provincial, and Federal governments is not unique to aquaculture. Examples such as the Fraser River Estuary Management Program, in which mechanisms to form an administratively accountable framework were created to manage an exceptionally complex physical and social environment, will be considered later in this paper. It is the opinion of this office that aquaculture shares with estuary management the technical, social and legal complexity which demands imaginative and effective administrative solutions drawn from Canadian and international experience in integrated resource governance.

The importance of the physical subject matter - the shoreline of British Columbia - and of the institutional framework for its management is expressed well in the following excerpt from a paper entitled "Canadian Freshwater Lake and Marine Shore Areas - Uses and Management", presented by J.C. Day and J.G. Michael Parkes to the Shore Management Symposium in Victoria, 1978:

"The shore zone is of critical importance to all Canadians for historical, economic, ecological and social reasons. It contains important food resources and transportation advantages upon which present lifestyles depend while supporting a range of habitats for fish and wildlife species which Canada has international obligations to preserve. The land-water interface supports most recreation activities. In recent decades the shore zone has been subjected to rapidly increasing urbanization, transportation, industrialization, and leisure-space demand. Canadian shore areas are becoming a focus of environmental and resource-use problems for many reasons. The most fundamental concerns current institutional arrangements. As Craine (Craine, L. 1972, final report on institutional arrangements for the Great Lakes II-4. Ann Arbor, Mich.: Great Lakes Basin Commission) observed, institutional deficiencies are not necessarily related to the agency or the personnel involved but rather to the institutional system, or lack thereof, in which they operate. For example, Canadian federal responsibilities are mainly water related, with the exception of certain federal lands. Land management to the low-water mark is essentially a provincial responsibility. But neither administrative system is usually broad enough to

recognize that land and water management strategies applied separately do not deal with the symbiotic opportunities and constraints peculiar to the land-water interface. A fundamental problem relates to the fact that current institutional arrangements have failed to ensure that shorelines are an integral component of a coordinated land and water management system."

Complaints

Individuals who have approached the Office of the Ombudsman with complaints specific to aquaculture have focused primarily on two areas: the land allocation and tenure granting process; and environmental impact and health issues. Woven throughout these complaints was a common concern that basic principles of fairness had been bypassed, and that mechanisms for conflict resolution were either non-existent or ineffectual. In addition, it appeared to some complainants that Ministries were not following their own guidelines.

It should be remembered firstly that the following allegations reflect the perceptions of some coastal residents and do not, for the purposes of this report, reflect findings of fact by the Office of the Ombudsman. Secondly, the volume of complaints relative to the total number of aquaculture tenures, while significant to this office, is low. The number of new complaints has further declined, indicating perhaps the successful implementation of recommendations from the Gillespie inquiry.

Several examples of typical complaints follow:

- (a) Residents living in the same bay as a proposed fish farm made extensive representations to both federal and provincial authorities as to the environmental inappropriateness of a fish farm in that particular location. They argued that depth and tidal flushing were inadequate to ensure that disease would not be transferred from cultured fish stock to nearby shell fish beds. Aesthetic considerations were also advanced, as well as recreational concerns due to a perceived degradation of local water quality - i.e. the residents no longer wished to swim in the waters adjoining their homes. They didn't like their access impeded, their views altered, or their peace disturbed. Despite considerable protest

before, during, and after issuance of tenure, approval was granted for the fish farm to commence operations.

- (b) An individual who owned waterfront property with a spectacular coastal vista awoke one morning to find salmon farm net-pens anchored off the shore of adjacent property. The individual was taken completely by surprise and resented the fact that the fish farm tenure application had been "fast-tracked" to allow commencement of operations, with little or no perceived public involvement. In spite of considerable protest after the arrival of the farm, the Ministry of Forests and Lands subsequently issued a long-term lease for operation of the facilities at that location.
- (c) Application was made for a tenure in a sheltered bay of a small island community. Residents opposed the application on the basis that navigational safety and access would be impaired, there would be adverse environmental impact consequences, and coastal aesthetics would be harmed. There was also a general perception that the public involvement in the licence application process was not meaningful but was mere "window dressing" in that a decision to issue the tenure had been made regardless of local opposition.

More specifically, complainant perceptions and concerns can be grouped as follows:

(a) The land allocation process:

- lack of a clear publication of Ministry procedures and requirements;
- lack of a statutory framework clearly related to the subject of aquaculture;
- an "uncertain" referral process, with lack of meaningful participation by the parties to whom applications were referred for comment;
- the lack of a fair and effective appeal process;
- "fast-tracking", with no tangible observance of due process and a yielding to external pressures from "vested interests";

- lack of effective public notice of application for tenure and inadequate lead time for community planning and response;
- speculation in site acquisition could occur, whereby aquaculture operators would "tie up" a site with net-pen facilities for appearance purposes only, the ultimate purpose being to turn the site over at a profit to larger aquaculture firms.

(b) Environmental impact:

- adverse impact on aesthetics of the coastal environment;
- adverse impact on residential property values through alteration of the character of the coastline from wilderness to industrial;
- adverse impact on seabed marine life (non-motile organisms and flora);
- disruption of ecology: certain aquatic life forms might be removed or destroyed, while others might be attracted as predators to the salmon net-pens;
- perceived adverse impact of uneaten or excess fish feed and fish feces covering the seabed, and a general concern for the period of time necessary for sub-aquatic lands to recover to their former state;
- human waste disposal on self-contained "floating farms" (i.e. residential facilities attached to floating net-pens), and disposal of dead fish ("morts");
- lack of adequate regulation either to monitor or to control environmental impact by fish farms; and no appeal process by which affected parties can have their concerns adjudicated by an impartial, expert tribunal;
- the adverse impact of metal-based anti-foulant agents used on salmon nets to discourage marine plant growth on the nets.

(c) Conflict resolution:

- lack of any effective, or meaningful appeal process;
- lack of any mechanism for effective mediation or arbitration of individual and community concerns relative to aquaculture facility applications.

(d) Health considerations:

- effluent impact and water quality;
- possible intrusion of antibiotics into the food chain;
- a concern that farmed fish should be identified as such at the point of sale.

P A R T I I

PRINCIPLES OF ADMINISTRATIVE FAIRNESS
APPLICABLE TO LAND AND RESOURCE ALLOCATION,
AND CONFLICT RESOLUTION

PRINCIPLES OF ADMINISTRATIVE FAIRNESS APPLICABLE TO LAND AND RESOURCE ALLOCATION, AND CONFLICT RESOLUTION

In the annual and public reports produced by this office, the common goal has been to articulate the core elements of fair administration. It is appropriate to review these basic principles, as they will form the context within which the administration of aquaculture is reviewed and assessed in this report.

The following elements have been distilled from the experience and expertise of this office in matters of administration and are, in essence, foundational aspects of administrative law, with some specific modification appropriate to serve their application within the context of resource management and conflict resolution.

- (a) In matters affecting the rights and interests of Provincial residents, fairness, certainty, and predictability are best served through a legislative foundation by way of a specific statute, with enabling sections to provide for regulations.

Public trust and confidence in the regulation of an industry is best provided through the mechanism of a well-defined legal framework, especially in matters that may give rise to disputes among individuals with legitimate but competing interests. Where it is foreseeable that the rights of individuals and/or communities will be in conflict, the legal framework should be established by legislation, to which interested parties can refer in planning their affairs or resolving their disputes. Government performance and accountability then becomes measurable.

- (b) An opportunity for meaningful participation of those individuals or groups whose interests are affected, directly or indirectly.

Meaningful participation means that individuals, groups, local government, or any other party or parties with significant and legitimate interests will be recognized in the planning, implementation, and conflict resolution processes. It implies that their representations will receive careful consideration and will be accorded due regard consistent with the importance of the individual's interest. In other words, a duty is placed upon the

decision maker, insofar as is reasonably possible, to appreciate fully the significance of and the foundation for the various individual or group interests.

(c) A structured framework for the exercise of discretion.

The structuring of administrative discretion in decision making is essential to assure public confidence, and is most effectively achieved through the application of objective process and assessment criteria which are set out in legislation, regulations, and published official Ministry policy documents.

When administrative discretion is exercised in areas where potential conflict exists between private and industrial interests, there will always be suspicion that either the "vested interests" or the "squeaky wheels" have inordinately or improperly influenced the system for decision making. The publication of clearly defined criteria by which discretion is to be exercised, with clearly defined parameters such that similar situations are treated consistently and different situations are treated individually, is essential.

(d) Policy guidelines, rules and regulations promulgated by Ministries must be clearly defined in plain language and publicly available.

Public confidence is bolstered when the public knows and understands the decision-making process.

(e) Adequate and appropriate reasons for administrative decisions with significant impact should be provided in written form, whether required by law or not.

This enables parties to measure accurately performance against policy. Individuals are able to determine clearly the basis upon which the decision was reached, and are less likely to challenge the decision, particularly if the reasons provided make it clear that the available evidence was considered fairly. The decision thus made and articulated is also more likely to withstand later scrutiny by an independent review agency or tribunal.

(f) Internal review procedures that allow an affected individual to understand clearly the basis upon, or process by which the original decision was made, and to advance quickly and efficiently his

opposing views to an individual who has power to act, are useful and necessary to ensure that errors, such as incorrect or inappropriate interpretation of policy and regulatory requirements are either speedily rectified or openly justified to the satisfaction of all parties.

Whenever administrative decisions are made which are not consistent with the desires of parties who have legitimate interests, there exists the possibility of suspicion and resentment that the process was biased in favour of the party whose interests were apparently favoured. An effective internal review system in which individuals can participate and by which the rationale for a decision can be made known is the foundation for dispelling such suspicions.

- (q) External review procedures - appeals: an independent appeal process which is available without excessive cost is a vital aspect of assuring public confidence in the integrity of the regulatory process.

The appeal body should be expert in the technical area being administered, and as well should have at least one member well versed in the principles of administrative law. The appeal body must be truly independent with wide powers to hear evidence, call witnesses, and, if necessary, to substitute its decision for that of the administrative body in appropriate cases.

Section 59 of the Land Act is an example of an appeal system which is inadequate. The Minister appoints one of his internal staff members to hear the appeal if the Minister considers it advisable that the appeal be heard at all. An external appeal to court may be exercised only after the s. 59 appeal has been conducted, and on questions of law only. In other words, evidence may not be presented and reviewed on the merits at the "external appeal" in court.

- (h) An integrated, inter-disciplinary, and inter-ministerial planning process, based on a specific enabling statute and incorporating a long-range conception of the physical areas being administered or managed and which makes ample allowance for meaningful public participation at the beginning of the land allocation process, is basic to the achievement of administrative fairness; its application should extend not only

to maximizing benefits which may accrue from the development of a particular industry, but also to avoiding, rather than the more difficult and time-consuming resolving, of conflicts.

Before individuals and agencies can decide on the methods used to achieve certain goals, they have to decide where they want to be. This entails the creation of a long-range vision or concept. The translation of the vision into practical goals, objectives, and mechanisms for attracting public participation and dealing with public disputes, must be based on an overall framework for planning which respects diverse interests, mandates and expertise. Useful examples with practical emphases include: s. 90.58.020 of the Washington Shoreline Management Act of 1971, s. 302, Coastal Zone Management Act of 1972 (both found in Appendix 6); and "A Living River by the Door", documenting the proposed management system for the Fraser Estuary. Integrated planning allows each party to participate in the decisions which will affect its interests. In the case of industrial or commercial development in areas in which such development has previously been rare, the planning component becomes critical. The time period which may be allowed for publication of an application for Crown land, or even a public hearing, can be entirely inadequate for communities properly to address properly issues and concerns which will likely be manifested over the life of the industrial or commercial project. Since most developments of this nature are established with a long term private plan, so also should the local community be able to engage in long-term planning on a cooperative basis with provincial authorities. This will help to ensure that industrial developments on Crown land do not occur without the careful consideration that a planning process can provide, by way of sufficient lead time and a measure of informed anticipation.

- (i) An efficient mechanism for the independent assessment of environmental or social impact, in instances where the ability of the parties to make reasonable or accurate impact predictions is limited, and the magnitude of an unexpected adverse impact may be significant.

There may be instances where risks, minor to major, will be unavoidable, and a mechanism for securing information from a diverse range of interests will not be adequate in creating an information base for decision making sufficient to minimize risks. Where an error in siting of

an industrial facility could result in major injury to a fragile resource, (e.g., the location of a chemical processing plant relative to shellfish harvesting areas) a system of impact assessment which recognizes public interest and expertise as a valuable information source should be fostered. This is not formal conflict resolution, nor is it purely a planning matter. Rather, administratively fair systems of impact assessment should be directed at the unbiased acquisition of the best available data and predictions, which can then be applied to the critical questions of where, when, how, and whether or not to proceed with a project. Integral to the process and useful in enhancing the cost-effectiveness of the process, is the establishment of a threshold level at which a social or environmental impact assessment should be conducted.

The basic components of an environmental or social impact assessment which involves public participation may include, and should account for, the identification of the issue and determination of interests; the procedure for public notice and location and timetable of the proceedings; the style of hearing to be conducted; the access of parties to expert assistance, and their ability to obtain necessary relevant information. The sophistication of the parties for the type of hearing being conducted, and the procedure for appointment of the assessor or assessors are also important elements of such a process.¹⁰

A process to be avoided is the effect of experts retained to present data in a fashion which will advance only the interests of their client. Where such a presentation is made in a judicial (court) or quasi-judicial (administrative tribunal) environment, there remains the prospect that the best answer may be distilled from conflicting evidence; this is the heart of the adversarial system. A more satisfactory initial approach, consistent with an ultimate finding which is more likely to secure a lasting resolution, is contained within the concept of consensual dispute resolution. In its most basic form, the concept requires that opposing experts be required to create a consensus among themselves as to the accuracy of available data and areas in which legitimate questions remain, and an appropriate approach to the answering of those questions.

Any system of environmental or social impact assessment should be, as far as possible, time and cost efficient for all parties involved. If such assessments become a