

ALASKA LEGISLATURE SPECIAL COMMITTEE/SUBJECT FILE 8672
1860 SCOMM 75: MARICULTURE (FISH FARMING), 1987-1990

77

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

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

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

Sincerely,



Senator Dick Eliason, Chair
Senate Resources Subcommittee on Fisheries

cc: Senate Resources Committee Members
House Resources Committee Members

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF THE COMMISSIONER

STEVE COWPER, GOVERNOR

400 WILLOUGHBY AVE.
JUNEAU, ALASKA 99801-1796
PHONE: (907) 465-2400

May 5, 1987

The Honorable Richard Eliason
Alaska State Legislature
P.O. Box V
Juneau, AK 99811

Dear Senator Eliason:

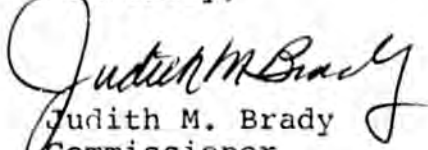
Thank you for your letter of April 2, 1986 regarding a moratorium on mariculture tideland permits. I share your concern that the program proceed in an orderly manner.

As you are aware, an interdepartmental work group has been formed to study the issues and concerns surrounding the potential development of a mariculture industry in Alaska. A moratorium is among the issues under discussion, although a final decision on this issue awaits further study of the legal ramifications of such a moratorium as well as administrative and developmental concerns.

The administration is committed to working with and keeping the Legislature informed of its progress on these issues, and members of the various resource agencies have appeared before the Senate Fisheries Subcommittee to apprise the Legislature of its work on these topics. Please rest assured that your views will play an integral part in any decision.

As always, my staff and I are available to discuss these issues further with you or your staff.

Sincerely,


Judith M. Brady
Commissioner

cc: Commissioner Collinsworth
Commissioner Smith
Commissioner Kelso

MEMORANDUM

State of Alaska

DEPARTMENT OF FISH AND GAME

TO: Grace Schaible
Attorney General
Department of Law

DATE: March 26, 1987

FILE NO.:

TELEPHONE NO.: 465-4100

SUBJECT: Pen-Reared Salmon
Farming

FROM: Don W. Collinsworth
Commissioner
Department of Fish and Game

Thank you for the work you have been doing to research and clarify the authorities presently available to the department to permit mariculture activities in Alaska. The recent hearings in House Resources highlight the interest in this issue. The March 10 memorandum from Sarah McCracken to Commissioner Collinsworth (enclosed) indicated that there may need to be clarification from the Board of Fisheries regarding the use of the Fish Transport Permit to govern the possession and transportation of live fish for farming purposes.

In your opinion, can the department under the current regulation issue permits for these fish farming purposes without action by the Board of Fisheries?

cc: Larri Spengler

Enclosure

DWC/DB/rlc

This was discussed in House Resources this morning. Rep. Herrmann expressed concern that NO answer has been received

Not yet intro-
just thinking about
it

5-1201A
Hein
5/7/87

SewZharoff is
also drafting a
resolution —

1 IN THE HOUSE

BY

2 HOUSE CONCURRENT RESOLUTION NO.

3 IN THE LEGISLATURE OF THE STATE OF ALASKA

4 FIFTEENTH LEGISLATURE - FIRST SESSION

5 Establishing a Joint Committee on
6 Aquatic Farming.

7 BE IT RESOLVED BY THE LEGISLATURE OF THE STATE OF ALASKA:

8 WHEREAS aquatic farming has taken place in the state on a small scale
9 since the early 1920s and is a clean industry for which the state's south-
10 ern coast is suited; and

11 WHEREAS aquatic farmers have shown an interest in expanding their
12 operations and range of products in response to worldwide consumer trends;
13 and

14 WHEREAS the possibility of the expansion of aquatic farming in the
15 state has generated many questions with regard to potential coastal and
16 resource-user conflicts, the socioeconomic effects on the coastal communi-
17 ties of the state and existing sea harvesting industry, and the effects on
18 the environment and on the biological integrity of Alaska's wild aquatic
19 species; and

20 WHEREAS public testimony overwhelmingly indicates a desire for the
21 development of environmental and biological safeguards before an expansion
22 of the existing industry is allowed in the state; and

23 WHEREAS pending litigation involving the state may result in the
24 state's inability to legally halt the expansion of aquatic farming; and
25 WHEREAS Norway, Japan, British Columbia, and Chile have experience
26 with regulating aquatic farming from which we can learn;

27 BE IT RESOLVED by the Alaska State Legislature that a Joint Committee
28 on Aquatic Farming is established consisting of two members of the Senate
29 and two members of the House of Representatives; and be it

1 FURTHER RESOLVED that the Joint Committee on Aquatic Farming, after
2 holding public hearings, shall develop proposals for the state's policy on
3 aquatic farming, taking into account the experiences of other countries and
4 the socioeconomic effects of worldwide aquatic farming on existing Alaska
5 sea harvesting industries; the committee shall report its recommendations
6 and findings to the Legislature on the first day of the Second Session of
7 the Fifteenth Alaska State Legislature; and be it

8 FURTHER RESOLVED that the committee may hire staff to assist in the
9 duties of the committee and may appoint advisory committees; and be it

10 FURTHER RESOLVED that the committee may meet during and between
11 sessions of the Fifteenth Alaska State Legislature and shall terminate at
12 the end of the 10th day of the Second Session of the Fifteenth Alaska State
13 Legislature.
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STATE OF ALASKA

DEPARTMENT OF COMMERCE & ECONOMIC DEVELOPMENT

OFFICE OF THE COMMISSIONER

BILL SHEFFIELD, GOVERNOR

POUCH D
JUNEAU, ALASKA 99811
PHONE: 465-2500

April 16, 1987

Honorable Richard I. Eliason
Alaska State Senate
P.O. Box V
Juneau, AK 99811

Dear Senator Eliason:

I have reviewed your March 30 letter regarding department plans for a mariculture socioeconomic study in the event that funding becomes available in the near future.

While a number of studies have been released, I would agree that those currently available address areas other than the impact on the Alaska fisheries industry. I understand that Mr. Robert R. Logan, Assistant Professor of Economics at the University of Alaska-Fairbanks, is nearly finished with a report detailing the impacts of salmon farming in Alaska. His results should be available soon; however, I have not had the opportunity to review his assumptions or evaluate the validity of his work. His office indicates that the work should be completed within the month.

In addition, the Department of Commerce and Economic Development is currently working on a supply/demand study for all salmon species that is aimed at pacing increases in production (primarily through hatcheries) to demand. While focused on pink and chum salmon, the data base is the most extensive and complete in the country and includes all salmon species. We undertook this study in-house, with the Office of Research, Analysis and Support doing the economic analysis. Due to difficulties in obtaining a data base adequate to do projections and due to other demands on the staff's time, the project is still several months from completion. While the modeling and data analysis are incomplete, several conclusions concerning the data and the ability to predict future events can be made.

First, the data is most complete for king salmon. The coho price data available is not as thorough. Atlantic salmon price data only go back four years in a useable format. Production and consumption data for Atlantic salmon show major increases each year -- a steeply increasing

demand curve, with little change in price. This indicates expansion into a new market. It is not clear yet whether there is a statistically valid correlation between Atlantic salmon production and price for kings and cohos. The decline of the dollar, the rapidly expanding market for fresh salmon and other factors complicate the relationships.

In order to project the effects of increased pen reared production, it is necessary to either have adequate historical data to define the demand curve or to make a number of assumptions that will shape the demand curve. The shape of the demand curve is fundamental to determining the impact of increased production on price. As the projected production is two to three times the current level, any projections must be based on assumptions rather than hard numbers.

Another consideration is that the Alaskan increment of production is expected to be quite small in comparison to projected worldwide production. To measure its impact with any degree of confidence would require a very good data set or very accurate assumptions. At this macro level of analysis, it seems unlikely to have much impact on price, though the worldwide production impact is likely to be significant.

To demonstrate the problem, the projected worldwide production of pen reared salmon by 1995 is roughly 250,000 metric tons. The entire west coast production of king and coho salmon from common property fisheries, including British Columbia, has averaged 70-80,000 metric tons over the last 10 years. The highest realistic Alaskan production figure is 10,000 metric tons, which is unlikely to occur before 1995. In 1995, the Alaska increment of production would be 3% of the worldwide total. That increment would be added to a rapidly increasing total, if supply projections are accurate.

Clearly there are many assumptions necessary to construct demand and supply curves. Any study would require projections of production, estimates of various market sizes and price levels, and estimates of production costs in various producing areas. Much of the discussion by pen rearing opponents seems centered on the assumption that the studies available to date were conducted by pen rearing proponents and are by definition based on biased assumptions. A similar charge could be leveled at opponents' assumptions. Unfortunately, there is no way to deal with the issue without making assumptions.

I believe the best way to deal with the dilemma is a Delphi study of 25 or so marketers and producers of Pacific and Atlantic salmon, academicians, and government analysts. Care would be taken in the selection of the panelists to get a balanced group. By asking the group to make the necessary projections and by working to achieve consensus, the resulting assumptions should be the best available. The range in responses and the difficulty in reaching consensus should

April 16, 1987

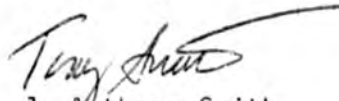
provide a measure of the confidence in the results. The resulting "assumptions" would be used to build beyond the range of existing data, to predict market price through time as production increases and the market matures.

The amount of time required would likely be six to nine months, and if done in-house could be done for less than \$50,000 if there are economists available. We are, however, faced with the probability of transfer of the analysis staff to the Office of the Governor. In the event of transfer, the study would have to be contracted out, though the models already done should be of some use, and the department has a macroeconomic model which can be used to predict the overall economic effects. In the case of a Delphi-type study, bias is not as much a consideration as the contractor's ability to perform, as the result is a consensus decision by expert panelists.

I hope that I have answered your questions. While I have serious reservations about whether we can get definitive answers to the questions you ask, and whether any crystal ball gazing can be free of bias charges, we would perform the study in a professional and competent manner whether in-house or under contract.

In my absence, I would ask that you direct your comments and inquiries to John Williams. Please do not hesitate to ask if we may be of further assistance.

Sincerely,


J. Anthony Smith
Commissioner

JAS/cw5168c
41687a

cc: William G. Paulick
Office of Commercial Fisheries Development



MOSS LANDING MARINE LABORATORIES

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APR 17 1987

April 10, 1987

Dear Senator Cochill,

I moved to Alaska in 1981 and fell in love with the State. Later I graduated from U.A.A. with a degree in Natural Science. Currently I'm in California attending graduate school as a Marine Biology/Ichthyology student with the intention of returning to Alaska when my course work is completed.

While I was in undergraduate in Alaska I worked as a seasonal wide creel censusing salmon for the Department of Fish and Game Sportfish Division. I am very proud of the Alaskan salmon runs and the progressive management by the State of Alaska that has ensured the continuation of healthy wild salmon stocks.

I am not proud that the Alaskan lawmakers are apparently conforming to reactionary, uninformed, and grossly biased tactics being used by special interest groups to stymie the development of mariculture. Just last week I attended a meeting of the Pacific Fisheries Biologists in Portland, Oregon where the strongest sentiments expressed were of regret for failing to develop mariculture for the fish export market. Oregon is now importing more salmon annually than their commercial fishery produces.

Commercial fishermen work very hard for their living and I would not deny them the opportunity to earn their livelihood. But I do object to a select, self-interested group overriding the best interests of Alaska. It should be kept in perspective that the ocean and the fish that the commercial fishermen are exploiting are public resources.

Compared to the world development of mariculture, the United States is a laggard country. The countries that have committed to mariculture have been very successful (Chile, Norway, Japan, Italy for example) and are exporting fish around the world.

Because of heavy exploitation, Alaskan salmon stocks are now carefully regulated. Similarly the quality of mariculture operations can be regulated through the permitting processes and revenues generated by licensing.

The time is right for Alaska to diversify it's economic base. Mariculture, like commercial fishing, is hard, honest work. If Alaska continues to block the efforts of would-be maricultural

entrepreneurs, the development will happen elsewhere where the political climate is more receptive. As a consequence, the fish will still be produced and exported worldwide, at no benefit to Alaska.

I will be finishing my Master's Degree in 1988 and I hope to be able to return to Alaska to develop my own mariculture business. If I'm faced with an uphill battle all the way and denied the opportunity to earn a living in the manner I choose, I'll be forced to go elsewhere. That's the cold, hard reality for Alaska. Alaska can't afford to lose creative, forward thinking people that care about the State and its future.

Sincerely,

Lucy Wold

Lucy Wold



Desk of Sheila

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April 24, 1987

Senator Richard Eliason
Chair, Senate Rules Committee
Alaska State Senate
P. O. Box V
Juneau, Alaska 99811

Dear Senator Eliason:

Enclosed are two recent reports on aquaculture. One is a general review of aquaculture in Japan. In particular, note Professor Fuji's concerns with overcrowding and disease. This has been a particular problem with growing seaweeds in areas of high pollution.

I have attended conferences on aquaculture in Japan where disease was discussed. It appeared to affect the cultivated stocks, but I heard no reports of the same thing happening in wild stocks. Overcrowding and man caused pollution from city and industry were the cause.

I hope this is of use to you.

Sincerely,

John P. Doyle
Professor of Fisheries

enclosures

Im



Marine Fisheries REVIEW



On the cover: An adult male northern fur seal, *Callorhinus ursinus*. Photograph by Charles Fowler, NMFS National Marine Mammal Laboratory, NWAFC, Seattle, WA 98115.



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U.S. DEPARTMENT OF COMMERCE

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National Marine Fisheries Service

Editor: W. Hobart

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Pen Rearing Pacific Salmon, *Oncorhynchus* spp., in San Francisco Bay

WILLIAM S. LEET, ROGER E. GREEN, and DANIEL RALPH

Introduction

Saltwater net-pen culture of Pacific salmon, *Oncorhynchus* spp., is a recent development in salmonid management. The technique consists of transferring smolts directly from fresh water into saltwater net pens. The salmon are reared in salt water, where their growth rate is accelerated, and at the appropriate time or size of fish, they are released or harvested for marketing.

Research on saltwater pen rearing on the U.S. west coast was initiated in 1969 by the National Marine Fisheries Service's (NMFS) Northwest and Alaska Fisheries Center at its Manchester Field Station on Clam Bay in Puget Sound, Wash. (Novotny, 1975). Coho, *O. kisutch*, and chinook, *O. tshawytscha*, salmon held in saltwater net pens in Puget Sound beyond the time of their normal migration into the sea tended to remain in the Sound and were more accessible to recreational fishermen (Novotny, 1975; Moring, 1976). In addition, chinook salmon were found to

Figure 1.—Pacific salmon pen-rearing study area.



ABSTRACT—Chinook, *Oncorhynchus tshawytscha*, and coho, *O. kisutch*, salmon were pen-reared in San Francisco Bay from 1974 to 1979 at the NMFS Southwest Fisheries Center's Tiburon Laboratory, Tiburon, Calif. Environmental and experimental conditions varied from year to year and tag returns indicated an inconsistent contribution of the different pen-reared groups to the local sport fishery and ocean harvest. The best results were from chinook salmon reared in 1976. Although commercial applications of pen rearing in San Francisco Bay might succeed, we do not see the release of pen-reared fish as an effective management technique for increasing the ocean catch in California.

return to streams closest to the pen-rearing site rather than to their natal or hatchery streams (Novotny, 1975). Such delayed release of pen-reared salmon resulted in improved returns to the fishery as well as better spawning escapement (Mahnken and Joyner, 1973).

The authors are with the Tiburon Laboratory, Southwest Fisheries Center, National Marine Fisheries Service, NOAA, 3150 Paradise Drive, Tiburon, CA 94920. The current address of R. E. Green is Tin Cup Road, Darby, MT 59829. The current address of D. Ralph is 8 Fifth Street, West Keansburg, NJ 07734.

The Squaxin Indian tribe, Shelton, Wash., has pen-reared coho salmon since 1976 and is currently releasing over 1 million fish annually. This program has increased the tribal catch dramatically. Consistent returns of 15-20 percent are being achieved¹.

In 1974, the NMFS Southwest Fisheries Center's Tiburon Laboratory, Tiburon, Calif. (Fig. 1), in cooperation with the San Francisco Tyee Club (a

¹Tim Tynan, Squaxin Indian Tribe, Shelton, Wash. Unpubl. data.

recreational fishermen's association), the California Department of Fish and Game (CDFG) and the University of California Cooperative Extension Service—Sea Grant (UCSG) began a series of salmon pen-rearing and release experiments to investigate the feasibility of pen rearing in San Francisco Bay. The primary objectives were to learn if seawater pen rearing of Pacific salmon would be possible in San Francisco Bay and if a recreational coho fishery could be established inside the Bay. As the study progressed, we added the ancillary objectives of measuring the contribution of pen-reared salmon to the ocean harvest and determining if pen rearing salmon in San Francisco Bay would be a cost-effective technique for augmenting the ocean harvest of Pacific salmon.

Rearing Environment

The pen-rearing site at the Tiburon Laboratory was on the northeast shore of the Tiburon Peninsula on San Francisco Bay (Fig. 1). The pens were fastened alongside a concrete quay where the depth was 3.2 m at mean lower low tide and the mean daily tidal range was 1.75 m. Tidal currents typically reached 1 km/hour. The pens were exposed to wave action from wakes of passing ships and from wind waves ranging up to 1.6 m. Annual ranges in salinity and temperature recorded at the pen-rearing site were 9-31‰ and 9.5°-21.0°C, respectively.

Net-pen enclosures, constructed of nylon mesh in the form of topless rectangular boxes, were hung from floats which also served as walkways (Fig. 2, 3). Mesh sizes were 22-32 mm stretched measure. To prevent deformation of the net in tidal currents, plastic gallon jugs filled with sand were suspended from lines inside each corner, and at about 1.8 m intervals along the sides and ends.

Predaceous seabirds were excluded from the open tops of the net pens by nylon nets stretched over the pens about 1 m high on pipe stanchions and polypropylene rope crisscrossed over the pen structure.

Pen-Rearing Procedures

Table 1 summarizes information on

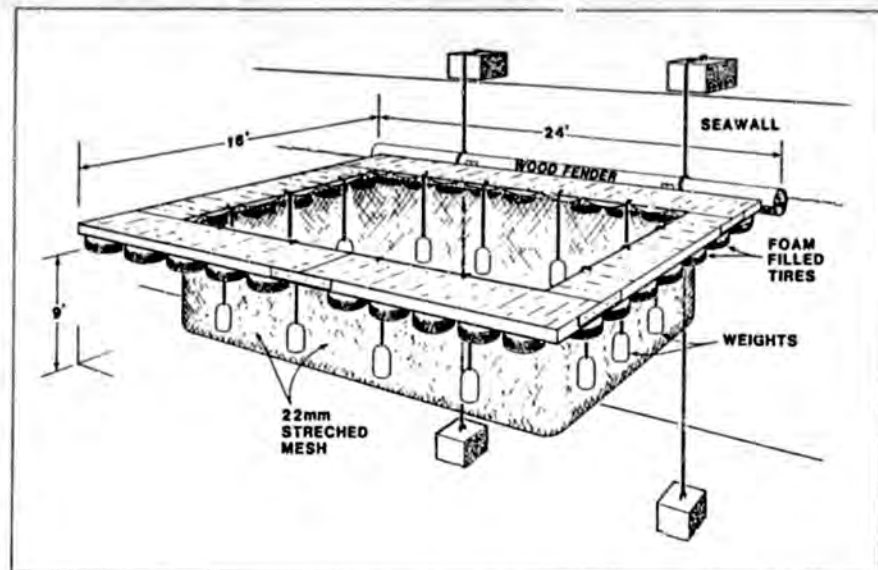


Figure 2.—Diagram of rearing pen.

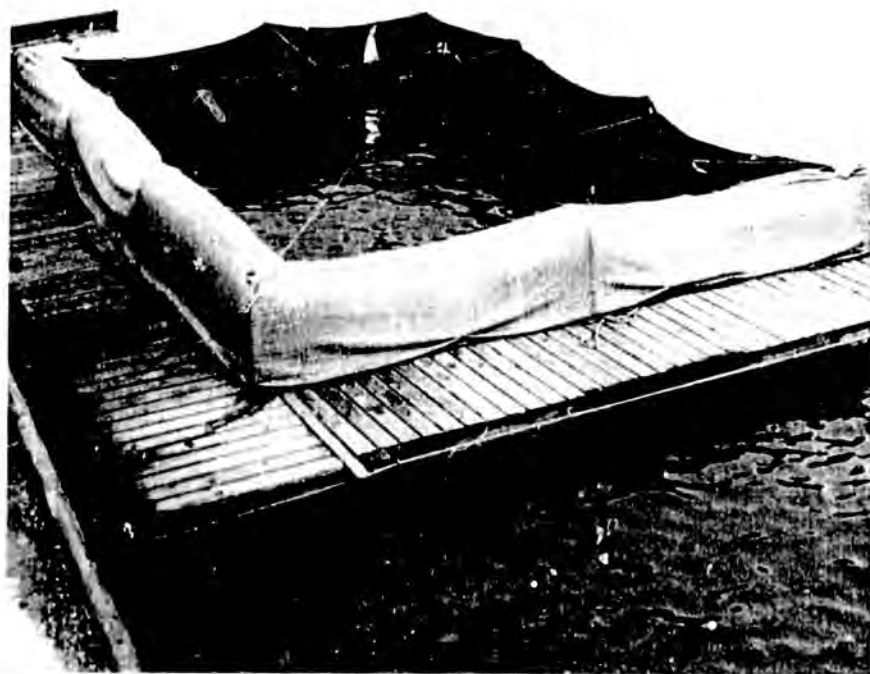


Figure 3.—Rearing pen in place.

the nine groups of salmon reared during the study. Coho salmon were initially selected for the pen-rearing ex-

periments on the basis of the NMFS Manchester Field Station reports and the evaluation guidelines given by Novotny

Table 1.—Summary of details pertaining to Pacific salmon pen-reared and released at the Tiburon Laboratory, 1974-79.

Group no.	Species	Brood stock	Last hatchery	No. fish delivered	Release date	Days in pen	No. fish released	Mean size (g/fish)	
								at delivery	at release
1	Coho	Noyo R., Calif.	Mad R., Calif.	10,000	11/06/74	119	4,000	15	200
2	Coho	Kalama R., Wash.	Manicure N.W., Wash.	40,000	11/24/75	116	30,320	19	220
3	Coho	Alsea R., Oreg.	San Joaquin, Calif.	30,000	3/31/76	74	5,700	62	90
4	Chinook	Fall run Feather R., Calif.	Feather R., Calif.	20,250	12/17/76	78	6,900	34	103
5	Coho	Skagit R., Wash.	Mad R., Calif.	30,000	7/14/77	128	3,430	23	131
6	Coho	Toutle R., Wash.	Aqua Dell, Oreg.	28,250	9/12/77-11/08/77	53-110	9,220	22	86 206 233
7	Chinook	Fall run Feather R., Calif.	Feather R., Calif.	100,480	6/13/78	53	24,700	3.2 3.5	7.9
8	Chinook	Fall run Feather R., Calif.	Feather R., Calif.	100,000	10/26/78, 11/03/78	129-136	19,900	6.7 8.5	68 85
9	Chinook	Fall run Feather R., Calif.	Feather R., Calif.	76,050	11/20/79, 11/21/79	92-93	12,720	14	75

(1975). These reports indicated that cohos are more resistant to disease and handling mortality during saltwater culture than chinook salmon, and exhibit good first-year growth in salt water. Also, since coho salmon are not normally found in either the Sacramento-San Joaquin River system or the San Francisco Bay-Delta system (Hallock and Fry, 1967) we could assume that most cohos found near the rearing site or upstream had originated at our net pens.

Smolts (young fish physiologically capable of osmoregulating in seawater) were provided by State or Federal hatcheries in California or were purchased from commercial hatcheries in Oregon or Washington. The fish were delivered to Tiburon by hatchery trucks usually equipped with refrigeration and recirculating pumps.

Several factors led to our decision to use chinook salmon for the final three rearing experiments. They were readily available from California State hatcheries free of charge, whereas cohos were not, and funds were not available to purchase cohos from commercial hatcheries. In addition, we had successful results with the chinooks reared in the Group 4 experiment.

Groups 1, 2, and 5 (Table 1) were

inoculated against *Vibrio anguillarum* by vaccine injection at least 2 weeks before transport. Group 9 was inoculated against *V. anguillarum* by immersion in vaccine. The other groups were not inoculated.

In 1974, the first year of the pen-rearing experiments, the fish were fed Oregon Moist Pellets² (OMP). Thereafter, rearing capacity was quadrupled and dry-pellet salmon diets were substituted because sufficient refrigerated storage capacity for the OMP was not available.

Feeding rates of 3-5 percent body weight per day were used, dividing daily rations into four feedings. For groups with a large size range, the daily ration was divided into three feedings so that toward the end of each feeding period there was food left for the smaller, less aggressive fish after the larger ones had fed to satiation.

Pen stocking did not exceed the recommended density of 16 kg/m³ (Novotny, 1975). As the salmon grew, fish were transferred to avoid exceeding this capacity.

After release of the salmon, nets were

²Mention of trade names or commercial firms does not imply endorsement by the authors or the National Marine Fisheries Service, NOAA.

Table 2.—Summary of tag release and return details for groups of salmon pen-reared at the Tiburon Laboratory, 1974-79.

Group no.	Tagged ¹ fish released (no.)	Tag ¹ returns (no.)	Percent return	Adjusted ² return rate (%)
1	4,000 N	16 N	0.4 N	— ³
2	300 F	2 F	0.3 F	— ³
3	7,631 C	67 C	0.9	3.9
4	4,717 C	42 C	0.9	3.9
5	2,645 C	144 C	5.4	23.5
6	2,417 C	2 C	0.1	0.4
7	6,433 C, B	13 C	0.2 C	0.8 C
8	16,300 N	275 N	1.7	— ³
9	18,500 N	2,461 N	13.3 N	— ³
	1,400 C	20 C	1.4 C	5.9 C
	12,720 n	1,435 N	12.8	— ³

¹Tag types: B = Freeze brand, C = Carlin, F = Floy dart, and N = nose.

²Adjusted for tagging mortality/tag shedding.

³The tagging mortality/tag shedding adjustment factor of 4.32 demonstrated for Carlin tags only.

removed from the Bay and hung to dry. The nets were cleaned of fouling growth, inspected, and mended. At the end of the rearing year, pen sections were disassembled in the water, lifted out, and inverted for drying. When the sections were dry, the fouling organisms were scraped away and repairs were made. The work was usually accomplished in less than 100 worker-days.

Tagging

All 10,000 coho salmon of Group 1 (1974) and many chinook salmon in Groups 7, 8, and 9 were internally nose-tagged with binary-coded magnetic wire tags (Jefferts et al., 1963) and adipose-fin-clipped for field recognition (Table 2). Additionally, 600 fish from the 1974 rearing were double tagged with plastic dart tags (Dell, 1968). Carlin tags (Saunders, 1968) were used from 1975 through 1978. Tagged fish were held in recovery pens until normal feeding behavior resumed—usually 1-2 days. Mass releases into the Bay were timed for an ebbing tide when the water was turbid to help conceal them from predators.

In addition to being Carlin-tagged, one group (Group 6) was also freeze-branded (Mighell, 1969) to test the effectiveness of this less expensive marking procedure. For this test, a 6.35 mm dual brand (symbol IH) was applied under the dorsal fin. When fish were not

marked and therefore not counted, the number released was estimated by weighing and counting random samples of the fish as they were dipnetted from the pens.

Pen-Rearing Experience by Year

Between July 1974 and November 1979, nine groups of salmon were reared and released at the Tiburon Laboratory saltwater pen site. Tables 1 and 2 summarize details of rearing and tag returns. Because of the great experimental dissimilarity among the rearing groups, we present here notes, by group, on our experiences in rearing these fish. Group numbers match those used in Tables 1 and 2.

Group 1, 1974

In the first year of the project, 10,000 coho salmon were reared in one pen as a pilot study. The fish, from Noyo River brood stock, were hatched and reared by CDFG at the Mad River Fish Hatchery, Arcata, Calif. They were injected with vibrio vaccine when they were nose-tagged at the hatchery. They were delivered to the Tiburon Laboratory and placed in a floating pen on 10 July 1974 at an average size of 15 g.

Observed mortalities in this group of fish during pen rearing were 2,845, of which about 10 percent were found on the surface. The release of an estimated 4,000 fish revealed an inventory discrepancy of 3,000 fish. The problem of unaccountable inventory losses was also prevalent in each succeeding rearing throughout the later years, and has been reported by other workers who have reared salmon in pens³.

Group 2, 1975

This group of coho salmon was obtained from a commercial salmon grower in Washington. They had already been injection-immunized for vibriosis. On 1 August, 40,000 fish were delivered to Tiburon and placed in one net pen.

For several days, the salmon were fed a mixture of OMP and dry pellet feed

prayed with fish oil. After this adjustment period, they were fed a straight diet of dry pellets. As the salmon grew, they were transferred to other net pens until they were about equally divided among four pens. This group experienced fewer problems and greater survival during rearing than any other group. On 24 November, the 30,320 fish remaining were released; 7,631 of these were tagged.

Group 3, 1976

Yearling coho salmon were the first of two groups reared in 1976. Because the fish were delivered on short notice, the pens and nets were not ready; however, two above-ground plastic swimming pools were available for use. These pools were supplied with Bay water by a submersible pump.

On 16 January the salmon were delivered and stocked in the two pools. One net pen was made ready, and 7,500 fish were transferred to it on 4 February. That night the pump supplying the pools failed and the 22,000 fish still in the pools suffocated by the next morning.

The salmon placed in the net pen were the largest received during the entire project and had a large size range (20-270 g), as they had never been graded during their year of hatchery rearing. This presented feeding problems due to the dominance of the larger fish.

Pen rearing lasted through March, and the fish were released on 31 March. Of the 5,700 released, 4,717 had been Carlin-tagged the week before.

Group 4, 1976

Cohos were not available but 20,250 fall-run chinook salmon were obtained from the CDFG Feather River Hatchery in Oroville, Calif. These fish were just under 1 year old, and upon delivery on 1 October they averaged 34 g. They had not been vaccinated against vibriosis.

On 14 November waves broke the first pen loose from its moorings and about 12,000 salmon escaped before the net was repaired and the pen returned to its mooring. The remaining fish were unharmed.

This group, the first chinook salmon reared in the project, was healthier than

most others. Size range was small and all fish appeared to feed well throughout the rearing period. They were hand-fed dry pellets four times per day at a daily ration of 4 percent of their weight. No disease problems were encountered. We were impressed by the ease of rearing and the good growth rate for this first group of chinooks, both being contrary to reports that chinook salmon were more difficult to rear than cohos. On 17 December, after 78 days of rearing, the surviving 6,900 chinooks were released, 2,645 of which were Carlin-tagged.

Group 5, 1977

These coho salmon from the Mad River Hatchery were delivered to Tiburon on 3 March. At delivery, the 30,800 fish had a mean weight of 23 g (range 10-199 g). A high incidence of cannibalism was anticipated, and was verified by observation. The cohos appeared to be in poor health at delivery and suffered heavy mortality during their confinement. At release on 14 July, only 3,430 fish remained, of which 2,417 were Carlin-tagged.

Group 6, 1977

This group consisted of coho salmon from Toutle River (Washington) brood stock reared in fresh water at Aqua Dell Farms in Oregon. A total of 28,250 salmon, averaging 22 g, was delivered to Tiburon on 21 July. Initial mortality in this group was high: 33.1 percent of the number delivered died within the first 5 days.

Freeze-branding and Carlin-tagging began on 7 September, about 1½ months after the fish were introduced into the net pen. The number of marked fish released was 6,433. These were the last coho salmon reared and released during the project.

Group 7, 1978

Chinook salmon for the 1978 and 1979 rearings were obtained from fall-run Feather River brood stock spawned and reared by CDFG at the Feather River Hatchery, Oroville, Calif. The first 1978 group was delivered to Tiburon on 21 April and consisted of about 100,480 fish, of which 38,160 were nose-tagged.

³A. Novotny, NMFS Northwest and Alaska Fisheries Center, Seattle, Wash. Personal commun.

We planned to rear tagged and untagged fish in adjacent pens. However, the net pen into which the untagged fish were being stocked was of a slightly larger mesh size which allowed some of the fish to escape. After the problem was discovered, the remaining untagged fish were put into the smaller mesh pen with the tagged fish. On the third day after delivery, nose-tagged fish averaged 3.5 g and untagged fish averaged 3.2 g; these were the smallest salmon received during the project.

The fish were reared for 53 days and the 24,700 remaining after disease mortality and escape were released on 13 June. At an average weight of 7.9 g, these fish were smaller than those of any other release group. Indeed, they were smaller at release than the mean size of any other group at delivery.

Group 8, 1978

The second group of chinook salmon in 1978 was composed of 50,000 nose-tagged and 50,000 untagged fish, reared in separate pens. The nose-tagged fish were delivered on 19 June, and the untagged fish the following day. The same problem of fish escaping the pens occurred with these untagged fish as had occurred in the spring delivery; there were two distinct size modes of fish, and the smaller ones easily passed through the net. Weight samples were taken 2 days after delivery. Nose-tagged fish averaged 8.5 g and untagged fish 6.7 g.

For prophylactic treatment, Terramycin was administered in the food for 10 days, starting with the initial feeding. When the Terramycin was discontinued on 29 June, tagged fish began to die in increasing numbers, and heavy mortality occurred on 5 July. The dying fish exhibited whirling behavior, external lesions, and hemorrhaging fins.

On 7 July, live samples of tagged and untagged fish were examined at the State Fish Disease Laboratory. Preliminary diagnosis for the tagged fish was vibriosis. No disease organisms were detected in the untagged fish; however, a vitamin deficiency was found. Thereafter, Terramycin and vitamin supplements were added to the feed.

The untagged fish suffered a negligible mortality rate, but many had

escaped. On 17 August the net pen with untagged fish was inventoried and at least 35,000 fish were unaccounted for. The counting process killed 25 percent of those remaining. Several factors, in particular heavy scale loss and high water temperature, may have been responsible.

The nose-tagged fish were released on 26 October. On the release date a tag-retention check was performed which indicated 98 percent retention of the coded-wire nose tag.

The remaining untagged fish were Carlin-tagged 30 October-1 November. Only 2,000 of the expected 9,600 were present in the net pen. These fish, the last to be Carlin-tagged in the project, were released on 3 November 1978.

Group 9, 1979

In the final rearing experiment, two separate groups of chinook salmon were used—one reared in net pens as in previous years and the other released at the pen site upon delivery. Each group was nose-tagged. The second group served as a control to learn the effects of saltwater rearing and delayed release on survival. Both groups received identical treatment during freshwater residence, including immersion vaccination against vibriosis. Fish were delivered on 20-22 August. Average weight of both groups at delivery was 14 g. The pen-reared group numbered 76,050 fish and the release group numbered 24,800.

Feed rations were maintained at 3 percent throughout the rearing period, and Terramycin and vitamins were added at regularly scheduled intervals. Sulfamethazine was administered for 5 days immediately following the removal of a few dead fish from two of the net pens; however, no epidemic problems were encountered as in the previous year's two rearings.

The fish were released 20-21 November. The number released, adjusted for tag recognition percentages provided by CDFG, was 11,223 at an average weight of 75 g. The total number released was 12 percent higher. The adjusted figure for the control group was 21,730. The adjustment for tag recognition purposes is an estimate based on the size of fish, the experience of the tagging crew, and

other factors which might affect tag retention and recognition of the adipose-fin clip.

Results and Discussion

Growth

The average weight of salmon in all groups increased exponentially with time during the rearing period. Growth curves fit to average weight at delivery and release for all nine groups of salmon are presented in Figure 4. The mean weight of each rearing group (except 3, 4 and 5) doubled during each 30- to 32-day period they were in the pens.

Group 3 cohos, yearling fish delivered in January 1976, grew more slowly than any other group. Their mean size was large at delivery and the size range was extreme. Both factors, together with cool winter water temperatures, probably accounted for the slow growth.

Somewhat slower growth was noted in Groups 4 and 5 than in the remaining six groups. For Group 4, the likely cause was cool water; for Group 5 the range of size at delivery was so extreme that the growth curve based on mean size was of little significance.

Tagging Mortality, Tag Shedding, and Tag Recognition

The returning coho salmon from the 1975 and 1976 releases provided an opportunity to estimate the combined tag shedding and tagging mortality of these Carlin-tagged fish during their time spent at sea. The releases consisted of the 1975 fall and 1976 spring Tiburon releases, and a 1975 UCSG release which had been held at Tiburon for a week before transfer to and rearing in Tomales Bay. The Tomales Bay salmon apparently imprinted to the Tiburon site, as returns for this group were recorded only at Tiburon.

The estimation of tagging mortality and/or tag shedding involved comparing numbers of tagged and untagged salmon released with the numbers of tagged and untagged returning salmon captured in a gill net set at the pen site in 1976. All returning cohos were assumed to be returns from the 1975 and 1976 releases rather than wild stock, as

wild cohos were not normally found in the San Francisco Bay-Delta system. None of the adipose-fin-clipped cohos released in 1974 were caught in the gill net. The gill net was assumed to be an unbiased sampling gear with respect to untagged and tagged fish. A *t*-test was used to determine if the length of tagged and untagged fish had the same mean. Mean length was equal at the 0.01 significance level so the assumption seemed justified.

Given these circumstances, the percent tagging mortality and/or tag shedding while at liberty is:

$$M = \left[1 - \left(\frac{C_t}{R_t} \right) \div \left(\frac{C_u}{R_u} \right) \right] \times 100,$$

where M = tagging mortality and/or tag shedding,

C_t = number of tagged salmon recaptured by gill net,

R_t = number of tagged salmon released,

C_u = number of untagged salmon recaptured by gill net, and

R_u = number of untagged salmon released.

It was not possible to distinguish between tag shedding and tagging mortality, as only tagged vs. untagged fish were discernible after return to the gill net. The tagging mortality/tag shedding rates in these releases were very high. Only 20 tagged salmon were among the 159 caught in the gill net. Of the total of 43,118 salmon released, 16,552 were tagged. This would indicate a tagging mortality and/or tag shedding rate of 77 percent.

It follows that, in the absence of such tagging mortality/tag shedding, 4.3 times as many tagged fish would have been recaptured. This adjustment was used in estimating return rates (Table 2). An assumption has been made that the tagging mortality/tag shedding rates were the same for all groups of Carlin-tagged fish and has been used in estimating the percentage of tag recoveries for all groups released with Carlin tags.

In the case of nose-tagged fish, re-

coveries from the sport and commercial ocean catch are made by samplers at each port where the fish are landed. Total nose-tagged fish returns are then estimated by the CDFG by dividing the number of actual recoveries by the percentage of the landings sampled. This calculation estimates the number of nose tags that would be recovered if all the landings were censused.

Our freeze-branding trial produced no

returns. It can be concluded that the marks faded, because Carlin-tagged fish that were recaptured from group 6 showed no evidence of having been freeze-branded.

Tag Returns

Tag returns are important because they measure the contribution of each group to the fishery. Several factors in this study make it difficult to analyze the

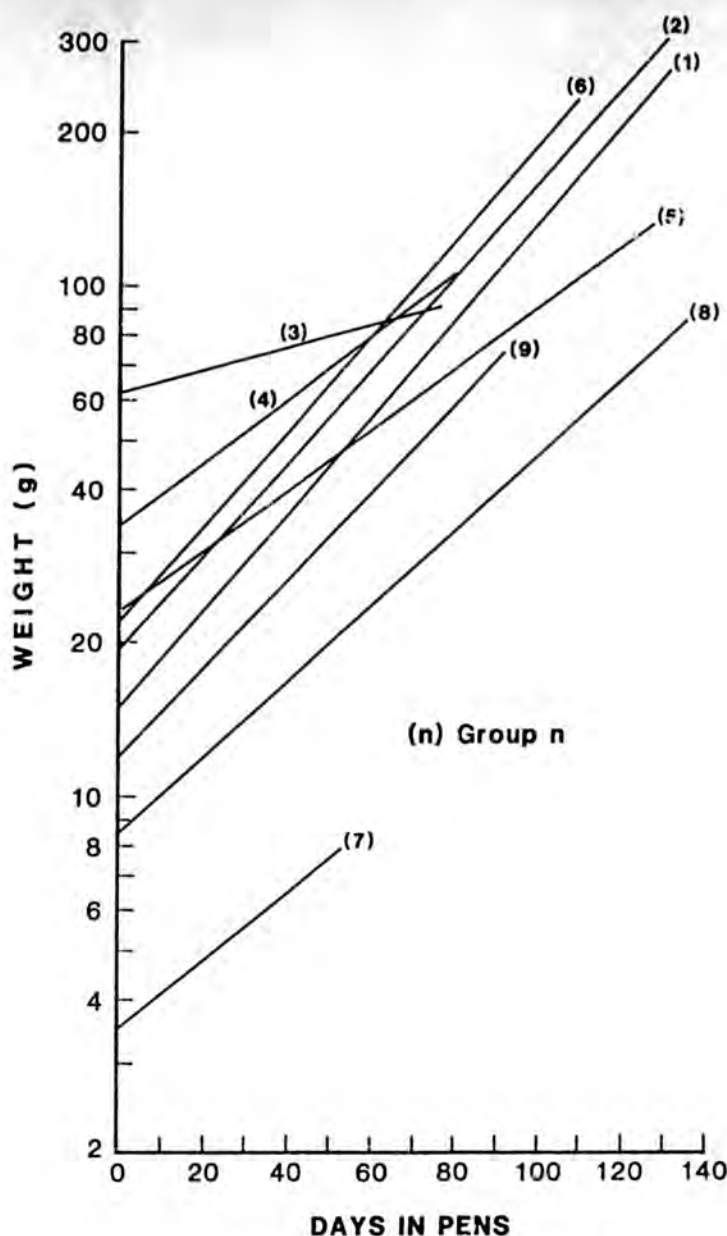


Figure 4.—Growth curves for pen-reared salmon by group.

tag return information and therefore to draw conclusions from it. There was a high degree of variability in the rearing experience from year to year. Changes in species, brood stock, hatchery, date, size, and uniformity of size at delivery were usually dictated by factors that were beyond the control of the experimenters. Varied environmental conditions, such as the drought in 1975 and 1976, not only affected rearing conditions but also caused some regulatory changes (season and size) that may have influenced tag return rates. It is also likely that the adipose fin clip identifying nose-tagged fish escaped observation in some groups more than others. For example, many cohos from Group 1 were caught by sportfishermen fishing along the shoreline of the Bay, where their catches were not censused. Group 1 returns therefore are probably underestimated.

Because a minimum mesh size of 22 mm was found to be necessary to assure adequate circulation and prevent the attendant problems of fouling and reduction of dissolved oxygen, many fish escaped soon after delivery and throughout the rearing period. Unfortunately this problem occurred in all the batches of nose-tagged fish that were received. To whatever extent such fish survived after their escape, the return rates are overestimated because the pool of tagged fish from which recoveries were drawn would have been larger than the number used to calculate the percentage or rate of recoveries. The groups most affected were 8 and 9. There also was a mass escape from Group 7, but it is unlikely that many of these pre-smolt fish survived⁴.

As would be expected from the preceding discussion, the tag return rates varied greatly from group to group. Nonetheless, certain trends appear and we believe that despite the various dissimilarities and uncertainties from year to year, certain conclusions become apparent from a subjective analysis of the tag returns.

The best return rate was from Group

4, the first batch of chinooks reared. As stated, this group was healthy throughout the rearing period. Although more than half of the fish escaped, those fish had not been tagged and would not affect the return rate calculation. The mean weight at delivery was the second largest of all the groups, and the size variation was small. Also, these fish were reared in the autumn when the water temperature was cool. As noted, this was one of the groups that grew somewhat more slowly than most others. Whatever the reason, the tag return rate of 23.5 percent (adjusted) was four times as good as from any other of the externally tagged groups.

The worst return rate for external tags was from Group 5, the first group of 1977 cohos. Only two tags were recovered, for an adjusted rate of 0.4 percent. Apparently the extreme size range (10-199 g) and poor health at delivery were contributing factors.

The next lowest return rate for Carlin-tagged fish was from the second batch of 1977 cohos, Group 6. This group suffered a high initial mortality—about one-third—and the fish were much handled, having undergone freeze-branding as well as Carlin-tagging.

The Group 7 experiment, which was fraught with problems from start to finish, produced the lowest return rate of nose-tagged fish. The critical factor in this group probably was the small size of the fish at delivery and release.

Earlier in this section we suggested that nose-tag return rates for Groups 8 and 9 are overestimated. The release of Carlin-tagged fish as well as nose-tagged fish in Group 8 provides an opportunity to gauge the magnitude of the over-

estimate by comparing the return rates for the two types of tags. The 13.3 percent return rate estimate for the nose tags is about 2.25 times as high as the 5.9 percent return estimate for the Carlin tags. This "overestimate factor" is subject to some degree of uncertainty because the Carlin-tagged and nose-tagged fish had slightly different histories. Nonetheless, it is probably realistic to assume that at least as many nose-tagged fish escaped and survived as were released and counted at the end of the rearing period.

The Group 9 experiment compared the return rate from pen-reared fish with those from a control group released at the pen site at the beginning of the rearing period. Table 3 summarizes the tag recovery data from Group 9. The return rate for the control subgroup was 2.6 percent. The return rate for the pen-reared subgroup is given first as a percentage of the fish that were counted out of the pen after the rearing period. The 12.8 percent figure neglects the more than 55,000 fish (adjusted for tag recognition) that were not accounted for in the release, most of which escaped. The second tag recovery rate is given as a percentage of all the fish that were delivered to the pens for rearing. Even though only one-sixth of the fish that were delivered for pen rearing were actually pen-reared, the 2.1 percent return in this comparison suggests that pen rearing was not advantageous.

Cost Effectiveness of Pen Rearing

One problem with the preceding analysis of tag returns from Group 9 deliveries of chinook salmon is that the

Table 3.—Nose-tag returns from Group 9.

Years recovered	Subgroup				
	Control		Pen-reared		
	Number recovered	Percent of release (21,730)	Number recovered	Percent of release (11,223)	Percent of delivery (67,900)
1980	0	0	14	0.1	0.0
1981	503	2.3	1,243	11.1	1.8
1982	69	0.3	178	1.6	0.3
Total	572	2.6	1,435	12.8	2.1

⁴Fred Meyer, California Department of Fish and Game, Region 2, Rancho Cordova, Calif. Personal communication.

Table 4.—Annual pen-rearing costs for 40,000 fish for 3 months; labor = \$50/worker-day

Item	Cost (dollars)	
	Materials	Labor
Nets and pens		
Amortized at 12% over 10 years	\$2,650	
Maintenance and repair	400	\$1,800
Medications	800	300
Feed	3,000	4,500
Miscellaneous supplies	1,700	
Subtotal	\$8,550	\$6,600
Grand total, materials and labor	\$15,150	

experience with Group 9 was not a best-case episode. The fact that a 23.5 percent return of tagged fish was achieved once suggests that under a certain set of circumstances pen rearing might be a cost-effective management technique for augmenting ocean harvest.

Critical to determining the benefits of pen rearing is the cost involved—specifically, the cost in producing the incremental increase in returns that can be attributed to the pen rearing. To deal with this question, it is necessary first to accept a return rate that might be expected from fish released directly into San Francisco Bay, as was the control portion of Group 9. Recent CDFG studies have led to their adopting a policy of releasing chinook smolts (45/pound or 10 g/fish), instead of yearlings, directly into San Francisco Bay. Return rates have been as good or better (up to 4 percent) than for yearlings and cost per fish is lower⁴.

If we assume a cost of \$0.06/fish to rear salmon to 45 fish/pound (an approximation using data from McCormack et al., 1984, which does not include an amortization of capital costs) and a 4 percent return, then each fish caught represents an operational investment of \$1.50.

The annual costs of pen rearing 40,000 fish for 3 months are shown in

Table 4. Capital expenditures are amortized over 10 years at 12 percent interest, and labor costs valued at \$50 per worker-day. If we assume that good pen-rearing techniques will bring about an ocean harvest of 25 percent of those fish released, then the cost of adding 10,000 fish to the catch would be \$15,150, or roughly \$1.50 for each fish. This cost does not include fixed costs, lease fees, management salary, or the cost of hatching and rearing the 40,000 fish to the size at which they would be introduced into the pens.

The objective of establishing a sport fishery for coho inside the Bay was best met by Group 1. Sufficient numbers returned to and remained in the vicinity of the rearing site that a fairly extensive fishing effort developed. The local fishery was less evident in subsequent rearings, possibly because we were no longer able to obtain fish from the Noyo River brood stock. Further testing with Noyo River fish would be required to determine if a sport fishery for coho could be consistently established inside San Francisco Bay.

Summary

Our successful experience with the Group 4 chinooks demonstrated that pen rearing is, indeed, possible in San Francisco Bay, and that chinook salmon have excellent potential for the various forms of net-pen salmon ranching. On the other hand, we know that the hatchery production cost of 40,000 fish that can be either directly released or released after pen rearing is roughly \$2,400. If we assume that the respective return rates for the two procedures would be 4 and 25 percent, then we can choose between getting 1,600 returns at a cost of \$2,400, or an additional 8,400 returns for an additional cost of \$15,050. The additional cost per additional return then, is about \$1.80 for each fish. To the extent that our assumed return rates are valid, this project did not demonstrate

that pen rearing would be a cost-effective management technique for adding to the ocean harvest in California. However, cost efficiency probably would improve if the project were scaled up.

Acknowledgments

Members of the San Francisco Tyee Club participated in pen construction and maintenance, tagging, and feeding. We are especially grateful to Jean Les-tanguet for his efforts on behalf of the Tyee Club. Tag rewards were paid from Tyee's treasury. Seventy different people spent long hours at the tedious task of tagging and we thank them all. We wish also to thank Sus Kato of the Tiburon Laboratory for his guidance and manuscript review and reviewers Earl Prentice of the NMFS and Fred Meyer of the CDFG. Valuable contributions were also made by CDFG hatchery personnel and State Fish Disease Laboratory staff.

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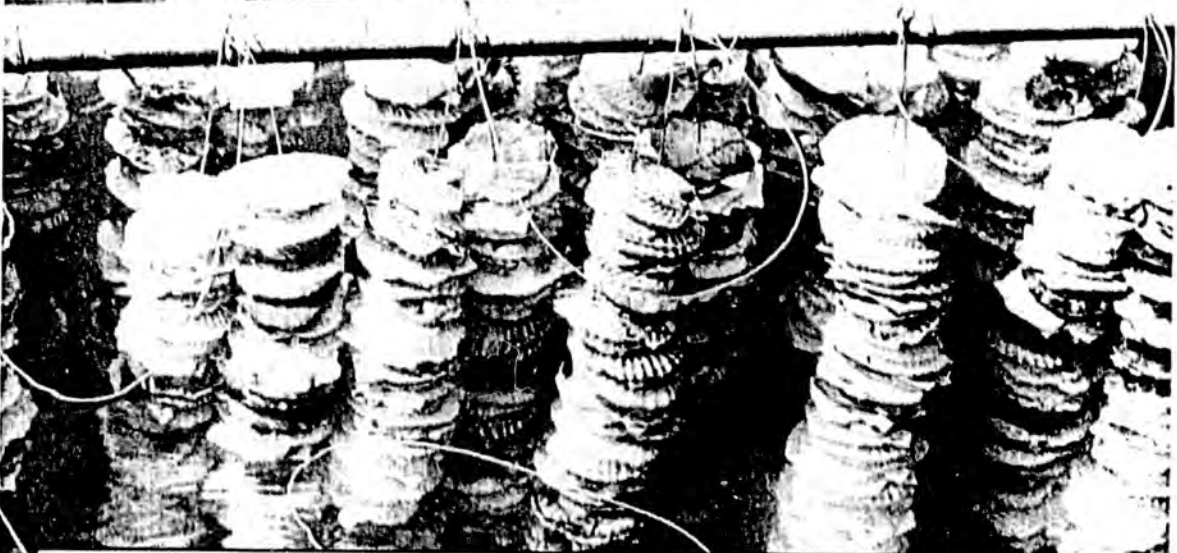
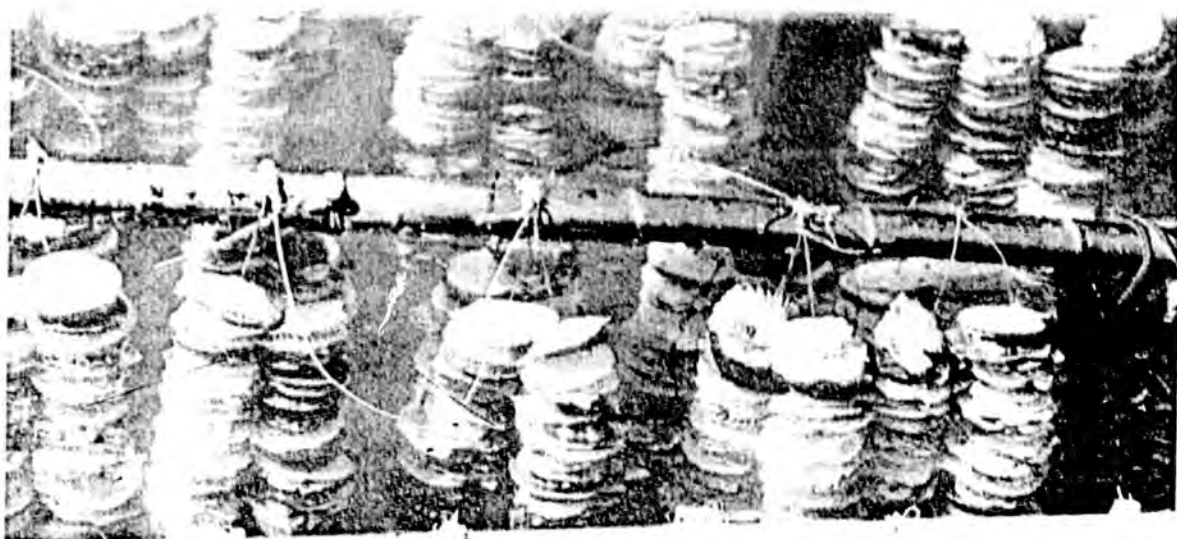
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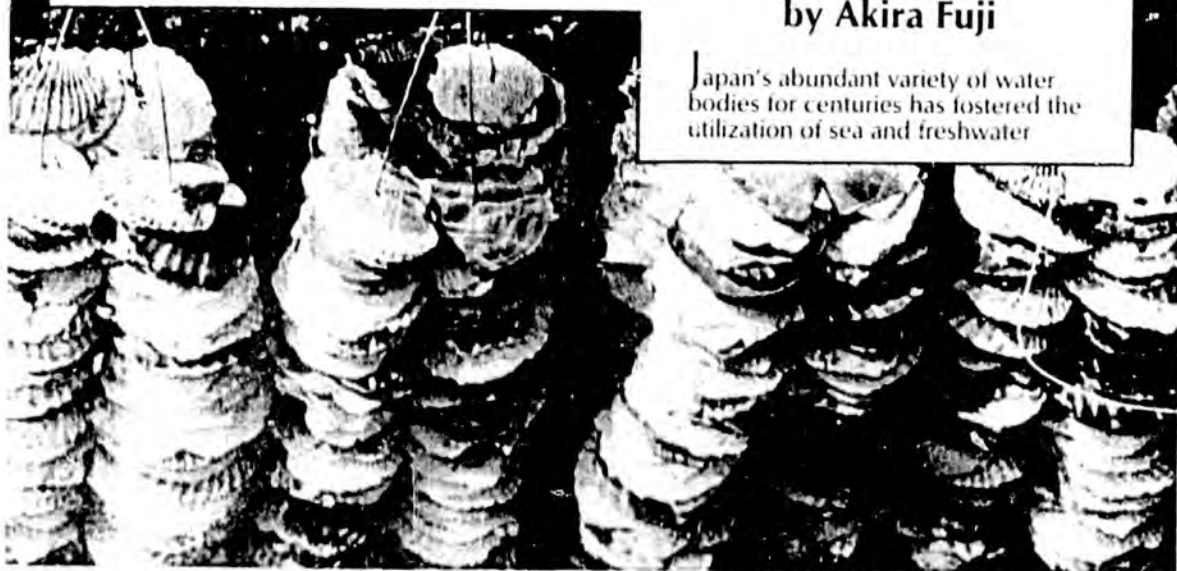
日本と海
の文化



Aquaculture and Mariculture

by Akira Fuji

Japan's abundant variety of water bodies for centuries has fostered the utilization of sea and freshwater



food supplies. Aquaculture, the farming and husbandry of such supplies, has developed over the years from a side activity of farmers into an industry in its own right. In the last 30 years, innovations in techniques and facilities have transformed it into a successful and productive enterprise. It now accounts for 10 percent of the total fisheries yield, and in 1984 it netted an income of 676.6 billion yen (US\$4.2 billion) (Figure 1).

Aquaculture aims to optimize the number of individuals of a given species that can grow to a commercial product within a defined aquatic area. It achieves this by controlling environmental elements and the life history of the organisms. In Japan, three categories of aquaculture—stocking, feeding, and sowing—represent different approaches to this final goal.

Aquaculture without feeding (stocking type), requires the establishment of a settling area for the spores or seeds of the organism to be grown, but demands no food input from the culturist. The organism drifts or is introduced to the settling area, and attaches itself to the supports provided—nets, empty shells, or bamboo stalks, depending on the species. It then feeds on nutrients and plankton in the water flowing through the area, and thus grows to harvestable size. This culture method is used for seaweed as well as scallops and oysters.

Aquaculture with feeding, the second major category, applies to the cultivation of all fresh water and marine bony fish. The organisms are confined in ponds or specifically-designed nets, and fed formulated preparations until they reach commercial size. Aquaculture by this second method requires artificial "seeding": fingerlings or fry collected in the wild are used as the starting stock in the holding areas. Although culturists have been able to rear seeds for certain species, many fish still require field collection of larval stages.

Culture-based fisheries ("sowing type") is a compromise between the first two methods. Natural fishing grounds are artificially seeded with field-collected or hatchery-reared seedlings, but the organisms are not fed by the culturist. Also, no special substrates are provided to promote growth. This method is successfully employed in scallop culture, and is still common for oysters in some areas.

All three techniques have been applied to the culture of both marine and fresh water species in Japan.

Mariculture

Both mariculture, the culture of marine species, and freshwater aquaculture are practiced in Japan, but mariculture is by far the more productive of the two industries. Its yield has increased about seven fold over the last 30 years. In 1984, it accounted for 92 percent of the total aquaculture yield. Mariculture employs all three categories of aquacultural techniques, since it involves shellfish and algae as well as finfish.

A shellfish, the Japanese oyster *Crassostrea gigas*, and a red alga called "Nori" (*Porphyra* species) have been cultivated in Japan since the

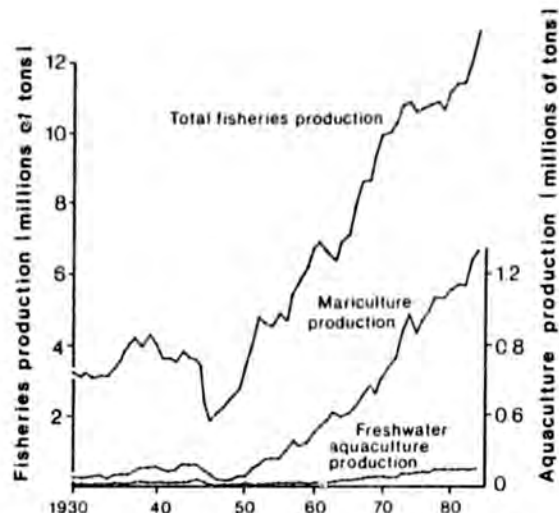


Figure 1. Annual production of total fisheries and aquaculture.

1700s, and have been the major products of mariculture up to the present. New species introduced in 1960–70 account for the recent marked increase in maricultural yield. The species include two fish, the yellowtail jack (*Seriola quinqueradiata*) and the red sea bream (*Pagrus major*); two types of brown algae, "Wakame," (*Undaria pinnatifida*), and "Konbu," (*Laminaria* species); and the scallop, (*Patinopecten yessoensis*). Money earned by mariculture of these seven organisms contributed about 77 percent of the entire income from Japanese mariculture production in 1984.

Innovations in all three aquaculture categories for marine species have been key in increasing harvest and income. The establishment of techniques for the production of large amounts of artificial hatchlings in 1975 resulted in a rapid increase in red sea bream yield; similarly, the development of the floating net cage culture method in 1965 markedly incremented the yield of yellowtail; and hanging methods in oyster farming have made it one of the most successful examples of aquaculture.

Aquaculture with feeding is used to grow yellowtail and bream. Fingerlings, hatchery-reared for bream but collected in the wild for yellowtail, are cultured to an initial stage in holding tanks. They are then released into net cages until they reach commercial size. A floating net cage (Figure 2) permits water flow through all of its surfaces. The resulting aeration and oxygen availability allows the stocking of larger numbers of fish per unit area than would be possible in embayments or holding ponds. Higher productivity is thus obtained. The technique is now the primary method of yellowtail cultivation, and in 1984 yielded a catch 3.7 times that of the wild fish.

Scallop culture can involve stocking or sowing aquaculture. Either category requires three basic operations: collection of larvae (spat) in the wild; intermediate culture of spat; and finally,

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Figure 2. and oxy stocking

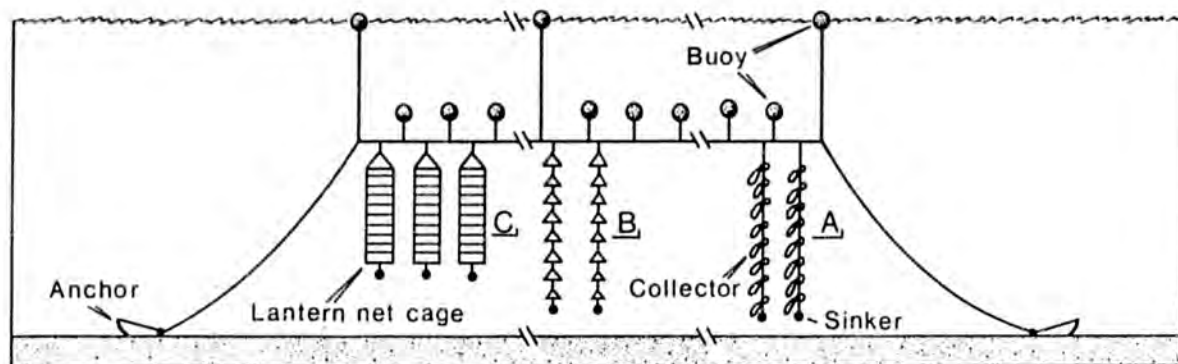


Figure 3. The three stages of scallop culture: A) spat are gathered in seed collectors—net bags filled with cedar twigs, B) collected spat grow to intermediate size inside pearl nets, and C) scallops are hung in lantern net cages where they grow to market size.

the scallop to the commercial product by growing. Figure 3 shows how the three stages are operated simultaneously in a culture system. The seed collectors, intermediate scallop growing cultures, and lantern net cages are placed in special "lantern nets," which are suspended from a long-line set in the water. In the growing culture method, the spat are literally sown on selected harvesting bottoms, from which they are collected 2 to 4 years later. Annual yield from both types of cultivation has been 200,000 tons in recent years.

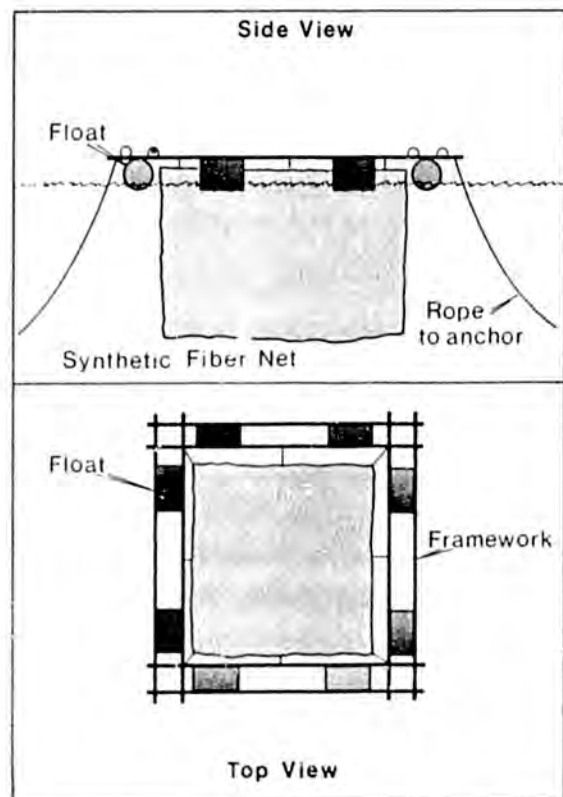


Figure 2. A floating net cage for yellowtail culture. Aeration and oxygen flow through all sides of the cage permit stocking of large numbers of fish in a limited area.

Oyster cultivation follows a pattern similar to that of the scallop. Seeds are obtained from the wild through the use of collectors. These consist of oyster or scallop shells ("culches") strung on a metal wire and hung vertically in the water. Seeds attach to these, and are grown to market size by further hanging of the strings of culches off racks, rafts, or long-lines (see Figure 4). The three-dimensional nature of the hanging method has permitted a remarkable increase in oyster productivity per unit area. The present industry has become stable at a yield of 250,000 tons per year in live weight.

Nori, which provides the most abundant seaweed harvest, is cultured through the use of several recently-developed techniques. Nets laid horizontally in the sea are sown with artificially-grown spores. These attach to the twine, develop into germlings, and eventually grow into fronds. The harvested fronds are dried and processed mechanically for market. Artificial spore cultivation and mechanization of the processing operation have permitted a rapid increase in nori production. Annual yield in 1984 reached as high as 400,000 tons in wet weight.

Freshwater Culture

The development of freshwater aquaculture has been quite slow compared to that of mariculture, due perhaps to the Japanese preference for marine fish over freshwater fish. Nonetheless, freshwater culture yields have similarly benefited from culturing improvements and introduction of new species, and income from the industry was 123.3 billion yen in 1984 (US\$780 million). Four types of fish—rainbow trout, (*Salmo gairdneri*); a salmonoid fish called ayu, (*Plecoglossus altivelis*); common carp, (*Cyprinus carpio*); and eel, (*Anguilla* species)—accounted for 91 percent of the entire earnings from freshwater culture in 1984. All are grown by variations on feeding aquaculture.

Eel, the most commonly eaten freshwater fish, is the species yielding the largest income. Its traditional consumption on special Japanese holidays accounts for its popularity and its extraordinarily high market price. The high value of

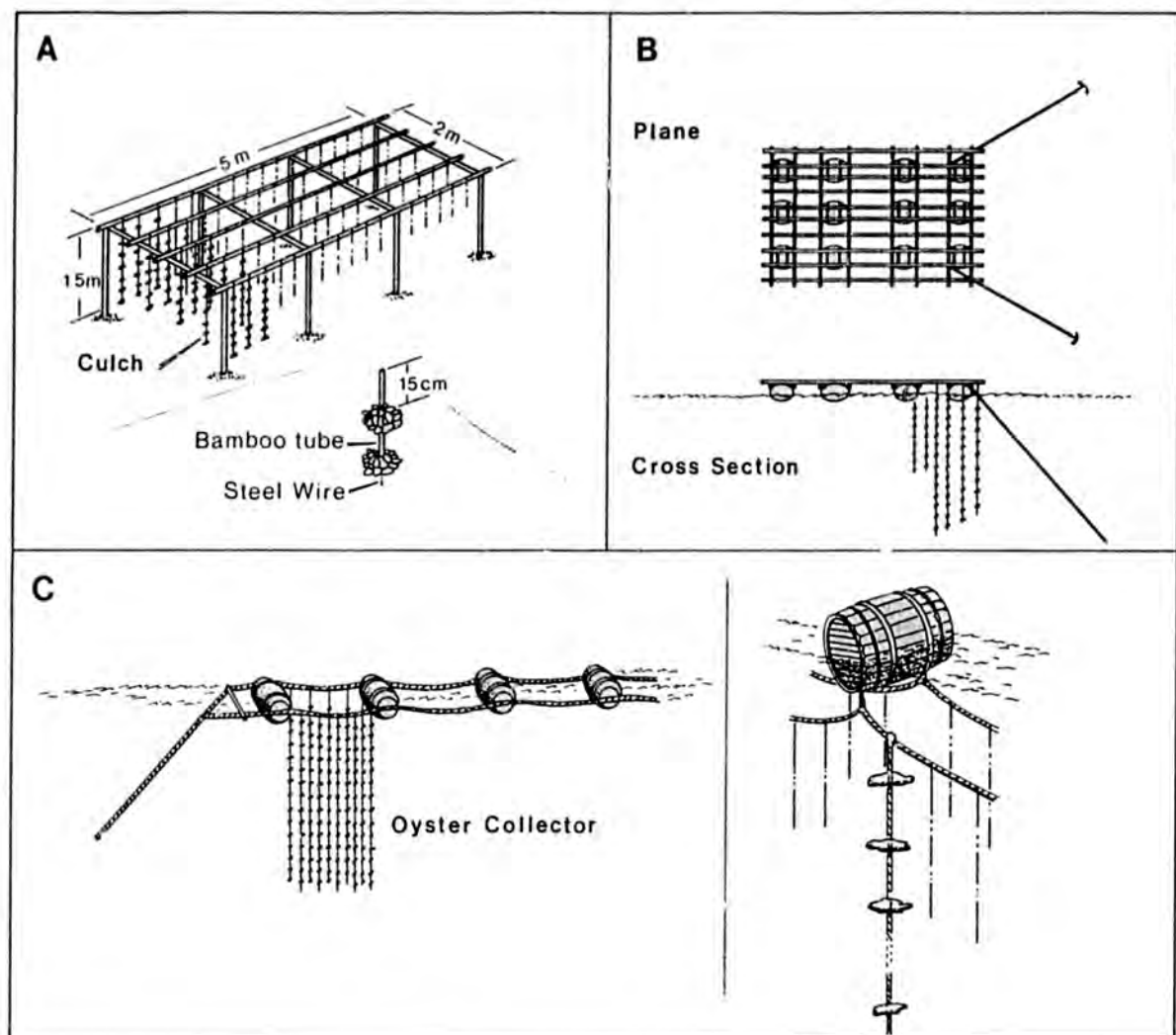


Figure 4. Different hanging methods for oyster culture: A) rack method—culches with attached oyster seeds are hung on a rack fixed to the seabed, B) raft method (the most employed)—strings of culches are hung on a cedar or bamboo raft, C) long-line method (can be used in open and deep waters)—the culches are hung on long lines kept afloat by buoys.

the fish has encouraged improvements in rearing facilities. In recent years, the outdoor still-water ponds that were used for eel culture have been replaced by indoor tanks supplied with heating and water circulating systems. Elvers for seeding the tanks, however, must still be collected in the wild.

Several other fish species are commonly grown. Like the eel culture, carp culture has progressed from the use of ordinary ponds or rice paddies as holding tanks to the employment of more sophisticated running-water ponds. In 1984, 21,071 tons were produced by culture. Rainbow trout culture began in 1877, when 10 000 eggs were imported from California. After the war, culture was sustained by a U.S. market that encouraged export, and which has permitted its steady increase to the present. The most recent addition to freshwater aquaculture is ayu. Commercial culture of this fish began after the war, and recent catches have yielded some 15,000 tons

per year. It is now distributed from central to southern Japan.

Future Research

Many problems hinder further expansion of the aquaculture industry in Japan. First, culture of major species, with the exception of seaweeds, still depends on natural seeds collected from the wild. A stable, reliable supply of larvae and fries is the basis for stabilizing culture. Preparation of suitable feed for rearing fish fry is therefore important. In Japan, successful techniques now exist for mass production of the rotifer *Brachionus plicatilis*, the most efficient and essential food for the early larval stage of marine fish. Next, it is necessary to grow natural food and to formulate artificial preparations for post-larval stages of fish.

Diseases and epidemics are another concern of aquaculturists. Fungal, viral, and bacterial diseases have been diagnosed in several cultured

An aerial view of cages used for oyster culture.

organisms, a mortality even prevention and identification of therapeutic

Environ use of aquaculture the product necessary to carrying cap organisms.

Finally cultivating n seafood and rapid establish of successful gynogenesis maternal ch and cold-sh chromosom the develop and desirab improveme methods wi developme

Akira Fuji is a Aquaculture, Hakodate, H



An aerial view of Suzakinomi Bay in the Kochi Prefecture. The rows of square rafts in the center of the bay support the net cages used for yellowtail culture. (Photo courtesy of Japan Information Center)

organisms, and have repeatedly resulted in mass mortality events. High priority must go to the prevention and control of diseases, and to the identification of causes of epidemics. Establishment of therapeutics on each disease is essential.

Environmental hazards caused by intensive use of aquatic areas also can result in declines in the productivity of culturing grounds. It is necessary to establish, for each culture area, the carrying capacity that will permit the normal life of organisms.

Finally, efforts must concentrate on cultivating new species to meet demands for seafood and fish. Selection and inbreeding promise rapid establishment and subsequent conservation of successful genetic lines. Induction of artificial gynogenesis (resulting embryo contains only maternal chromosomes) by irradiation of sperm and cold-shocking uploid (having the basic chromosome number doubled) eggs may result in the development of induced organisms with new and desirable biological characteristics. Parallel improvements in biological and technological methods will continue fostering aquacultural development.

Akira Fuji is a Professor in the Department of Biology and Aquaculture, Faculty of Fisheries, Hokkaido University, Hakodate, Hokkaido.

Whaling and Research

—Commercial whaling has come to its final season.

by Akito Kawamura

In June 1972, when the United Nations Conference on the Human Environment was held in Stockholm, Sweden, great whales suddenly became important symbols of the conservation movement. As a result, there was a vigorous new campaign to seek an end to whaling. Although the adopted resolution calling for a 10-year moratorium



UNITED FISHERMEN OF ALASKA

907-586-2820
1-800-478-FISH

MORATORIUM POSITION

United Fishermen of Alaska believes a moratorium on permits allowing mariculture operations must be instituted immediately.

This moratorium should be established by the legislature since it created the statutes under which these permits are now being issued. It is seriously questionable whether the governor has the legal authority to suspend this program.

This moratorium should be in effect until statutes and regulations are adopted that explain how the State wants these operations to be conducted.

This moratorium should include permit applications for both shellfish and finfish mariculture. We are also concerned about applications that ostensibly are for siting of docks, float homes and similar projects on state tidelands but in reality are attempts to establish space for mariculture operations. We want to address these without bringing a halt to legitimate projects. The Department of Natural Resources should be consulted for a list of activities that may fall into this category.

This moratorium should include a provision for grandfather rights for activities legally operating before the effective date of the moratorium. Those who began their operations in good faith should not be penalized while the legislature deliberates on the policy it wishes to establish.

UFA believes the need for this moratorium is clearly indicated by the record built in testimony before House and Senate Resources and Labor & Commerce committees. The many unanswered questions presented to legislators indicate concerns that need to be researched and resolved before lawmakers can determine whether mariculture operations will benefit the state. In the meantime it is urgent that a de facto policy not be established by allowing the State to continue issuing permits while the legislature considers the question.

STATE OF ALASKA THE LEGISLATURE

LEGISLATIVE AFFAIRS AGENCY

POUCH Y. STATE CAPITOL
JUNEAU, ALASKA 99811
907 465 3800

MEMORANDUM

April 30, 1987

SUBJECT: Fish farming moratorium
TO: Senator Dick Eliason
FROM: Edward H. Hein *EHA*
Legislative Counsel

The following licenses, permits, and authorizations are, or may be, required to operate a fish farm:

1. authorization for use of an interim-use permit for the experimental commercial taking of a fishery resource (AS 16.05.050(10)); granting is discretionary by commissioner of fish and game;
2. fish farming license (AS 16.05.340(a)(14); 16.05.330(a)); issuance by Department of Revenue is mandatory if applicant pays \$200 biennial fee;
3. collection permit (AS 16.05.340(b)); issuance is discretionary by commissioner of fish and game;
4. land use or tidelands permit (AS 38.05.035); issuance discretionary by commissioner of natural resources;
5. land lease (AS 38.05.070); discretionary by commissioner of natural resources;
6. fish transport permit (5 AAC 41.005); issuance mandatory if commissioner of fish and game makes determinations specified under 5 AAC 41.030;
7. permit to appropriate water (11 AAC 93.120); issuance mandatory if commissioner of natural resources finds that requirements of AS 46.15.080 have been met;

Senator Ellason
April 30, 1987
Page 2

8. temporary water use permit (11 AAC 93.210 - 11 AAC 93.220); issuance discretionary by commissioner of natural resources;

9. certification under Sec. 401 of the Federal Water Pollution Control Act (18 AAC 15.180); certification by commissioner of environmental conservation according to federal requirements.

EHH:csh
c8/018

PRIVATE NONPROFIT HATCHERY PROGRAM

STATUS SHEET

Attached is a listing of Private Nonprofit (PNP) Salmon Hatchery Permits issued and applications that are currently in process. Also included are the Scientific/Educational Permits for PNP research projects and school district aquaculture programs that have been issued in 1986. This list is organized according to region and contains information regarding location, production status, and number of eggs or fish permitted.

To date, 24 PNP Salmon Hatchery Permits have been issued and one permit was given up. Sixteen of the permitted hatcheries are currently in operation. Thirteen of the permitted hatcheries had adult returns in 1985. Currently, there is one application for a permit under active consideration.

Regional comprehensive salmon plans have been approved by the Commissioner of Fish and Game for the Northern and Southern Southeast, Cook Inlet, Prince William Sound, Kodiak, and Yakutat Regions.

This status sheet will be updated quarterly.

DECEMBER 1986

PRIVATE NONPROFIT HATCHERY PROGRAM
ORGANIZED BY REGION

REGION

Southern Southeast

	<u>STATUS</u>	<u>LOCATION</u>	<u># OF EGGS OR FISH PERMITTED</u>
1. Southern Southeast Regional Aquaculture Association 1649 Tongass Ave. Ketchikan, Alaska 99901 Office - 225-9605 Whitman Lake Hatchery - 225-2635 Neets Bay Hatchery - 247-8790 Attn: Don Amend, General Manager Keith Johnson, Operations Manager Mike Blanchard, Special Proj. Mgr. Bill Halloran, Whitman Lake Hatchery Manager George Carnes, Neets Bay Hatchery Manager	Regional Association PNP Permit #8, Operational Issued 3/9/78 PNP Preliminary Application Submitted 1/27/82 Accepted 5/10/82 Inactive PNP Permit #19, Operational Issued 6/17/83 PNP Preliminary Application Submitted 2/18/83 Review Suspended PNP Permit #24, Operational Issued 7/1/86 Sci/Ed Permit #86-114 Sci/Ed Permit #86-115	Ketchikan Whitman Lake, Ketchikan Tyee Lake, Wrangell Neets Bay, Revillagigedo Island Virginia Lake, Wrangell Beaver Falls, Ketchikan Orchard Lake, off Shrimp Bay Virginia Lake	31.8 million chum 3.4 million coho 1.5 million chinook 2.5 million sockeye Requested at capacity: 40 million pink & chum 4 million coho 2 million chinook 60 million chum 5 million coho 4 million chinook Requested at capacity: 40 million chum 4 million coho 2 million chinook 4 million sockeye .3 million sockeye Take tissue and ovarian fluid samples from 60 kokanee and 60 cutthroat in spawning condition in order to determine the pathological status of the salmonid populations. 60 cutthroat juveniles/adults and 60 sockeye fry/smolt/adults for pathological examination to determine presence of disease in the water source.
2. Alaska Aquaculture, Inc. P.O. Box 1288 Wrangell, Alaska 99929 Office - 874-2250 Hatchery - 874-2441 Attn: Tod A. Jones - 874-2013 Jim Pace - 874-3521	PNP Permit #5, Operational Issued 4/28/76	Burnett Inlet, Etolin Island, Wrangell	10 million pink 20 million chum .25 million coho .75 million chinook

Northern Southeast1. Northern Southeast Regional
Aquaculture Association

103 McNastery

Sitka, Alaska 99835

Office - 747-6850

Medvejie Creek Hatchery - 747-5863

Attn: Peter Esquiro, General Manager

Bruce Bachen, Operations Manager

Dail Hurdlow, Mgr., Medvejie Ck.

STATUS

Regional Association

PNP Permit #14, Not Operational
Issued 4/17/81PNP Permit #16, Operational
Issued 8/17/81PNP Permit #23, Operational
Issued 12/19/85

Sci/Ed Permit #86-103

Sci/Ed Permit #86-116

Sci/Ed Permit #86-118

LOCATION

Sitka

Salmon Creek, Juneau

Medvejie Creek, Sitka

Port Camden, Kuiu Island

Baranof Island, Chichagof
Island, Kruzof Island, and
Kuiu Island, to include:

Virginia Lake

Chilkat River, NSRAA
spawning channel,
26-mile Haines Highway# OF EGGS OR
FISH PERMITTED30 million pink & chum
.8 million coho28 million chum
3.3 million coho
.3 million chinook
.1 million pink

10 million chum

Preliminary Lake Surveys-
To assess the potential of
previously unstudied lakes for
the rearing of coho salmon
fry to smolts;
Detailed Lake Surveys-
Study of selected barrier lakes
which have been chosen for
stocking with coho salmon fry to
determine the proper number of
coho to plant; and
Adult Return-Enumeration of
coho returns to determine and
assess the success or failure
of lake stocking as an enhancement
technique.

Capture, measure, weigh, and
release up to 500 kokanee
juveniles/adults, up to 500 Dolly
Varden juveniles/adults, and up
to 100 samples of other species
to determine what species reside
in the lake and inlet/outlet
streams.

125 adult female chum salmon
and 125 adult male chum salmon
(250,000 eggs) will be taken
for 2 incubation boxes in an
attempt to increase fry
production and to test the
effectiveness of this
incubation box design.

CORRECTION

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

PRIVATE NONPROFIT HATCHERY PROGRAM
ORGANIZED BY REGION

REGION

Southern Southeast

1. Southern Southeast Regional
Aquaculture Association

1649 Tongass Ave.

Ketchikan, Alaska 99901

Office - 225-9605

Whitman Lake Hatchery - 225-2635

Neets Bay Hatchery - 247-8790

Attn: Don Amend, General Manager

Keith Johnson, Operations Manager

Mike Blanchard, Special Proj. Mgr.

Bill Halloran, Whitman Lake

Hatchery Manager

George Carnes, Neets Bay

Hatchery Manager

STATUS

Regional Association

PNP Permit #8, Operational

Issued 3/9/78

PNP Preliminary Application

Submitted 1/27/82

Accepted 5/10/82

Inactive

PNP Permit #19, Operational

Issued 6/17/83

PNP Preliminary Application

Submitted 2/18/83

Review Suspended

PNP Permit #24, Operational

Issued 7/1/86

Sci/Ed Permit #86-114

Sci/Ed Permit #86-115

PNP Permit #5, Operational

Issued 4/28/76

LOCATION

Ketchikan

Whitman Lake, Ketchikan

Tyee Lake, Wrangell

Neets Bay, Revillagigedo
Island

Virginia Lake, Wrangell

Beaver Falls, Ketchikan

Orchard Lake, off Shrimp Bay

Virginia Lake

Burnett Inlet, Etolin
Island, Wrangell

OF EGGS OR
FISH PERMITTED

31.8 million chum
3.4 million coho
1.5 million chinook
2.5 million sockeye

Requested at capacity:
40 million pink & chum
4 million coho
2 million chinook

60 million chum
5 million coho
4 million chinook

Requested at capacity:
40 million chum
4 million coho
2 million chinook
4 million sockeye

.3 million sockeye

Take tissue and ovarian fluid
samples from 60 kokanee and 60
cutthroat in spawning condition
in order to determine the
pathological status of the
salmonid populations.

60 cutthroat juveniles/adults and
60 sockeye fry/smolt/adults for
pathological examination to
determine presence of disease
in the water source.

10 million pink
20 million chum
.25 million coho
.75 million chinook

2. Alaska Aquaculture, Inc.

P.O. Box 1288

Wrangell, Alaska 99929

Office - 874-2250

Hatchery - 874-2441

Attn: Tod A. Jones - 874-2013

Jim Pace - 874-3521

<u>Southern Southeast (continued)</u>	<u>STATUS</u>	<u>LOCATION</u>	<u># OF EGGS OR FISH PERMITTED</u>
3. Meyers Chuck Aquaculture Association 5001 Nottingham Way Anchorage, Alaska 99501 Attn: Robert M. Meyer - 261-4625	PNP Permit #10, Operational Issued 7/22/79	Meyers Creek, Meyers Chuck	5 million pink 1 million coho 5 million chum
	Sci/Ed Permit #86-133	Lake Helen Creek, Black Bear Creek, Karta River, and Meyers Stream	35 adult pink salmon, 35 adult coho salmon, 60 adult chum salmon, and 30 spawned-out adult coho salmon will be taken for disease-testing purposes.
4. Aquaculture, Inc. P.O. Box 1499 Wrangell, Alaska 99929 Attn: Robin Larsson - 874-3458	PNP Permit #22, Not Operational Issued 4/17/83	Crittenden Creek, Wrangell	12 million chum 3 million pink
5. Gro-Fish, Inc. P.O. Box 8 Juneau, Alaska 99802 Attn: Robert M. Meyer - 261-4625 Jodi Hilton - 586-7441 Steve Johnson - 789-3171	PNP Permit #21, Not Operational Issued 2/2/84	Santa Anna Creek, Ernest Sound	3 million pink 10 million chum
6. Twin Creek Salmon Ranch, Inc. P.O. Box 90 Petersburg, Alaska 99833 Attn: Darline M. Clausen - 772-3282	PNP Preliminary Application Submitted 11/1/78 Accepted 12/14/81 Inactive	Twin Creek, Wrangell Narrows, Petersburg	Requested at start-up: .5 million pink
7. Petersburg High School P.O. Box 289 Petersburg, Alaska 99833	Sci/Ed Permit #86-124	Five-Mile Creek, Petersburg	50 adult pink salmon for use in the high school aquaculture program.
8. Hollis Junior/Senior High School P.O. Box 101 Klawock, Alaska 99925 Attn: Jim Daly	Sci/Ed Permit #86-131	Harris River, east coast of Prince of Wales Island, near Hollis	20 adult pink salmon for initiation of an in-stream incubation project and school aquaculture program.
9. Houghtaling Elementary School 2940 Baranof Street Ketchikan, Alaska 99901 Attn: Anne Germain	Sci/Ed Permit #86-140	Houghtaling Elementary School	Up to 2,000 chum eggs from Beaver Falls Hatchery for school salmon-rearing project.
10. Bob Campbell Rediscovery Lodge Bell Island, Alaska 99950	Sci/Ed Permit #86-145	Bell Island Lakes, Behm Canal Narrows	60 adult kokanee, 60 adult Dolly Varden char, and 60 adult cutthroat trout for disease-testing purposes.
11. University of Alaska - AEIDC 707 A Street Anchorage, Alaska 99501 Attn: Michael D. Kelly	Sci/Ed Permit #86-138	Tyee Creek, near Wrangell	2 adult pink salmon and 2 adult chum salmon for study of incubation in tailrace of Tyee hydroelectric powerhouse.

Northern Southeast1. Northern Southeast Regional
Aquaculture Association103 Monastery
Sitka, Alaska 99835
Office - 747-6850

Medvejie Creek Hatchery - 747-5863

Attn: Peter Esquiro, General Manager
Bruce Bachen, Operations Manager
Dail Hurdlow, Mgr., Medvejie Ck.STATUS

Regional Association

PNP Permit #14, Not Operational
Issued 4/17/81PNP Permit #16, Operational
Issued 8/17/81PNP Permit #23, Operational
Issued 12/19/85

Sci/Ed Permit #86-103

Sci/Ed Permit #86-116

Sci/Ed Permit #86-118

LOCATION

Sitka

Salmon Creek, Juneau

Medvejie Creek, Sitka

Port Camden, Kuiu Island

Baranof Island, Chichagof
Island, Kruzof Island, and
Kuiu Island, to include:

Virginia Lake

Chilkat River, NSRAA
spawning channel,
26-mile Haines Highway# OF EGGS OR
FISH PERMITTED30 million pink & chum
.8 million coho28 million chum
3.3 million coho
.3 million chinook
.1 million pink

10 million chum

Preliminary Lake Surveys-
To assess the potential of
previously unstudied lakes for
the rearing of coho salmon
fry to smolts;
Detailed Lake Surveys-
Study of selected barrier lakes
which have been chosen for
stocking with coho salmon fry to
determine the proper number of
coho to plant; and
Adult Return-Enumeration of
coho returns to determine and
assess the success or failure
of lake stocking as an enhancement
technique.Capture, measure, weigh, and
release up to 500 kokanee
juveniles/adults, up to 500 Dolly
Varden juveniles/adults, and up
to 100 samples of other species
to determine what species reside
in the lake and inlet/outlet
streams.125 adult female chum salmon
and 125 adult male chum salmon
(250,000 eggs) will be taken
for 2 incubation boxes in an
attempt to increase fry
production and to test the
effectiveness of this
incubation box design.

Northern Southeast (continued)

	<u>STATUS</u>	<u>LOCATION</u>	<u># OF EGGS OR FISH PERMITTED</u>
	Sci/Ed Permit #86-119	Klehini River, at 31 mile Haines Highway	460 adult female chum salmon and 460 adult male chum salmon (a maximum of 1,000,000 eggs) for testing of an expanded version of the incubator box studies initiated in 1984.
	Sci/Ed Permit #86-121	Turner Lake, off Taku Inlet	3 hydroacoustic and trawl surveys will be conducted during the 1986 field season. Up to 500 Kokanee juveniles/adults, 10 cutthroat trout, 10 Dolly Varden char, and 10 three-spine stickleback will be collected, sampled for age, weight, and length, and released. 100 Kokanee adults will be retained for stomach analysis. The purpose is to quantify the abundance and distribution of kokanee salmon in the lake.
2. Sheldon Jackson College Aquaculture Program P.O. Box 479 Sitka, Alaska 99835 Office - 747-5254, Hatchery - 747-5209 Attn: Mel Seifert Bill Davidson, Manager Message - 747-5231	PNP Permit #3, Operational Issued 4/29/75	Indian River, Sitka	16 million pink & chum .15 million coho .1 million chinook
3. Tlingit & Haida Fisheries Development Corp. 320 W. Willoughby Ave., Suite 300 Juneau, Alaska 99801 Office - 586-1432, ext. 249 Attn: Ed Thomas	PNP Permit #4, Not Operational Issued 12/18/75	Maksoutof River, Sandy Bay, Baranof Island	25 million pink & chum
4. Douglas Island Pink and Chum, Inc. P.O. Box 168 Juneau, Alaska 99802 Attn: Ladd Macaulay Sheep Creek Hatchery - 586-3663 Kowee Creek Hatchery - 586-4041 Net Pen Site - 586-4833	PNP Permit #6, Operational Issued 7/30/76 PNP Permit #11, Operational Issued 9/18/79 PNP Preliminary Application Accepted 8/11/83 Inactive PNP Hatchery Application Submitted 11/25/85	Kowee Creek, Juneau Sheep Creek, Juneau Fish Creek, Juneau Gastineau Channel, Juneau	10 million pink & chum 40 million pink & chum .05 million coho Requested at Capacity: 60 million pink 10 million chum undetermined trout 50 million pink 111 million chum 1 million coho .2 million chinook

<u>Northern Southeast (continued)</u>	<u>STATUS</u>	<u>LOCATION</u>	<u># OF EGGS OR FISH PERMITTED</u>
	Sci/Ed Permit #86-134	King Salmon River, Limestone Creek	Collection of age, weight, and length data for identification of potential chum, pink, and coho broodstocks. Efforts will will be coordinated with ADF&G efforts at these locations.
5. Kake Nonprofit Fisheries Corporation c/o City of Kake P.O. Box 500 Kake, Alaska 99830 Gunnuk Creek Hatchery - 785-6460 Attn: Steve Andison	PNP Permit #7, Operational Issued 4/1/77	Gunnuk Creek, Kake	18 million pink and chum
6. Burro Creek Farms P.O. Box 455 Skagway, Alaska 99840 Hatchery - 983-2355 Attn: Eugene W. Richards	PNP Permit #12, Operational Issued 5/23/80	Burro Creek, Skagway	10 million pink & chum 15,000 coho
7. Armstrong-Keta, Inc. P.O. Box 39 Juneau, Alaska 99802 Office - 586-3443 Attn: Joe Smatlan - 789-9363 Bob Lium - 586-1164 Wm. Ritchie Phillips, Hatchery Manager	PNP Permit #13, Operational Issued 2/23/81 Sci/Ed Permit #86-142	Port Armstrong, Baranof Island Port Armstrong, Baranof Island	16 million pink 4 million chum .08 million chinook 18 adult female coho salmon and 18 adult male coho salmon (50,000 eggs) to determine feasibility of rearing coho salmon at Port Armstrong.
8. Angoon Aquaculture Association, Inc. P.O. Box 138 Angoon, Alaska 99820 Office - 788-3411 Attn: Martha Jack	PNP Permit #18, Not Operational Issued 8/5/82	Favorite Bay, Angoon	7.5 million pink 20 million chum 1.5 million coho
9. Pelican Cold Storage P.O. Box 5538 653 NE Northlake Way Seattle, Washington 98105 Office - (206) 632-9000 Attn: Cavin Philbin	Preliminary Application Accepted 11/25/81 Public Hearing scheduled 10/10/82 Postponed indefinitely	Pelican Creek, Pelican	Requested at capacity: 2.2 million chum
10. Skagway High School Skagway, Alaska 99840 Attn: Jerry Meyers 983-2960	Sci/Ed Permit #86-110	Pullen Creek, Skagway	70 adult pink salmon, 12 adult coho salmon, and 2 adult king salmon for use in the high school aquaculture program.

Northern Southeast (continued)

11. Angoon Schools
P.O. Box 209
Angoon, Alaska 99820
Attn: John Anderson

STATUS

Sci/Ed Permit #86-139

LOCATION

Kanalku Creek, Thayer
Creek, or Favorite Creek

OF EGGS OR
FISH PERMITTED

120 adult pink salmon for disease-
testing purposes.

12. Kake City Schools
P.O. Box 450
Kake, Alaska 99830
Attn: Charles Larson

Sci/Ed Permit #86-141

Gunnuk Creek

10 adult pink salmon and 10 adult
chum salmon for high school fish
husbandry class.

Prince William Sound

1. Prince William Sound
Aquaculture Corporation
P.O. Box 1110
Cordova, Alaska 99574
Office - 424-7511 or 424-7512
Attn: Brian Allee, President
Bruce Suzumoto, Vice President

Regional Association

PNP Permit #2, Operational
Issued 7/1/76

PNP Permit #20, Operational
Issued 6/17/83

Cordova

Port San Juan, Evans Island

Esther Lake

150 million pink
13 million chum

211 million pink
111 million chum
1 million chinook
1 million coho
31 million sockeye

Sci/Ed #86-117

Eyak River, Aleganik River,
Mile 18 Creek, Mile 25
Creek, and Salmon Creek, all
in the Copper River Delta

Conduct qualitative evaluations
of the coho and sockeye salmon
smolts being produced in these
Copper River Delta systems.

Sci/Ed #86-120

Esther Lake, Lake #344 in
Shoestring Bay, Prince
William Sound

Dolly Varden char, three-spine
stickleback, and sockeye salmon
will be captured to determine the
size, age structure, and dynamics
of the Sound resident Dolly
Varden char population and to
examine the resident fish for
disease, parasites, and heavy
metal accumulation.

Sci/Ed Permit #86-130

Eyak Lake at the north end
of Power Creek Arm, Cordova

60 adult sockeye salmon
(approximately 100,000 eggs) will
be used for initiation of a
streamside incubation project.

Sci/Ed Permit #86-144

Eyak Lake

1.2 million coho salmon eggs to allow
on-site incubation until eye-up.

<u>Prince William Sound (continued)</u>	<u>STATUS</u>	<u>LOCATION</u>	<u># OF EGGS AND FISH PERMITTED</u>
2. NERKA, Inc. P.O. Box 80165 Fairbanks, Alaska 99708 Attn: Dr. Jack M. Van Hyning - 479-2476	PNP Permit #1, Not Operational Issued 9/19/75	Perry Island	10 million pink 10 million chum
3. Valdez Fisheries Development Assoc. P.O. Box 125 Valdez, Alaska 99686 Office - 835-4874 Attn: Jason Wells, Project Director Paul McCollum, Manager	PNP Permit #15, Operational Issued 6/26/81	Solomon Gulch, Valdez	136 million pink 18 million chum 1 million coho .05 million chinook
	Sci/Ed Permit #86-104	Hell's Hole Creek	60 adult coho salmon will be taken for pathological examination.
	Sci/Ed Permit #86-159	Hatchery Special Harvest Area	Tag/recovery program with 5,000 pink, 1,000 chum, and 100 coho salmon.
4. McClure Bay Hatchery, Inc. 121 West 11th Anchorage, Alaska 99501 Office - 272-2679 Attn: Jerry McCutcheon	PNP Preliminary Application Accepted 12/23/83 Inactive	Port Nellie Juan, McClure Bay	30 million pink undetermined chum
5. Prince William Sound Community College P.O. Box 97 Valdez, Alaska 99686 Attn: Robert S. Benda 835-2681 (Ext. 131)	Sci/Ed Permit #86-132	Crooked Creek, Corbin Creek	70 adult pink salmon, 50 adult chum salmon, and 20 adult coho salmon for use in the school aquaculture program.
<u>Cook Inlet</u>			
1. Cook Inlet Aquaculture Association Route 2, Box 849 Soldotna, Alaska 99669 Office - 283-5761 Hatchery - 745-5692 Attn: Tom Mears, Exec. Director Loran Waldron, Hatchery Manager	Regional Association	Soldotna	
	PNP Permit #17, Operational Issued 2/8/82	Eklutna Hydroelectric project, Matanuska Valley	20 million pink & chum 1.1 million coho .1 million chinook
	Sci/Ed Permit #86-105	Fisher Lake, west side Cook Inlet	In-lake egg incubation experiment with sockeye salmon (50 adult females) to determine the capability of rearing juvenile sockeye salmon.
	Sci/Ed Permit #86-106	Grant Creek, near Moose Pass	To take, count, mark, and release 4,000 coho salmon adults to evaluate coho salmon stocking by ADF&G. Cooperators include CIAA, ADF&G, and U.S. Forest Service.

Cook Inlet (continued)

STATUS

LOCATION

OF EGGS AND
FISH PERMITTED

Sci/Ed Permit #86-107

Larson Lake, Chelatna
Lake, Shell Lake,
Stephan Lake

To assess densities of juvenile
salmon in four lakes as part of
a feasibility study for lake
fertilization.

Sci/Ed Permit #86-108

Larson Lake, near Talkeetna

To hold alive, subsample, and
release 10,000 sockeye salmon
adults, 65,000 sockeye salmon
smolts, and 4,000 coho salmon
smolts and adults as part of a
prefertilization study.

Sci/Ed Permit #86-109

Shell Lake, near Skwentna

To hold alive, subsample, and
release 10,000 sockeye salmon
adults, 100,000 sockeye salmon
smolts, and 4,000 coho salmon
smolts and adults as part of
a prefertilization study.

Sci/Ed Permit #86-111

Chunilna River, Birch
Creek, Talkeetna River,
and Susitna River, near
Talkeetna

Collection of 60 chum salmon
adults at each location for
disease screening of potential
broodstocks for the Eklutna
hatchery.

Sci/Ed Permit #86-112

Packers Lake, Kalgin Island

Enumeration of $\pm$ 20,000 sockeye
salmon adults, $\pm$ unestimated
number of coho salmon adults,
and $\pm$ 500,000 sockeye salmon
smolts as part of a continuing
lake fertilization study in
cooperation with ADF&G.

Sci/Ed Permit #86-113

Polley Creek, Cottonwood
Creek, Ursus Creek, Little
Kamishak River, Kamishak
River, and Iniskin Creek,
on the lower west side of
Cook Inlet

Collection of tissue samples
from 60 female chum salmon in
post-spawn condition at each
location. Purpose is to add
to the fish health history of
Cook Inlet salmon stocks and
to identify stock suitable for
seeding the Paint River.

2. Irreantum, Inc.
P.O. Box 1656
Homer, Alaska 99603
Attn: Lawrence McCubbins - 728-1315
c/o OMS/Tatalina
McGrath, AK 99627
728-1262

Preliminary Application
Submitted 3/22/82
Inactive

Tonsina Bay

Requested at capacity:
2 million pink
9 million chum

Preliminary Application
Accepted 3/9/84
Inactive

Chugach Bay,
Kenai Peninsula

Requested at capacity:
11 million pink & chum
.1 million coho

<u>Cook Inlet (continued)</u>	<u>STATUS</u>	<u>LOCATION</u>	<u># OF EGGS AND FISH PERMITTED</u>
3. Port Graham Elementary/High School General Delivery Port Graham, Alaska 99603 Attn: Ralph A. Hensley	Sci/Ed Permit #86-146	Port Graham River	Take up to 47 spawned-out adult coho salmon (kidney samples) for disease testing.
<u>Bristol Bay</u>			
1. Imapik Regional Aquaculture Association c/o General Delivery Dillingham, Alaska 99576	Inactive Regional Association	Dillingham	No hatcheries
<u>Alaska Peninsula</u>			
1. Sand Point JOM Aquaculture Program Sand Point City Schools P. O. Box 158 Sand Point, Alaska 99661	Sci/Ed Permit 86-143	Humboldt Creek	20 adult male and 15 adult female coho salmon and 20 adult male and 20 adult female coho salmon for school aquaculture program.
<u>Arctic/Yukon/Kuskokwim</u>			
1. Lower Yukon/Kuskokwim Regional Aquaculture Association General Delivery Russian Mission, Alaska 99657 Attn: John Massey	Inactive Regional Association	Bethel	No hatcheries
2. Takotna Community Association Box 86 Takotna, Alaska 99675 Attn: Dick Newton	Sci/Ed Permit 86-#101	Takotna	60 adult chum salmon will be taken for pathological examination.
	Sci/Ed Permit #86-102	Mouth of Takotna River to 5 miles above Waldron's Rock	Collect, measure, weigh, and release unharmed resident species in an attempt to determine which species are present in the Takotna River.
<u>Kodiak</u>			
1. Kodiak Regional Aquaculture Association P.O. Box 3407 Kodiak, Alaska 99615 Office - 486-3453 Attn: Nick Troxell, President	Regional Association	Kodiak	No hatcheries
2. Kodiak Borough Schools 722 Mill Bay Road Kodiak, Alaska 99615 Attn: Jack Witteveen	Sci/Ed Permit #86-137	Katmai Creek or Little Kitoi	10 adult male and 20 adult female coho salmon for initiation of a scientific-education facility at Ouzinkie School.

<u>Kodiak (continued)</u>	<u>STATUS</u>	<u>LOCATION</u>	<u># OF EGGS OR FISH PERMITTED</u>
Mariculture Pilot Projects (under auspices of ADF&G FRED Division, Kodiak)			
3. Jeffrey P. Barnhart P.O. Box 3170 Kodiak, Alaska 99615	Sci/Ed Permit #86-122	Anton Larsen Bay	Collection and possession of blue mussel seed.
4. Timothy Coffin Ward c/o City of Port Lions P.O. Box 278 Port Lions, Alaska 99550	Sci/Ed Permit #86-123	Raspberry Strait, Port Bailey, Whale Pass, and Port Lions boat harbor	Collection and possession of weathervane scallop.
5. Ann Barker 3880 Woodland Drive Kodiak, Alaska 99615	Sci/Ed Permit #86-125	Olga Bay, south end of Kodiak Island	Collection and possession of blue mussel seed.
6. Don Dumm Box 1723 Kodiak, Alaska 99615	Sci/Ed Permit #86-126	Anton Larsen Bay	Collection and possession of blue mussel seed.
7. William Osborne c/o Kodiak Area Native Association 402 Center Avenue Kodiak, Alaska 99615	Sci/Ed Permit #86-127	Kemoff Bay and southeast of Akhiok Island	Collection and possession of scallop spat.
8. Jerry Johnson Box 85 Larsen Bay, Alaska 99624	Sci/Ed Permit #86-128	Amook Bay near Amook Island, Uyak Bay	Collection and possession of weathervane scallop.
9. Peter Danelski Box 2333 Kodiak, Alaska 99615	Sci/Ed Permit #86-129	North end of Amook Island in Uyak Bay, and in Zachar Bay	Collection and possession of weathervane scallop.
10. Robin Barefield-Munsey c/o Munsey's Bear Camp Amook Pass Kodiak, Alaska 99615	Sci-Ed Permit #86-135	Amook Bay and Uyak Bay	Collection and possession of weathervane scallop spat and blue mussel seed.
11. Jack Alexander 2730 West 80th Anchorage, Alaska 99502	Sci/Ed Permit #86-136	Vikoda Bay, West Point, and Village Islands	Collection and possession of weathervane scallop spat.
12. Dan Ogg Box 2754 Kodiak, Alaska 99615	Sci/Ed Permit #86-147	Uganik Bay	Collection and possession of weathervane scallop spat, blue mussel seed, and clam spat.
13. Sue Klemzak Box 3363 Kodiak, Alaska 99615	Sci/Ed Permit #86-148	Uganik Passage	Collection and possession of weathervane scallop spat, blue mussel seed, and clam spat.

STATE OF ALASKA

DEPARTMENT OF COMMERCE & ECONOMIC DEVELOPMENT

DIVISION OF INVESTMENTS

STEVE COWPER, GOVERNOR

P. O. BOX D
JUNEAU, ALASKA 99811-0800
PHONE: (907) 465-2510

April 23, 1987

Honorable Dick Eliason
Alaska State Senate
P.O. Box V
Juneau, AK 99811

Dear Senator Eliason:

In accordance with your request, enclosed is a list of the Fisheries Enhancement loans made through this division.

If you have any questions, do not hesitate to contact me at 465-2510.

Sincerely,



Martin J. Richard
Director

MJR/ss0587Z
042287a
Enclosure

Dick -
Here is the
list you wanted
of state loans
to PNP hatcheries

<u>NAME</u>	<u>DOLLAR AMOUNT</u>
ALASKA AQUACULTURE, INC.	390,000
ALASKA AQUACULTURE, INC.	10,000
ALASKA AQUACULTURE, INC.	145,700
ALASKA AQUACULTURE, INC.	102,600
ALASKA AQUACULTURE, INC.	25,100
ALASKA AQUACULTURE, INC.	31,130
ALASKA AQUACULTURE, INC.	275,270
ALASKA AQUACULTURE, INC.	39,735
ALASKA AQUACULTURE, INC.	33,750
ALASKA AQUACULTURE, INC.	290,000
ALASKA AQUACULTURE, INC.	180,000
ALASKA AQUACULTURE, INC.	47,500
ALASKA AQUACULTURE, INC.	113,125
ALASKA AQUACULTURE, INC.	63,700
ALASKA AQUACULTURE, INC.	117,700
ALASKA AQUACULTURE, INC.	121,630
ALASKA AQUACULTURE, INC.	127,270
ALASKA AQUACULTURE, INC.	83,700
ALASKA AQUACULTURE, INC.	55,650
ARMSTRONG-KETA, INC.	474,045
ARMSTRONG-KETA, INC.	421,000
ARMSTRONG-KETA, INC.	75,000
ARMSTRONG-KETA, INC.	182,100
ARMSTRONG-KETA, INC.	252,500
ARMSTRONG-KETA, INC.	200,000
ARMSTRONG-KETA, INC.	30,000
ARMSTRONG-KETA, INC.	200,000
ARMSTRONG-KETA, INC.	193,000
ARMSTRONG-KETA, INC.	42,000
ARMSTRONG-KETA, INC.	273,000
BURRO CREEK FARMS, INC.	92,000
BURRO CREEK FARMS, INC.	36,200
BURRO CREEK FARMS, INC.	58,700
BURRO CREEK FARMS, INC.	68,975
BURRO CREEK FARMS, INC.	27,500
COOK INLET AQUACULTURE ASSN	113,310
COOK INLET AQUACULTURE ASSN	331,445
COOK INLET AQUACULTURE ASSN	1,348,881
DOUGLAS ISLAND PINK & CHUM	125,000
DOUGLAS ISLAND PINK & CHUM	50,000
DOUGLAS ISLAND PINK & CHUM	44,000
DOUGLAS ISLAND PINK & CHUM	37,000
DOUGLAS ISLAND PINK & CHUM	15,500
DOUGLAS ISLAND PINK & CHUM	75,000
DOUGLAS ISLAND PINK & CHUM	50,000
DOUGLAS ISLAND PINK & CHUM	163,000
DOUGLAS ISLAND PINK & CHUM	40,000
DOUGLAS ISLAND PINK & CHUM	30,000
DOUGLAS ISLAND PINK & CHUM	118,000
DOUGLAS ISLAND PINK & CHUM	42,000

<u>NAME</u>	<u>DOLLAR AMOUNT</u>
DOUGLAS ISLAND PINK & CHUM	67,700
DOUGLAS ISLAND PINK & CHUM	57,300
DOUGLAS ISLAND PINK & CHUM	67,500
DOUGLAS ISLAND PINK & CHUM	150,000
DOUGLAS ISLAND PINK & CHUM	162,000
DOUGLAS ISLAND PINK & CHUM	195,500
DOUGLAS ISLAND PINK & CHUM	198,000
DOUGLAS ISLAND PINK & CHUM	51,000
DOUGLAS ISLAND PINK & CHUM	263,000
DOUGLAS ISLAND PINK & CHUM	196,000
DOUGLAS ISLAND PINK & CHUM	95,000
DOUGLAS ISLAND PINK & CHUM	55,000
KAKE NONPROFIT FISHERY CORP	346,900
KAKE NONPROFIT FISHERY CORP	196,187
KAKE NONPROFIT FISHERY CORP	188,000
KAKE NONPROFIT FISHERY CORP	104,500
KAKE NONPROFIT FISHERY CORP	184,000
KAKE NONPROFIT FISHERY CORP	66,780
KAKE NONPROFIT FISHERY CORP	195,383
KAKE NONPROFIT FISHERY CORP	272,863
MEYERS CHUCK AQUACUL ASSN, INC.	10,000
NORTHERN SE REG AQUACULTURE ASSN	270,196
NORTHERN SE REG AQUACULTURE ASSN	1,500,000
NORTHERN SE REG AQUACULTURE ASSN	15,000
NORTHERN SE REG AQUACULTURE ASSN	260,000
NORTHERN SE REG AQUACULTURE ASSN	224,715
NORTHERN SE REG AQUACULTURE ASSN	288,989
NORTHERN SE REG AQUACULTURE ASSN	494,084
NORTHERN SE REG AQUACULTURE ASSN	450,125
NORTHERN SE REG AQUACULTURE ASSN	100,000
NORTHERN SE REG AQUACULTURE ASSN	201,369
NORTHERN SE REG AQUACULTURE ASSN	261,500
PRINCE WM SOUND AQUACULTURE CORP	329,000
PRINCE WM SOUND AQUACULTURE CORP	1,388,000
PRINCE WM SOUND AQUACULTURE CORP	7,692,000
PRINCE WM SOUND AQUACULTURE CORP	1,786,000
PRINCE WM SOUND AQUACULTURE CORP	585,500
PRINCE WM SOUND AQUACULTURE CORP	1,000,000
PRINCE WM SOUND AQUACULTURE CORP	1,400,000
PRINCE WM SOUND AQUACULTURE CORP	650,000
PRINCE WM SOUND AQUACULTURE CORP	204,000
PRINCE WM SOUND AQUACULTURE CORP	265,000
PRINCE WM SOUND AQUACULTURE CORP	62,000
PRINCE WM SOUND AQUACULTURE CORP	1,345,500
PRINCE WM SOUND AQUACULTURE CORP	1,217,039
PRINCE WM SOUND AQUACULTURE CORP	500,000
SHELDON JACKSON COLLEGE	177,254
SHELDON JACKSON COLLEGE	185,000
SHELDON JACKSON COLLEGE	61,370
SOUTHERN SE REG AQUACULTURE ASSN	1,100,000

<u>NAME</u>	<u>DOLLAR AMOUNT</u>
SOUTHERN SE REG AQUACULTURE ASSN	3,783,000
SOUTHERN SE REG AQUACULTURE ASSN	900,000
SOUTHERN SE REG AQUACULTURE ASSN	351,000
SOUTHERN SE REG AQUACULTURE ASSN	538,342
SOUTHERN SE REG AQUACULTURE ASSN	2,700,000
SOUTHERN SE REG AQUACULTURE ASSN	410,000
SOUTHERN SE REG AQUACULTURE ASSN	200,000
SOUTHERN SE REG AQUACULTURE ASSN	300,000
SOUTHERN SE REG AQUACULTURE ASSN	211,600
SOUTHERN SE REG AQUACULTURE ASSN	525,000
SOUTHERN SE REG AQUACULTURE ASSN	406,000
SOUTHERN SE REG AQUACULTURE ASSN	517,000
TLINGIT-HAIDA FISHERIES DEV CORP	89,860
TLINGIT-HAIDA FISHERIES DEV CORP	1,464,000
VALDEZ FISHERIES DEV'T ASSN	188,000
VALDEZ FISHERIES DEV'T ASSN	406,530
VALDEZ FISHERIES DEV'T ASSN	38,000
VALDEZ FISHERIES DEV'T ASSN	1,950,000
VALDEZ FISHERIES DEV'T ASSN	240,000
VALDEZ FISHERIES DEV'T ASSN	266,300
VALDEZ FISHERIES DEV'T ASSN	240,000
VALDEZ FISHERIES DEV'T ASSN	105,000
VALDEZ FISHERIES DEV'T ASSN	147,000
VALDEZ FISHERIES DEV'T ASSN	240,000
VALDEZ FISHERIES DEV'T ASSN	371,000
VALDEZ FISHERIES DEV'T ASSN	25,000
VALDEZ FISHERIES DEV'T ASSN	407,000
VALDEZ FISHERIES DEV'T ASSN	511,879
VALDEZ FISHERIES DEV'T ASSN	380,000
VALDEZ FISHERIES DEV'T ASSN	130,000
VALDEZ FISHERIES DEV'T ASSN	538,664



STATE OF ALASKA
LEGISLATIVE INFORMATION OFFICE

TESTIMONIES GIVEN
4/24/87 FROM PETERSBURG
ON S.B. 106. TELconference

We are pleased to enclose this
material for your information.

LEGISLATIVE INFORMATION
OFFICE

..... P.O. BOX 1470
PETERSBURG, AK 99833

W. W. W.

TESTIMONY ON SB 106 4-24-87

My name is Debra Carpenter, I live on the west side of Prince of Wales Island in Sea Otter Sound. I used to live at Edna Bay and now reside in Tokeen and fish with Dave Lyons on the KRAKEN out of Petersburg.

I make my living commercial fishing and contracting from the Forest Service. About three years ago Dave and I became interested in oyster culture and began researching the idea of raising oysters and began looking for private land with adjacent tidelands suitable for aquaculture. Well, I discovered that other than the native corporations there is no private land available. The Trillium Corporation, which is also called Lynn Canal Investment Corporation, does have some land for sale. It's \$5000 per acre, minimum purchase 20 acres. The state land disposal program has created communities whose populations and resulting pollution problems prohibit the location of adjacent aquaculture sites. There are a few old cannery sites available. They are in the hands of real estate speculators from Juneau who already have them subdivided.

Very reluctantly, we have pursued the course of applying for a tidelands permit and hoping that at some later date we will be able to obtain an uplands lease from the Forest Service.

I think that I have a valuable point of view because I am involved both with the fishing industry and the aquaculture field.

First, I must say I'm dismayed and confused by the terms aquaculture and mariculture. Why don't we just say that we have a bill here that calls for pen reared salmon for profit by the private sector.

I attended the Southeast Conference and heard Fred Harris, a lobbyist for Sealaska, speak. He stated flatly that pen reared salmon would not compete with troll fish and that salmon farming would be a mom-and-pop style business. We've received phone calls from salesmen who want to sell nets, floating docks, collapsible portable tanks, vinyl coated wire mesh, etc. It's incredible the amount of money these people are ready for us to make and give them.

I think the psychology that is motivating the pen-reared salmon proponents is, "How quickly can I invest 60 to 100,000 bucks and make my 150 to 200,000 dollars a year on my salmon farm?" That kind of thinking is buying the lobbyists who composed this misbegotten bill of dubious percentage. The pen reared salmon proponents have made a prostitute of an honest, struggling, fledgling shellfish industry by marrying the interests, the welfare and the future of the shellfish industry to the short-sighted and selfish interests of a few by corporations and investors who smell money!

The future shellfish industry and economy needs a rational and well-thought out plan and support from the State of Alaska.

We need a PSP lab in southeast.

We need a coherent criteria for evaluating sites for shellfish culture with respect to other area uses.

We need a position, in writing, from the Forest Service. A firm and fair policy on the leasing of uplands for support facilities for shellfish culture. It would be great to have a lab for culturing oyster spat and abalone spat. But a lab must be located on the uplands. Presently a person has to locate their aquaculture site in a floathouse; and floathouses and the resulting contamination of the water aren't compatible with shellfish culture.

Many other issues seek to discourage the private sector from venturing into shellfish farming. Marketing out-of-state requires a processors license. That means bonding and prepayment of estimated taxes. This increases the initial capital investment. With changes in the tax laws, you can now write off only as much in losses as your small business generates in sales of product. Well, with shellfish farming there is no product for the first three years. There is only investment, investment, investment...and the gamble that on some bright future day you will be able to make living, growing and selling shellfish on Forest Service and DNR leases, which won't unexpectedly terminate.

Personally, we don't expect to select our site, move through the permitting process, get the oysters into production, go through more permitting for uplands and long term lease of the tidelands if the oysters do produce, clear the land, install the generators, get the floathouse onto the beach, etc. and etc. in any less than 10 years. But we are willing to make that 10-year commitment of the days of our lives and the dollars that, by the way, wild and hatchery salmon have produced.

I ask you to support the shellfish industry by NOT supporting any bill that suggests we pen rear salmon at the expense of our existing fishing industry.

Also, I absolutely despair at seeing all the argument and wasted time and effort this bill has generated.

Shellfish farms desperately need a well-constructed and well-thought out plan and guidelines and support for their industry. Quick return, big profit for big investment salmon farming under the guise of mariculture has only clouded the issues and muddied the water.

Thank-you for your time and attention.

Gerry Merrigan
Box 1069
Petersburg, AK 99633

TESTIMONY ON SB 106 4/24/87

I realize there is a great need in Alaska for a comprehensive mariculture program. However, this bill is a poor step in formulating such a program. It raises many questions and provides very few answers. It does not provide for a speculation-free permitting process; it does not provide for public input on siting on public lands and waters; it does not provide for adequate biologic and genetic safeguards. What it does provide is accelerated licensing of a private industry that involves public resources along with very few safeguards for those same resources. The attitude is "Trust us."

In addition, the bill specifically excludes the public and the Board of Fish--hence the fishermen--from the licensing process.

Advocates of the pen-rearing of salmon would have you believe that aquatic farming would create more jobs and stabilize the economy with no threat to commercial fishermen. This simplistic view could not be further from the truth. Salmon pen rearing--within Alaska and outside Alaska--directly competes with existing Alaskan fishermen in fresh and frozen markets. It also poses critical environmental and genetic hazards for our present resources. The bill does not address these problems but instead paves the way for swift licensing of highly capital intensive farms which would be quite out of reach of most Alaskans. Who would benefit from this bill? Clearly not Alaskan fishermen or the average Alaskan resident and especially not the natural resources from which we derive our livelihood.

Salmon pen rearing is portrayed as a long term economically viable industry... the jury is still out. It can only grow as much as the market will bear.

Most of my objections to this bill are in regards to finfish with particular emphasis on gambling with our wild stocks in regards to viral and genetic contamination. As for other forms of mariculture--shellfish, mussels, kelp--the previous problems of physical siting criteria and speculation-free permitting still exist. As this bill has more holes than substance and since it raises more questions than it answers, I would hope to see this bill fail.

Rather than have a haphazard mariculture policy result from legislative time constraints, a moratorium will allow an unbiased study to be conducted. I'm not talking about studies like the House Research report on the effects of mariculture--a document over 100 pages in length with all of one page on negative effects.

I would like an honest look at the net benefit of pen rearing with the cost of displaced fisheries, the cost to the state pocketbook, and the cost in natural resource degradation. In short, the net benefit to all Alaskans, especially in jobs lost versus jobs created.

Since any type of mariculture is private resource consumption of public natural resources, the public should be included in the permitting process. One avenue for this is the inclusion of the Board of Fish, thus the local Fish & Game Advisory Boards. The public has the right to be included in any process which changes multiple use to single use.

Thank-you.

Julie Hursey
Box 213
Petersburg, Alaska
F/V Thunder

Senate Bill 106

I am opposed to the passage of House Bill 108, but before outlining the arguments I have with this bill, I will say that I am not opposed to mariculture ever being developed in Alaska. In particular, I think that shellfish mariculture could coexist well with the existing fisheries. However, the development of any kind of mariculture must follow a careful management plan to minimize adverse effects to the marine environment and our existing fisheries resources. My main argument with this bill is that it does not outline any such specific management plan, and too many crucial issues are left unresolved. Some of these issues include possible environmental degradation and adverse impacts on wild stocks of fish, realistic costs to the state, and conflicts over area use by different groups. I will address each of these in turn.

In order to ensure that development of the mariculture industry does not damage the environment, it is essential that a thorough monitoring plan is in place PRIOR to development. This program would oversee site selection, monitor water quality, conduct inspections of sites to maintain health standards and control any problems with disease. However, BEFORE such a monitoring program can be designed, and BEFORE the costs to state agencies can be assessed, there must be some sort of policy on the development of mariculture which would delineate the ultimate size and direction of industry growth. This bill fails to address controls over size and rate of growth of the mariculture industry.

Without knowing the ultimate number of farms, what size they will be or even where they will be, it is impossible to design an adequate environmental monitoring program, or to ensure environmental protection. According to the Gillespie Report "An Inquiry Into Finfish Aquaculture in British Columbia", environmental monitoring represents a major deficiency in the regulation of fish farms. In fact, this report mentions that site inspections have become infrequent because "approval agencies were too busy with the backlog of plans to conduct field inspections". To jeopardize environmental health because of such poor planning is inexcusable. We can learn from Canada's mistakes.

My particular concern is the effects that the uncontrolled development of salmon farming could have on environmental quality and the health of our wild stocks. It is a fact that if salmon farms are not carefully sited, fish wastes and excess feed can cause a pollution problem. Also, if a site is not properly located, penned salmon populations can become stressed and subject to disease. Canada is already having problems with farms that are improperly sited, and this in part led to the moratorium on new permits.

Julie Hursey
Box 213
Petersburg, Ak.
F/V Thunder

SB 106 The probability of disease transmission from farmed salmon to wild salmon is unknown at this time. In Norway, where most of the research has been done, there were few natural stocks to worry about. Eventually, however, even they are planning to develop "green zones" or areas that are aquaculture free to protect what wild stocks they do have. ~~House Bill 108~~ does not adequately address the question of protecting the health of the wild stocks. Perhaps these "green zones" should be considered. In any case, no industry should be allowed to develop at the expense of our healthy marine environment, and our wild stocks of fish.

If mariculture is to benefit state revenues, then we must have an accurate assessment of its costs to state agencies. Questions raised last week during testimony indicate that this is an area which needs to be addressed more carefully.

The number of farms that will be developed will determine the costs in part. According to Bryan Alle, the Fish and Game fiscal note is predicated on 100 permits being issued the first year, and an actual 20 farms being operational by 1992. What if this prediction falls short? Alle says that then costs will go up. But how much would they increase, and does the state have the resources to cope with a greater than expected increase in the numbers of farms? It is obvious that a range of fiscal scenarios must be presented by each agency, in order to have a more realistic picture of the probable costs, and to be able to plan accordingly.

In Canada, staff and funding levels have not kept pace with industry growth. According to Bryan Alle, there is a critical lack of pathologists in British Columbia, and we could face the same problem here if the mariculture industry grows beyond present predictions. Do these agencies have a contingency plan to deal with such a problem if it arises? What will happen if there are not adequate funds to cover the costs? Diverting funds from existing fisheries management programs is not an option. I must admit, the zero fiscal note submitted by the Department of Environmental Conservation mystifies me. Now they are reassessing that note. Good idea. I think this entire area needs more thorough investigation.

Another issue that is not addressed in this bill is how disputes over use of an area will be resolved between conflicting user groups, and the possible pre-emptive use of areas by the mariculture industry. Fish farms could be located in areas that have been traditionally used for anchorages, fishing grounds, gear storage areas, recreational uses, and even marine transportation corridors. Another source of conflict would arise if fish farms were placed in areas that are already used as spawning or nursery grounds for wild stocks. Canada is already having problems with these kinds of conflicts now, and it has reached serious proportions, according to Vince Goboyan, a Canadian delegate from the Canadian Standing Senate Committee on Fisheries.

Julie Hursey
Box 213
Petersburg, Alaska
F/V Thunder

A coastal zone management plan is urgently needed, to take inventory of our coastal resources, and to designate areas for specific uses. At this time, no such plan exists in the areas where mariculture could occur. It is essential to acknowledge the multiple uses of coastal waters and tidelands, and the diversity of user groups in order to minimize conflicts.

This brings to mind the question of how decisions will be made on area designations. Will this be made on a site by site basis, or will there be a comprehensive plan with public hearings? How much will it cost? Will the user groups have any input into this process, and what avenues will be available? The bill specifically precludes the Board of Fish from participating in site selection, but does not address the question of public participation in the process. This hardly seems fair.

In summary, I will say that I strongly object to the passage of this vaguely worded bill. I do not believe that enough planning and research has gone into determining an adequate environmental monitoring program to protect the marine environment, or our wild stocks of fish. I don't think that the costs to the state have been adequately assessed. I think the great potential for conflicts over area use could create a miasma of problems. I do not believe that we should start this industry, then develop the management plan as we go along. This would be extremely short-sighted, and could offer only band-aid solutions to the major problems which could arise. I think we can learn from the mistakes that Canada has been making.

~~SB 106~~
~~House Bill 108~~ does not adequately address the problems that could arise from the development of mariculture. Until we have a better plan for avoiding problems, and until we know that we have the resources to deal with these problems as they occur, I am opposed to the passage of ~~House SB 106~~ ~~Bill 108~~. Thank you very much for taking the time to consider this.

AS A FISHERMAN IN SOUTHEAST ALASKA, I HAVE AN INTEREST
IN MARICULTURE AND HAVE PUT SOME TIME INTO GATHERING INFORMA-
TION ON THE SUBJECT. I'VE BARELY SCRATCHED THE SURFACE OF
SUCH A COMPLEX ISSUE BUT AM AWARE ENOUGH TO REALIZE THAT
MARICULTURE IN ALASKA DESERVES MORE CAREFUL SCRUTINY THAN
SENATE BILL 106
WHAT ~~HOUSE BILL 108~~ SUGGESTS.

BESIDES HAVING OBVIOUS FLAWS WITH ADMINISTRATIVE CONCERNS
SUCH AS FUNDING AND MANAGEMENT, ~~HOUSE BILL 108~~ ^{SENATE BILL 106} IS CONTENT
TO RUBBER STAMP AN APPROVAL AS IF THERE WERE NOTHING AT RISK
IN THE BIOLOGICAL AND SOCIO-ECONOMIC RESULTS OF MARICULTURE.

MARICULTURE NEED NOT BE TREATED AS AN INEXORABLE
CONDITION OF ALASKA'S FUTURE SIMPLY BECAUSE SOMEONE SAID
THERE'S MONEY TO BE MADE IN IT. THE ECONOMICS OF MARICULTURE
DEPEND ON AN UNDERSTANDING OF COMPLEX BIOLOGICAL CONSIDER-
ATIONS WHICH MUST BE UNDERSTOOD TO BE SUCCESSFULLY
IMPLEMENTED. THIS UNDERSTANDING COULD BE COSTLY ON A
TRIAL AND ERROR BASIS.

+ ~~PROBABLY~~
RISK/REWARD
DO WE HAVE TO LOSE
SOMETHING TO GET
WHAT WE WANT

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106 - Senator Ellason

mariculture

I came to Alaska in 1946 and lived thru the time of fish traps. I sat thru the presentation at the SE Conference and the Sitka Marine Trade Fair in March. I can see ^{SE} Alaska being carved up into special harvest areas ^{for} ~~in~~ the mariculture lease areas. I like the proposal that a special committee be appointed to look into site selection before any leases permits are issued. I feel there should be a good representation of fishermen, conservationists, ^{including their associations} industry, ADF&G and US Forest Service, ^{and NMFS}, who has done the preliminary work on pen-rearing. I also favor a moratorium until this group can report back. I understand there has already been 30-40 lease application for oyster farms in the Wrangell-Petersburg areas alone. As the pen-reared salmon are easily stressed according NMFS Bill Heard, I can see signs at the mouth of bays where the net-pen ^s are located that say, No motorized vessels allowed. I can see pens being placed in the best anchorages. We must consider the other uses for the areas. Looking at all the criteria which I won't take time to list, I can think of few areas that meet all of them ^{including habitat, salmon, etc.}

We just had an outbreak of BKD at the Crystal Lake hatchery where the best biologists are watching the fish. There is great danger of it getting into the pen-reared stocks where people without biological training will be taking care of the fish. Recently Norway had to destroy many of their fish due to disease. This could happen here.

Where is the money going to come from to get started in pen-rearing. I've heard of figures from \$300,000-1 million. It will stretch the ADF&G budget to decide where to let lease, inspect the fish for disease, etc. I am opposed to using any state money for mariculture. As soon as a group gets a state loan, they want concessions in regulations or ^{to} they won't be able to pay back their loan. I also do not want any of the 3% the fishermen are paying ^{for aquaculture} to be used for mariculture.

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the hatchery gets its water. They are expected out of the incubators by Feb. 15. They will not need the four raceways, which have not been completed, until June 15.

Crystal Lake hatchery will be releasing 700,000 king smolts, an all-time high, and 60,000 king fry in 1986, Billi said. Of these 400,000 will be released into Crystal Creek on which the hatchery is located, and 200,000 into Gunter Creek near-by of which 100,000 will be raised in net pens. If permits can be obtained, they plan to release 100,000 king smolts into Earl West Cove, south-east of Grangeville in the Snake Channel.

They will release 135,000 coho smolts into Crystal Creek and 1 million unfed coho fry into Irish Creek. Due to lack of space, they have put 250,000 eyed coho eggs into boxes in Crystal Creek.

In 1985, the hatchery had a record king return of 3375 and from those they took a record number of 6,275,000 eggs. They also took 110,000 eggs from kings in the Tahini and Farragut rivers, which they will raise in their isolation-incubation facilities and return to those rivers in the spring of 1986. Of the 2,100,000 eggs they took from Crystal Lake kings, they hope to have 1.5 million smolts to release in 1987. Of the remaining eggs takenⁿ in 1985, 5.5 million were transferred to ADF&G hatchery at Shattishan, 319,000 to Hedvigle in Sitka, 272,000 to ADF&G hatchery at Hidden Falls and 97,000 to Sheldon Jackson, Billi reported. Of the 3,440 cohoes that returned to the hatchery in 1985, they took 1.6 million eggs. They also took 329,000 anad eggs and 68,000 steelhead eggs.

Mr Chairman, members of the Committee, my name is David Bedford. I live in Petersburg.

I am very concerned that the potential for transmission of disease from farmed salmon to wild Alaskan stocks has not received adequate attention.

Curt Kevus in Marine Advisory Bulletin #26 World Salmon Farming: An Overview with Emphasis on Possibilities and Problems in Alaska devotes three sentences to the problem. He terms it a "calculated risk", but assures us that "new fish diseases pose little long term risk to indigenous populations. This would appear ingenuous at best when 80% of disease problems in the Norwegian fish farming industry come from the 'hitra' disease, a new disease that arose with the advent of intensive fish farming.

According to Dr. Arthur H. Whiteley, Professor of Zoology at the University of Washington, salmon pens "enrich the local environment for bacterial growth", and can foster a variety of diseases not only in penned fish, but in the water column and in sediments on the ocean floor. Infection of wild ~~stock~~ ^{fish} often occurring through the gills, requires only a few minutes of ^{proximity &} exposure. The tendency of outmigrating salmon smolts to gather around docks, floats and rafts will certainly create the opportunity. To quote Dr. Whiteley "it is the opinion of microbial ecologists that an infected fish pen would in all likelihood serve as a focus for the infection of fish in the environment and from them for the transmission of disease to their offspring."

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Dr. Whiteley further points out that some bacteria associated with salmon pens cause shell disease and internal infections in King crab, Tanner crab and shrimp. Some of these bacteria are known to infect oysters and abalone as well.

Alaska produces 43% of the world's harvest of pacific salmon. We have important crab and shrimp fisheries. These resources are the basis for much of our coastal economy. The potential risk of a salmon farming industry to these resources is very real, regardless of how proponents of pen rearing may gloss it over. We can not go forward with Senate Bill 106 until guarantees are in place from both the mariculture industry and the responsible agencies of government for the continued health of our existing fisheries resources.

Some relationships between pathogenic bacteria and
salmon net pen culture
Pacific Fisheries Legislative Task Force, State Capitol, Olympia,
Feb. 7, 1987

Dr. Arthur H. Whiteley, Professor, Department of Zoology,
University of Washington

I intend in these few minutes to comment on one aspect
only of pen rearing of salmon - the relationship to pathogenic
bacteria and other agents of disease.

The growth of bacterial populations in a natural environment
is limited by the availability of nutrients. In a typical, natural
marine environment the bacterial populations are relatively
sparse. Given appropriate nutrients, either in the form of
dissolved materials or sediments, the opportunity for growth in
these populations will be much enhanced. It is generally agreed
that salmon pen culture contributes substantially to the
eutrophication of the environment of the pen - both in terms of
soluble and finely suspended material, and in terms of larger
particles that form heavy sediments on the bottom. In this
way, the pens enrich the local environment for bacterial growth.
Those bacteria already present in the water and substratum can
increase. Any brought in with the introduced fish can increase
as well. A variety of diseases can thereby be fostered by the
pens. Some of these are of bacterial origin, some are viral, and
some are due to organisms such as fish lice, parasitic worms,
etc. The enhancement of the bacteria by nutritional enrichment
works to the disadvantage of the penned fish. They are already
stressed by the conditions in which they grow. They are
therefore susceptible to bacterial invasion. Notably *Vibrio*
anguillarum and *Renibacterium salmonarum* infect the penned
fish and often kill them, and other vibrios and aeromonads are of
major importance as salmon pathogens. *Vibrio anguillarum*
produces disease in penned salmon in this State and in British
Columbia. It also is ubiquitous in Norwegian waters, and is
responsible for many of their fish farm diseases. With the
advent of intensive fish farming in Norway, a new disease, the
"hitra" disease, has appeared and now is responsible for 80% of
the disease problems in the Norwegian fish farms. Its cause is
uncertain, but vibrio species occur in connection with the disease

outbreaks (Håstein, 1986).

A significant question is whether these infections affect wild fish. Weston (1986) concludes that the evidence argues against such transmission. Others point out the difficulty of making such a determination because of the mobility of the wild fish and other complexities associated with working in a submerged, marine environment (Trust, 1986; Johnson, 1989; Staley, pers. com.). It takes only a few minutes exposure for a fish - penned or wild - to become infected. Often the route of transmission is through the gills. The infected fish often die, but if they survive, they frequently become carriers of the pathogenic organism. Both viruses and bacteria can be shed through the feces of the fish, thus spreading the focus of contamination in the natural environment. Moreover, in certain cases (*Renibacterium*) the bacteria can be passed from a female to her eggs, where it associates with the yolk, and transmits the disease to her offspring (Trust, 1986). It is too early to conclude that there is no transmission from a pen to the general environment and to the wild fish there. On the contrary, it is the opinion of microbial ecologists that an infected fish pen would in all likelihood serve as a focus for the infection of fish in the environment, and from them for the transmission of disease to their offspring (Staley, pers. com.).

In addition to pathogenic bacteria, the stressed salmon can serve as a focus for a number of serious viruses. These, too, may enter their host through the gills, and can be transmitted to other fish and to next generations (Trust, 1986). It is expected that they will be locally enhanced by the concentrations of wastes associated with fish pens (Staley, pers. com.), and this enhancement poses problems for the penned fish, and for wild fish as well. The danger that such viruses can be transmitted to wild fish is recognized by laws that prevent introduction of salmonids from the Columbia River system, which is infected by viruses, into any other river system in this State.

These pathogens and related ones that will multiply in the accumulated fish wastes, can serve as a reservoir of infection of marine invertebrate organisms as well. This, too, is a difficult field of inquiry because of the nature of the environment and the mobility of some of the organisms, and most information is derived from study of captive invertebrates. It is believed,

however, that animals living in degraded environments (which I assume would include under-pen locales) can be seriously disabled by such bacteria. Bacteria that degrade chitin, including *Vibrio*, *Beneckea* and *Pseudomonas*, cause shell disease in a host of crustacea, including spiny lobsters, tanner crabs, king crabs, various shrimp, and others of economic importance (Johnson, 1983). The species of *Vibrio* bacteria that infect crabs and shrimp include those associated with salmon pens or are present in local waters: *V. anguillarum*, *V. parahaemolyticus*, *V. alginolyticus*. (Johnson, 1983). Laboratory experience indicates that animals kept in clean sea water are difficult to infect, but those in the presence of sewage sludge developed shell disease. In addition to causing shell diseases, bacteria invade shrimp, crabs and other crustacea and cause internal infections. Again, the total relation of these infections to stress, to polluted environments, to salmon pen sewage is not resolved (Johnson, 1983), but we believe this relationship needs analysis in relation to establishing fish pens in the vicinity of shrimp and crab populations.

There is a well documented literature demonstrating that molluscan embryos and larvae - some of commercial significance - are subject to serious infection by these same species of vibrio bacteria. Abalone embryos and Pacific oyster (*Crassostrea gigas*) embryos and veliger larvae in hatcheries suffer serious mortalities from vibriosis (Sparks, 1985; Jeffries, 1984; Tubiash and Elston, 1984). It would be prudent to determine carefully the potential damage that may be caused by juxtaposing salmon pens to oyster and abalone culture facilities, and to native bivalve beds.

It would be of interest, also, to determine if vibriosis similarly affects these same kinds of molluscan larvae and embryos in the natural plankton, thereby affecting natural populations. Beyond that, it is important to know if populations of these *Vibrio* species or other pathogens, enhanced by sewage or fish pen wastes, infect other forms of invertebrate larvae or adults. I am thinking of the sponges, sea urchins, starfish and the host of other invertebrates which, though not of direct commercial value, are absolutely fundamental to the ecosystems of these water and to their productivity. Their impairment would sound the death knell for these waters.

Some of these bacteria are pathogenic to man as well. Knowledge of the genus *Vibrio* is expanding rapidly. This genus, which includes *V. cholerae*, includes species that typically live in marine locales (Kelly et al., 1982). *V. anguillarum* appears not to infect humans. However, *V. vulnificus* and *V. parahaemolyticus* do infect humans. *V. vulnificus*, a recently recognized species, is a deadly pathogen that is carried in sea water. It is readily filtered and concentrated from sea water by oysters and clams and it is easily transmitted to humans when these bivalves are eaten. The results are often fatal. Other than through ingestion, humans can contract the disease through simple contact of sea water with open wounds or mucosal tissues. It is predominately a warm water organism, which suggests that our waters may be safe from it, but virulent strains of this species have been found in Oregon associated with fish, crabs and clams and in Japan associated with eels (Tison and Kelly, 1986; Kelly and McCormick, 1981; Tison and Kelly, 1984; Blake, Weaver and Hollis, 1980). A preliminary search for this species in the San Juan Islands has not revealed it, but its presence in warmer bays there, and in the Canadian Gulf Islands, or elsewhere in the Sound cannot yet be discounted (Kelly, pers. com.). *V. parahaemolyticus* is, by contrast, commonly found around the San Juan Islands and doubtless is ubiquitous here (Kelly, pers. com.). It causes acute gastroenteritis in humans (Tison and Kelly, 1984; Blake, Weaver and Hollis 1980). This form of gastroenteritis appears to be transmitted exclusively through food, usually seafood (Blake, Weaver and Hollis, 1980). It can be a very significant infectious agent: in Japan, over a 10 year span, 24% of reported cases of food poisoning were attributed to this bacterium.

V. parahaemolyticus, thus, is present here, is a known pathogen of humans, and is transmitted through filter feeders such as clams and oysters. *V. vulnificus* is found nearby, and with further searching may be found in the Sound and Gulf. Simple contact with infected sea water will lead to serious infection. The former species, and probably the latter as well, thrives in heavy, enriched sediments such as sewage sludge. It can also be expected to grow in salmon pen sludge (Staley, pers. com.; Kelly, pers. com.).

It has been argued by associates of the salmon pen aquaculture industry that human diseases associated with these vibrios have been rarely found in the Puget Sound region, and therefore no danger is posed by them. Thus fish pen aquaculture is justified. It is good that the base line now, before salmon pens are well established, is essentially zero. The water is relatively clean, now, and the populations of these pathogens are within tolerable limits, using customary screening methods for detecting these pathogens. But a further complication is introduced by a recent paper (Grimes, et al, 1986). They find that when such pathogens as I have been discussing are introduced into marine waters, they rather quickly lose their identity as measured by conventional culture methods. They enter into dormancy, but remain viable though not culturable by traditional methods. Failure to find them using these methods could lead to overlooking a substantial, but cryptic source of serious pathogens in the environment.

The important question, then, is not whether these organisms pose a present health threat, or ecological threat. The proper question is: can these organisms, and this ecosystem, and these humans tolerate the eutrophic burden that will be imposed by a full blown fish pen industry? It is our belief that there are many too many questions that need resolution, of a public health nature, and of an ecological nature, before we proceed further.

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SB 106

TESTIMONY OF CHRISTOPHER PACE CONCERNING ~~FOR SB 106 BEFORE THE HOUSE~~
~~RESOURCES SUBCOMMITTEE, MARCH 31, 1987~~

April 24, 1987

Thank you. My name is Christopher Pace. I'm from Petersburg. I'm an aquaculture biologist, a commercial salmon fisherman, a member of the American Fisheries Society and a member of the Alaska Trollers Association. I support the concept of mariculture adopted by the 1986 Southeast Conference, and I'm considering personally investing in mariculture technology. However, I have reservations concerning the private captive rearing of salmon for profit in Alaska, and I'm opposed to the ~~Committee Substitute for SB 106~~. I'm requesting my district's legislators, Representatives Sund and Taylor and Senator Jones, to take those actions necessary to stop passage of this bill. It contains some good concepts, but overall it is a bad piece of legislation and acts as a detriment both to the creation of a viable mariculture industry and to the people and institutions of this state.

First, I'm against a law that takes control and responsibility of fishery resources away from the commissioner of fish and game. This bill places vital fisheries decision making on a par with decisions regarding licensing of the state's professional support industries, such as hairdressers, building contractors, chiropractors, and realtors. The other chapters in Title 08 reference professional qualifications, examination and competency boards, and performance bonds. None of these kind of stipulations are present in the proposed Chapter 6.

Another criticism I have is with regard to the potential issuance of hatchery permits by the commissioner of commerce and economic development. The fish and game statutes (Title 16) governing private hatchery permits stipulate that the commissioner of ADF&G "may" issue a hatchery permit, while Bill 106 implies that the commissioner of commerce "will" issue the same permit as a matter of course. I believe it is an invitation to legal chaos to allow for the issuance of a hatchery permit by either of two separate state agencies. This would occur if Bill 106 is adopted. As it is written, Bill 106 would place the burden of proof on the departments of fish and game and environmental conservation to provide to the commissioner of commerce the measures necessary to mitigate impacts caused by commercial hatcheries authorized under Title 08. This situation is reminiscent of the flawed logic that led to the space shuttle disaster, i.e., the necessity to prove that a system will not self-destruct rather than to prove that it will actually work safely.

I'm against a law that could permit the commissioner of commerce to make decisions that result in obligating the commissioner of fish and game. The result is the creation of a super agency of state government with extraordinary power over ADF&G. This sort of power should be reserved for the governor, the legislature, and the courts. Additionally, the bill does not address how the commissioners of fish and game or environmental conservation should adopt the regulations necessary to implement the proposed mariculture policy.

I'm also confused regarding the difference between an "aquisition permit" and the present fish and egg transport permits (FTP) issued by the commissioner of fish and game as per 5 AAC 41.005. Are they the same thing or will there be two alternative permit processes? I'm afraid that with two separate processes the existing pathological, genetic, and management safeguards may be lessened or neutralized. If it is necessary to have a new statute, I want to see

transport or aquisition remain under Title 16. However, I believe the existing FTF system is adequate to allow for development of algal and shellfish culture.

What clinches my opposition to Bill 106 are the proposed ammendments to Title 16 of the Alaska Statutes. It is the proposed exemption of fish farming from regulation by the Board of Fisheries, from participation in ASMI, from recognition as a commercial fisheries activity, or from regulation by the Commercial Fisheries Entry Commission, that generates the animosity from most segements of the fish production industry against the concept of mariculture. All the other participants in the Alaska seafood business have to play by the system. Bill 106 would give an unfair competitive advantage to a new mariculture industry that is supposed to be complementary to the existing industry.

Next, I'd like to question certain conclusions presented in the report titled "Aquaculture in Alaska". I believe the report understates the current level of salmon cultural technology practiced in Alaska. I would argue that Alaska already has legal salmon pen culture for coho and chinook, and you can see examples of it at Neets Bay, Hidden Falls, Medvejie Creek, Taku Harbor, and Carroll Inlet. These are FRED and PNP facilities that rear the salmon to the optimal size necessary to generate maximum social and economic benefits in relation to dollar expenditure.

I agree with the report that this program is the best investment the state has made in renewable natural resources and that it remains the first choice for future investment. However, the report seems to imply that the investment is completed and that now it is time tap the enhancement loan fund to enable development of private salmon farms. Who said the present program is done? If Alaska needs to increase chinook and coho production to avoid erosion in premium salmon markets then why not promote expansion of the FRED and PNP programs? I believe that from a social standpoint it would be the most cost-effective method to retain Alaska's market share of world salmon production and would be consistent with earlier recommendations from the Fisheries Mini Cabinet.

The report understates the impact of the regional aquaculture associations. Alaska's associations rival any of the Japanese, Norwegian, or Canadian "models of cooperation" mentioned by the House Research Agency. Much of the success of the present FRED and PNP program arises because of the comprehensive salmon production planning that resulted from the cooperation of the state, the regional associations, and the federal government. The existence of the programatic goals contained in these plans increased the probability of success of the present investments.

What disturbs me is the lack of evidence of a reciprocal publically identifiable plan or goal for a new mariculture industry, presented either in the bill or in the report. Without a publically supported plan, and quantifiable goals and objectives, an Alaskan mariculture industry will quickly resemble the uncontrolled Canadian example. Problems will arise that will be impossible to resolve.

Another conclusion in the report I question is the premise that there will be surplus chinook eggs that could be sold to salmon farmers without affecting the quota imposed on Alaska by the U.S./Canada Salmon Treaty. This is incorrect. What limits Alaska's hatchery-originated chinook production is not

egg incubation space but rather water availability and containment structures for feeding and rearing juvenile fish. The present method to bypass these constraints is to transport surplus fry to saltwater rearing pens at locations away from the hatchery central incubation facility in order to maximize production and spread the locus of terminal harvests. These fish are optimally released as either 0. or 1. check smolts and result in an addition to Alaska's chinook quota. Further, they serve to secure Alaska's access to our coastal production resources.

What happens when a FRED or PNP project cannot site a saltwater net complex because a private salmon farm also desires the same site? What happens is that existing Alaska industry loses potential market share for premium quality salmon. This is an example of the allocative issues mentioned last week by Dr. Allee.

Should these siting questions be addressed or coordinated through a comprehensive salmon production plan? I think they should. However, it would be difficult to revise or update the present salmon production plans to include recommended development zones for mariculture without a comprehensive assessment of the state's potential. The only quantification of viable culture sites is the report's statement that the potential appears to be "quite large". The case with actual salmon hatcheries has proven otherwise. The real number of viable salmon enhancement opportunities has turned out to be quite less than original estimates.

I believe it is ill advised for the state to throw the door wide open for the development of the remaining sites by private industry without knowing the potential of the resource. Further, it is ill advised to invite site development without a clear goal and a plan for utilization that provides for the greatest public benefit.

In summary, while I oppose Bill 106, I support the concept of a complementary mariculture industry. I'm in favor of funding for a mariculture resource inventory and for the resumption of funding for the regional comprehensive planning program that was halted in FY 87. Without this information, and a relevant salmon production plan, Alaska's fish production industry will actually resemble the inefficient and overcapitalized situation alluded to in the House Research Agency report.

Thank you. I've left a copy of my prepared remarks with the LIO in Petersburg and I'm available for any additional questions the committee may have.

*CHRIS did not have the
time to present this
Testimony to the Committee*

MARICULTURE
ISSUES AND PROPOSED GOALS AND GUIDELINES

PLANNING TEAM DRAFT

PRINCE WILLIAM SOUND AREA PLAN
PRINCE OF WALES ISLAND AREA PLAN

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INTRODUCTION TO MARICULTURE IN ALASKA

The headlines of the Southeastern Log on August 25, 1986 read, "Mariculture, a boom about to happen." In recent months, with the state economy on the skids and people taking a fresh look at options for finding viable and stable economic projects in the state, the subject of mariculture has been receiving increased interest. In just this year alone, DNR has issued a total of XXXXXX permits for mariculture. An additional XXXXXX applications are currently waiting to be processed. Along with the increase in the number of permits issued there also has been an increase in the number of voices that are identifying problems with mariculture. User groups, local residents, native corporations and federal agencies are identifying conflicts that have not been clearly articulated to date since up until recently mariculture received only minor interest in the state. The department does not have a clear policy or set of guidelines for dealing with mariculture.

This paper is intended to be a starting point for discussions that will result in DNR policy. The paper first outlines the department's proposed goals for mariculture. Then, issues that have been identified are presented and recommendations made. Those recommendations that are accepted will be included in the Prince William Sound and Prince of Wales Island Area Plan Agency Review drafts as area wide policies and guidelines for mariculture. The plans may also identify areas where mariculture is a designated use or a prohibited use based on its compatibility or incompatibility with other important uses of state tidelands.

Proposed Definition of Mariculture. The culture and husbandry of marine aquatic organisms, including but not limited to fish,* shellfish, mollusks, crustaceans, kelp and other algae. This does not include fish hatcheries.

*Note: At this time, rearing salmon is not legal in Alaska. Two identical bills were introduced in the legislature on February 4, 1987 (HB 108 and SB 106) that would enable finfish mariculture to be allowed through a change in regulations by the Department of Commerce and Economic Development.

Issue 1: DNR Goals

Description of the Issue

Mariculture is a new industry in Alaska and has potential to play a role in a diversified state economy. For these reasons the Department of Natural Resources supports mariculture development along with other uses of state lands.

The competition between mariculture and other uses is the subject of the rest of this paper. At this point, it is important to

establish the department's goals for mariculture. The proposed goals are as follows.

Proposed Goals for Mariculture

- GOAL #1 Economic Opportunities and Community Development.
Opportunities to increase income and diversify the state's economy through the use of state tide and submerged lands for mariculture.
- GOAL #2 Optimum Use of Areas. The optimum use of the most suitable mariculture areas.

Issue 2: Competition Between Mariculture and Other Commercial and Industrial Uses of State Tide and Submerged lands.

Description of the Issue

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

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

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

In Washington State mariculture sites have created navigational hazards. Log rafts towed by tugboats need ample space to navigate and may be effectively blocked by a mariculture facility.

Commercial Fishing. Mariculture sites are often located in good anchorages for protection from the weather. Though operations may initially be small (1-3 acres), mariculture sites can grow to be, or even start, quite large (over 20 acres). Use of bays as important anchorages by the fishing fleet and associated operations, such as fish buyers, could slowly be displaced as the

mariculture facility expanded. A fishing boat at anchor requires considerable room to allow for changing tides, winds and currents. Although permits retain legal public access outside of improvements, the area remaining may not be sufficient to allow for adequate anchoring in smaller coves with expanding mariculture facilities. There is also the potential for commercial setnet sites, purse seine hook-offs, and other commercial harvest areas to be blocked by mariculture facilities.

Recreation. As a result of human waste, high coliform develops in the vicinity of high recreational boat use, wharves and marinas. Commercial fishing operations (tenders, seiners, etc.) experience similar coliform counts. Washington prohibits mariculture within one-quarter mile of state parks, popular recreation areas and anchorages, and primary navigational routes. There is also the potential for toxic effects from bottom paints on boats.

Mariculture. Mariculture operations may compete with other mariculture operations for space and for food carried by the tidal currents. They may also impact each other by transmitting disease or lowering down-current water quality. Separation guidelines in British Columbia and Washington require 0.8 kilometer (proposed to be increased to 3 km) and 2 miles respectively between most operations.

Current Process for Addressing the Issues

The department has no policy to guide adjudicators when potentially conflicting uses are proposed for the same area. Some of the issues raised above are addressed under the current permit review process. The Army Corps of Engineers and the Department of Environmental Conservation do a public notice for concerns related to navigation, wetlands, and water quality. Adjacent upland owners who might be planning mineral or timber development are notified of the proposed project by DNR adjudicators.

However, the DNR permitting process does not require public notice (a lease does), so concerns of competing tideland users are not specifically sought through a public process. This can make it difficult to assess the potential conflicts between proposed mariculture facilities and other uses such as existing mariculture facilities, anchorages used by the commercial fishing fleet, or potential timber or mineral development sites.

Recommendations

There are several fundamental assumptions underlying the policies and designations proposed as the means to address the issues raised here. First, it is assumed that there are enough suitable tideland sites to avoid potential conflicts and accommodate all potentially competing uses somewhere without having to unreasonably restrict any use. Fortunately, Prince William Sound has a

long, 3,200-mile, coastline with many capable mariculture sites. There is only a small portion of that coastline where developed uses are planned that could preclude mariculture. Therefore, an appropriate method for accommodating and encouraging the mariculture industry in the Prince William Sound will be to allow mariculture in most areas and rely on siting guidelines to resolve potential conflicts.

* A second assumption is that some uses may be restricted in some areas in order to avoid conflict. The general approach is to only restrict uses where there is an absolute conflict that cannot otherwise be reasonably mitigated. Where a choice has to be made, the use with the greater public benefit and fewer options for alternative siting will be favored. The Prince of Wales Island Area Plan proposes alternative approaches to designations for mariculture while the Prince William Sound Plan will deal with the issue primarily through guidelines.

The third assumption is that, unlike some uses such as mineral and timber transfer and support facilities, it is doubtful that there will be adequate data to allow the identification and designation of many areas for mariculture.

The following guidelines are intended to help managers fairly balance potentially competing uses when they make tideland allocation decisions the plans do not have the information to make now.

For Prince of Wales Island Area Plan Guideline A below should be reviewed under the assumption that the alternative that does not prohibit mariculture in any areas is chosen.

Guidelines for competing commercial uses

- A. Mariculture and Competing Uses. Mariculture is encouraged on all state tidelands where there is not a significant competing use. The siting of mariculture facilities is discouraged on all tidelands designated for log transfer or storage, mineral transfer or access, or other commercial activities. These areas will be available for mariculture (a) if the land manager determines that it is possible to site, design, and operate the two or more uses compatibly in the area, or (b) there is no feasible and prudent alternative for mariculture while one exists for the competing use. In no case will mariculture be allowed to foreclose access to mineral, timber, or developed recreation resources unless feasible or prudent alternative access exists. In some cases it may be in the public interest to concentrate uses in one bay, (i.e. pen-reared salmon and timber transfer) rather than allowing the proliferation of uses in many bays.
- B. Separation Between Facilities. Mariculture operations will be sited to avoid the risk of disease transmission and competition for food from existing mariculture developments.

Permitted mariculturists that may be affected by a proposed operation should be notified and given an opportunity to comment. Generally, a two mile separation should exist between finfish operations. Other types of mariculture, such as shellfish may be more closely grouped together.

Issue 3. Mariculture and Upland Management.

Description of the Issue

Mariculture may affect activities on adjacent and nearby uplands. Resource extraction on the uplands, even without associated support facilities on the tidelands, may, for instance, affect water quality or reduce wind protection. Forcing mitigation on the upland manager to protect mariculture facilities could reduce or eliminate economic viability of upland resource development.

Mariculture generally requires a caretaker for feeding and security purposes. At this time, DNR permits for mariculture are generally only for the actual mariculture facilities. Caretaker facilities require a separate permit. Upland managers (primarily the USFS) are reluctant to issue permits for caretaker cabins because of the implied permanence and the potential for abandonment. Therefore, where caretaker facilities are not addressed in the tidelands permit and where decisions on the tidelands are not coordinated with the upland owner, floathouses or upland cabins are likely to be placed in trespass.

The economic viability of the mariculture operation may be in jeopardy if the upland owner does not grant the operator the right to use the uplands for needed support facilities, thus forcing the operator to develop more expensive floating facilities.

Because of access to transportation systems and commercial support services, mariculturists may find it economical to locate near communities. However, mariculture may also be incompatible with residential uses on adjacent uplands. Sewage disposal, theft, the potential for trespass, aesthetic concerns, and competition for tideland space by upland residents can make mariculture undesirable directly adjacent to residential areas.

Current Process for Addressing the Issues

Under the current DNR permit review process, the immediately adjacent upland owner is notified during the coastal consistency process. Nearby upland owners whose activities may be impacted by the stringent water quality standards of mariculture are notified only in the DEC/COE public notice. By procedure, DNR permittees in the southeast region request applicants to submit applications or identify the method of caretaking. The department does not have a policy on what to do if upland owners object to mariculture facilities.

Recommendations

Proposed guidelines for upland owner concerns

- C. Coordination with the Upland Manager. The department will try to coordinate its management of the tidelands with the needs of the upland owner. While the department can neither put a moratorium on permitting mariculture facilities adjacent to private or federal uplands nor close those areas to mariculture, it will endeavor to coordinate its tideland management with the upland needs. On the other hand, upland owners are encouraged to locate areas where mariculture (including upland facilities) should be encouraged and to communicate their conclusions to the department and to the mariculture industry.
- D. Upland Owner Objections. An application for mariculture facilities adjacent to private or federal land will be approved if the application meets the other guidelines of this plan, and either the applicant has the approval of the upland owner or the department receives no objection from the upland owner. If the upland owner does object and suggests a feasible alternative site (one that is both physically suitable, meets both the guidelines of this plan and other permit requirements, and has the approval of that upland owner), the department will uphold the upland owner's objection. If the objection is not accompanied by the suggestion of a feasible alternative site, the department will adjudicate the permit or lease application considering at least the following:
- (1) the feasibility of using site design and/or operating stipulations to minimize or eliminate the objection;
 - (2) the presence or absence of feasible alternative sites where there would be no conflict between upland management and mariculture facilities; and
 - (3) the cost to the public or the upland owner of approving the facility.
- E. Permission of Upland Owner. Permits/leases will not be granted for applications that show support facilities, including shoreties, on the adjacent uplands unless there is a demonstrable agreement between the applicant and the upland owner. The term of the lease/permit will not be longer than the term of the agreement between the applicant and the upland owner. If the applicant has not made arrangements for the use of the adjacent uplands, the application must show how all necessary housing, warehousing, processing and other associated uses will be accommodated on the tidelands.

F. Consistency with State Upland Management. Mariculture facilities adjacent to state uplands will be consistent with the upland management intent.

** See also guideline V for coordinated permitting proposal.

Issue 4: Mariculture and Public Use

Description of the Issue

Mariculture sites may effectively block or inhibit public access to important recreation and subsistence use areas. The expectation and desire for seclusion when recreating in rural Alaska is highly valued by residents and visitors. If the sense of seclusion is lost an important part of the aesthetics of many bays is lost and the recreational experience is less valuable. A mariculture facility, particularly with caretaker facilities and in a smaller cove, will essentially eliminate that sense of seclusion for recreation users other than the permit holder. The tendency will be for traditional recreational users of the cove to find other, secluded and aesthetically pleasing areas. This is a significant problem in Washington, British Columbia and California. The Washington Department of Ecology has documented the aesthetic impacts of mariculture in Puget Sound. British Columbia placed a moratorium on issuing permits partly because of aesthetic effects.

These experiences, plus some here in Alaska, demonstrate that activities affecting the natural and scenic features of an area may cause controversy. Interestingly, AS 41.21.302 specifically allows aquaculture facilities in the State Marine Park system. The Division of Parks and Outdoor Recreation interprets aquaculture in this statute to mean only facilities operated by the Department of Fish and Game.

In order to protect their investment from sewage discharge, theft, etc., mariculturists may discourage recreationists from using the area. In other states and in Canada bays have been roped off and shots fired to discourage public use of areas with mariculture facilities.

The noise and general effects of local habitation associated with mariculture will also tend to displace wildlife. Mariculture employees will increase competition for resources such as beach logs, berries, and wildlife. Facilities may also bar access to or directly impact traditional harvest areas.

Current Process for Addressing the Issue

Land Use Permits technically allow public access to all but the actual physical improvements covered under the permit. Thus, some of the problems are primarily ones of perception and enforcement and not legality. Access is addressed through the Coastal Consistency process, but public notice for area users to

comment is not included in the DNR permit review process. Besides the coastal standards, DNR only has the general policy that legal public access be maintained along state tidelands.

Recommendations

In general, mariculture facilities are compatible with dispersed recreation. However, in chapter 3 of the Prince William Sound Area Plan mariculture will be discouraged from high use areas where the amount of recreation currently exceeds or is projected to exceed the capacity of the available anchorages or campsites. In addition, mariculture -- especially the caretaker facilities -- are discouraged in Prince William Sound in areas proposed for wilderness, tourist attractions (like the Columbia Glacier), and adjacent to developed recreating facilities. In both plans access will be maintained to resources such as campsites, fishing/hunting areas, anchorages, and trails.

For Prince of Wales Island Area Plan the following guidelines should be reviewed under the assumption that the alternative which does not prohibit mariculture in any areas is chosen.

Proposed Guidelines for recreation and public use conflicts

G. Use of Anchorages and Recreation Areas. Mariculture is discouraged from designated or other important anchorages, campsites, or high use recreation areas where the land manager finds that mariculture will significantly diminish the remote, secluded nature of the anchorage or would significantly diminish its capacity. These areas are delineated in the management intent discussions or on the maps in Chapter 3 of the plans.

H. (Prince William Sound only) Developed Recreation Facilities. Mariculture is not allowed adjacent to designated recreation sites or developed recreation facilities unless the facility manager or the land manager determines that the two uses can be made compatible by design, siting, or operating guidelines.

I. Mariculture Caretaker Facilities. Floating caretaker facilities for mariculture operations are encouraged in areas where there is no significant competing use. Floating caretaker facilities for mariculture operations will not be allowed in designated recreation or personal use areas unless the regional manager determines that there is no feasible or prudent alternative. The determination will be made available for public comment.

J. Access to trails and other public access points. Mariculture will not foreclose public access to important

clamming areas, trails, public beaches or other similar public resources.

Issue 5: Mariculture Facilities in Crucial and Prime Habitat Areas

Description of the Issue

In his 1986 report entitled, "The Environmental Effects of Floating Mariculture in Puget Sound," Dr. Donald P. Weston, of the University of Washington School of Oceanography, found that few negative impacts from mariculture operations on fish and wildlife or their habitats have been substantiated. However, there is the possibility that significant habitats, such as eel grass beds, and species such as geoducks could be buried by debris and lost. Furthermore, mariculture facilities, like any other floating facility, can block fish passage if placed in the mouth of a fish stream they can compact productive substrates if allowed to ground.

Marine mammals are attracted to the concentration of delectable food contained within mariculture facilities. The presence and "trespass" of marine mammals can be a nuisance to mariculturists. Unfortunately, they not only cause the mariculturists grief but also put themselves at risk by becoming entangled in the nets and occasionally drowning. In Washington state, some mariculturists have received exclusion to the Marine Mammal Protection Act and are allowed to kill marine mammals that are a nuisance to their operation.

Petroleum spills may cause long term degradation of the habitat value of public tidelands and may impact adjacent mariculture facilities. The impacts are worse where currents and flushing are minimal.

Current Process for Addressing the Issue

Agency review of leases and permits is the process now used to identify potential conflicts between mariculture and habitat areas. DNR permits do not receive public review nor are adjacent mariculturists or some nearby upland managers asked to comment (the directly adjacent upland owner is given notice), therefore, many potential conflicts may not be identified at the time the permit decision is made. The Corps of Engineers and Department of Environmental Conservation issue public notices and copy any comments to DNR.

DEC does not regulate oil and gas storage below XXXXXX gallons, so there is no formal method of addressing this potentially significant issue. ADNR has in the past required stipulations on its land use permits that address petroleum storage below amounts covered under DEC regulations.

Recommendations

Outlined below are guidelines that will be used to help managers decide how to avoid potential conflicts between Mariculture facilities and crucial or prime habitats.

Proposed guidelines for mariculture in significant habitats

- K. (Prince of Wales only) Siting in Certain Habitats. Mariculture facilities should not be sited on or within 300 feet of extensive kelp or eelgrass beds; seaweed harvest areas; or shellfish concentration areas (as identified in the ADF&G Regional Guides or determined by ADF&G) unless the manager determines after consultation with ADF&G that there is no feasible and prudent alternative.
- L. Siting Near Anadromous Fish Streams. Mariculture facilities will not be sited within 300' of the mouth of a catalogued anadromous fish stream at Mean Lower Low Water without the approval of ADF&G.
- M. (Prince of Wales only) Siting Near Marine Mammals and Seabirds. Mariculture facilities will be at least one-half mile from marine mammal and seabird concentration areas (as identified in the ADF&G Regional Guides or determined by ADF&G).
- N. Designing to Prevent Marine Mammal Entanglement. Mariculture facilities should be designed to prevent entanglement of marine mammals.
- O. Dissolved Oxygen Depletion. Pens will not be sited where respiration and biochemical oxygen demand will significantly depress dissolved oxygen concentrations or where nutrient input attributable to net-pen culture will affect the frequency, extent, intensity or duration of phytoplankton blooms.
- P. Tri-n-butyltin. Tri-n-butyltin should not be used as an antifouling agent on nets.
- Q. Water Circulation. In order to maintain water circulation and flushing action which disperses pollutants, net-pens should occupy no more than one-third the water column depth.
- R. Storage of Petroleum Products. Petroleum products will be stored in a manner that will prevent spillage onto the tidelands or aquatic waters.
- ** See also Guideline X2 for policy on grounding at mean lower low water.

Issue 6: Floathomes and Mariculture

Description of the Issue

There is potential for coliform pollution of mariculture sites from nearby floathome waste water discharge. The waste of one person requires 8 million cubic feet of water to dilute to acceptable standards. Greywater presents related problems. These concerns are the same for floating mariculture caretaker facilities.

While few floathouses exist in Prince William Sound, there are up to 100 unauthorized floathomes on Prince of Wales Island. These may not conform to DEC wastewater standards. They occupy potential sites for mariculture development. Refer to the issue papers and proposed guidelines for floating settlement facilities under Floathomes in the Draft Plan.

Current Process for Addressing the Issue

The current permit process does not require DNR public notice for floathomes (although the COE and DEC do a joint notice) so mariculture permit holders do not get a chance to comment on proposed floathome permits. Since most floathome owners do not bother to get permits it is almost impossible to control the problem before it occurs and a complaint is filed.

Proposed guidelines for floathome conflicts

S. Highest Economic Benefits. Where there are conflicts between floathomes and other uses, the department generally will decide in favor of the applicant with the greatest economic benefit to the state. Except for areas designated for floathome settlement, competing applications between floathomes and mariculture will favor economically viable mariculture unless the regional manager determines it is in the state's interest to permit the floathome or there are more reasonable and prudent alternatives for the mariculturist. Where a floathome is already permitted at a site proposed for a mariculture facility, the regional manager will determine if there are feasible and prudent alternatives for the mariculture operation and weigh the impacts on the permitted floathome resident. Unpermitted floathomes will not be given any standing in the permit adjudication process. This guideline also applies to floating caretaker facilities for mariculture.

** See also Guideline I for policy on floating caretaker facilities.

** See also Guideline W for policy on public notice.

** See also Guidelines on Floathomes.

Issue 7: Speculation and Economic Viability

Description of the Issue

Aquaculture permits do not require proof of economic viability or intent. A non-existent or perennially non-profitable operation may continue to occupy a favorite bay to the detriment of other public benefits or uses and other mariculture operations. There is concern that permits are secured for speculation purposes, making the area unavailable to legitimate applicants. For example, only a small percentage of existing mariculture permits in Southeast actually have development on them, let alone produce seafood.

Mariculture permits may be used as a front for acquiring a private secluded residence or vacation home on public lands. A small oyster raft next to a floathouse might grease the wheels for getting the right to use a particular bay for an exclusive private residence. The mariculture permit may provide a loophole for obtaining a USFS Special Use Cabin Permit.

Current Process for Addressing the Issue

Economic viability is currently not addressed in ADNR permitting. The USFS requires an Environmental Assessment and economic prospectus in order to issue a "Special Use Permit" for commercial upland facilities, this includes support facilities or caretaker cabins for aquaculture sites. The USFS is not inclined to issue "Special Use Permits" for aquaculture support facilities until an operation is proven to be successful.

Proposed guidelines for speculation and economic viability

- T. Performance Standards. The Regional Manager will attach reasonable performance standards to the permit or lease for project development and operation. The performance standards are to ensure the permitted area is used for the approved activity, the proposal is economically viable, and the permit is not held for speculation or removal of a land base from competition. In all cases the approved development plan must be adhered to. If the performance standards are not met, the permit or lease may be cancelled.
- U. Clean-up Bonds. A clean-up bond may be required to protect existing resources for future use.

Issue 8: Permit Procedures

Description of the Issue

Agencies requiring permits related to siting of mariculture facilities include the Departments of Natural Resources, Environmental Conservation, possibly Fish and Game, and the Army Corps of Engineers. The upland land owner/manager may also require permits. Separate applications are required from each agency. The Division of Governmental Coordination coordinates review of