

ALASKA LEGISLATURE SPECIAL COMMITTEE/SUBJECT FILE 8672
1881 SCOMM 75: MARICULTURE (FISH FARMING), 1987-1990

99

PUBLIC HEARING: Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing.

CULTURAL RESOURCES: The latest published version of the National Register of Historic Places has been consulted for the presence or absence of registered properties, or properties listed as being eligible for inclusion therein, and this worksite is not registered property or property listed as being eligible for inclusion in the Register. The construction site may be located at the abandonment townsite of Coppermount.

ENDANGERED SPECIES: No threatened or endangered species are known to use the project area. Preliminarily, the described activity will not affect endangered species, or their critical habitat designated as endangered or threatened, under the Endangered Species Act of 1973 (87 Stat. 844). This application is being coordinated with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Any comments they may have concerning endangered or threatened wildlife or plants or their critical habitat will be considered in our final assessment of the described work.

FEDERAL SPECIES OF CONCERN: None

FLOOD PLAIN MANAGEMENT: Evaluation of the described activity will include conformance with appropriate State or local flood plain standards; consideration of alternative sites and methods of accomplishment; and weighing of the positive, concentrated and dispersed, and short and long-term impacts on the flood plain.

SPECIAL AREA DESIGNATION: The project is located within the Tongass National Forest.

EVALUATION: The decision whether to issue a permit will be based on an evaluation of the probable impacts including cumulative impacts of the proposed activity and its intended use on the public interest. Evaluation of the probable impacts which the proposed activity may have on the public interest requires a careful weighing of all those factors which become relevant in each particular case. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. The decision whether to authorize a proposal, and if so the conditions under which it will be allowed to occur, are therefore determined by the outcome of the general balancing process. That decision should reflect the national concern for both protection and utilization of important resources. All factors which may be relevant to the proposal must be considered including the cumulative effects thereof. Among those are conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people. For activities involving 404 discharges, a permit will be denied if the discharge that would be authorized by such permit would not comply with the Environmental Protection Agency's 404(b)(1) guidelines. Subject to the preceding sentence and any other applicable guidelines or criteria (see Sections 320.2 and 320.3), a permit will be granted unless the District Engineer determines that it would be contrary to the public interest.

AUTHORITY: This permit will be issued or denied under the following authorities:

(X) Perform work in or affecting navigable waters of the United States - Section 10, Rivers and Harbors Act 1899 (33 U.S.C. 403).

(X) Discharge dredged or fill material into waters of the United States - Section 404, Clean Water Act (33 U.S.C. 1344). Therefore, our public interest review will consider the guidelines set forth under Section 404(b) of the Clean Water Act (40 CFR 230).

Comments on the described work, with the reference number, should reach this office no later than the expiration date of this Public Notice to become part of the record and be considered in the decision. If further information is desired concerning this notice, contact Mr. Don R. Rice at (907) 753-2712.

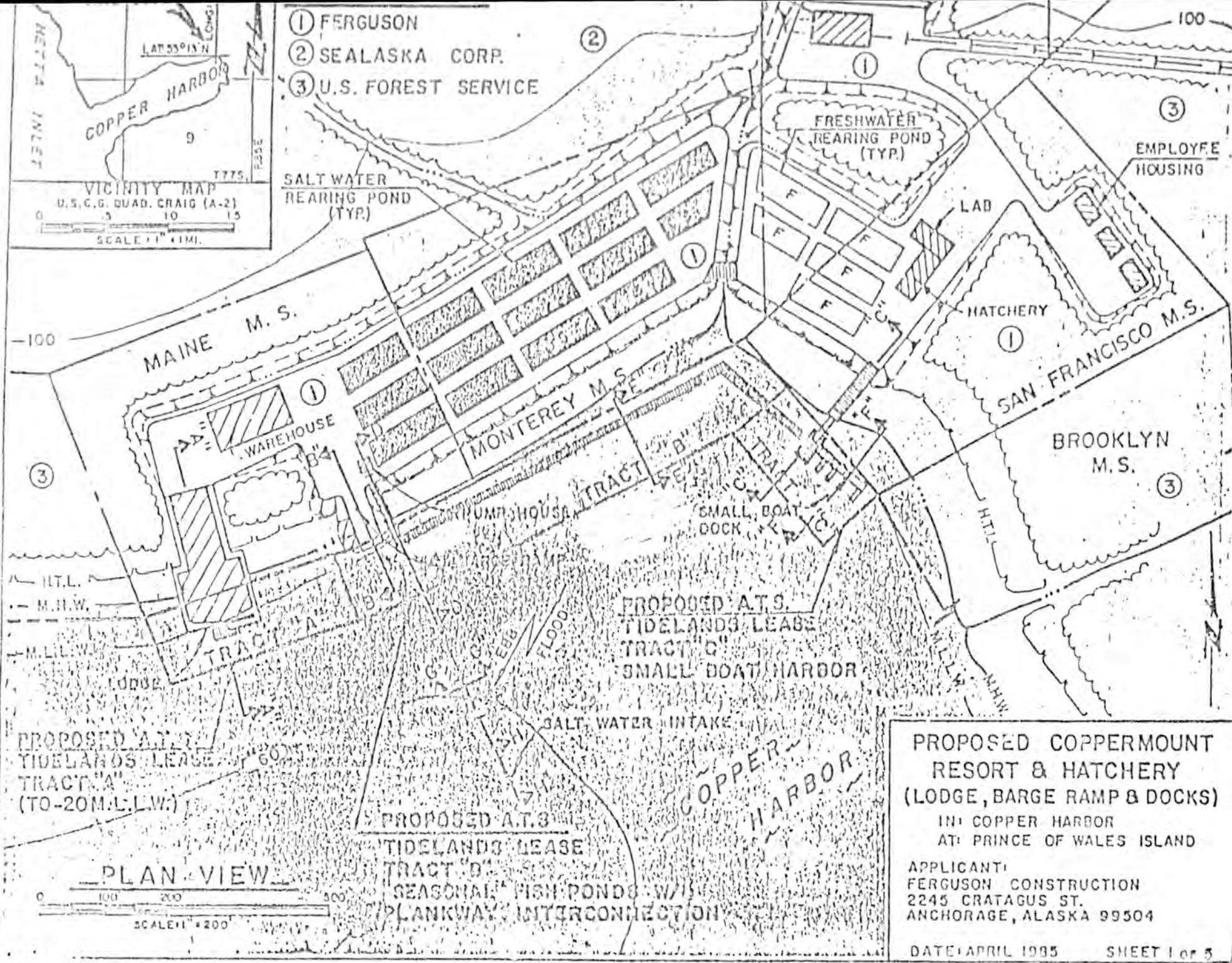
A plan, Notice of Application for Certification of Consistency with the Alaska Coastal Management Program, and Notice of Application for State Water Quality Certification are attached to this Public Notice.

District Engineer
U.S. Army, Corps of Engineers

Attachments



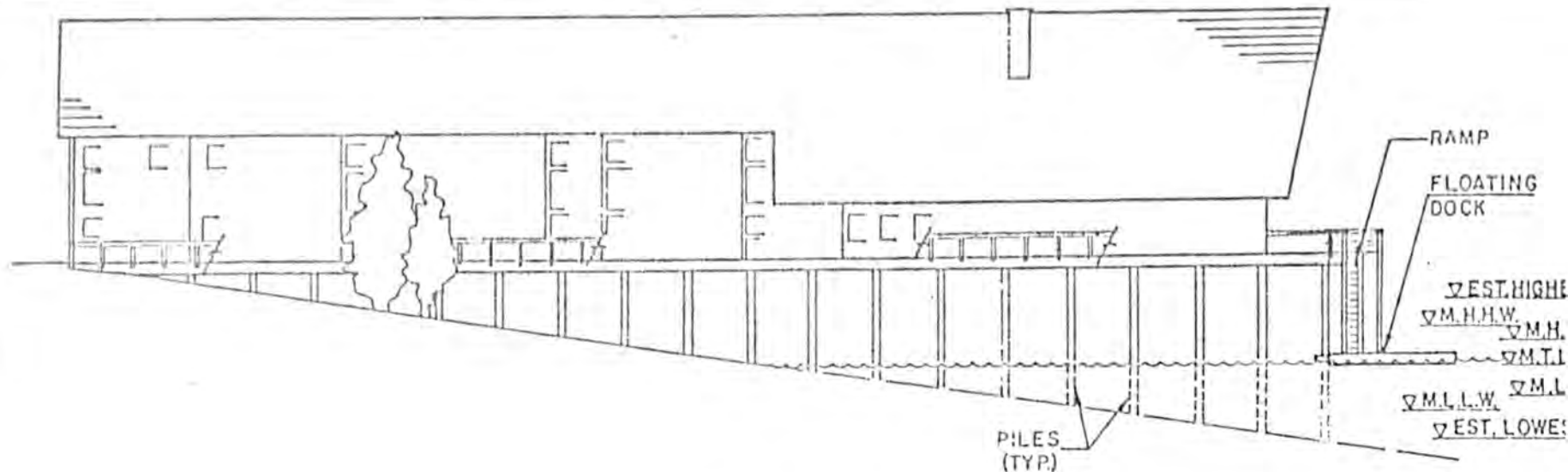
- ① FERGUSON
- ② SEALASKA CORP.
- ③ U.S. FOREST SERVICE



**PROPOSED COPPERMOUNT
RESORT & HATCHERY
(LODGE, BARGE RAMP & DOCKS)**

IN: COPPER HARBOR
AT: PRINCE OF WALES ISLAND

APPLICANT:
FERGUSON CONSTRUCTION
2245 CRATAGUS ST.
ANCHORAGE, ALASKA 99504



SECTION "A-A"

NOTE: APPROXIMATELY 60. TIMBER PILES WILL BE PLACED BELOW THE MEAN HIGH WATER LINE, AND WILL BE USED AS THE FOUNDATION FOR A LODGE. ALSO, A RAMP AND DOCK WILL BE CONSTRUCTED AS SHOWN.

COPPER HARBOR
TIDAL DATUM
U.S.C. & G.S. - 1958
LAT. 55° 12.6'; LONG. 132° 37.5'

ESTIMATED HIGHEST WATER	16.5'
MEAN HIGHER HIGH WATER	12.8
MEAN HIGH WATER	11.9
MEAN TIDE LEVEL	8.7
MEAN LOW WATER	1.5
MEAN LOWER LOW WATER	0.0
ESTIMATED LOWEST WATER	-4.0

SOURCE: U.S.C. & G.S. PUBLICATION
S.E. ALASKA - GG

NOTE: THE HIGH TIDE LINE EL. = 14.5', AS
FURNISHED BY THE ARMY CORPS OF ENGINEERS

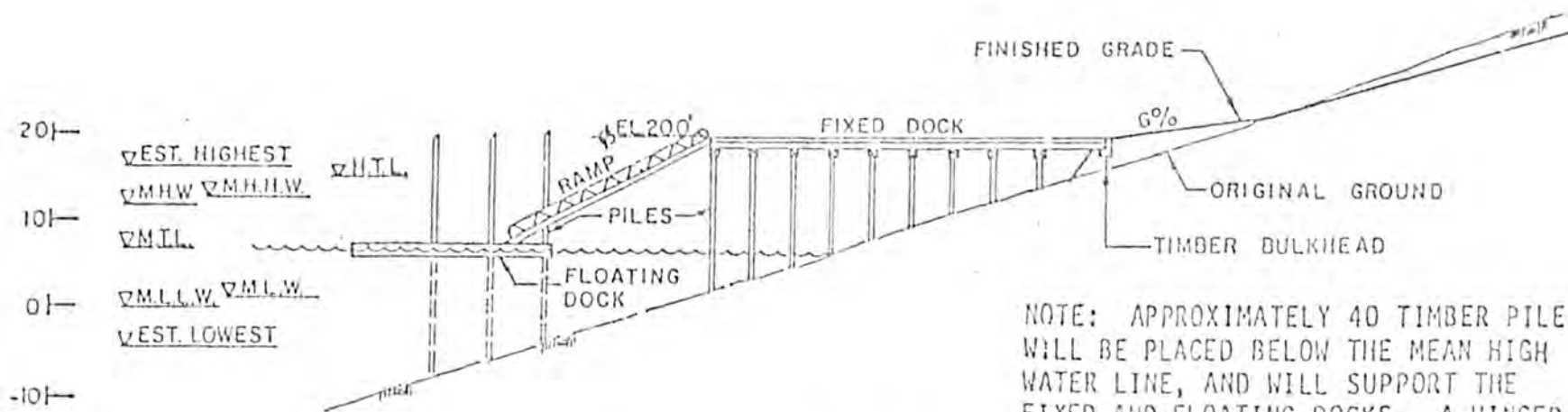
PROPOSED COPPERMOUNT RESORT & HATCHERY (LODGE, BARGE RAMP & DOCKS)

IN: COPPER HARBOR
AT: PRINCE OF WALES ISLAND

APPLICANT:
FERGUSON CONSTRUCTION
2245 CRATAGUS ST.
ANCHORAGE, ALASKA 99504

DATE: APRIL 1985

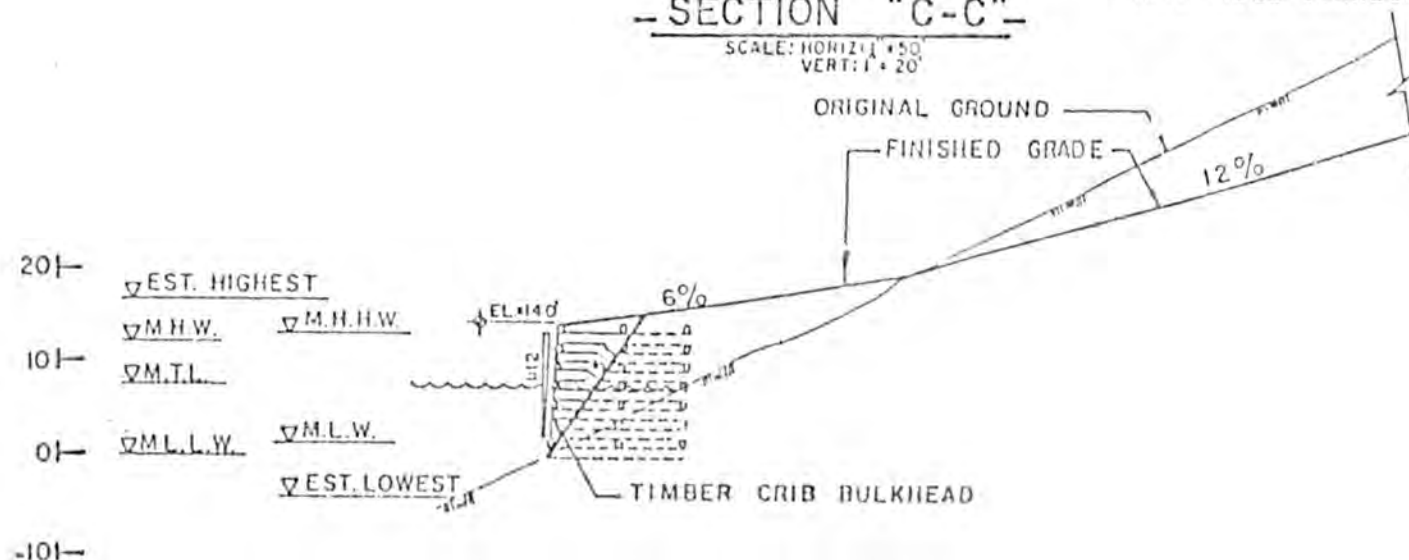
SHEET 2 of 5



SECTION "C-C"

SCALE: HORIZ: 1" = 50'
VERT: 1" = 20'

NOTE: APPROXIMATELY 40 TIMBER PILES WILL BE PLACED BELOW THE MEAN HIGH WATER LINE, AND WILL SUPPORT THE FIXED AND FLOATING DOCKS. A HINGED RAMP WILL CONNECT THE TWO AS SHOWN.

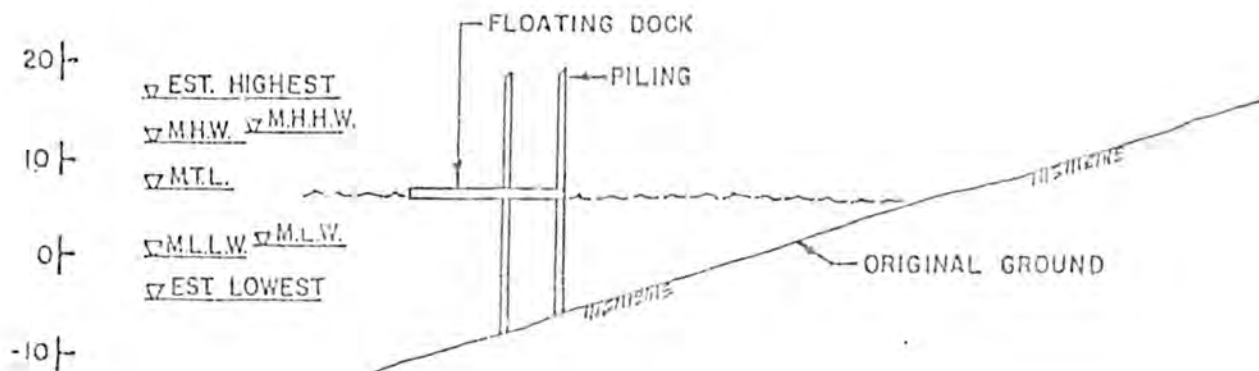


SECTION "B-B"

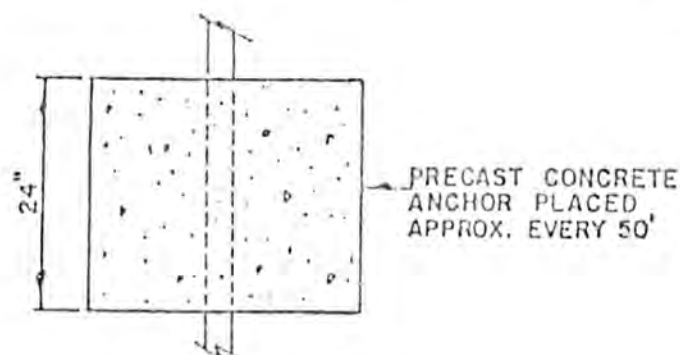
SCALE: HORIZ: 1" = 50'
VERT: 1" = 20'

NOTE: TO CONSTRUCT THE BARGE RAMP, A TIMBER CRIB BULKHEAD WILL BE CONSTRUCTED AT MEAN LOWER LOW WATER AND BACKFILLED WITH APPROXIMATELY 1,000 CUBIC YARDS OF SHOT ROCK FILL MATERIAL.

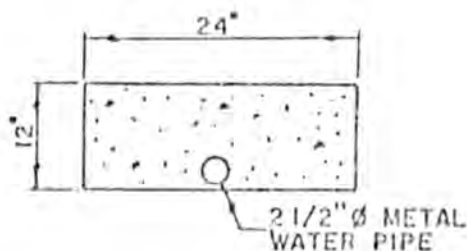
PROPOSED COPPERMOUNT
RESORT & HATCHERY
(LODGE, BARGE RAMP & DOCKS)
IN: COPPER HARBOR
AT: PRINCE OF WALES ISLAND
APPLICANT:
FERGUSON CONSTRUCTION
2245 CRATAGUS ST.



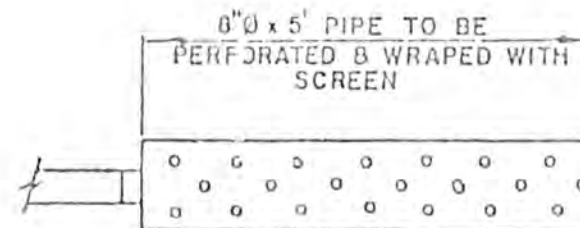
SECTION "F-F"
 SCALE: HORIZ: 1" = 50'
 VERT: 1" = 20'



PLAN VIEW



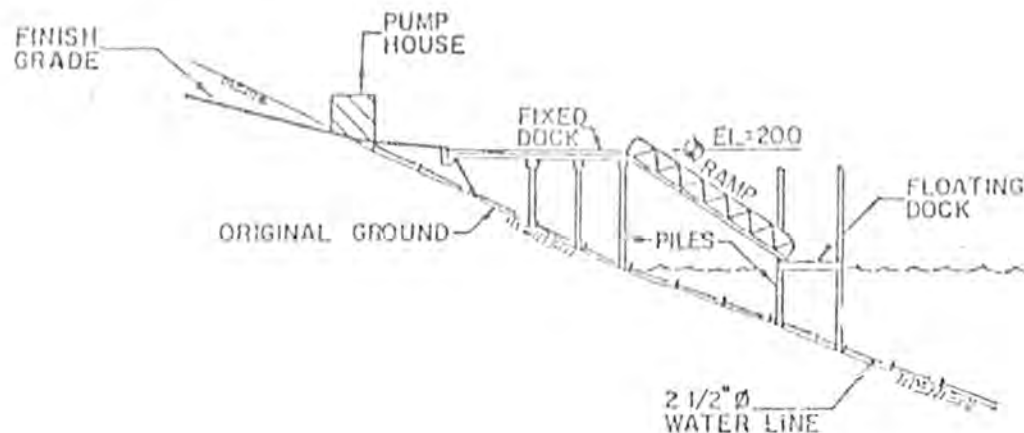
SECTION "G-G"
 N.T.S.



SECTION "H-H"
 N.T.S.

**PROPOSED COPPERMOUNT
 RESORT & HATCHERY
 (LODGE, BARGE RAMP & DOCKS)
 IN: COPPER HARBOR
 AT: PRINCE OF WALES ISLAND**

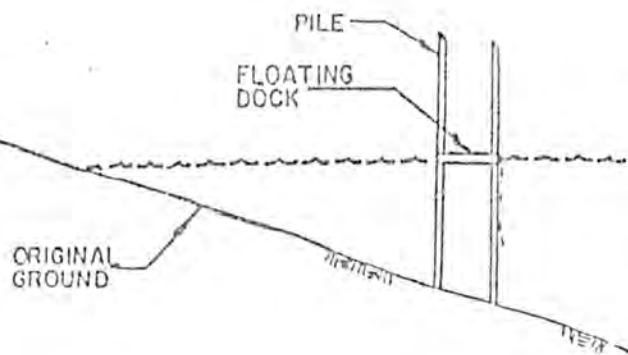
**APPLICANT:
 FERGUSON CONSTRUCTION
 2245 CRATAGUS ST.
 ANCHORAGE, ALASKA 99504**



∇ HTL	∇ EST. HIGHEST	-17
	∇ MHHW	
	∇ MHW	-10
	∇ MTL	
	∇ MLW	
	∇ MLLW	-10
	∇ EST. LOWEST	
		-10

SECTION "D-D"

SCALE: HORIZ: 1" = 50'
VERT: 1" = 20'



∇ EST. HIGHEST	-120
∇ MHHW	
∇ MHW	-10
∇ MTL	
∇ MLW	
∇ MLLW	-10
∇ EST. LOWEST	
	-10

SECTION "E-E"

SCALE: HORIZ: 1" = 50'
VERT: 1" = 20'

PROPOSED COPPERMOUNT
RESORT & HATCHERY
(LODGE, BARGE RAMP & DOCKS)

IN: COPPER HARBOR
AT: PRINCE OF WALES ISLAND

APPLICANT:
FERGUSON CONSTRUCTION
2245 CRATAGUS ST.
ANCHORAGE, ALASKA 99504

DATE: APRIL 1985 SHEET 4 of 5

STATE OF ALASKA

OFFICE OF THE GOVERNOR

OFFICE OF MANAGEMENT AND BUDGET DIVISION OF GOVERNMENTAL COORDINATION

BILL SHEFFIELD, GOVERNOR

CENTRAL OFFICE

POUCH AW
JUNEAU, ALASKA 99811-0165
PHONE: (907) 465-3562

SOUTHEAST REGIONAL OFFICE

131 NORTH FRANKLIN
POUCH AW, SUITE 101
JUNEAU, ALASKA 99811-0165
PHONE: (907) 465-3562

SOUTHCENTRAL REGIONAL OFFICE

2600 DENALI STREET
SUITE 700
ANCHORAGE, ALASKA 99503-2738
PHONE: (907) 274-1581

NORTHERN REGIONAL OFFICE

675 SEVENTH AVENUE
STATION H
FAIRBANKS, ALASKA 99701-4596
PHONE: (907) 455-3084

August 22, 1985

Mr. Thorne Ferguson
Ferguson Construction
1200 East 76th, Suite 1222
Anchorage, AK 99502

Dear Mr. Ferguson:

SUBJECT: Hetta Inlet 7
COE Number 071-OYD-2-850240

We have received copies of the coastal project questionnaire, the U.S. Army Corps of Engineers (COE) application and Department of Natural Resources (DNR) leave application you submitted for the referenced project. The COE permit application also serves as application for the Alaska Department of Environmental Conservation Certificate of Reasonable Assurance.

We have been informed by your agent that you have dropped the hatchery portion of your proposal at this time. DNR has recently informed me that a water right permit will be required for the resort. A handbook and application form are enclosed. Please contact DNR (Chris Landis, 465-3400) quickly to avoid as much delay as possible.

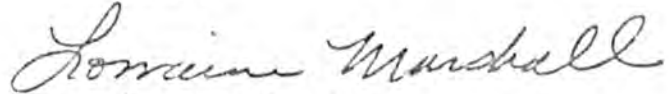
Also, have you contacted the Department of Fish and Game (DFG) (Jack Gustafson, 225-2027) to determine if a permit will be required from that department, and advise me of the DFG answer.

We will hold this material until we receive copies of all required permit applications and a notice from the COE regarding your application. Upon receipt of these items, the State will

August 22, 1985

begin review of your project, and we will then send you a letter informing you of that fact.

Sincerely,



Lorraine Marshall
Project Coordinator

cc: Jack Gustafson, DFG, Ketchikan
Paula Burgess, DNR, Juneau
Jerry Fiscus, DNR, Juneau
Chris Landis, DNR, Juneau
Permit Processing Section, COE, Anchorage

eb850822011md

STATE OF ALASKA
Interdepartmental Route Slip

TO: <i>W. G. Gustafson</i>	Department: <i>DNR</i>
Attention: <i>Sala Hunt</i>	
☐ Approval ☐ Signature ☐ Comment ☐ Contact Me ☐ Prepare Reply ☐ For Your File	☐ Note & Return ☐ Initial & Return ☐ Return as Requested ☐ Return for Approval ☐ Necessary Action ☐ For Your Information
Remarks:	
FROM: <i>W. G. Gustafson</i>	Department: <i>DNR</i>

WILHELM STREET
DEPARTMENT OF NATURAL RESOURCES
JUNEAU, ALASKA

return

Chris A. & Mary

Spoke with Dr. Ross Antipa, Chief of Staff of the Washington State Senate Committee on Environment and Natural Resources.

(Has PhD in fisheries biology and has done considerable research on fish disease. Now Committee staff in Senate. Olympia, phone number 206-786-7413)

So far no one has proven that the recent outbreaks of the deadly VHS fish disease in Washington are caused by the fish farming industry, but timing and other evidence certainly indicate the connection.

Last year over 500 Atlantic salmon were sold on commercial fish tickets. This is proof that large numbers of fish are escaping from fish farms and are entering the fisheries.

Many of the stocks used by Washington hatcheries and fish farms are imported from Europe. The eggs must be certified which should guarantee that they are disease-free. But certification is done by statistical sampling which leaves room for a large margin of error.

VHS virus first appeared last year at two hatcheries. This year it appeared at one more. Two of these three occurrences were within 10 miles of major Atlantic salmon farms. VHS has now shown up in wild salmon, so there are at least four areas with the virus. It has shown up in both coho and chinook. In Europe it has killed off huge numbers of wild trout.

Dr. Antipa notes that as soon as any fish farming is allowed, the farmers become a real political force, contributing to campaigns, lobbying, forming coalitions with other groups, working for changes in the regulations which restrict them, and so on. He said that has certainly been the experience in Washington and British Columbia.

STATE OF ALASKA

DEPARTMENT OF LAW

OFFICE OF THE ATTORNEY GENERAL

March 23, 1990

The Hon. Dick Eliason
Alaska State Legislature
P.O. Box V
Juneau, Alaska 99835

Dear Senator Eliason:

I am writing to reply to your letter of February 22 concerning the legal status of finfish farming after July 1, 1990. Although your letter was addressed to Larri Spengler, I am responding because I am now handling most of the mariculture issues that come before this office.

You asked the following, "What will the legal situation regarding finfish farming be in Alaska after July first if no bill is passed on the subject this session?" Your question acknowledges the fact that the current moratorium on finfish farming, enacted in ch. 70, SLA 1987 and extended in ch. 145, SLA 1988 will expire on that date. 1/

If current bills that permanently prohibit commercial finfish farming, i.e., SB 397 and HB 432, are not enacted this session, one pertinent statute that will remain is AS 16.05.920. This law says that unless it is authorized by another statute or regulation, a person may not possess fish. Current regulations do allow a person to hold fish if a certain permit is issued by the Department of Fish and Game. 5 AAC 41.001, 5 AAC 41.005. However,

1/ While current law imposes a general moratorium on finfish farming, it does authorize the Board of Fisheries to amend its regulations to allow issuance of a transport permit for finfish farming in a privately owned pond that has no outlet to state water. Sec. 1, ch. 70, SLA 1987. However, the Board of Fisheries has not amended 5 AAC 41.001 to include this type of activity as a permissible purpose for issuing a transport permit. Thus, even though the moratorium was inapplicable, a transport permit could not legally be issued to a fresh water pond farmer. When the moratorium expires in July a saltwater farmer will be in the same situation as a pond farmer; as discussed later in this letter, neither one can be issued a transport permit unless 5 AAC 41.001 is amended by the board.

REPLY TO:

☐ 1031 W 4th AVENUE SUITE 200
ANCHORAGE, ALASKA 99501-1994
PHONE: (907) 276-3550
FAX: (907) 276-3697

☐ 1st NATIONAL CENTER
100 CUSHMAN ST. SUITE 400
FAIRBANKS, ALASKA 99701-4679
PHONE: (907) 452-1568
FAX: (907) 456-1317

☒ P.O. BOX K—STATE CAPITOL
JUNEAU, ALASKA 99811-0300
PHONE: (907) 465-3600
FAX: (907) 463-5295

as we have explained in the past, we do not believe that these regulations authorize the department to issue this permit to a finfish farmer.

The permit, called a fish transport permit, can only be issued for certain purposes. These purposes include the possession of live fish "cultivated for human consumption" or "as part of an aquaculture program for scientific, educational, or propogative purposes." 5 AAC 41.001. We have previously stated that the regulatory history of this permit reveals that the Board of Fisheries probably did not intend that its scope include the holding of live fish for the purpose of commercial finfish farming. See attached 1987 Inf. Op. Att'y Gen. (July 8; 663-87-0454); 1988 Inf. Op. Att'y Gen. (June 24; 663-88-0500).

We believe that the board does have statutory authority to amend 5 AAC 41.001 so that a fish transport permit could be issued for holding finfish in a commercial farm. AS 16.05.-251(a)(9). Unless such a change is made, however, we believe that the department cannot issue the permit for this purpose, and without it, a finfish farm cannot legally operate in Alaska. 2/

Although the inability to obtain a transport permit is the greatest obstacle to establishing a finfish farm in Alaska, there are other legal and practical impediments. One of these is the limited source of stock for the farms. These impediments are more fully discussed in the attached June 24, 1988 informal opinion, cited above.

I hope this answers your question. Please contact me if I can help you further.

Sincerely yours,

DOUGLAS B. BAILY
ATTORNEY GENERAL

By:


Stephen M. White
Assistant Attorney General

2/ Even if such a change were made to 5 AAC 41.001, we note that under 5 AAC 41.030 the department, before it decides on the issuing, terms, and conditions of a transport permit, must consider the effect of the proposed possession of farmed fish on the continued health and perpetuation of native, wild, or hatchery stocks.

The Hon. Dick Eliason
Alaska State Legislature

March 23, 1990
Page 3

SMW:dm

Enclosures

cc: Norm Cohen, Deputy Commissioner
Department of Fish and Game

TO Honorable Don Collinsworth
Commissioner
Dept. of Fish and Game

DATE June 24, 1988
FILE NO 663-88-0500
TEL NO 465-3600
SUBJECT Fish farming:
status under current
statutes and regula-
tions

FROM

LIS
Larri Irene Spengler
Assistant Attorney General
Natural Resources Section
Department of Law

You have asked that we respond to some questions posed by Senator Jim Duncan with respect to the status under current statutes and regulations of fish farming and of possible stock acquisition sources for fish farms. Under a recently enacted bill, ch. 145, SLA 1988, the legislature has authorized shellfish farms and shellfish hatcheries; the former have been provided for already in regulations, the latter have not. Further, the bill authorized acquisition of stock for those shellfish farms and shellfish hatcheries, prohibited the farming of Atlantic salmon, and extended the moratorium originally enacted in ch. 70, SLA 1987, on finfish farming (other than in some private ponds) until July 1, 1990. 1/

Apart from that, current statutes and Board of Fisheries regulations (1) do not allow finfish farming in private ponds or elsewhere, (2) do not permit private for-profit finfish hatcheries, (3) prohibit the use of eggs, fry, or smolts from a private nonprofit salmon hatchery in a fish farm, (4) prohibit the use of eggs, fry, or smolts taken from the wild for use in a finfish farm, (5) prohibit the importation of eggs, fry, or smolts for use in a fish farm, and (6) prohibit the use of eggs, fry, or smolts from state hatcheries for use in a finfish farm. As discussed below, some of these activities are prohibited by board regulation, which could, consistent with the existing statutes, be amended to allow the activity, and others are prohibited by statutes, which would require legislative action to change the ground rules.

1/ For an analysis of ch. 145, SLA 1988, and its effects, see 1988 Inf. Op. Att'y Gen. (June 7; 883-88-0143), attached.

BACKGROUND

The existing statutes and regulations pertaining to fish farming, apart from those added by ch. 145, SLA 1988, 2/ have been discussed in three relatively recent memoranda from the Attorney General's Office, attached. 1985 Inf. Op. Att'y Gen. (Jan. 31; 663-84-0187); 1987 Inf. Op. Att'y Gen. (Mar. 10; 661-87-0360); 1987 Inf. Op. Att'y Gen. (July 9; 663-87-0454). The 1985 memorandum concluded that there are no constitutional problems posed by fish farming and that it is statutorily provided for as a legal possibility, although not a legal mandate. That memorandum also explained that fish farmers could not obtain stock from private nonprofit salmon hatcheries in the state because AS 16.10.420 allows transfer of hatchery eggs only to other similar hatcheries and to the department. Further, that memorandum noted that fish farmers generally could not import stock from out of the state because 5 AAC 41.070 prohibits importing any live fish (defined in AS 16.05.940(10) to include eggs) other than oysters or ornamental fish.

The March 1987 memorandum reiterated those conclusions, and in answer to the department's inquiry, agreed it was possible that fish farmers could obtain stock from a commercial fishing harvest. However, that memorandum also noted that in order to hold those fish for farming a permit would be needed under 5 AAC 41.001 and 5 AAC 41.005. The memorandum further explained that it was not clear whether a permit could be issued for those purposes as the regulations were written, but that the board had the authority to clarify them. The ambiguity is described in note 7 on pages 4 and 5 of the March 1987 memorandum.

The July 1987 memorandum addressed the question of how the department should interpret the scope of 5 AAC 41.001 and 5 AAC 41.005, governing the transportation, possession, and release of live fish, until and unless they were clarified by the board. The question asked basically was whether the board intended that a 5 AAC 41.005 permit could be issued for commercial fish farming purposes. The memorandum discussed the record of the January 1981 meeting of the Board of Fisheries, when the regulations in question were adopted, as well as discussing other regulations on similar subjects, and concluded that, although the answer was not absolutely clear, the scope of 5 AAC 41.001 and 5 AAC 41.005 (absent a clarifying amendment by the board)

2/ See note 1.

probably did not cover issuing permits to hold live fish for commercial fish farming purposes.

Since the July 1987 memorandum was completed, the language of 5 AAC 41.001, governing the scope of the permits authorized under 5 AAC 41.005, has been amended by the board to include "the transportation and possession of shellfish for commercial purposes in conjunction with a shellfish farming operation." This strengthens the earlier conclusion that commercial finfish farming is not currently provided for by board regulation, because commercial shellfish farming has been specifically addressed, with no similar change being made with respect to commercial finfish farming.

THE SPECIFIC QUESTIONS

1. Are there Board of Fisheries' regulations currently authorizing or regulating finfish farming in private ponds?

As noted above, the July 1987 Department of Law memorandum, attached, concludes that the Board of Fisheries regulations do not currently authorize holding of live finfish for commercial farming purposes. That lack of authorization applies to private ponds as well as to other waters of the state, since AS 16.05.920(a) provides that a person may not possess fish unless provided for in statute or regulation, and AS 16.05.930(c) states that regulations adopted by the Board of Fisheries apply to "rearing and sale of fish from private ponds."

It is true that the bill which last year imposed a moratorium on finfish farming in the state until July 1, 1988, extended until 1990 by ch. 145, SLA 1988, also provided in sec. 1(b), ch. 70, SLA 1987, that "a fish farming license and a fish transport permit may be issued for commercial finfish farming in a privately owned freshwater body that has no outlet to state water." (Emphasis added.) That statement is permissive rather than mandatory, and does not require that such permits be issued. Thus, the status of finfish farming in private ponds under that bill was the same as the status of shellfish farming -- it was not currently authorized by regulation, but if the board chose to authorize it before July 1, 1990, that was acceptable to the legislature. This is contrasted with the legislative prohibition on finfish farming elsewhere in the state until the specified date, regardless of what the Board of Fisheries might choose to authorize. In fact, as discussed above, the Board of Fisheries did amend the regulations to allow shellfish farming, but has not yet

similarly amended 5 AAC 41.001 to permit finfish farming in private ponds. 3/

2. Absent legislative action, can the Board of Fisheries authorize other types of finfish farming, such as net-pen rearing of salmon?

As discussed in the introductory section above, the moratorium on finfish farming other than in certain private ponds has been extended until July 1, 1990, so currently such activities cannot be authorized by the board. Sec. 21, ch. 145, SLA 1988.

3. Is it legal, under current statutes and regulations, to have a private for-profit finfish or shellfish hatchery to supply a farming industry?

The only fish hatcheries provided for in statute, other than those run by the state itself, are private nonprofit salmon hatcheries, and shellfish hatcheries associated with shellfish farms. The legislature has addressed those in detail in AS 16.10.375 -- 16.10.480 and AS 16.40.100 -- 16.40.199. Thus, under current statutes and regulations, it is not legal to have a private for-profit finfish hatchery for any purpose, including supplying a farming industry.

The Board of Fisheries in AS 16.05.251(a)(9) has the general authority to adopt regulations governing the "live capture, possession, transport, or release of native or exotic fish or their eggs." It might be argued that under that statutory provision, the board has the authority to adopt regulations establishing private for-profit finfish hatcheries. Whether or not the board has that authority is beyond the scope of the question asked here, but it is worth noting that since the legislature has addressed the private nonprofit salmon hatcheries and shellfish hatcheries in such detail, a logical legal conclusion might be that it did not expect other hatcheries -- either private-for-profit salmon hatcheries, or any hatcheries for finfish other than salmon -- to be authorized without a similarly detailed legislative statement.

3/ In the letters of intent accompanying ch. 145, SLA 1988, quoted and discussed on page 9 of the 1988 Department of Law memorandum cited in note 1, both houses of the legislature have encouraged the consideration of such regulations.

4. Could a private nonprofit hatchery supply stock to a fish farm? Can a private nonprofit hatchery sell or give eggs, fry, or smolts to a person for the purposes of supplying a farm?

With respect to shellfish hatcheries, the recently enacted ch. 145, SLA 1988, authorizes shellfish hatcheries (not yet themselves authorized by regulation) to sell or transfer stock to another permitted hatchery or farm. AS 16.40.140. 4/

As noted above, the only other hatcheries currently authorized are private, nonprofit salmon hatcheries. Therefore, your question can be answered on one level by simply referring to 5 AAC 41.001 and 5 AAC 41.005, which, as discussed above, probably do not permit a person to hold live fish for commercial finfish farming purposes. Thus, even if private nonprofit hatcheries could supply eggs, fry, or smolts for that purpose, the recipient could not hold them for that purpose.

Looking at the authorities of the private nonprofit hatcheries, however, the answer is also in the negative. As discussed in the 1985 and March 1987 memoranda from the Department of Law, attached, fish farmers could not obtain stock from private nonprofit hatcheries, because under AS 16.10.420(3) and (7) hatchery eggs and fry may be sold only to another private nonprofit hatchery or to the department, not to a fish farmer. Further, although AS 16.10.450 does allow fish returning to hatcheries to be sold, such fish would be fully grown, since they would already have returned "from the natural waters of the state." Thus, such fish could not be a source of fry or smolts for the purposes of supplying a fish farm, and if they were intended as a supply of eggs, then the purchasing individual would probably actually be engaged in a hatchery operation; "hatchery" is defined in AS 16.10.560 for purposes of the fisheries enhancement loan program as "a facility for the artificial incubation of salmon eggs" As discussed above, private finfish hatcheries are not currently authorized by statutes or regulations.

5. Could eggs, fry, or smolts be taken from the wild to supply a for-profit fish farm? Would this be subject to regulations by the Board of Fisheries?

With respect to shellfish farms, the recently enacted ch. 145, SLA 1988, authorizes the Commissioner of Fish and Game

4/ See the 1988 Department of Law memorandum, cited in note 1.

to issue acquisition permits for wild stock, with provisions also for Board of Fisheries regulation. AS 16.40.120. 5/

As discussed at page 2 of the March 1987 memorandum from the Department of Law, fish could be harvested from the wild in commercial fish farm, if the board set a fishery for the collection of fish for fish farms, though participation in normal commercial fisheries, assuming timing and lawful gear made that practical. However, even if an individual could obtain eggs, fry, or smolts in that fashion, the above discussion with respect to the need to obtain a permit to hold live fish under 5 AAC 41.001 and 5 AAC 41.005 is applicable here; as noted above, the Board of Fisheries has not currently authorized permits to be issued for holding live fish for commercial finfish farming purposes, so even if fish could be obtained from the wild through commercial fishing, they could not be held for that particular purpose.

6. Can eggs, fry, or smolts be imported into the state to supply a fish farm?

As explained on page 3 of the 1985 memorandum from the Department of Law, attached, under 5 AAC 41.070(a), fish other than oysters and ornamental fish may not be imported into the state for any purpose. 6/ Further, as discussed above, even if that regulation were changed, finfish could not be held legally for commercial fish farming purposes because of the provisions of 5 AAC 41.001 and 5 AAC 41.005.

7. Can the state hatcheries supply eggs, fry, or smolts to a fish farm? What criteria would be used to judge who would get these eggs, fry, or smolts? Is this an allocation issue which is subject to regulation by the Board of Fisheries?

Preliminarily, even if state-run hatcheries can supply eggs, fry, or smolts to a fish farm, under 5 AAC 41.001 and 5 AAC 41.005 individuals cannot currently hold live fish for commercial finfish purposes, as discussed above. If that were not a

5/ See the 1988 Department of Law memorandum cited in note 1.

6/ Under recently enacted ch. 145, SLA 1988, shellfish may not be imported into the state for use in shellfish farms unless authorized by the Board of Fisheries. AS 16.40.130. No such regulations have been adopted.

consideration, it is probable that the department could sell eggs, fry, or smolts from state hatcheries to fish farms under existing statutes.

Under AS 16.05.050(3), the department is authorized to "design and construct hatcheries ... and other projects beneficial for the fish ... resources of the state." Under AS 16.05.050(6), the department is authorized to, among other things, "sell or exchange fish ... or eggs for propagating, scientific or stocking purposes." That limitation on sale and exchange of fish or eggs by the department appears at first similar to the scope of activities for which the department may issue a permit to collect fish under AS 16.05.340(b) for a "scientific, propagative, or educational purpose." As discussed in note 5, page 3, of the March 1987 memorandum from the Department of Law, attached, the term "propagating" in AS 16.05.340(b) is not restrictively defined and could be viewed as including breeding for commercial sale. As discussed in that note, the Department of Law believes that the better reading is that "propagative" in that statute addresses purposes similar to "scientific" or "educational" purposes, and that would probably not include commercial uses, such as fish farming.

However, there are different factors to consider in examining the use of the term "propagating" in AS 16.05.050(b). AS 16.05.050 asserts that the commissioner has, "but not by way of limitation," the powers and duties listed there. It may be argued that under AS 16.05.050(6), the purposes listed there for which the commissioner may sell or exchange fish or their eggs -- propagating, scientific, or stocking -- need not be read narrowly as the purposes listed in AS 16.05.340(b) for which the commissioner may issue a permit -- scientific, propagative, or educational. The term "propagating" as used in AS 16.05.050(6) could be interpreted to include commercial farming purposes.

That conclusion is buttressed by AS 16.05.02.(2), which mandates that the commissioner shall "manage, protect, maintain, improve, and extend the fish ... resources of the state in the interest of the economy and the general well-being of the state," and subsection (3) of that statute, which gives the commissioner the "necessary power to accomplish the foregoing." Further, AS 16.05.092, which establishes the Division of Fisheries Rehabilitation, Enhancement and Development within the department, specifies that the division shall, among other things, develop a comprehensive state plan for the "orderly present and long-range ... development of all aspects of the state's fisheries for the perpetual use, benefit and enjoyment of all citizens," and "encourage the investment by private enterprise in the technological

development and economic utilization of the fisheries' resources," as well as through development programs "do all things necessary to insure perpetual and increasing production and use of the food resources of Alaska waters and continental shelf areas."

Those broad responsibilities would appear to vest in the department the discretion to sell fish or eggs to commercial fish farms, should those be otherwise authorized by law. In light of those broad authorities and mandates, the term "propagating" in AS 16.05.050 probably includes propagating for commercial purposes, and thus authorizes sale or exchange of eggs by the department for those purposes, in the commissioner's discretion.

With respect to what criteria would be used to judge who would get the eggs, fry, or smolts which might be sold by state hatcheries to fish farms, it is certainly consistent with the commissioner's authorities under AS 16.05.020(3) to adopt regulations setting out those criteria, should he believe that more specific guidelines than the general charges and mandates discussed above would be useful.

Finally, you ask whether such transfer of eggs from state hatcheries to private fish farms would be an allocation issue subject to regulation by the Board of Fisheries. The answer is probably no. Under normal circumstances, fish from state hatcheries are released into the natural waters of the state, and are subject before they return to harvest by subsistence, commercial, sport, and personal use fisheries which may be authorized by the Board of Fisheries. Thus, if the department sold eggs, fry, or smolts from a state hatchery to a fish farm which would otherwise have been released into the natural waters of the state, less fish may be available for those fisheries authorized by the board, but that would not be because of a board allocation decision. (However, it would certainly be acceptable for the department to consult with the board about the advisability of such a transfer.) On the other hand, if the eggs, fry, or smolts which might be transferred by the department to private fish farms were surplus to the hatchery needs, and would not in any event have been released into the natural waters of the state, the fisheries authorized by the Board of Fisheries would not be impacted by the department's decision. Nevertheless, the board's authority in AS 16.05.251(a)(9) over transfer and possession of live fish would still be applicable to finfish, and thus its regulations governing transportation and possession of live fish would apply. 5 AAC 41. Further, it is possible that the recently enacted AS 16.40.120(e) would give the board some authority over such transportation, although that authority may only apply to wild stock acquisition.

Hon. Don Collinsworth
Dept. of Fish & Game
Our File No. 663 8-0500

June 24, 1988
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SUMMARY

Board of Fisheries regulations currently do not allow any finfish to be held for commercial fish farming purposes, in contrast to the board's authorization of the holding of shellfish for those purposes. 5 AAC 41.001 and 5 AAC 41.005. In addition, the legislature has extended until July 1, 1990 the moratorium of finfish farming (other than in some private ponds). Ch. 145, SLA 1988. Thus, even if there were a mechanism for individuals to obtain eggs, fry, or smolts for finfish farming purposes, under current regulations, they could not be held for those purposes.

Shellfish farms and hatcheries have recently been comprehensively dealt with in ch. 145, SLA 1988, including stock acquisition mechanisms.

With respect to potential mechanisms for stock acquisition for finfish farms, current statutes and regulations do not authorize private for-profit finfish hatcheries for any purpose, including supplying a farm, do not authorize private nonprofit hatcheries to supply finfish (including eggs) for fish farms, and do not authorize the import of fish (including eggs) for fish farming purposes. Under commercial fishing regulations an individual could conceivably harvest finfish for use in commercial fish farms, but in general those regulations do not authorize harvests at times and in locations which would result in the taking of fry or smolts, and if adult finfish were taken for purposes of using their eggs, an individual would be involved in a hatchery operation, which is not authorized under current statutes. Current statutes probably would authorize the sale of fish (including eggs) from state hatcheries to finfish farms, if such farms were authorized.

If you have any further questions, please let me know.

LIS:dlm

Enclosures [4]

cc w/encls.:

Norman Cohen, Deputy Commissioner, ADF&G
Warren Wiley, Assistant Commissioner, ADF&G
David Benton, Special Assistant, ADF&G
Brian Allee, Director, FRED Division
Ken Parker, Director, Div. of Comm. Fisheries,
ADF&G
Elizabeth Stewart, Director, Div. of Boards, ADF&G
Gary Slaven, Chairman, Board of Fisheries
Rod Swope, Governor's Office
Liza McCracken, Anchorage AGO

MEMORANDUM

State of Alaska

Department of Law

TO: Hon. Don Collinsworth
Commissioner
Department of Fish and Game

DATE: July 8, 1987

FILE NO.: 663-87-0454

THRU: TELEPHONE NO.: 465-3600

SUBJECT: Current scope of permits to hold live fish

FROM: Larri Irene Spengler
Assistant Attorney General
Natural Resources Section

LIS

You have asked whether the Department of Fish and Game currently has authority under 5 AAC 41.005 to issue a permit to hold live fish for commercial mariculture purposes. Under current law a person cannot hold live fish for any other purpose without a permit issued under regulation. The regulation, which governs issuance of permits to hold live fish, is quite ambiguous with respect to whether a permit could be issued for mariculture purposes. However, as discussed below, it probably does not authorize a permit for such use. Although not free from doubt, we believe that, without regulatory action by the Board of Fisheries or legislative action re-structuring department and board authorities and mandates, the department probably does not currently have authority to issue a permit to hold live fish for commercial fish farming.

The existing statutes and regulations pertaining to fish farming have been discussed in two relatively recent memoranda from the Attorney General's Office, attached. 1985 Inf. Op. Att'y Gen. (Jan. 31; 663-84-0187); 1987 Inf. Op. Att'y Gen. (Mar. 10; 661-87-0360). The 1985 memorandum concluded that there were no constitutional problems posed by mariculture and that it was statutorily provided for as a legal possibility, rather than a legal mandate. That memorandum also explained that fish farmers could not obtain stock from hatcheries in the state because AS 16.10.240 limits transfer of hatchery eggs to other hatcheries and the department. Further, that memorandum noted that fish farmers generally could not import stock from out of the state because 5 AAC 41.070 prohibits importing any live fish (defined in AS 16.05.940(10) to include eggs) other than oysters or ornamental fish.

The 1987 memorandum reiterated those conclusions, and in answer to the department's inquiry, agreed that it was possible that fish farmers could obtain stock from a commercial harvest. However, that memorandum also noted that in order to hold those fish for mariculture a permit would be needed under 5 AAC 41.005. The memorandum further explained that it was not clear whether a permit could be issued for those purposes as the regulation was written, but that the board had the authority to clarify it. The ambiguity is described in footnote 7 on pages 4 and 5 of the 1987 memorandum.

Commissioner Don Collinsworth
Department of Fish and Game
663-87-0454

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You have now asked how the department should interpret the scope of 5 AAC 41.005, until and unless it is clarified by the board. The question is whether the board intended that a 5 AAC 41.005 permit could be issued for commercial purposes, such as fish farming.

Under AS 16.05.920(a), a person may not possess fish unless authorized by statute or regulation. This is reinforced by AS 16.05.930(c), which states that AS 16.05.920 does not prohibit rearing and sale of fish from private ponds under regulations adopted by the board. The board is given the authority in AS 16.05.251(a)(9) to regulate possession of live fish and eggs. Thus, unless the board has allowed possession of fish for a commercial purpose, it is unlawful to hold them in a commercial fish farm.

The purposes for which the board has said a permit to hold live fish may be issued by the department are listed in 5 AAC 41.001, but these do not include "commercial" uses. As discussed in the 1987 memorandum, the only listed purpose that might be construed to include commercial mariculture is "human consumption." ^{1/} We have reviewed the regulatory history of that regulation, in the form of tape number 42 from the Board of Fisheries January 1981 board meeting, and the accompanying log notes to attempt to help resolve the ambiguity. Unfortunately, major portions of that tape are inaudible because of a loud hum superimposed over the discussions. Specifically, the portion of the meeting during which the board went through the proposed regulations governing the transport and possession of live fish is virtually completely inaudible, although from the earlier portions of the tape some clues can be gained about board intent.

The proposed regulations at that January 1981 meeting (which included 5 AAC 41.001 and 5 AAC 41.005) were referred to during the discussion as "fish disease regulations." At the outset, staff of the department explained to the board that these regulations were being proposed because of a bill that passed the legislature in 1980, ch. 110, SLA 1980, relating "to fish disease control and the cost of fish inspections." That legislation

^{1/} Questions might arise over whether "commercial purposes" are encompassed by the language of 5 AAC 41.001, "as part of an aquaculture program for scientific, educational, or propagative purposes." As explained in footnote 5 on page 3 of the 1987 memorandum, we believe they are not.

clarified in AS 16.05.251(a) that the Board of Fisheries not only had the authority to adopt regulations concerning the extent and effect of "predation and competition among fish" and exercising necessary control measures, but also could properly be concerned about "the extent and effect of disease" among fish of the state. Sec. 1, ch. 110, SLA 1980; AS 16.05.251(a)(8). Further, not only could the board prohibit the "live capture, possession, transfer, or release" of fish or their eggs, but it was clarified that the board could also regulate those activities. Sec. 2, ch. 110, SLA 1980; AS 16.05.251(a)(9). The remainder of that bill dealt with fish health inspection authority.

In line with that focus in the bill on fish disease control, the portions of the tape that are audible evidence concern by the department and the board about the risks involved in transporting fish and the importance of the "genetic makeup" of each stock. The only testimony on the proposed regulations came from people involved with private nonprofit hatcheries, who voiced concern about fish disease and genetics as well.

In the portions of the tape that are audible, neither the department nor the individuals testifying nor the board made any mention of commercial mariculture endeavors or any intention to further those. 2/ Because the tape was inaudible during main part of the discussion, in which the department explained each of the proposed regulations to the board, I consulted with staff of the department who were involved in making that presentation and was informed that neither they nor the board ever mentioned that permits to hold live fish would be issued for commercial mariculture purposes. In fact, I am informed that at least the people involved from the department assumed that commercial purposes would not be encompassed by the regulation, since no such endeavors were ongoing at the time.

2/ The only reference to anything related to commercial fish farming was in the summary given by the department of the existing statutes relating to the board's authorities over fish in general. The department, in passing, mentioned the authority of the board in AS 16.05.930(c) to regulate the rearing and sale of fish from private ponds. That reference was one of a laundry list of references given in the department's introduction and is not mentioned again at any time during the audible portion of the discussions.

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663-87-0454

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The above regulatory history seems to indicate that the board did not specifically consider including commercial purposes within the scope of the permits to hold live fish, and in fact did not so intend.

For further guidance, we can turn to regulations and statutes on similar subjects. For example, 5 AAC 41.070(b) specifically authorizes the import of oysters "for aquaculture purposes." This contrasts with the absence of any specific reference to such purposes in 5 AAC 41.001, suggesting that if the board intended commercial mariculture purposes, it would so state. Further, in a statute allowing private possession of fish and game that is analogous in purpose to the regulation at issue here, the legislature specifically provided that surplus buffalo and musk oxen may be granted to private individuals "for commercial purposes." AS 16.40.010. In light of the fact that such clear statements of intent are possible (and have been used) by both the board and the legislature, it would be appropriate for the department to assume that if the board had meant a permit to hold live fish to be issued for "commercial purposes" it would have so specified.

Although the answer is not absolutely clear, it is probably correct that without action by the board clarifying the scope of 5 AAC 41.005 it would be consistent with the regulatory history, and with recognition of analogous regulations and statutes, for the department to refrain from issuing permits to hold live fish for commercial mariculture purposes until the board modifies the regulation. 3/

3/ In this regard, it is worth noting that HCS CSSB 297, passed by the legislature in May 1987, places a moratorium on the issuance of permits under 5 AAC 41.005 until July 1, 1988, with respect to commercial fin fish farming operations. The bill also provides an exemption from that moratorium for fin fish farming in "a privately owned fresh water body that has no outlet to state water." Thus, under the moratorium, until July 1, 1988, the board would be free to modify 5 AAC 41.001 and 5 AAC 41.005 with respect to commercial shellfish farming and commercial fin fish farming in private ponds and have those modifications translate into permits which could be issued. If the board desired to modify those regulations with respect to all other commercial fin fish farming operations, permits for those purposes could not be issued until July 1, 1988.

Original sponsor(s): REP. GRUSSENDORF, Ulmer, Goll, Davidson, Navarre,
Wallis, Hudson, Taylor, C.Davis, Jacko, Kubina, MacLean, Swackhammer

1 IN THE HOUSE BY THE RESOURCES COMMITTEE

2 CS FOR HOUSE BILL NO. 432 (Resources)

3 IN THE LEGISLATURE OF THE STATE OF ALASKA

4 SIXTEENTH LEGISLATURE - SECOND SESSION

5 A BILL

6 For an Act entitled: "An Act prohibiting finfish farming; and providing
7 for an effective date."

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

9 * Section 1. FINDINGS. Based on a legislative examination of the
10 potential effects of allowing finfish farming in the state on the common
11 property resources and on the overall economic well-being of the state; the
12 number of serious concerns associated with finfish farming and the need for
13 study of finfish farming that has caused the legislature to enact two
14 moratoriums on finfish farming and establish a nonlegislative task force to
15 study the issue and to report its findings and recommendations to the
16 legislature; a review of the final report of the Alaska Finfish Farming
17 Task Force which notes several possible benefits and some serious risks of
18 finfish farming; the need for the legislature to take action before the
19 current moratorium on finfish farming expires on July 1, 1990; the recom-
20 mendation of the task force that the legislature not extend the moratorium,
21 but make a final determination to either allow or prohibit finfish farming;
22 and the testimony and evidence received; the legislature finds that

23 (1) the state has the healthiest stocks of wild salmon and other
24 wild finfish in the world and benefits from thriving commercial, sport, and
25 subsistence fisheries for these fish and a growing tourism industry related
26 to sport fishing;

27 (2) the people, economy, and environment of the state are depen-
28 dent in large measure upon the continued health of the state's wild finfish
29 resources;

1 (3) serious risks are posed by commercial finfish farming,
2 including the spread of disease among wild fish by farmed fish, genetic
3 intermingling of wild fish stocks with genetically manipulated farmed fish,
4 degradation of water quality near finfish farms, and land use conflicts
5 over the siting of commercial finfish farms;

6 (4) the state has invested significantly in marketing efforts to
7 promote Alaskan finfish as wild and natural fish products, and this invest-
8 ment in developing the reputation of Alaskan finfish would be lost by
9 allowing commercially farmed finfish to be produced and marketed from
10 Alaska;

11 (5) the cost to the state to regulate the commercial finfish
12 farming industry would be high;

13 (6) few jobs would be generated by a commercial finfish farming
14 industry in the state;

15 (7) the state is responsible for ensuring the protection and
16 wise use of the renewable natural resources of Alaska and providing a
17 framework for a sound economy;

18 (8) a long-term decision must be made regarding the future of
19 commercial finfish farming in the state;

20 (9) avoiding harm to the state's wild finfish, land, and water
21 resources must take precedence over the development of a new speculative
22 and potentially harmful commercial finfish farming industry;

23 (10) the best interests of the state are served by prohibiting
24 commercial finfish farming.

25 * Sec. 2. AS 16.40 is amended by adding a new section to read:

26 Sec. 16.40.210. FINFISH FARMING PROHIBITED. (a) A person may
27 not grow or cultivate finfish in captivity or under positive control
28 for commercial purposes.

29 (b) This section does not restrict

1 (1) the fishery rehabilitation, enhancement, or development
2 activities of the department;

3 (2) the ability of a nonprofit corporation that holds a
4 salmon hatchery permit under AS 16.10.400 to sell salmon returning
5 from the natural water of the state, as authorized under AS 16.10.450,
6 or surplus salmon eggs, as authorized under AS 16.10.420 and 16.10.-
7 450;

8 (3) rearing and sale of ornamental finfish for aquariums or
9 ornamental ponds provided that the fish are not reared in or released
10 into water of the state.

11 (c) In this section "ornamental finfish" means fish commonly
12 known as "tropical fish," "aquarium fish," or "goldfish," that are
13 imported, cultured, or sold in the state customarily for viewing in
14 aquaria or for raising in artificial systems, and not customarily used
15 for sport fishing or human consumption purposes.

16 * Sec. 3. This Act takes effect July 1, 1990.

ALASKA STATE LEGISLATURE - SENATE

SENATOR RICHARD I. ELIASON

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



P.O. BOX 143
SITKA, ALASKA 99835

P.O. BOX V
JUNEAU, ALASKA 99811
(907) 485-4916

MEMORANDUM

TO: Senator Dick Eliason

FROM: Sheila Peterson, staff
Senator Eliason's office *Sheila*

RE: Status of Permits

DATE: March 8, 1986

In response to your inquiry about whether or not Thorne Ferguson has obtain or has applied for the necessary permits to farm fish in saltwater tanks on Prince of Wales Island, I contacted Diane Mayer, Southeast Regional Office, Division of Governmental Coordination.

According to Diane's records, Thorne received permits from the Army Corps of Engineers and the Department of Environmental Conservation in May, 1986, for a lodge, barge, and dock facility. He has not applied for any permits necessary to begin raising fish in saltwater tanks.

When Thorne Ferguson made his original request, he was planning on building a resort and hatchery. During the permitting process, the resort and hatchery idea was dropped. The application for the lodge, barge and dock proceeded separately.

MEMORANDUM

State of Alaska

Department of Law

TO: Honorable Don Collinsworth
Commissioner
Dept. of Fish and Game

DATE: June 24, 1988
FILE NO: 663-88-0500
TEL. NO: 465-3600
SUBJECT: Fish farming:
status under current
statutes and regula-
tions

FROM:

LIS
Larri Irene Spengler
Assistant Attorney General
Natural Resources Section
Department of Law

You have asked that we respond to some questions posed by Senator Jim Duncan with respect to the status under current statutes and regulations of fish farming and of possible stock acquisition sources for fish farms. Under a recently enacted bill, ch. 145, SLA 1988, the legislature has authorized shellfish farms and shellfish hatcheries; the former have been provided for already in regulations, the latter have not. Further, the bill authorized acquisition of stock for those shellfish farms and shellfish hatcheries, prohibited the farming of Atlantic salmon, and extended the moratorium originally enacted in ch. 70, SLA 1987, on finfish farming (other than in some private ponds) until July 1, 1990. 1/

Apart from that, current statutes and Board of Fisheries regulations (1) do not allow finfish farming in private ponds or elsewhere, (2) do not permit private for-profit finfish hatcheries, (3) prohibit the use of eggs, fry, or smolts from a private nonprofit salmon hatchery in a fish farm, (4) prohibit the use of eggs, fry, or smolts taken from the wild for use in a finfish farm, (5) prohibit the importation of eggs, fry, or smolts for use in a fish farm, and (6) prohibit the use of eggs, fry, or smolts from state hatcheries for use in a finfish farm. As discussed below, some of these activities are prohibited by board regulation, which could, consistent with the existing statutes, be amended to allow the activity, and others are prohibited by statutes, which would require legislative action to change the ground rules.

1/ For an analysis of ch. 145, SLA 1988, and its effects, see 1988 Inf. Op. Att'y Gen. (June 7; 883-88-0143), attached.

BACKGROUND

The existing statutes and regulations pertaining to fish farming, apart from those added by ch. 145, SLA 1988, 2/ have been discussed in three relatively recent memoranda from the Attorney General's Office, attached. 1985 Inf. Op. Att'y Gen. (Jan. 31; 663-84-0187); 1987 Inf. Op. Att'y Gen. (Mar. 10; 661-87-0360); 1987 Inf. Op. Att'y Gen. (July 9; 663-87-0454). The 1985 memorandum concluded that there are no constitutional problems posed by fish farming and that it is statutorily provided for as a legal possibility, although not a legal mandate. That memorandum also explained that fish farmers could not obtain stock from private nonprofit salmon hatcheries in the state because AS 16.10.420 allows transfer of hatchery eggs only to other similar hatcheries and to the department. Further, that memorandum noted that fish farmers generally could not import stock from out of the state because 5 AAC 41.070 prohibits importing any live fish (defined in AS 16.05.940(10) to include eggs) other than oysters or ornamental fish.

The March 1987 memorandum reiterated those conclusions, and in answer to the department's inquiry, agreed it was possible that fish farmers could obtain stock from a commercial fishing harvest. However, that memorandum also noted that in order to hold those fish for farming a permit would be needed under 5 AAC 41.001 and 5 AAC 41.005. The memorandum further explained that it was not clear whether a permit could be issued for those purposes as the regulations were written, but that the board had the authority to clarify them. The ambiguity is described in note 7 on pages 4 and 5 of the March 1987 memorandum.

The July 1987 memorandum addressed the question of how the department should interpret the scope of 5 AAC 41.001 and 5 AAC 41.005, governing the transportation, possession, and release of live fish, until and unless they were clarified by the board. The question asked basically was whether the board intended that a 5 AAC 41.005 permit could be issued for commercial fish farming purposes. The memorandum discussed the record of the January 1981 meeting of the Board of Fisheries, when the regulations in question were adopted, as well as discussing other regulations on similar subjects, and concluded that, although the answer was not absolutely clear, the scope of 5 AAC 41.001 and 5 AAC 41.005 (absent a clarifying amendment by the board)

2/ See note 1.

probably did not cover issuing permits to hold live fish for commercial fish farming purposes.

Since the July 1987 memorandum was completed, the language of 5 AAC 41.001, governing the scope of the permits authorized under 5 AAC 41.005, has been amended by the board to include "the transportation and possession of shellfish for commercial purposes in conjunction with a shellfish farming operation." This strengthens the earlier conclusion that commercial finfish farming is not currently provided for by board regulation, because commercial shellfish farming has been specifically addressed, with no similar change being made with respect to commercial finfish farming.

THE SPECIFIC QUESTIONS

1. Are there Board of Fisheries' regulations currently authorizing or regulating finfish farming in private ponds?

As noted above, the July 1987 Department of Law memorandum, attached, concludes that the Board of Fisheries regulations do not currently authorize holding of live finfish for commercial farming purposes. That lack of authorization applies to private ponds as well as to other waters of the state, since AS 16.05.920(a) provides that a person may not possess fish unless provided for in statute or regulation, and AS 16.05.930(c) states that regulations adopted by the Board of Fisheries apply to "rearing and sale of fish from private ponds."

It is true that the bill which last year imposed a moratorium on finfish farming in the state until July 1, 1988, extended until 1990 by ch. 145, SLA 1988, also provided in sec. 1(b), ch. 70, SLA 1987, that "a fish farming license and a fish transport permit may be issued for commercial finfish farming in a privately owned freshwater body that has no outlet to state water." (Emphasis added.) That statement is permissive, rather than mandatory, and does not require that such permits be issued. Thus, the status of finfish farming in private ponds under that bill was the same as the status of shellfish farming -- it was not currently authorized by regulation, but if the board chose to authorize it before July 1, 1990, that was acceptable to the legislature. This is contrasted with the legislative prohibition on finfish farming elsewhere in the state until the specified date, regardless of what the Board of Fisheries might choose to authorize. In fact, as discussed above, the Board of Fisheries did amend the regulations to allow shellfish farming, but has not yet

similarly amended 5 AAC 41.001 to permit finfish farming in private ponds. 3/

2. Absent legislative action, can the Board of Fisheries authorize other types of finfish farming, such as net-pen rearing of salmon?

As discussed in the introductory section above, the moratorium on finfish farming other than in certain private ponds has been extended until July 1, 1990, so currently such activities cannot be authorized by the board. Sec. 21, ch. 145, SLA 1988.

3. Is it legal, under current statutes and regulations, to have a private for-profit finfish or shellfish hatchery to supply a farming industry?

The only fish hatcheries provided for in statute, other than those run by the state itself, are private nonprofit salmon hatcheries, and shellfish hatcheries associated with shellfish farms. The legislature has addressed those in detail in AS 16.-10.375 -- 16.10.480 and AS 16.40.100 -- 16.40.199. Thus, under current statutes and regulations, it is not legal to have a private for-profit finfish hatchery for any purpose, including supplying a farming industry.

The Board of Fisheries in AS 16.05.251(a)(9) has the general authority to adopt regulations governing the "live capture, possession, transport, or release of native or exotic fish or their eggs." It might be argued that under that statutory provision, the board has the authority to adopt regulations establishing private for-profit finfish hatcheries. Whether or not the board has that authority is beyond the scope of the question asked here, but it is worth noting that since the legislature has addressed the private nonprofit salmon hatcheries and shellfish hatcheries in such detail, a logical legal conclusion might be that it did not expect other hatcheries -- either private-for-profit salmon hatcheries, or any hatcheries for finfish other than salmon -- to be authorized without a similarly detailed legislative statement.

3/ In the letters of intent accompanying ch. 145, SLA 1988, quoted and discussed on page 9 of the 1988 Department of Law memorandum cited in note 1, both houses of the legislature have encouraged the consideration of such regulations.

4. Could a private nonprofit hatchery supply stock to a fish farm? Can a private nonprofit hatchery sell or give eggs, fry, or smolts to a person for the purposes of supplying a farm?

With respect to shellfish hatcheries, the recently enacted ch. 145, SLA 1988, authorizes shellfish hatcheries (not yet themselves authorized by regulation) to sell or transfer stock to another permitted hatchery or farm. AS 16.40.140. 4/

As noted above, the only other hatcheries currently authorized are private, nonprofit salmon hatcheries. Therefore, your question can be answered on one level by simply referring to 5 AAC 41.001 and 5 AAC 41.005, which, as discussed above, probably do not permit a person to hold live fish for commercial finfish farming purposes. Thus, even if private nonprofit hatcheries could supply eggs fry, or smolts for that purpose, the recipient could not hold them for that purpose.

Looking at the authorities of the private nonprofit hatcheries, however, the answer is also in the negative. As discussed in the 1985 and March 1987 memoranda from the Department of Law, attached, fish farmers could not obtain stock from private nonprofit hatcheries, because under AS 16.10.420(3) and (7) hatchery eggs and fry may be sold only to another private nonprofit hatchery or to the department, not to a fish farmer. Further, although AS 16.10.450 does allow fish returning to hatcheries to be sold, such fish would be fully grown, since they would already have returned "from the natural waters of the state." Thus, such fish could not be a source of fry or smolts for the purposes of supplying a fish farm, and if they were intended as a supply of eggs, then the purchasing individual would probably actually be engaged in a hatchery operation; "hatchery" is defined in AS 16.10.560 for purposes of the fisheries enhancement loan program as "a facility for the artificial incubation of salmon eggs" As discussed above, private finfish hatcheries are not currently authorized by statutes or regulations.

5. Could eggs, fry, or smolts be taken from the wild to supply a for-profit fish farm? Would this be subject to regulations by the Board of Fisheries?

With respect to shellfish farms, the recently enacted ch. 145, SLA 1988, authorizes the Commissioner of Fish and Game

4/ See the 1988 Department of Law memorandum, cited in note 1.

to issue acquisition permits for wild stock, with provisions also for Board of Fisheries regulation. AS 16.40.120. 5/

As discussed at pages 4-5 of the March 1987 memorandum from the Department of Law, attached, fish could be harvested from the wild in commercial fisheries to supply a for-profit finfish farm, if the board set up a special fishery for the collection of fish for fish farms, or through participation in normal commercial fisheries, assuming the timing and lawful gear made that practical. However, even if an individual could obtain eggs, fry, or smolts in that fashion, the above discussion with respect to the need to obtain a permit to hold live fish under 5 AAC 41.001 and 5 AAC 41.005 is applicable here; as noted above, the Board of Fisheries has not currently authorized permits to be issued for holding live fish for commercial finfish farming purposes, so even if fish could be obtained from the wild through commercial fishing, they could not be held for that particular purpose.

6. Can eggs, fry, or smolts be imported into the state to supply a fish farm?

As explained on page 3 of the 1985 memorandum from the Department of Law, attached, under 5 AAC 41.070(a), fish other than oysters and ornamental fish may not be imported into the state for any purpose. 6/ Further, as discussed above, even if that regulation were changed, finfish could not be held legally for commercial fish farming purposes because of the provisions of 5 AAC 41.001 and 5 AAC 41.005.

7. Can the state hatcheries supply eggs, fry, or smolts to a fish farm? What criteria would be used to judge who would get these eggs, fry, or smolts? Is this an allocation issue which is subject to regulation by the Board of Fisheries?

Preliminarily, even if state-run hatcheries can supply eggs, fry, or smolts to a fish farm, under 5 AAC 41.001 and 5 AAC 41.005 individuals cannot currently hold live fish for commercial finfish purposes, as discussed above. If that were not a

5/ See the 1988 Department of Law memorandum cited in note 1.

6/ Under recently enacted ch. 145, SLA 1988, shellfish may not be imported into the state for use in shellfish farms unless authorized by the Board of Fisheries. AS 16.40.130. No such regulations have been adopted.

consideration, it is probable that the department could sell eggs, fry, or smolts from state hatcheries to fish farms under existing statutes.

Under AS 16.05.050(3), the department is authorized to "design and construct hatcheries ... and other projects beneficial for the fish ... resources of the state." Under AS 16.05.050(6), the department is authorized to, among other things, "sell or exchange fish ... or eggs for propagating, scientific or stocking purposes." That limitation on sale and exchange of fish or eggs by the department appears at first similar to the scope of activities for which the department may issue a permit to collect fish under AS 16.05.340(b) for a "scientific, propagative, or educational purpose." As discussed in note 5, page 3, of the March 1987 memorandum from the Department of Law, attached, the term "propagating" in AS 16.05.340(b) is not restrictively defined and could be viewed as including breeding for commercial sale. As discussed in that note, the Department of Law believes that the better reading is that "propagative" in that statute addresses purposes similar to "scientific" or "educational" purposes, and that would probably not include commercial uses, such as fish farming.

However, there are different factors to consider in examining the use of the term "propagating" in AS 16.05.050(b). AS 16.05.050 asserts that the commissioner has, "but not by way of limitation," the powers and duties listed there. It may be argued that under AS 16.05.050(6), the purposes listed there for which the commissioner may sell or exchange fish or their eggs -- propagating, scientific or stocking -- need not be read as narrowly as the purposes listed in AS 16.05.340(b) for which the commissioner may issue a collecting permit -- scientific, propagative, or educational. The term "propagating" as used in AS 16.05.050(6) could under that interpretation include commercial farming purposes.

That conclusion is buttressed by AS 16.05.020(2), which mandates that the commissioner shall "manage, protect, maintain, improve, and extend the fish ... resources of the state in the interest of the economy and the general well-being of the state," and subsection (3) of that statute, which gives the commissioner the "necessary power to accomplish the foregoing." Further, AS 16.05.092, which establishes the Division of Fisheries Rehabilitation, Enhancement and Development within the department, specifies that the division shall, among other things, develop a comprehensive state plan for the "orderly present and long-range ... development of all aspects of the state's fisheries for the perpetual use, benefit and enjoyment of all citizens," and "encourage the investment by private enterprise in the technological

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development and economic utilization of the fisheries' resources," as well as through development programs "do all things necessary to insure perpetual and increasing production and use of the food resources of Alaska waters and continental shelf areas."

Those broad responsibilities would appear to vest in the department the discretion to sell fish or eggs to commercial fish farms, should those be otherwise authorized by law. In light of those broad authorities and mandates, the term "propagating" in AS 16.05.050 probably includes propagating for commercial purposes, and thus authorizes sale or exchange of eggs by the department for those purposes, in the commissioner's discretion.

With respect to what criteria would be used to judge who would get the eggs, fry, or smolts which might be sold by state hatcheries to fish farms, it is certainly consistent with the commissioner's authorities under AS 16.05.020(3) to adopt regulations setting out those criteria, should he believe that more specific guidelines than the general charges and mandates discussed above would be useful.

Finally, you ask whether such transfer of eggs from state hatcheries to private fish farms would be an allocation issue subject to regulation by the Board of Fisheries. The answer is probably no. Under normal circumstances, fish from state hatcheries are released into the natural waters of the state, and are subject before they return to harvest by subsistence, commercial, sport, and personal use fisheries which may be authorized by the Board of Fisheries. Thus, if the department sold eggs, fry, or smolts from a state hatchery to a fish farm which would otherwise have been released into the natural waters of the state, less fish may be available for those fisheries authorized by the board, but that would not be because of a board allocation decision. (However, it would certainly be acceptable for the department to consult with the board about the advisability of such a transfer.) On the other hand, if the eggs, fry, or smolts which might be transferred by the department to private fish farms were surplus to the hatchery needs, and would not in any event have been released into the natural waters of the state, the fisheries authorized by the Board of Fisheries would not be impacted by the department's decision. Nevertheless, the board's authority in AS 16.05.251(a)(9) over transfer and possession of live fish would still be applicable to finfish, and thus its regulations governing transportation and possession of live fish would apply. 5 AAC 41. Further, it is possible that the recently enacted AS 16.40.120(e) would give the board some authority over such transportation, although that authority may only apply to wild stock acquisition.

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SUMMARY

Board of Fisheries regulations currently do not allow any finfish to be held for commercial fish farming purposes, in contrast to the board's authorization of the holding of shellfish for those purposes. 5 AAC 41.001 and 5 AAC 41.005. In addition, the legislature has extended until July 1, 1990 the moratorium of finfish farming (other than in some private ponds). Ch. 145, SLA 1988. Thus, even if there were a mechanism for individuals to obtain eggs, fry, or smolts for finfish farming purposes, under current regulations, they could not be held for those purposes.

Shellfish farms and hatcheries have recently been comprehensively dealt with in ch. 145, SLA 1988, including stock acquisition mechanisms.

With respect to potential mechanisms for stock acquisition for finfish farms, current statutes and regulations do not authorize private for-profit finfish hatcheries for any purpose, including supplying a farm, do not authorize private nonprofit hatcheries to supply finfish (including eggs) for fish farms, and do not authorize the import of fish (including eggs) for fish farming purposes. Under commercial fishing regulations an individual could conceivably harvest finfish for use in commercial fish farms, but in general those regulations do not authorize harvests at times and in locations which would result in the taking of fry or smolts, and if adult finfish were taken for purposes of using their eggs, an individual would be involved in a hatchery operation, which is not authorized under current statutes. Current statutes probably would authorize the sale of fish (including eggs) from state hatcheries to finfish farms, if such farms were authorized.

If you have any further questions, please let me know.

LIS:dlm
Enclosures [4]
cc w/encls.:

Norman Cohen, Deputy Commissioner, ADF&G
Warren Wiley, Assistant Commissioner, ADF&G
David Benton, Special Assistant, ADF&G
Brian Allee, Director, FRED Division
Ken Parker, Director, Div. of Comm. Fisheries,
ADF&G
Elizabeth Stewart, Director, Div. of Boards, ADF&G
Gary Slaven, Chairman, Board of Fisheries
Rod Swope, Governor's Office
Liza McCracken, Anchorage AGO

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FOR MORE DETAILS



ANOTHER SALMON RECORD

—but no huge leap in 1987

ALTHOUGH late harvesting may push up the figure, Norway's farmed salmon harvest in 1987 was expected to be around 47,000 metric tons, less than 2000 tons above the previous record production of 45,675 tons. This is one of the smallest rises in recent years, and reflects the problems the industry has had with hitra disease in some of the farms.

But the industry did not expect a very big increase last year, and the harvest is not very far below that forecast on the basis of smolts put in and growing.

Altogether, the Norwegian crop of Atlantic farmed salmon and sea-grown trout was around 53,000 tons in 1987.

This year, the Fish Farmers' Sales Organisation

expects a big rise to around 70,000 tons, and then to 90,000 tons in 1989.

There are now 728 fish farms in Norway with an estimated total capacity of 90,000 to 100,000 tons a year. These farms are supplied by 611 hatcheries with a production capacity of 183 million smolts a year.

Faster

Other Atlantic salmon farming areas have expanded much faster than Norway during 1987. As FFI reported earlier in the year, the Irish Republic seems likely to exceed earlier forecasts. Iceland is showing encouraging progress and so is the industry in the Faroes Islands.

Scotland and her islands, however, are the real pace setters for 1987, with production expected to end up at around 16,000 tons, and set for 23,000 to 25,000 tons this year.

According to estimates collected by the Federation Europeenne de la Salmoniculture (FES) eight countries in Western Europe harvested just over 70,000 tons of salmon in 1987.

The forecast for 1988 is for nearly 107,000 tons.

Twelve member countries of the FES gave estimates and forecasts for large trout. These added up to 29,700 tons in 1987 and were expected to increase to 30,820 tons in 1988.

Sri Lanka shrimp to Gambia

SRI LANKA recently made its first export of tropical shrimp post-larvae when Serendip Seafoods Ltd. exported US\$15,000 to a farm project in The Gambia in West Africa.

Mrs. P. C. Benedict, administrative manager of Serendip Seafoods, said this initial order was expected to lead to a regular airlift of post-larvae to The Gambia via London.

One reason for the development of this trade in small shrimp is that the guerilla war in the north-east of Sri Lanka has hit the local on-growing operation. This has left the company hatchery with stock for sale outside and the trade has been started, despite the high air freight charge of Rs190.45 a kilo.

Serendip Seafood was formed in 1983 as a joint venture with a Hong Kong based US company called Asian Agricultural Products.



Focus on Orkney

MARINE pump-ashore tanks of Mainland Salmon farm on the island of Rousay in Orkney. This archipelago in the north of Britain consists of some 70 islands, and they are separated from the Scottish mainland by a six-mile strait called the Pentland Firth.

Like the Shetland Islands and the Western Isles, Orkney has been

expanding its fishing activities to include aquaculture. It already has a promising shellfish industry, and, when technical editor Tom Wray visited the islands, he found that an Orkney Salmon Growers' Association was being set up to serve the ten on-growers and five hatcheries operating there. The farms produce between 50 and 250 tons a year, and the accent is on supplying the highest quality fish. Tom Wray's special feature report starts in this issue and will be concluded in February.

Oyster boost

IN THE Catalan region in north-east Spain, fish farming will be given a boost through an investment of 1000 million pesetas by the regional government.

The declared aim is to make the Catalan coast the main producer of shellfish in the western Mediterranean by 1990. The focus will be on oyster farming, but mussels will also be grown.

By 1989, reports FFI cor-

respondent Robert Richards, production of oysters should reach 4000 metric tons a year worth 2000 million pesetas (about £10 million).

The EEC is also supporting this development, providing 600 mpts, and floats are being extended from traditional sites in the River Ebro delta to others further seaward.

Spain is already a leading mussel grower, with its raft farms in Galicia.

Frog appeal

THE Seafood Exporters Association of India has appealed to the government to allow exporters to carry out commercial scale farming of frogs. There is now a complete ban on export of wild-caught froglegs.

According to Association president C. Cherian, frog culture would be easier and cheaper to develop than prawn culture and could bring in Rs200 million (£10 million) a year.

Apart from boosting exports, frog farming would also utilise 25 per cent of installed freezing capacity now lying idle in India.

In 1981, India exported 4366 metric tons of frozen froglegs worth Rs120 million.

BRIDGESTONE LEADS THE FIELD IN LARGE-SCALE FISH CAGES



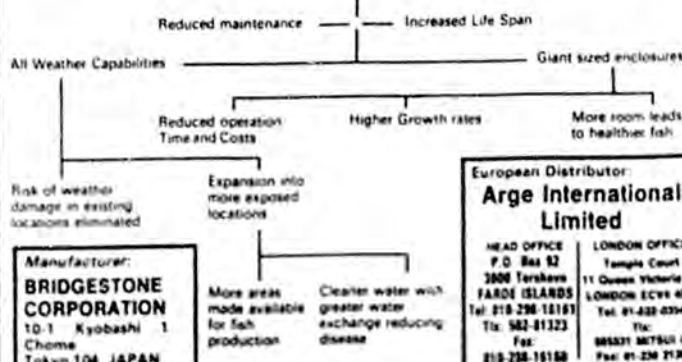
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Spanish farm starts turbot

IN RECENT years, the company Maricultura SA has been among the leaders in marine farming in Spain and was one of the first there to develop the commercial culture of salmon and turbot.

The company was originally owned by Seasalter Shellfish of Whitstable in south-east England. It changed hands a few times before being bought in 1984 by its present owner Juan Queiro, who planned to use its facilities for the holding of live shellfish.

At the time he had just begun importing brown and spider crabs from Britain in vivier containers. The crabs were held in Spain in Maricultura's tanks in Esteiro, Galicia.

But Antonio Pallares, a marine biologist on his staff, persuaded him to venture into fish farming and in 1985 he started a hatchery for flat oysters (*Ostrea edulis*) and carpet shell clams (*Venerupis decussatus*).



Hatchery nursery tanks of Maricultura SA at Esteiro in north-west Spain.

The waters of the Rio de Muros in Esteiro are a rich environment for growing bivalves and production has increased rapidly. But the project was hit last year by heavy rain on the Spanish north coast.

Salinity was reduced to a level which killed off much of the stock and the company has been looking for fresh supplies of spat from France.

Antonio Pallares had also

done some work on turbot rearing. Juan Queiro therefore let him go ahead with a test project.

Using 100 mature turbot weighing between three and ten kilos, he obtained spawn for the base stock of the project.

Maricultura intends to concentrate on its turbot venture, aiming for an annual harvest around 100 metric tons, plus broodstock to become self-sufficient.

Salmon group opens office

THE Scottish Salmon Growers Association has opened an administrative office in Drummond House, Perth. The executive appointed to take charge is Robert F. Gray.

Mr. Gray has had long experience in textiles, mostly with Robert Laidlaw & Sons Ltd. of Keith, Banffshire, as Commercial Director/Company Secretary.

● The address of the office is Drummond House, Scott Street, Perth PH1 5EJ. Tel: 0738 35420.

Disease order

THE British Ministry of Agriculture, Fisheries and Food last month made an order designating Valley Springs Trout Farm in Devon, England, following the discovery of infectious pancreatic necrosis (IPN) at the farm.

Salmon output below forecast

AT AROUND 2500 metric tons, farmed salmon production in British Columbia appears to be substantially down on the 4000 tons originally projected.

Two factors contributing to this are fish losses resulting from algal blooms in the autumn and premature harvesting by some farmers to avert losses from the bloom.

Production by species is about evenly split between chinook and coho and prices have been strong. US wholesalers in Seattle have been quoting US\$4.50 a lb for 4-6 lb BC farmed coho, and \$4.70 a lb for chinook in the same size range.

Reflecting the crisis in the commercial catch of chi-

nook, farm hatchery orders for 27 million eggs have been trimmed to four million where eggs have been taken from wild stock. To offset this, farm chinook broodstock is expected to provide 15 million eggs this season.

Requests for wild stock coho eggs, which should be met in full, have increased to 17 million.

Egg allocation figures and

demand confirm an increasing trend towards chinook, which is being identified as the prime Pacific salmon species for farming.

BC aquaculture quoted stocks were affected like many others by the recent world-wide stock crash.

Despite this, Aquarius successfully placed an additional C\$13.2 million of financing.

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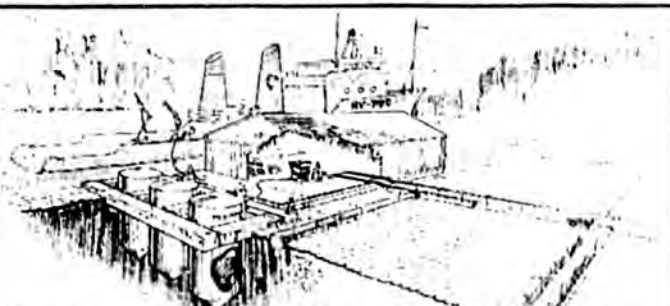
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This drawing shows the silage delivery ship alongside a Sea-Lo storage system.

Ship and store for silage

THE firm Hy-Pro Manufacturing in Vancouver, British Columbia, says that early this year it will be producing a high-quality silage for the salmon farming industry. The silage will be mixed with readily available commercial dry components.

According to Hy-Pro, the product will be distributed using a 1000-ton extensively converted delivery vessel. Dan-Buoy of Ladner has devised a novel method of storing liquid silage in a low-profile floating silo known as Sea-Lo.

Silage production involves the liquification of raw fish into a high protein feed for salmon and other farmed species. Success with silage in European aquaculture stimulated research development in Canada.

Hy-Pro has obtained exclusive rights to a "dramatically improved" process.

"In recent tests conducted by the Federal Department of Fisheries, our product was shown to dramatically increase the rate of growth of smolts and to decrease the incidence of disease," says Hy-Pro.

"Stored in Sea-Lo's at surrounding water temperature, the silage can be safely kept for at least a year without significant deterioration in nutritional value, or risk of spoilage."

The firm explains that the farmer uses the silage in conjunction with a dry component. The two parts are mixed together at the site and then extruded into pellet form.

"The result is a fresh moist feed which is extremely palatable," says Hy-Pro. It can arrange for lease financing of both storage and mixing equipment.

Marine Harvest plans new farm

MARINE HARVEST Ltd. plans to develop a new on-growing unit on Loch Inchard in Sutherland, Scotland.

The Crown Estate Commissioners have granted the company a 20-year lease to a section of Loch Inchard off Rhuvault.

Subject to the approval of the local planning authority, Marine Harvest is to build a shore base including a jetty, hard standing and a small building to house a feed store and staff facilities.

The on-growing unit will incorporate 24 salmon pens in three rafts, which the company hopes to instal

stock in April to produce the first marketable fish a year later.

Marine Harvest pioneered salmon farming in the Lochaber district in the 1960s. It now operates three hatcheries, four freshwater farms and 18 seawater on-growing units.

Wrong estimates may be costly

AFTER incorrectly forecasting the returning run of pink salmon for three successive years, a research institute in the Soviet Far East has been warned that further mistakes will have to be paid for.

According to reports from Vladivostok, the Kamchatka Department of the Pacific Ocean Fisheries and Oceanography Institute forecast that 160 million pink salmon would appear off the west coast of Kamchatka in the spring of 1985. But unfavourable conditions caused by over-crowding of the spawning areas in 1983 resulted in a return of less than a tenth of the forecast number.

The Institute forecast large returns for 1986 and 1987. Many vessels and fishermen moved to the Kamchatka coast and waited. But again the big runs did not appear.

Therefore, millions of roubles were wasted in vessel and crew time and fuel, and the institute has been told that from the beginning of 1988 further incorrect forecasts will cost it money.

Feed firm expands

DANSK Orrefoder A/S of Brande in Denmark has established a new subsidiary company called Danish Aqua Technique International (DATI), which will strengthen marketing of its ECOLINE feeds range.

DATI will also handle turnkey projects for the development of fish farms as well as the supply of com-

ponents such as purifying units, aeration and feeding equipment. And it will deliver equipment ranging from fry tanks to oxygen metres and bird wire, and will also supply this from its own retail store.

Dansk Orrefoder is now divided into three companies. In addition to DATI, it has DAFI A/S which deals in feed development and sale of licence products.



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Progress in recycle hatchery project

AN EXPERIMENTAL recycle salmon hatchery/on-growing unit developed at Heriot-Watt University, Edinburgh, Scotland, has completed its first year of operation with successes and failures, reports Keith Murray of the University's Department of Chemical and Process Engineering.

The system was briefly described in *FFI* in August 1987. The work is funded by the Chemical and Process Engineering Department and supported by the generous inputs of Dryden Aquaculture, George Fischer and Plastic Construction.

Two batches of eggs, 320 degree days, were collected from Hugh Horrex in Glasgow in early February 1987. Some 20,000 domestic and 20,000 wild stock were held at 6deg. C in the recycle hatchery trough section and, at 420 and 495 deg. days respectively, the stocks hatched. Egg losses by that stage were eight per cent and one per cent.

The alevins were held in the hatchery trough baskets until yolk-sac absorption. Bob Hyde's Mark II trough proved to be a marked improvement, says Mr. Murray.

Some 25 per cent of the domestic strain showed lack of tail development at swim-up, and with patience they were removed one-by-one. By the second week

in April, the domestic stock were being fed, and by the fourth week the wild strain were on feed.

The impact of uneaten food on water quality in a recycle system at this early stage is "horrendous", because of the need to feed to excess at first feeding, says Mr. Murray. He points out that anyone thinking of recycle salmon hatcheries should be aware that a careful management strategy is required at this crucial stage.

The inter-relationship between physical characteristics of proprietary feeds and water quality parameters is being researched by an MSc student at Heriot-Watt. Results from that study are expected within the year.

By May 1, some 15,000 domestic and 20,000 wild fry were actively on feed, and the recycle system was beginning to respond to its purifying duties. But May 5 went down in the log book as Black Tuesday. Staff went in to find the two 5 ft diameter fry tanks full of dead fish.

— but fry loss was a shock

"Many in the business will know the depression we felt that day," says Mr. Murray.

The log book showed that towards the end of April one of the ion exchange units was progressively blinding up. On May 4, the operator switched over to the spare ion exchange unit and, to prevent the first unit from flooding, cracked open the drain valve. He did not want a night-time call-out!

No oxygen

Unfortunately there was now more water going to drain than was being supplied to the system. The results were obvious for all to see: no water — no oxygen: no oxygen — no fish!

Says Mr. Murray: "It is always easy to look back on a disaster and say 'that was obvious, and I would not have been so stupid', but for many of us the safer philosophy is to acknowledge human error and say 'there but for the grace of God.'"

By coincidence, contact

was made that same week with Mark Pattison of Kinloch Damp. A generous offer of fish resulted in a quick dash to Kishorn and by May 25 the Edinburgh hatchery was operational again with 23,000 x 0.24 g swim-up fry.

Between then and the end of October, at different times, batches of 5000 reached weights in excess of 5 g, at which stage they were passed on to others for on-growing.

Stocking densities of 20 kg/cu. m were reached in some of the 5 ft diameter hatchery tanks, and in August, when the first batch were ready for despatch, Brian Austin of the Biological Sciences Department at Heriot-Watt took away 200 to check their condition and give them a clean bill of health.

For the system, the first choice ion exchange zeolite proved unsuitable for gravity flow filtration. The coarser grained material proved very effective, although it did need to be well washed before being brought back on-stream.

Solids removal by sedimentation was not needed during the earlier stage of fish growth but soon became an essential step for waste feed and faeces. There was quite a serious problem developing on localised dead spots, and this aspect is being changed.

Sewage filamentous growth dominated the fish tank outfalls, the sedimentation and biofiltration units as well as the ion exchange units. It did not get carried over to the reservoir tanks to create havoc as churned up colloidal matter through contact



Top: Wild stock (swim-up stage) photographed in April 1987, and below: Domestic stock (swim-up stage) showing tail-less fish in April 1987.

with the centrifugal circulation pumps.

Filter matting proved effective, but at the high biomass loadings it blinded-up within hours. This is an area that will be receiving attention in the revised design. Continuous monitoring of pH, DO and temperature produced interesting data that will be put to good use in future design studies.

Regular bacterial counts were taken and at no time did they go beyond 10,000.

At the end of October, the fish biomass held was 20 kg — 4000 x 5 g fish. The water temperature will be held at 12/14 deg. C throughout the winter months, so hopefully Heriot-Watt will be seeing a sizeable weight gain between now and April.

"If there is someone out there who would like to make us an offer on 'prime quality parr' next spring, please make contact," said Mr. Murray.

The economics, operating experience, design know-how and water quality information has not yet been assimilated. Between now and April 1988, certain controlled experiments will add to the researchers' knowledge and allow them to plan the re-siting of the Mark II system in the new Chemical and Process Engineering's Aquaculture Engineering Laboratory at Riccarton in the summer of 1988.

The general impressions are that controlled hatcheries for salmon are possible and should make a useful contribution to the industry's future growth, says Mr. Murray.

Like many new ideas floated in aquaculture in the last ten years there are still many "unknowns" to be resolved. So, for salmon hatchery managers the advice from Mr. Murray is: "Don't rush in."



Kinloch Damp salmon fry photographed in June 1987 after having settled into the Heriot-Watt recycle system

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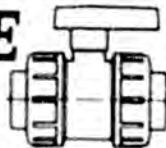
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Virus hits fishery

THE Montta fishery of the Oulujoki company at Muhos in Finland has been forced to destroy 400,000 fingerlings because of an unidentified virus disease.

The fish destroyed were one-year-old fingerlings of salmon, sea trout and lake trout valued at over £41,000. A sample of the virus is being identified in the UK and results are expected during the winter.

Destruction

If the disease proves dangerous, the whole fingerling and parent fish stocks of the Montta fishery is threatened with destruction and losses would then rise to millions of marks.

The Finnish State Veterinary Institute says the health of the fish in Finnish fisheries is generally good and the cool summer has been unfavourable to fish diseases.

Scottish guide to shellfish

THE suitability of marine bivalve molluscs for cultivation in the waters of the west of Scotland is pointed out in a new information pamphlet from the Department of Agriculture and Fisheries for Scotland.

Compiled by J. Drinkwater, it describes basic biology and cultivation methods for mussels, oysters, scallops and queens. Notes are included on the selection and testing of sites, methods of stock management, organisation of the industry and legal aspects of cultivation.

Drinkwater notes that there is a continuing and growing interest in shellfish cultivation in Scotland, pointing out that bivalve molluscs such as mussels and oysters have advantages for cultivation over other animals. They are non-motile and therefore easy to harvest, and can be kept in captivity without the need for constant attention and artificial feeding.

The various methods of shellfish cultivation lend themselves well to part-time

activities and thus help considerably in places such as the Highlands and Islands where employment is scarce. They combine particularly well with the traditional activities of crofting and inshore fishing.

According to Drinkwater, Scottish waters, particularly on the west coast, are well suited to bivalve cultivation. One of the main reasons is that they receive the benefit of the North Atlantic Drift, with sea temperatures higher than in many other areas of similar latitude.

Another reason is that the

geographical features include many inlets and islands which offer local shelter. In addition, many inlets are partly cut off from the open sea by narrow entrances with shallow sills, helping to produce relatively high summer temperatures.

Finally, Scottish waters are almost entirely free from troublesome pests and diseases, and from bacterial and chemical pollution.

● *Shellfish Cultivation in Scotland*, by J. Drinkwater, is available from The Librarian, Department of Agriculture and Fisheries for Scotland, Marine Laboratory, P.O. Box 101, Victoria Road, Torry, Aberdeen, AB9 8DB, Scotland.

fish farming INTERNATIONAL

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SHRIMP FEED YEAST PLANT



THIS drawing shows how the new Provesta Corporation fermentation products plant will look when completed in the spring of 1988. It is being built at the Phillips Petroleum Company Research Center in Bartlesville, Oklahoma.

The facility will have a capacity of three million lb a year, and will supply Provesta with a family of yeast products for its lines which include Microfeast, used in the feeding of shrimp and fish.

Export hopes for tilapia

FILLETED Philippines "red tilapia" is seen to have considerable potential for export to the United States and Europe, reports FFI correspondent Oscar L. Vilassiz.

The Philippines has become a world leader in tilapia production systems and much of this success is due to the initial efforts of Dr. Rafael Guerrero, director of the Fisheries Research Department of the Philippine Council for Agriculture Resources Development. He introduced the sex-reversal technique whereby seven to ten day old tilapia fry are fed hormone treated food for 21 days so that they become males.

With the simplification of sex-reversal in tilapia farm-

ing, it is now possible for the grower to apply it on his farm.

The Philippines is the first country to commercialise the production of sex-reversed tilapia fingerlings in outdoor net cages, and to produce a commercial sex-reversal feed at an affordable cost.

Dr. Guerrero also introduced cage culture of tilapia which is regarded as the most developed in the world in terms of area and output.

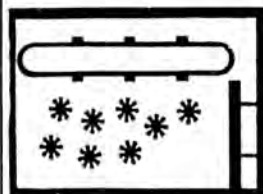
"While other countries are still experimenting or developing new technology," he says, "We already have an industry that is practically supporting itself."

"With our cheap labour and available technology, we can be competitive with other countries in the expanding world market for tilapia."

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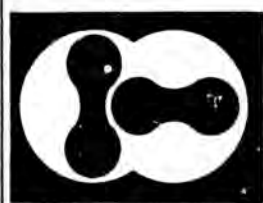
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Zimbabwe's fish needs stimulate farming

FISH FARMING in Zimbabwe, as a small but potentially valuable sector of the agricultural industry, is finally making slow but steady progress.

Early fish farmers had to compete with cheap local red meat and the importation of popular sea fish from Mozambique and South Africa, and they were soon discouraged.

Secondly, the technological breakthroughs of recent times were unknown then, and the fledgling industry was very much in an experimental phase.

Progress was also disrupted when the fisheries section of the Henderson Agricultural Research Station closed down, with the loss of laboratories and experimental ponds.

The subsequent transfer of the experimental function to a number of small and widely dispersed National Parks stations was a retrogressive step, from an aquaculture point of view, as research effort lost impetus, integration and co-ordination, and resulted in relative stagnation through the 1960s and 1970s.

Problems were also aggravated by the country moving into a period of international isolation, sanctions, and a costly bush war, following the declaration of UDI in 1965.

Nevertheless, interest in fish farming continued, as

economic and political factors caused a reduction in the import of marine fish products, and beleaguered Rhodesians found themselves increasingly looking at their own resources to meet the demands of fish-hungry consumers.

Not surprisingly, several major fisheries developed during this period, including the seine fisheries of Lakes Mcllwaine and Robertson, and the successful pelagic fishery on Lake Kariba.

Farmers and smallholders dabbled, but the first real breakthrough in commercial aquaculture came with the establishment of a trout farm in the Eastern Highlands in the 1970s, catering to the needs of the gourmet market. A precedent was set, and with the disappearance of Mozambican prawns from the market in the mid 1970s a new opportunity was created, opening the way for the establishment of a freshwater prawn farm at Lake Kariba in early 1980. This

imaginative and exciting

Reports Dr. Dale Kenmuir

development undoubtedly stimulated further interest in aquaculture among local entrepreneurs.

In 1980 Zimbabwe gained its independence, and conditions for the establishment of fish farming improved further, with the renewal of links with the international community. This allowed access to new technology, potentially valuable live culture fish imports, and international exports.

ICLARM, for example, has established a regional office in Malawi, allowing for the monitoring and co-ordination of fish farming activities in the region as a whole, and supplying a useful link to various important international aquaculture institutions and organisations.

In addition, the Zimbabwe government has been liaising with overseas experts, sending personnel abroad, and negotiating funds to establish facilities, such as a low-veld warm water aquaculture research centre.

Paradoxically, the greatest incentive for fish farming has come from a negative factor — increasingly scarce foreign currency in the country.

Imports of "luxury" or non-essential sea foods, such as hake and kingklip, have virtually ceased, creating a strong demand for local fish.

Current production of table-type fish in Zimbabwe, mainly tilapia, totals only a few hundred tons, and cannot possibly meet the demand from restaurants, hotels and supermarkets. As a result, the price of local fish, when available, has rocketed, and now greatly exceeds that of red meat.

While rump steaks at \$25/kg, and stewing beef at \$3/kg, tilapia fillets of sometimes dubious quality sell at \$12/kg, oily bottlenose fillets at \$9, bony tigerfish cutlets at \$7, whole small tilapia at \$5.60 and whole tigerfish at \$4.50 (all on a strictly "when available" basis).

Not surprisingly, businessmen have responded to the shortage of fish and the profit incentive and a number of pilot or operational fish culture schemes, mostly



Looking to the future, there seems to be good possibilities for the farming of carps. Roy Burns, manager of the Kariba prawn project, had this prime specimen grown in one of the farm ponds.

growing tilapia, have started up.

Cairn's Holdings, for example, has established a tilapia production unit at Mount Hampden, outside Harare, with the ultimate intention of producing 400 tons of fish a year. To assist such developments, exotics have been imported (as possible improvements on local species), including two tilapia species from Israel (*Oreochromis niloticus* and *O. aureus*), several carps and even channel catfish.

A further incentive for the development of fish farming has been the realisation that the country's numerous reservoirs, even if maximally harvested, cannot produce the country's total fish requirements.

Cooler water

Siting farm schemes closer to these markets offsets the problem, but results in reduced growth rates and lower overall production, because of the cooler water temperatures.

Ironically, another problem is the scarcity of foreign currency, which means the importation of essential equipment or materials, if unavailable locally, is often difficult or impossible.

Fish food is expensive. Capital and development costs have risen sharply in recent years, mainly as a result of supply and demand market forces and the governments minimum wage policy, and general expertise and advice on fish farming is scarce or lacking.

Production

Present production from all sources, including the pelagic, gill and seine net fisheries, and subsistence, ration, recreational and illicit fishing, probably totals about 25,000 tons a year, but a desirable target from a minimal nutritional point of view is estimated at 70,000 tons.

To even begin to meet this need the country's water resources have to be managed and manipulated

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Harvest time for Kariba freshwater prawns. They are in enormous demand from hotels and restaurants.



Scarcity of quality table fish means that even coarse indigenous species like the bottlenose and nchila (seen here) find buyers in the shops at inflated prices.

Another major constraint has been the paucity of fish seed — a discouraging factor to many prospective fish farmers. A general reluctance of entrepreneurs to share hard-earned knowledge and experience is another factor hindering development.

Despite these problems, aquaculture remains an attraction, and a pioneering spirit is strongly evident among practitioners of the art. Improvisation, trial and error, and dogged determination, will undoubtedly inch Zimbabwe towards eventual establishment of a successful fish farming industry.

Keith Nicholson, a former tobacco farmer, epitomizes the experimental spirit and approach. With no prior fish farming experience, he has established a modest nine-pond tilapia unit on the shores of Lake Kariba.

Tilapia unit

Through trial and error he has devised a production technique which minimises costs and maximises growth and production — basically using simple pond-breeding methods in preference to more sophisticated techniques, fertilising with chicken manure from a neighbour's poultry unit, thinning out, and then booster-feeding the remaining stock.

Using imported tilapia (*O. niloticus*) in preference to slower growing local species, he produces marketable fish well within a year. He has also experimented with duck/fish production, but found consumer resistance, as duck-eating is not a local tradition.

A reasonable cash flow is maintained between harvesting selling surplus fingerlings as ration fish (\$2/kg) and live fingerlings as stock-fish to other farmers (\$150/1000).

The point about this typical small culture unit is that experimentation is producing results, whereas many recommended methods or preconceived plans and ideas have not been successful. This is a characteristic feature of pioneering ventures, and seems particularly true with regard to fish farming, where methods have to be adapted to local conditions, markets and circumstances, and flexibility, rather than rigidity, is required. If this venture proves successful, its essen-

tial simplicity and easy of operation will undoubtedly allow duplication elsewhere.

The experience of the neighbouring Kariba prawn farm exemplifies another characteristic of aquaculture ventures — namely, that preliminary paper exercises showing rapid capital recovery and glowing profits seldom bare any resemblance to later events, when hidden costs escalate and unforeseen problems occur.

Struggled

This enterprise has struggled to gain full financial viability against a background of rising costs, staff turnover, and various other problems, including a receding lake level which almost left the farm high-and-dry on the Kariba shoreline.

Installation of new pumps, piping, and a transformer cost the company over \$100,000, appreciably adding to the loan repayment burden.

However, a spirit of optimism prevails, and Roy Burne, the manager, is confident that the turning point has been reached. The hatchery is functioning efficiently and 16 ponds totalling 12 hectares are now in production. A ready demand for the product exists, and if the production target of 1½ ha a year can be attained, the farm will start showing a profit. But the margin for error is small, and tight management will be required if viability is to be achieved and maintained.

An interesting development on the aquaculture scene is renewed interest in carp, with imported grass and silver carp thriving at Kariba.

Specimens intended for breeding purposes have attained 6 kg in the prawn ponds. Grass carp have now been induced to breed, using the hormone injection technique, opening the way for further polyculture experiments and the possible sale of fingerlings to farmers elsewhere. Attempts are also underway to induce breeding in the silver carp.

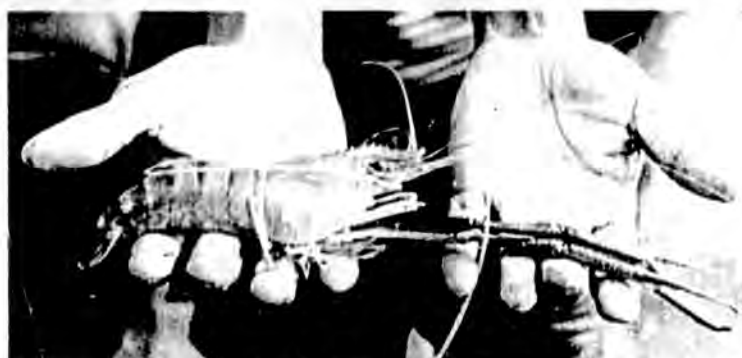
Keith Nicholson has grown carp to marketable size in his tilapia ponds, and to his surprise obtained a better price on the local market than for tilapia.

"People want a bigger, meatier fish," he explains. "They'll take carp first, tilapia second, and ducks third."

A pleasing factor with his carp production was that the fingerlings, unlike tilapia, all grew at the same rate, resulting in a crop of uniform-sized fish. This eliminates a grading problem, and helps with marketing. Karen Burne, wife of Roy, maintains that silver carp are not unlike kingklip in quality of taste, and feels they would do well on the local table market.

Zimbabwe fish farmers, mostly battling to grow tilapia near the markets in cool highveld conditions, and bedevilled by the wild-breeding problem that affects low technology systems, will probably show interest in carp if the market is receptive — as it appears to be.

In previous years, market taste were largely white orientated, whereas today black tastes prevail, and carp are not unlike, although superior to, the popular indigenous nchila species (labao). Carp might well be more acceptable to the market today than previously, especially if the comparison with good seafood holds true for some of the species.



The freshwater prawn is one of the promising farm species now being raised in Zimbabwe at Lake Kariba.

If a major constraint to aquaculture development in Zimbabwe has been the lack of easily available seed, then a few private large-scale producers of carp and tilapia seed could rectify this shortcoming, and pave the way for development.

Mike Moroney, of V & M Fisheries on Lake Robertson, is developing his tilapia farm both as a food and fry producer (using *O. niloticus* and *O. aureus*), and could emerge as a major producer of seed.

Breeding stocks of tilapia will need to be carefully husbanded, however, if hybridisation of imports and local species is to be avoided. As it is, invasion of river systems by imports is almost a certainty, if fry are distributed to growers around the country. Government will need to monitor the situation closely.

The present fish farming scene in Zimbabwe is an exciting one — still in its infancy, but seemingly poised for rapid expansion. The key to success could well be the availability of seed, and perhaps a movement away from tilapia culture towards carp production, or a mixed culture of tilapia, carp and perhaps even catfish.

The ultimate answer to large-scale fish production could well lie with the various carp species, already well proven on the international aquaculture scene. They are at home in both lowland and upland conditions, show vastly superior growth to tilapia, and require minimal supervision.



A farm pond owner gets help to harvest his tilapia crop.



The small size of these tilapia underlines a problem faced by local farmers — that of reduced growth and production in the watershed areas.

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Prawn harvest at a Bohai Sea farm site.



China has big plans for marine farms

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ALREADY established as the world's largest producer of fresh-water farmed fish, China is now developing ambitious plans to expand marine farming. A flourishing mariculture industry is taking shape along the country's extensive coastline.

According to figures released by the Ministry of Agriculture, Animal Husbandry and Fisheries, production of marine products from farming in 1986 increased by 21 per cent over that of 1985 to reach a total of 860,000 metric tons. Some 320,000 hectares of water surface were used.

At present, Liaoning and Shandong provinces in the north and Fujian province in the south-east are the nation's three leading marine farm areas. Each harvests more than 200,000 tons of products a year.

Situated along the west rim of the Pacific ocean, China has 18,000 km of coastline. It administers a total sea area of three million sq. km, which is equal to about one-third its land area.

For many people on the coast, marine breeding is a potentially quick way to improve earnings. One survey shows that marine products raised in a hectare of water surface bring in three to five times the income from farming a similar-sized piece of land.

With suitable farmland scarce and a huge population, China is facing a labour surplus problem. Also, excessive land reclamation is upsetting the ecological balance. Utilisation of beach and coastal waters is therefore seen as an ideal way to tackle the problems.

China's marine industry used to focus on catching rather than farming, thus draining offshore resources. Development of marine breeding, therefore, is a strategic shift of vital importance for the country.

Development plans aim at using more shallow water space and reclaiming more beach areas in the years ahead.

An early target is one million tons of farmed marine products by 1990. The main

harvest at present consists of seaweeds (kelp and laver), prawns, scallops, common mussels and abalone.

Seaweeds accounted for 23.7 per cent of the 1986 harvest. China is presently the world's largest producer of kelp, which is used as a food and as a source of iodine. Production is expected to increase further by 1990 and 50,000 to 70,000 tons of dry kelp will be utilised by the iodine-making industry.

China is now becoming one of the world's leading producers of farmed prawns, with most of the output exported to Japan and Hong Kong.

Once concentrated in the north, prawn farming is expanding rapidly in the southern coastal provinces

where fishermen and farmers are building large numbers of ponds.

Technical breakthroughs are helping the growth of prawn breeding which is earning much-needed foreign exchange.

The scallop was once shunned in China, but people are now recognising its high nutritional value, and it is appearing more and more on hotel and restaurant menus. Scallop eating is now very popular in Shandong and Liaoning provinces.

In 1986, China's harvested 230,000 tons of scallops.

Also increasing is the production of mussels, sea cucumbers and abalone.

"If the industry keeps growing at its present pace, our plan should be fulfilled, possibly ahead of schedule."

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Fremantle college develops marron battery farming

THE MARRON (*Cherax tenuimanus*) is a freshwater crayfish found in the wild in the south-west area of Western Australia. One of the world's largest crayfish, it is a promising species for farming and is being grown in a number of aquaculture projects.

Until recent years, however, very little was known about the marron and its culture possibilities, but training and research at institutions such as the Fremantle College of TAFE has developed steadily and courses are now being offered to farmers.

The Maritime Studies Department of the Fremantle College began with a collec-

tion of borrowed equipment, second-hand repaired tanks and donated marron, Wayne Hastings of the Department told FFI.

That was in 1984 when there was some uncertainty about the direction in which the marron and the aquaculture industry were heading.

Today, aquaculture subjects are being included in existing Fishing Certificate and Diploma courses. Marron farming short courses of 20 hours are planned for this year.

Courses on prawns, trout and other species are also being considered; and training manuals and videos are being produced.

But marron culture development has been the focus

of attention, the aim being to produce marron in large quantities, quickly, in various sizes, and in a commercially viable environment.

TAFE is not basically a research institution. But aquaculture is a relatively new industry in Western Australia and presently lacks established industrial techniques and methods. Training and research have therefore been linked.

Students have done research into marron culture as part of their study courses.

According to the college, considerable progress in marron battery culture has been made over the past four years.

"Through trial and error,

we are getting closer and closer to a practical and efficient marron battery system that will be commercially viable," Mr. Hastings told FFI.

Testing of the next generation of marron battery farming development will be part of student assessment for relevant courses in 1988.

"We can now see the light at the end of the tunnel for final development of a viable marron culture system," said Mr. Hastings.

Enquiries about the courses and marron battery systems can be made to Wayne Hastings, Maritime Studies Department, Fremantle College of TAFE, 41 South Terrace, Fremantle, Western Australia 6160.

Pollution down

THE environment for fish farming in the United States is better today than ten years ago. Pollution has been considerably reduced due to the introduction of unleaded petrol, upgraded sewage treatment and less use of pesticides.

This is the preliminary conclusion of Texas University researchers who are conducting a five-year study of coastal water contaminants. Their work is part of the federally funded National Status and Trends programme to determine long-range environmental conditions.

Oyster samples from 50 locations in the Gulf of Mexico have been tested for toxic metals, pesticides and other pollutants. Trace metal levels were discovered to be high in some places.



Harvesting razor clams on the coast of Fujian in south-east China.

said Ministry official Tu Fengjun.

Investment funds and incentives are crucial to implementation of the development programme.

Local governments have taken it upon themselves to pool funds from various sources and take out loans to develop projects. Individuals have been encouraged to start farms that will result in profits.

Dalian, a city in southern Liaodong Peninsula, is an example. The city has 62,000 ha of beach and shallow water space suitable for marine farming, but money is short.

The need is being met through government loans, co-operative investments, and investments from foreign countries. A total of 147 million yuan (about US\$40 million), including \$14 million in foreign exchange, has been pumped into the industry in recent years.

Dalian's mariculture output reached 228,000 tons in 1986, well over double the 102,000 tons of 1985. One-third of the city's sea area suitable for farming is being used.

Shenyang county in Jiangsu province provides another example of the development taking place.

There, farmers are being encouraged to work the waste beach and shallow waters. They are exempt from paying taxes for three

years after completion of their fish and prawn ponds.

As a result, 909 households with more than 3000 people have settled in the beach area and they have dug 730 ha of ponds.

Price reforms are making the structure of the marine industry more rational and the combined output of fish, prawns and other expensive marine products rose from nine per cent in 1985 to 15 per cent of total marine production in 1986.

Time to apply

APPLICATIONS can now be made for the third round of European Community grants for aquaculture projects which include the construction, equipment or modernisation of installations for rearing fish, crustaceans or molluscs.

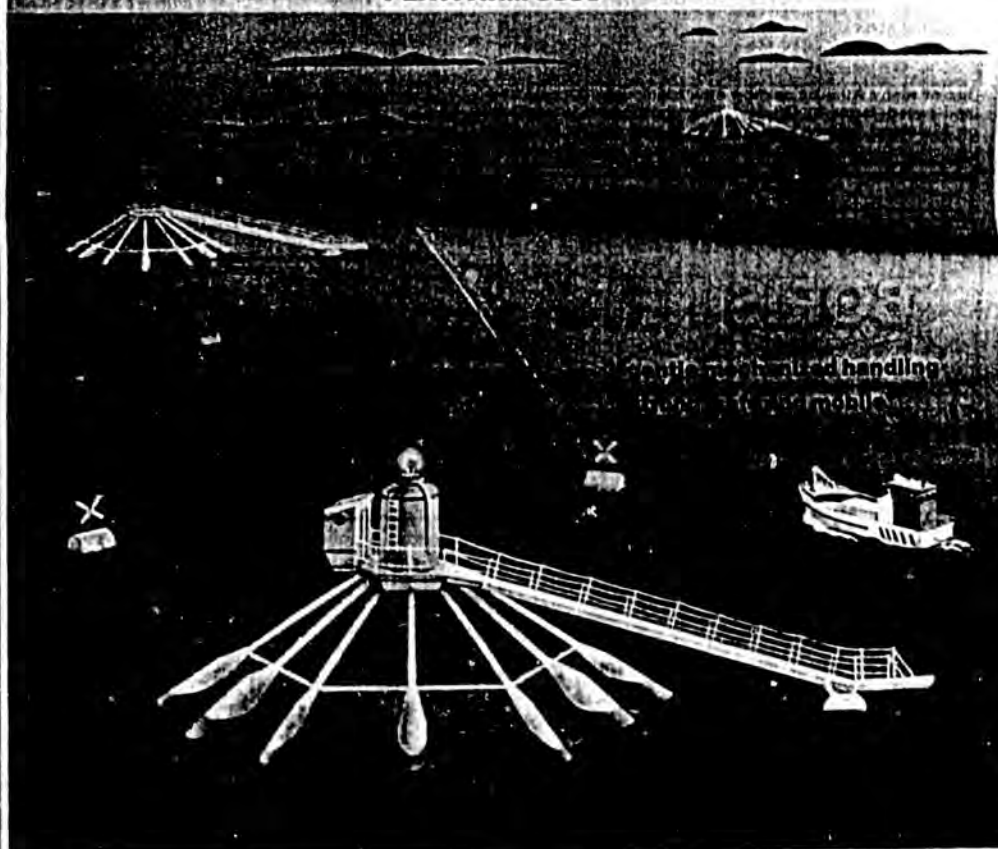
Aquaculture projects must have sufficient capacity to ensure sustained commercial operation.

In the UK, applications should be sent to the appropriate government departments of agriculture and fisheries.

The closing date for receipt of applications by the EEC Commission is March 31. Those submitting them for aquaculture in the UK are advised to get them into the fisheries departments by January 31.

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MARINE FARMING



One of many Atlantic salmon now being raised in sea and land-based farms in Orkney. This photograph was taken on Mainland Salmon's pump-ashore unit on the island of Rousay.

ORKNEY, the group of islands six miles north of the Scottish mainland, between the Atlantic Ocean and the North Sea, is fast gaining a reputation for the high quality of its farmed seafoods. Atlantic salmon and oysters head the present list of cultured species, and in a few years time farm-raised cod and halibut could also become products of these fertile islands.

A forward-looking community of some 19,000 people, Orkney has always tried to make the most of development opportunities provided by its natural resources, its strategic position and the enterprise and skill of its people.

Long renowned for the excellent of its beef, cheeses, oatcakes, lobsters and other high quality foods, Orkney is building on this reputation with the controlled expansion of its fish and shellfish farming industry.

Warmed by the Gulf Stream to give an annual temperature range of 4-14 deg. C, the clear waters surrounding the islands are said to be well suited to fish farming.

Due to their exposed location, the Orkney Islands have a limited number of sites suitable for cage culture but have gone on to develop a number of successful pump ashore salmon farms.

Superior

It is the proud boast of the Orkney Salmon Growers Association that its members produce superior fish of the finest quality.

"This quality is achieved by the farms mostly being run by owner/managers, ensuring a high level of attention to husbandry

THRIVES ON THE ORKNEY ISLANDS

Quality salmon and oysters lead the way, reports TOM WRAY in this special feature

which is reflected in the final product," says the Association.

While individual farms are small, ranging between 50 and 250 metric tons annual production, marketing is done co-operatively to fulfil larger orders and local quality control is said to ensure that each farm produces salmon of the highest standard. Orders are graded to requirements, and more and more Orkney farms will also be recognised by the Foodmark symbol indicating superior quality fish.

Processing of farmed salmon is already being developed in the islands and most salmon farms are now

able to supply smoked salmon and salmon portions as well as fresh salmon to suit customer requirements.

Good transport links mean that freshly harvested farmed fish can be delivered to London within 72 hours. For special deliveries, Orkney is well serviced by several daily flights linking the islands through the UK mainland with anywhere in the world.

Formerly an old Norse jarldom which was pledged to Scotland in 1468, the island group is administered by Orkney Islands Council. The Council actively promotes economic development, and has given considerable help to the emerging fish farming industry.

The Council assists new and expanding businesses in a variety of ways. It provides sites and premises; assists and advises on technical, financial and marketing aspects; arranges joint Orkney stands at trade fairs; provides financial assistance; and works closely with the

Highlands and Islands Development Board, which also offers development assistance.

Alan Coghill, the Council's industrial development officer, was convinced in the 1960s that salmon could be grown in Orkney.

"It was a long, up-hill struggle to persuade people that in fact Orkney is better suited to growing salmon than many other areas," he told FFI. "The results since we started have proved it."

Convinced

"Back before it all started a group of councillors and ourselves went and looked at what was going on elsewhere in fish and shellfish farming. We came back convinced that we should press on and ignore those advisors who said it was not possible to farm fish in the north."

Ken Sutherland, who now runs the successful farming and processing venture called Orkney Fish Farms, was the pioneer. He started



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Filling the hopper of a Tassomat automatic feeder on an Orkney salmon cage farm.



Orkney at a glance

ORKNEY is an archipelago of about 70 islands separated from Caithness in the Scottish mainland by a six-mile wide stretch of water called the Pentland Firth. The islands cover an area of 376 square miles, and they extend 53 miles north-north-eastwards. West to east, Orkney measures 23 miles.

Some 19,350 people inhabit 18 of the islands, the principal ones being Mainland (or Pomona), South Ronaldsay, Westray, Sanday, Stronsay and Hoy. The towns of Kirkwall and Stromness have populations of 6681 and 2160 respectively.

The terrain is fertile farmland mostly, undulating and low. The climate is relatively mild.

Access by road is by roll-on roll-off ferry from Scabster (125 minutes), by sea from Scrabster or John O'Groats (45 minutes) and by air from Inverness (45 minutes) or Glasgow (125 minutes).

measured in thousands of tons rather than hundreds," he pointed out. "But I don't think our industry is any the worse for that because we have seen fairly logical and consolidated growth.

farming salmon in the sheltered waters of Scapa Flow in 1980, when he embarked on a Council-assisted pilot scheme.

At the same time, the Council also began a programme of research into shellfish culture, looking at oysters, scallops and mussels. Ingeborg Dickie was employed as shellfish co-ordinator, and from those small beginnings a significant shellfish farming industry is now emerging based largely on oysters, but with queen scallops also showing significant promise.

To assist development of fish and shellfish farming the Council provided assistance towards the initial cost of trials, at the rate of 50 per

cent of costs up to a maximum of £1000 in the case of oyster farming and £3000 in salmon farming. The HIDB was not able to give Orkney's budding fish farmers assistance in their first year, so the Council had to find some means of providing production sites and giving people some experience.

Ten growing

There are now about ten companies active in on-growing salmon in Orkney as well as five hatcheries providing young stock.

According to Alan Coghill, the industry is developing satisfactorily. "It hasn't shown the enormous growth of Shetland, where output is



Simple wooden cages are used by many Orkney salmon farmers, but there is a growing interest in more substantial units capable of withstanding the conditions at more exposed sites.



Industrial development officer Alan Coghill (left) chats with Orkney shellfish farmer Dave Bichan.

"We are developing everything together instead of expanding production and hoping for the best. Orkney seems to have established a pretty good reputation for its farmed fish in terms of both supply and quality, and the growers have been careful not to get themselves into an over-supply situation."

Production statistics for the shellfish sector are hard

to come by. But, according to Stewart Crichton, secretary of the Orkney Shellfish Growers Association, the islands' 16 oyster farms had somewhere between three and four million oysters in the water during my visit in October 1987.

Orkney's oyster growers hope to have around 1.5 million oysters for sale in 1988. But if the industry is to really take off, said Mr.

Crichton, more attention will have to be paid to marketing and to acquiring better quality spat for on-growing.

Excellent progress is, however, already being achieved in the shellfish growing sector, which is forecast to make strong advances over the next few years as businesses become better established and the demand for their products increases.

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Orkney marine farms

Salmon pioneer also a processor

FRESH salmon, smoked salmon, smoked salmon pate and smoked salmon chipolatas. These are just some of the seafood products now available from Orkney Fish Farms, an enterprise started by pioneering fish farmer Ken Sutherland.

A former merchant navy captain, Mr. Sutherland is reputed to have been the first person to farm salmon in the Orkney Islands. Since he established his cage farm in the clean, sheltered waters of Scapa Flow in 1980, he has gone on to culture Pacific oysters and is now producing what must surely be some of the best sweet marinated herring products outside Denmark.

Starting out with 1000 smolts seven years ago, Mr. Sutherland has gradually expanded his salmon farming activities every year and plans to stabilise his annual smolt intake at about 25,000. This will enable him to pay due attention to his other seafood activities, which also include the production of smoked eels, kipper pate and smoked scallops.

Orkney Fish Farms presently raises salmon

in home-built wood and polystyrene cages. But when FFI visited Orkney in October, Mr. Sutherland and a number of other local farmers were planning to fly over to Shetland to check out the performance of the larger plastic Polarcle and steel Nordic and Viking cages used there in more open waters.

The oyster unit operated by Orkney Fish Farms is situated in Longhope and is looked after by Angus Budge. It presently consists of a small trestle system on which around 100,000 Pacific oysters are being ongrown. However, the firm is to concentrate on the raft culture of oysters and is planning to expand its shellfish farming operations if other commitments allow.

Full of ideas for adding value to Orkney's farmed fish and shellfish by further processing, Mr. Sutherland believes that more and more oysters will have to be processed into products that consumers really want to eat. He is presently considering marinating oysters in the same way as his herring products.



Birsay Hatcheries' Iain MacLeod and Kevin Grieve in front of the unit's C&H Plastics smolt rearing tanks. The automatic feeders were supplied by Tess Aquaculture.

Hatcheries supply home-bred stock

ORKNEY is developing the smolt production side of its salmon farming industry and aims to produce significantly more of its own young stock. This is so that in future, yearly supplies of salmon may be guaranteed of a quality especially bred in Orkney.

The development of several new salmon hatcheries in Orkney over the past few years should ease the demand for Scottish smolts in 1988, according to the Council's Department of Economic Development, which points out that the limited supply of freshwater is a major constraint on large-scale production.

October more tanks were being installed to boost future yearly production to 150,000.

Water from the large Loch of Swannay is pumped into a header tank from where it flows by gravity into an 8 ft deep sump and then to the hatchery and rearing tanks before returning to the loch via a large concrete settling tank. Filtration of the in-going water is provided by a Triangle filter, fitted with a 30-micron screen, supplied by Tess Aquaculture Ltd.

The Birsay hatchery has two pumps, one for normal use and one for emergency, and there is a standby generator set which starts up automatically in the event of a power failure. All the farm's rearing tanks are fitted with high/low water level

sensors, which form part of an AquaTronic monitoring and alarm system supplied by Hi-Sat Communications Ltd. This system also monitors the water level in the header tank.

Troughs

The Birsay hatchery is composed of two banks of C&H Plastics Mk. 3 hatching troughs. These are designed to provide a first class environment for eggs and young fish up to the first feeding stage. Each unit is based on the proven Californian principle with the water upwelling, into each basket. Egg screens are provided through which the young fish drop into the alevin trays which reduce fish movement and bunching.

When FFI visited Birsay,

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First cages were in Scapa Flow

ESTABLISHED in 1973, Orkney Seafoods Ltd. specialises in the supply of live lobsters and fresh or smoked salmon. As revealed in *FFI* last month, the firm recently commissioned an impressive new smoking plant and processing facility in Kirkwall, where its lobster storage ponds are also situated.

Orkney Seafoods farms its salmon in floating cages in the Lamb Holm area near the Italian Chapel, the only relic of Camp 60, which housed in the later years of World War II several hundred Italian prisoners.

These men, captured during the North African campaign, were sent to Orkney to work on the Churchill Barrier, a massive series of concrete causeways that seal the eastern approaches to Scapa Flow, which at that time was an important British naval base.

Today, the barrier linking Lamb Holm with the Orkney Mainland provides shelter for Orkney Seafoods'

salmon farm. Before the barrier was built 14 knot currents used to sweep through the sound.

Orkney Seafoods is an associate company of Konrad Sekkinstad of Sotra, near Bergen in Norway. The Norwegian company has been involved in salmon farming since the late 1960s, and was trading in lobsters well before that. It started buying Orkney lobsters in the 1960s and later established Orkney Seafoods.

But in 1984, when the lobster business in Orkney became more seasonal than the parent company would have liked, it decided to

diversify and expand into salmon farming.

The company's first site was on the Scapa Flow side of the barrier. It was reasonably successful, but the potential for expansion looked limited, for the area was later identified by the harbour authority as a refuelling zone for offshore vessels.

Accordingly, the salmon cages were positioned on the eastern side of the barrier off Lamb Holm and in the first year were stocked with 25,000 smolts. Some 40,000 smolts a year were taken in over the next two years, expansion being prevented in 1986 by the limited availability of smolts from mainland hatcheries. The 1987 intake was 100,000 smolts.

The 40,000 smolts have given a year production of salmon in excess of 100 tons, and Orkney Seafoods is cur-

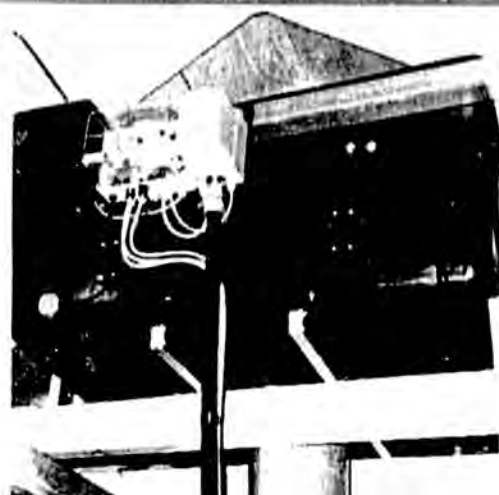
rently expanding its annual production to around 250 tons.

Salmon from Orkney Seafoods is sold on the fresh market in London, to smokers in Scotland, and quantities have also been exported to mainland Europe, particularly France. The company is now closely scanning other markets as potential recipients of its Superior Orkney Smokehouse salmon.

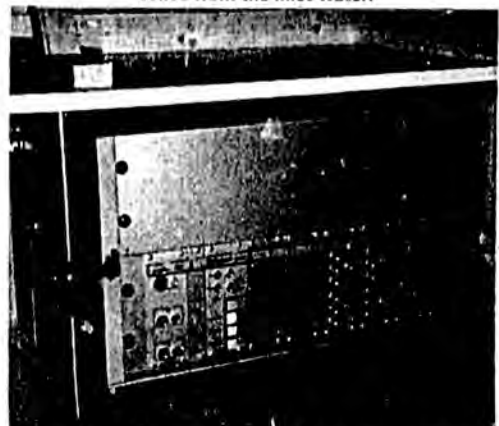
The firm's Orkney-raised salmon, most of which goes to the fresh market, is presently on-grown in ten metre square cages. These were locally built in timber and polystyrene and have survived remarkably well.

David McKeane, who until recently managed the farm, told *FFI* the south-east winds and large swells

continued next page



Birsay Hatcheries' Triangle filter takes out the suspended solids from the inlet water.



The farm's Aqua-Tronic monitoring and alarm system was supplied by Hi-Sat Communications. This is the control panel.

the outside rearing section was composed of 14 four-metre and two five-metre diameter C&H Plastics tanks, and another six five-metre units had been ordered to accommodate the extra production. All the outdoor tanks have fitted covers, and their automatic feeders were supplied by Tess Aquaculture.

Can check

The popular Tessomat fingerling feeder has a capacity of 15 litres and the hopper is made of transparent plastic so that the farmer can check the feed level even at a distance. The lid is hinged with an elastic strap at the back which is permanently attached to the hopper, making refilling easy. The lid is secured with another elastic at the front, keeping the unit tightly sealed.

Adjustment of the feed dispenser is straightforward

both in respect of quantity dispensed and feed size. The desired gap is achieved by loosening the locknut under the hopper and screwing the vibrating plate up or down. The locknut is then retightened.

All the salmon eggs hatched so far by Birsay have been obtained from Orkney Seafoods' Namsen broodstock. The smolts produced from these eggs have been sold back to Orkney Seafoods, which is growing them on to market size in its own cage farm.

Tanks

The smolts are delivered in two 310 gallon insulated transport tanks. Constructed in double skin glassfibre with a PU foam core, these C&H Plastics tanks feature integral steel skids and lifting eyes, a large clamp-down hatch, 15 cm Mucon diaphragm main outlet and 5 cm drain down valve.

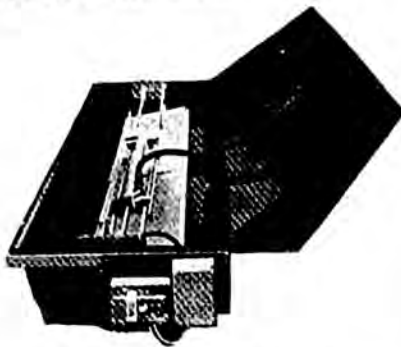
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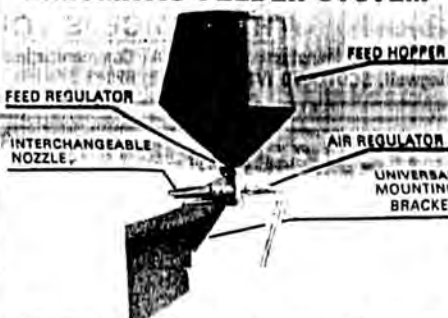
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Orkney marine farms

From Page 13

can create problems when trying to launch the work-boat from the beach.

If fish farming in Orkney is to expand into more exposed waters there is clearly a need for cages that will withstand the battering they are likely to get at certain times. Recently, a number of farmers from Orkney visited Shetland to view some of the larger steel and plastic cages employed there, so a move to more substantial enclosures could be on the cards.

Orkney Seafoods packs its salmon in an impressive modern plant close to the farm.

"When the Norwegians decide to do something they do it properly," observed David McKeane.

The fish is harvested into Paxton bins which once they enter the plant, are lifted by electric hoist and tipped onto the input table of the polished stainless steel processing line supplied by Sotra Rustfri Steel Industri of Norway. All the fish is bled. It is then gutted, washed and individually weighed, graded and finally packed with ice.

The plant, which was built in 1985, is equipped with a German Ziegler ice plant of 1.5 tons a day capacity, and has separate chill, box and food stores as well as wash-rooms and sleeping accommodation.



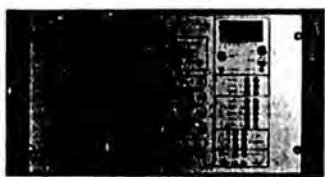
Orkney Seafoods' Dawson Shearer feeds salmon at the company's cage farm near Lamb Holm. Talking to him is Ken Chalmers of Hugh Norman (Aquaculture).

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Wind power pumps seawater to on-shore tanks

ESTABLISHED at the beginning of 1984 close to Kirkwall airport, the Ingness Bay Salmon Farm is owned and operated by Duncan and George Currie, both of whom are commercial divers and also run a construction business.

Their pump-ashore farm started with just four tanks. Another six were added the following year and when FFI visited Orkney three more pre-cast Ficem fibreglass reinforced concrete tanks measuring 25

metres in diameter and 2.5 metre deep were being erected.

"Each of these new tanks should hold between 15,000 and 17,000 salmon through to market, and will increase our annual output of top quality Orkney salmon to 110-130 tons," said George Currie.

All the construction work on the farm has been done by the Curries, who in 1986 invested in a 72 kW Vestas wind turbine. This turns nature's silent power into energy for pumping the seawater from the bay through the fish tanks.

Wind is the dominant feature in the Orkney climate, and Mr. Currie says the turbine looks as though it will be a good investment.

"We get plenty of wind up here, and though the generator is supposed to have an output of 75 kW, we have been getting up to 94 kW," he said. "At that time we were only using 70-75 kW at the farm so we were exporting the surplus to the Hydro."

The Curries installed the wind generator to help cut the running costs of their pump-ashore farm, something they see as essential if they are to cope with tumbling salmon prices that have been forecast as world-wide production of this fish soars.

Ingness Bay Salmon Farm's three new 25 metre diameter tanks are linked to smaller tanks, in which the fish can be starved before



George Currie of the Ingness Bay Salmon Farm gives his salmon a top-up feed using a BP high-energy diet. Looking on is Stewart Crichton of the Orkney Islands Council.

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Wild Orkney lobsters in Orkney Seafoods' storage ponds in Kirkwall. Some 1650 cwt of lobsters valued at £570,047 were landed in Orkney in 1986. Hatchery reared juvenile lobsters have for the last few years been released into Scapa Flow for restocking purposes. Fishermen FFI talked to recently reported catching a lot more small lobsters indicating that the restocking experiments are succeeding.



Flygt pumps which are used to continuously pump a large flow of water through the farm.

harvesting from these facilities.

The substantial volume of seawater that has to be moved through the farm is pumped from the bay by four electrically-driven Flygt pumps. The water is delivered through ten-inch diameter pipes to a header tank, and from there it flows by gravity through the tanks.

Feeding of the fish is carried out by Tess automatic

feeders, and the farm is provided with full back-up facilities. These include an emergency aeration system, a Gearing alarm system and a standby generator. The company tries to keep someone on the farm permanently, especially over the more critical winter months.

Shore-based salmon farms are easier to service than floating cage units, but this does not mean that they can be left to run themselves.

Family firm makes good use of farm products

ORKNEY farmed salmon smoked in the traditional way and hand sliced is a speciality of William Jolly, a family firm that has been in existence in Orkney for over 30 years.

In that time, the enterprise has developed from a small retail shop to a processing firm handling a cross-section of the seafoods available around Orkney. These include crab, scallops, oysters (whelks), oysters, white fish and, more recently, farmed salmon.

Mr. Jolly runs the business in partnership with his sister, Liz Johnson, and first got involved with salmon when he started to smoke wild fish. Very hard cures were then in vogue. Today the trend is for much milder smokes, and farmed salmon is predominantly used.

The William Jolly processing factory is on the Haistoun

Industrial Estate on the outskirts of Kirkwall. The original building used to be the airfield mortuary during the last war. With its thick walls and cool interior it was well suited for conversion to a fish processing plant, and it has been extended and modernised over the years.

The firm's traditional smoking kiln is about 5½ ft square and 20 ft high. The wood chip fire is situated at the bottom and the lowest products smoked are some 6 ft away. A screen in between prevents foreign matter entering the main smoking chamber.

"We have a standard routine but we vary the pickling and smoking times to suit customer requirements," said Mr. Jolly. The firm's traditional cure has been tried and proven over many years. It involves a sweet pickle followed by the firm's usual smoking procedure.

The pickling stage is where the basis of the flavour and texture is created. The sides of salmon are then smoked for eight to 12 hours and immediately vacuum packed to seal in the full flavour.

Giving the salmon a distinctive Scotch tang, William Jolly's Scotch cure is a blend of flavourings including sin-

gle malt whisky. Another favourite, the firm's Demerara cure, involves the same basic procedure but is enhanced by the addition of rum from the Caribbean.

Another of the company's salmon products is gravad lax. The firm has also smoked farmed Pacific oysters and Princess scallops for Dennis Gowland of Benesther Shellfish.

Princess scallops are smoked in the shell, and Mr. Jolly believes that oysters could be done in the same way. He usually boils the oysters when he has a batch of crabs. They are then pickled and smoked.

Mr. Jolly finds Torry Research Station an excellent source of advice on all

matters related to fish processing, including smoking, and singles out Torry Advisory Notes as particularly good value. Torry is a UK government body that works on the handling and processing of fish as food.

William Jolly has no ambitions to be in the big time. He told FFI he is striving for a "nice, small streamlined operation", expanding on his current lines in a controlled way and putting particular emphasis on the smoked salmon business.

It is the company's proud boast that from fish like those now being reared in Orkney it can produce smoked salmon to rival the best in the world.



William Jolly slicing farmed salmon smoked the traditional way in his factory in Kirkwall.

Smoked Atlantic Salmon by

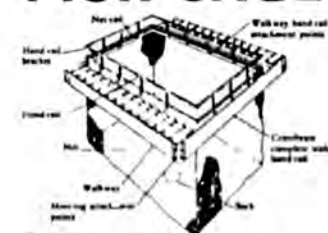
WILLIAM JOLLY of ORKNEY

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Orkney marine farms



Dave Bichan of Lang-Geo Oysters pulls up some of his produce to show FFI.

Shellfish develop on an oyster base

"FRESH oysters of the finest quality from the sparkling waters of Orkney. Top quality half-shell oysters fresh or frozen. Smoked oysters a speciality." These are some of the fine phrases being used by some of Orkney's leading shellfish growers to promote their products, which are finding increasing acceptance in the UK and beyond.

Orkney's oyster farming industry has for a number of years suffered from poor seed supply and this has extended the period before full production can get underway. However, the growers FFI met recently remain committed to the industry and are optimistic that full production will be achieved in the near future.

According to Stewart Crichton,

secretary of the Orkney Shellfish Growers Association (OSGA), three or four of the islands' 16 farmers are now well established and able to offer significant quantities of Pacific oysters and two more are coming up to the same stage. The remaining growers have either been established for a few years but are awaiting market developments before committing themselves

to further investment in stock, or have only recently started up.

The limited availability of good quality spat has been a major headache for the emerging industry, and this is why there are proposals for setting up a shellfish hatchery as well as nurseries in Orkney. Such developments would enable the growers to obtain a regular supply of quality spat that they could transfer to the water for on-growing when needed.

Methods

Alan Coghill, the industrial development officer for Orkney Islands Council, told FFI: "We have thought very hard about a hatchery. It is something we would like to see happen and the potential growth of the industry would be a good base for it."

A variety of oyster on-growing methods are employed in Orkney. They include beach trestles and trays stacked on the seabed as well as suspended culture from rafts and longlines. Several farmers have developed their own production ideas from what they have seen elsewhere, and they have clearly never been stuck for an answer to their equipment problems.

To start, most of their product was marketed through the council-sponsored Shellfish Growers Association. But as volume increased, farms like Lang-Geo Oysters and Benesther Shellfish went their own way and these concerns now also buy from other Orkney growers. There is, however, interest in setting up a joint marketing company.

"First, it must be established which growers are keen on joint marketing," said Stewart Crichton. "Some people have their own outlets and are keen to maintain them. As well as the restaurant market, there is the big bulk export market to France.

The Orkney growers have got to look at the area in between. This includes the smaller supermarket chains, large retail outlets and restaurant chains rather than individual restaurants.

"By combining their marketing efforts they could put out a regular supply of several thousand oysters a week."

One Orkney shellfish farmer who seems to be going well is Dave Bichan of Lang-Geo Oysters, in Finstown, a village a few miles north-west of Kirkwall. A former merchant navy deck officer who studied marine biology at university, he started his oyster growing business in 1980.

Mr. Bichan, who also works offshore for an oil company, has what he calls his 'base camp' in the inner reaches of the Bay of Firth. This comprises a raft equipped with a rotary grading machine and boxes. There, in relative comfort, he sorts, washes and packs the oysters harvested from his on-growing sites further out in the bay.

To seabed

He buys in seed at a size of 12-15 mm, mainly from Guernsey Sea Farms, and grows them in North West Plastics' trays for the first season. He likes to get the seed in the early spring so as to achieve a full season's growth. The young oysters are then transferred to seabed trays of his own design.

Lang-Geo Oysters is presently on-growing about 750,000 oysters. "We try to take in 200,000-300,000 spat a year, but there have been big problems in getting the quantity and quality of seed we need," Dave told FFI. "The last two years have been particularly bad."

He said he would not be in the shellfish business if he did not think it had good growth potential.

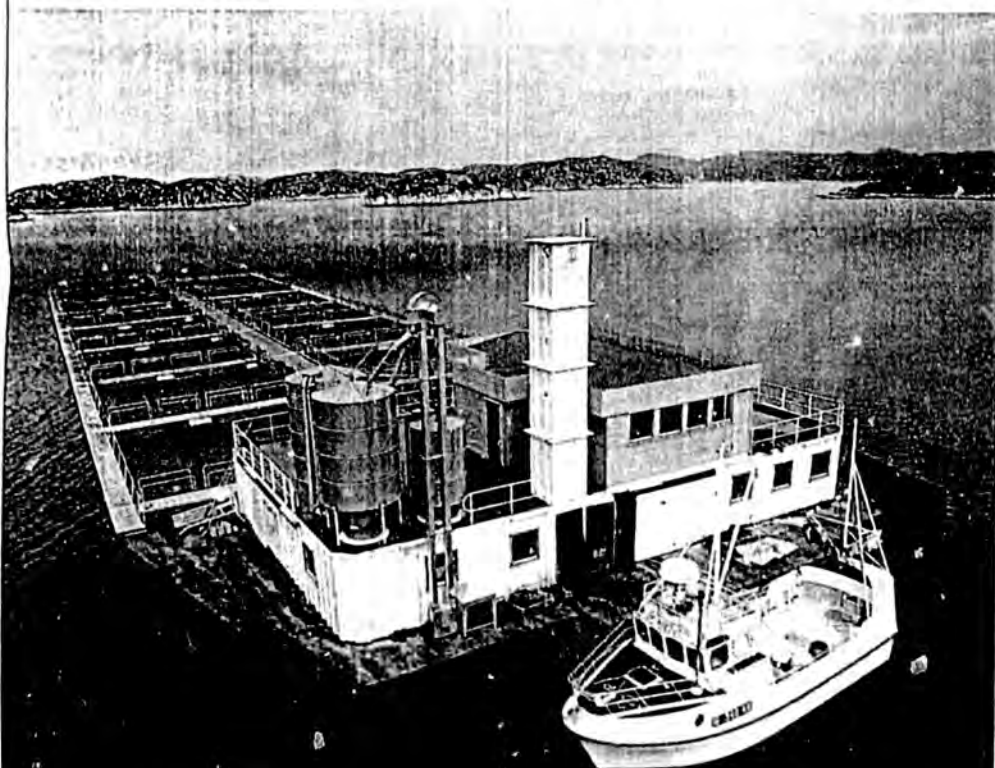
"We have had a lot of setbacks that should maybe be



A Pacific oyster from one of Orkney Oyster's lantern nets in Water Sound, where they had been for two years and two months when this photograph was taken.

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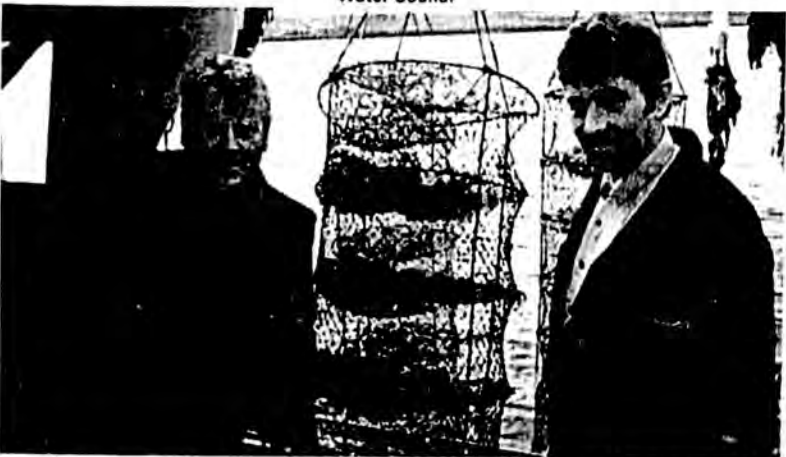
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Above: The Bay of Firth, where Lang-Geo Oysters has its on-growing sites. In the middle ground is Dave Bichan's workboat and 'base camp' raft. Below: Anthony Duncan and Mungo Montgomery of Orkney Oysters hoist up three of their lantern nets at their site in Water Sound.



changing our minds," he added. "But, provided we can get adequate investment to carry us through the lean years, when we are having to do a lot of research and development, oyster growing in Orkney is going to be a significant industry."

Mr. Bichan went into the business thinking he could grow oysters to market size in Firth Bay in three to four years. But he says that because his customers want larger product he is having to grow them on for another season. The grant structure needs to be changed to take account of this, he claims.

Lang-Geo Oysters is selling directly to the retail trade, restaurants and hotels in Aberdeen and Edinburgh, and is now sending product further south to London. The firm is concentrating on the high quality fresh trade to get the return on its investment as soon as possible.

Once he gets the return, Dave Bichan says he will be investing in better shore facilities, including storage tanks. At present he has to hold everything at sea and in poor weather it can be difficult to harvest oysters when the customer wants them.

Scallops

Mr. Bichan is growing queen scallops in suspended culture from a raft as an experiment, and also thinks there is considerable potential for mussel cultivation in Orkney. He says his customers keep asking him for mussels, which are becoming increasingly popular in the UK.

Dennis Gowland of Benesther Shellfish is also making significant progress. He is now producing in excess of 25,000 Pacific oysters a month and this figure is scheduled to rise to over 40,000 a month in 1988-89. In addition to fresh oysters for the half-shell trade, he produces smoked oysters vacuum packed in dozens, or as

required. Frozen oysters can also be produced as ordered.

Consignments of oysters are transported by sea and chilled road container or by air to anywhere in the UK. Overseas orders are serviced by air-freight to major airports.

Mr. Gowland, who was involved in geological survey work in the oil industry, has been in the oyster business for three years. Like Dave Bichan, he grows his own oysters, buys product from other growers and does his own marketing and selling. "He is considering setting up an oyster nursery in a quarry and even finds time to experiment in the cultivation of mussels and queen scallops."

He emphasises that shellfish from Orkney are grown in waters that are unaffected by compulsory cleaning orders. Not that he and other Orkney shellfish farmers rely on this fact alone. They claim that their on-growing sites and keep facilities are routinely and regularly checked to the most stringent standards.

"How much better to taste the delicate flavour of the oyster as it was in the sea, rather than after immersion in a cleansing tank for two days," says Mr. Gowland. "Each oyster filters up to 40 litres of plankton-rich seawater a day, and in so doing, builds up the plump and delicately flavoured meat so characteristic of Orkney oysters."

He employs a variety of cultivation methods at his two sites in Inganess Bay and Deer Sound on Mainland. They longline seabed trays similar to Dave Bichan's, sub-surface longlines and intertidal trestles. He has about 350,000 oysters in the water at present and will be increasing his total stock to about 550,000.

Growth rates vary from site to site and from beach culture to offshore. The beach grown oysters need an additional growing season to get them up to market size. They are nice oysters with a thinner shell and higher meat yield.

Anthony Duncan and

Mungo Montgomery of Orkney Oysters are achieving impressive growth rates at their site in Water Sound, between the island of South Ronaldsay and Burray. There, FFI was taken by boat and shown oysters that had been in the water for just over two years and many had already reached market size. The pair are aiming to produce oysters of 90-100 g average weight, though some of those in the lantern nets were clearly a lot larger.

Good seed

Anthony and Mungo started in the business four years ago with 160,000 seed oysters and now have nearly one million in the water.

"We obtained the last lot from Guernsey and it was very good seed," said Anthony. "We have been let down by some of our other suppliers. They promised seed in April but by the time we received it the growing season was nearly over. That set us back a bit."

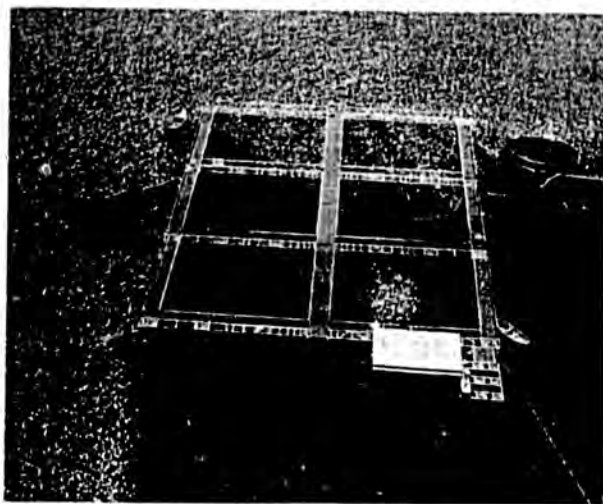
The seed oysters are placed in 90 stacks of ten or 11 North West Plastics' trays suspended from a raft fabricated from old oil pipes. On reaching a certain size, the juvenile oysters are transferred to the lantern nets, which are suspended in threes from Scanmarin buoys obtained through Hugh Norman (Aquaculture). No problems have been experienced with these buoys, which have been in use for over two years. The trays and lantern nets are lifted with the aid of gear Anthony and Mungo designed and fabricated especially for the purpose.

Commented Anthony: "Oyster farming in Orkney is definitely going to be a paying proposition once we get everything working and organised. But we have a lot to learn yet!"

● Tom Wray concludes this report on Orkney farming in our February issue.

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Bangkok focus on shrimp

BUYERS, suppliers, catchers, growers, processors and researchers from all over the world engaged in the shrimp and tropical prawn industry will be meeting in Thailand at the end of this month in an FAO-backed conference called Shrimp '88.

The conference will consider the huge trade in shrimp of various kinds, which involves the annual movement of some 1.8 million tons of product, but its main focus will be on the remarkable recent expansion in the farming of these crustaceans.

To be held from January 26 to 28 in the Dusit Thani hotel in Bangkok, it is being organised by Infosh, one of the four organisations started by FAO to assist and co-ordinate the marketing of seafoods in developing countries.

The conference is co-sponsored by AGB Heighway Ltd., publisher of *Fish Farming International*, *Fishing News International* and

other journals. Other sponsors are the Thai Fishery and Frozen Food Products Association, Thai Food Processors Association, and Thai Seafood Processors Association.

Over the three days, Shrimp '88 will consider in detail the present state of the shrimp industry, and the impact on it of developments in farming.

The conference opens on

January 26 with a keynote speech by Dr. Wolfgang Krone, director of FAO's Fishery Industries Division.

This will be followed by a session looking at the important Japanese and European markets, and also a talk on the impact of surimi-derived analogue products.

Regulations, marketing strategies and market research will be covered in subsequent sessions.

On January 27 and 28, participants will hear a number of speakers prominent in aquaculture talk about farming shrimp in Asia, Latin America, Africa and other regions.

Sessions will cover worldwide developments looking at constraints and future prospects.

● For further details of Shrimp '88 turn to Page 24.

EVENTS DIARY FOR 1988/89

THIS diary of aquaculture meetings and exhibitions is published in each issue of *FFI*. Organisers wishing to have their events included should write to the editor, giving the title of the exhibition or meeting, its scope, venue and date, and contact address.

Shrimp '88. International conference on world-wide shrimp production and trade. January 26 to 28, The Dusit Thani, Bangkok, Thailand. Infosh, P.O. Box 10899, 50728, Kuala Lumpur, Malaysia.

2nd International Aquaculture Congress. February 22 to 27, the Oceanographic Museum, Monaco. Oceanographic Museum, Monaco-Ville, MC 98000 Monaco.

Scottish Fish Farming Conference and Exhibition. Eden Court Theatre, Inverness, Scotland. February 23 to 25. Dr. Peter Landless, 45 Ashcroft Road, Cirencester, Glos. GL7 1QZ, England.

Management Schemes for Inland Fisheries. Symposium organised by European Inland Fisheries Advisory Commission (EIFAC) in Gothenburg, Sweden, from May 31 to June 3. EIFAC Secretariat, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy.

World Aqua Tromsøe 88. Seminars and exhibition in Tromsø, northern Norway, June 7 to 12. Forum Nord-Norge, Postboks 2203, Polarsentret, 9014 Haapet (Tromsø), Norway.

Aquaculture Engineering Technologies for the Future. Conference in University of Stirling, Scotland, June 20 to 23. The Conference Section, The Institution of Chemical Engineers, 165-171 Railway Terrace, Rugby CV21 3HQ, England. Telex 311780.

Aquaculture International Congress and Exposition. Trade and Convention Centre, Vancouver, British Columbia. September 6 to 9. Vancouver Trade and Convention Centre, Suite 200, 999 Canada Place, Vancouver, BC, Canada V6C 3C1. Telex 04-507702.

China Fishery 88. International exhibition on fish farming, fishery technology and equipment. Shanghai, China. September 5 to 11. SIK International Services Ltd., 22/F, 151 Gloucester Road, Hong Kong.

Fisheries Bio-engineering Symposium. Columbia River Red Lion Inn, Portland, Oregon, USA. October 24 to 28. David Owsley, US Fish and Wildlife Service, Dworshak National Fish Hatchery, P.O. Box 18, Ahsanka, Idaho 83520, USA.

Aquacultura-88. Fourth international exhibition of aquaculture techniques, equipment and products. Verona Fairgrounds, October 13 to 16. E. A. Fiere de Verona, Cas Post 525, Verona, Italy. Telex 480538.

4th International Fishery & Processing Exhibition. Exhibition Hall, Guangzhou, China. December 6 to 11. China Marine Industries Corporation, 1103 Loong San Building, 140 Connaught Road, Hong Kong.

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Busy programme for Inverness

THE 1988 Scottish Fish Farming Conference and Exhibition will be held in Inverness on February 23, 24 and 25. The conference sessions take place in the Eden Court Theatre and the exhibition will be in a large temporary hall erected in the adjoining grounds.

First event on the 1988 programme is the annual general meeting of the Fish Farming Section of the National Farmers Union for Scotland. This is on the morning of Tuesday, February 23.

The conference will be officially opened at 2pm by Lord Sanders, of Bowden, Minister of State for Agriculture at the Scottish Office.

First of the conference papers will be given by R. Cowan, chairman of the Highlands and Islands Development Board, who will talk on the place of fish farming in the Highlands.

Science and technology in marine farming and the market for seafoods will be two other topics covered.

The session on the following day will open with a talk on producing and marketing trout in the United States, which will be given by L. Cope of Clearsprings Trout Company.

Willie Baird of Seven Springs Trout Hatchery in Northern Ireland will then talk about 20 years in trout farming.

Speakers in a parallel ses-

sion on mechanisation of trout farming will cover cages, bulk feeding systems, pumps and graders and the bulk weighing of live trout.

There is no programme for the Wednesday afternoon and so participants will have the opportunity of visiting some 130 stands in the trade show.

The conference dinner, a highlight of this popular annual event, will be in the Eden Court Theatre on Wednesday evening.

On the Thursday, the morning session will deal with shellfish and other marine farming and will include reviews of progress in halibut cultivation and in the mechanisation of mussel culture.

The conference closes on the Thursday afternoon with a session on salmon farming. This will include a talk by Dr. John Forster of Sea Farm on salmon farming in the United States and Canada, and advice from Dr. Ted Needham on making salmon farming pay.

● Further information from Dr. Peter Landless, 45 Ashcroft Road, Cirencester, Glos. GL7 1QZ.

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On the shellfish scene



With Dr. Eric Edwards, Director, Shellfish Association of Great Britain

BRITISH newspapers and television have given plenty of coverage to the cleaning up of the North Sea at a special conference of North Sea states held in London at the end of November.

Some progress was made: it was agreed that incineration of toxic waste at sea will be greatly reduced by 1991, and ended by 1994. The volume of toxic substances and agricultural chemicals discharged into the sea will be halved by 1995.

However, Britain did not promise to end sewage dumping at sea. Instead, our government stated that levels of contaminants would not be increased beyond 1987 levels. Most of these contaminants occur in sewage sludge which contains high levels of heavy metals such as mercury, cadmium, arsenic, lead, etc.

Many European fishermen have protested about this dumping, which they claim causes unacceptable pollution problems in the North Sea.

Scientists from the Ministry of Agriculture, Fisheries & Food dispute their case, emphasising that this dumping only takes place in deep water, causing few problems. Greenpeace, the environmental pressure group, states that over five million tons of London sewage is dumped in the shallow Thames estuary where there are massive shellfish beds.

Our Shellfish Association supports any actions which reduce coastal pollution. We were, therefore, pleased to learn that Britain has agreed to host a European scientific task force, which will seek ways of controlling pollution.

It is important that this group also investigates the contamination of estuaries and inshore coastal waters where untreated, or partially treated sewage effluent, is often discharged in large volumes. We all know it is a common practice throughout the world to dispose of human excreta in this way but it often leads to sewage contamination of shellfish areas particularly in estuarine and near-shore waters.

What sort of risks do people who eat shellfish face? Crustaceans, such as lobsters, crabs and shrimps, have a relatively clean bill of health. Most catches are harvested from deeper waters, some way offshore, and they rarely carry organisms harmful to humans. The normal cooking processes

used to prepare these crustaceans for the table also kill any pathogens.

Occasionally, crustaceans pick up the bacterium *Vibrio parahaemolyticus*, which lives naturally in the sea. In hot countries, such as Japan and the Far East and warm Mediterranean countries, where shellfish are sometimes eaten raw, *Vibrio* does cause food poisoning. But, in cooler Europe, we traditionally cook all crustaceans before eating them so killing any bacteria and most viruses.

Bivalves, such as oysters, clams and mussels, are the biggest threat to public health because they are filter feeders, sieving food particles and sewage bacteria and viruses from the water thereby accumulating them in their body systems. Any polluted shellfish, eaten raw or lightly cooked, can cause illness.

Fortunately, the number of outbreaks blamed on shellfish is not large, but each outbreak can involve large numbers of people. Between 1941 and 1986 there were only 138 outbreaks of food poisoning associated with molluscan shellfish in England and Wales, with symptoms ranging from nausea and diarrhoea to hepatitis.

Figures from the Department of Health showed that few outbreaks are linked to crustaceans.

Molluscs taken from polluted coastal waters accounted for over 70 per cent of the foodborne illnesses with cockles and oysters causing most of the trouble.

How do we overcome the growing number of these public health problems associated with eating certain shellfish? Perhaps the best option would be to attack the problem at its source — that is by reducing coastal pollution or by treating effluent discharges in some way to sterilise them. Certain countries, including the

UK, have designated shellfish growing waters where the quality of the water is strictly controlled and pollution is kept to a minimum.

The coastlines of Scotland and Ireland are generally free of heavy pollution — a fact which Scottish and Irish shellfish growers must promote as part of their sales campaigns.

Other coastal areas of Europe — near major towns and cities — do not always have waters suitable for growing or harvesting safe shellfish. Should we close these areas to safeguard the

public and our industry's reputation?

At the moment in the UK we are considering, with the relevant government departments, a Code of Practice for the Hygienic Production and Sale of Bivalve Shellfish. The aim is to educate environmental health officers, shellfish producers and retailers on the proper methods and procedures applicable to the production of safe shellfish.

This Code includes a proposal, still under discussion, that we should copy the American system of classifying shellfish harvesting areas covering:

- Class 1. *Approved status* — area not contaminated.
- Class 2. *Controlled status* — shellfish need controlled purification,

heat treatment or relaying in Class 1 waters.

- Class 3. *Restricted status* — the area is contaminated to such an extent that purification or heat treatment solely is insufficient to render the shellfish safe to eat.
- Class 4. *Prohibited* — the removal of shellfish should be totally banned to protect the public's health.

The authorities suggest that this type of classification would be based on sanitary survey data. A shellfish area may sometimes be covered by a single classification but extensive fisheries may carry a series of classifications, depending on the siting of sewage outfalls, industrial effluents, etc.

Also suggested by the Code are better handling methods for shellfish. And it provides sound advice on purification methods using ultra-violet light irradiation — the cleansing system most widely used for molluscs in the UK.

The Code, at present, is only at a draft stage and members of the Shellfish Association of Great Britain will have a further opportunity to comment on the wide range of proposals early in 1988.

All in all, Britain's shellfish are safe to eat. According to researchers at the Ministry of Agriculture, Fisheries & Food, the risks of suffering a bout of food poisoning from eating shellfish are relatively rare compared to other foodstuffs. But we need this Code.

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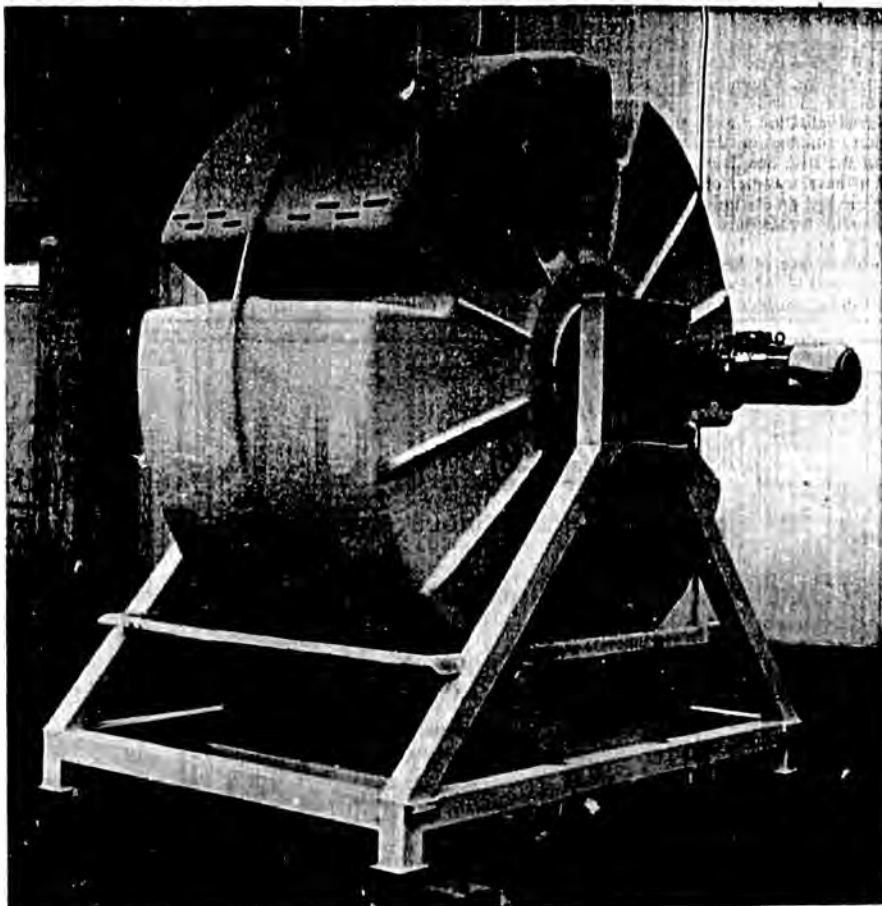
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Indians start new courses

WITH the commissioning of a modern shrimp hatchery at Vallarpadam near Cochin, India's Marine Products Export Development Authority (MPEDA) has prepared a training programme for state government officials and people in the industry.

The emphasis is on practical training in various aspects of shrimp culture and hatchery management techniques.

Previously, the MPEDA has been running a one-month course in shrimp culture, and 12 of these had been given.

The new course offers an integrated approach to shrimp farming right from site survey and selection, through food preparation and on to growing and harvesting.

It includes field demonstrations in shrimp farms.

The first of the courses was inaugurated by MPEDA director Dr. M. Sakthivel and had 16 participants.

In another programme, MPEDA's Prawn Farming Regional Centre at Karwar recently ran a five-day field-based training course. This was organised in conjunction with the local Agricultural Research Station.

Instruction was in the local language and covered topics such as seed collection, segregation, identification, counting, and packing for transportation.

New marine hatchery ready next month

A NEW purpose-built marine fish hatchery being set up in the Isle of Man by Mannin Seafarms Ltd. is to be completed in February 1988, rearing operations will begin in March and the first juvenile turbot will be available in May/June.

As briefly announced in FFI in November 1987, the company's two principals are Richard Slaski and Paul West. They have worked in the development of turbot culture for the last nine years, and have been prime movers in the successful development of a current commercial leader, Golden Sea Produce Ltd., a wholly owned subsidiary of the Norsk Hydro group.

Their knowledge of the technical and financial aspects of the business has enabled them to identify the opportunity, and given them the confidence to consider exploiting it. They point out that a clear gap between supply and demand of turbot juveniles has become manifest.

"The gap will inevitably be filled as the market exerts stronger pressure, but the specialised technical nature of the business limits the number of entrepreneurs who can consider such an operation," Mr. Slaski told FFI. "The time required to develop necessary skills will also limit the speed of development of any effective competitors."

Mannin Seafarms chose the Isle of Man for its hatchery project for a number of reasons. As an island with low industrialisation and population, situated in the middle of the Irish Sea, it is claimed to have seawater of excellent quality; an essential for successful turbot larval rearing.

The maintenance of healthy photoperiod broodstocks is fundamental to such an

operation, and according to Mr. Slaski experience to date has shown that this is best achieved in cooler Northern European waters.

He says the safest and most cost-effective way to transport juvenile turbot over long distances is by air, and the Isle of Man is well served by regular flights into major UK airports, particularly London Heathrow. Connection from these airports means that Mannin Seafarms' juveniles can arrive at many European destinations within a working day.

Another advantage of the Isle of Man is that there are good incentives for new businesses on the island, in the form of capital and other grants available from the Isle of Man government.

The Mannin Seafarms' project has a total funding of over £500,000, with major support from National Westminster Growth Options Ltd., and the Isle of Man government. The directors are majority shareholders in the equity of the company. The directors say that the venture capital nature of the support for such a development within the British Isles is rare and they value this support highly.

Located at Derbyhaven, in the south-east of the island, the Mannin Seafarms' hatchery is adjacent to Ronaldsway Airport. Covering an area of 900 sq. metres, it is of timber frame construction, clad in steel sheeting and is insulated. Seawater for the hatchery is pumped ashore continuously and

heated by a diesel-fired boiler and heat exchanger system.

The main production will be of weaned juvenile turbot weighing three to four grams. According to Mr. Slaski, experience has shown that this is the optimum size for transport and survival at the nursery stage in the on-growing farm.

Juvenile turbot will be packed in specially prepared seawater with an oxygen environment.

Package weights will be low, and total cost of transport to most destinations is said to be less than ten per cent of the actual fish value. This applies to both small and large scale shipments, allowing flexibility for the customer.

"The system is tried and tested, and Mannin Seafarms will generally be responsible for the fish until they are unpacked at the customer's site," said Mr. Slaski.

The company has already collected from a variety of sources sufficient broodstock turbot for the foreseeable future. Target production for 1988 is 125,000 weaned turbot juveniles, and this figure is planned to be increased to a maximum projected output of 500,000.

Mr. Slaski and Mr. West have many years experience of large-scale marine farming covering a number of species. The company is therefore able to provide practical consultancy based on this experience, particularly concentrating on advice to customers for juvenile turbot.

● Further information from Mannin Seafarms Ltd., 10 Mount View Road, Onchan, Isle of Man.



Paul West (left) and Richard Slaski in front of their new £500,000 turbot hatchery in the Isle of Man.

Coldbox 20 for long journeys

INCREASING interest is being shown in a new Swedish fish box by fish farmers and processors in a number of countries following its successful use in airfreighting farm fresh rainbow trout to Japan and the United States and its use in the group land transport of fish and fish products with other goods.

Called the Coldfish 20, the box features a patented waterproof inner container designed to ensure that there are no problems with meltwater from the ice. The ability to tranship the Coldfish box with all kinds of goods makes increased distribution of fish possible. Until now it has been necessary to transport the fish separated from other foods, using special trucks.

The Coldfish 20 box consists of three components: an outer box and a top, both of which are made of 25 mm expanded polystyrene, and an inner container of high-density plastic.

Meltwater can collect in the bottom of the inner container, which is subdivided into a series of small compartments. The upper edge of the outer box is grooved to achieve a close fit with the top.

Weighing only two kilos when empty, the Coldfish 20 box will hold 20 kilos (22

litres) of fish and four to five kilos of ice. Its outer dimensions are 800 x 400 x 240 mm (0.077 cu. m).

"Thanks to the good insulating properties of the Coldfish box it can maintain the temperature of the fish below 2 deg. C for two to four days depending on the ambient temperature," Coldfish product manager Ove Björjesson told FFI.

An additional advantage is that the inner container can be used for deep-freezing fish or for displaying seafood at in-store

counters. If the products are not sold they can be replaced in the box, which can then be held in the store's cold room with other goods until the next day.

Coldfish says it has already sold tens of thousands of its Coldfish 20 boxes in Sweden, where a major use has been in airfreighting farmed trout to export markets. The company is now marketing hard in Denmark and is also looking at Norway and the United Kingdom (where Autotransit Ltd. of Immingham is its agent).

● Further information from Coldfish Sweden AB, Hertig Eriks väg 8, S-432 00 Varberg, Sweden. Telex: 3457 Fishman S.



The new Coldfish 20 fish box is catching on in the fish hunting industry too. It is used for the transport of fish and fish products from wholesalers and processors to their customers.

Farmed fish from seafood group

COMBINING the "best" Swedish seafood products and suppliers in one organisation to make the search, selection and purchase of quality products easier and more convenient, the newly established Swedish Seafood Group claims to offer buyers a unique opportunity.

It was set up with help from the Swedish government, and consists of 11 companies working in co-operation with the Swedish Trade Council. The companies are the Baltic Aqua Group, BD-Fisk, Festab, Halmstadiax, Hallöfisk, Halleviks, Scandifish, the SE Group, Vastkustfiske, Vastkustfiskarna/Bohuslän and Yedo. Several of these companies offer farmed fish and fish products.

Based in Helsingborg, the

Baltic Aqua Group AB is one of the largest producers of rainbow trout in Sweden. It covers every stage of fish farming from research to distribution and marketing worldwide. The group includes a number of fish farmers whose farms lie in the open sea, mainly in the Baltic.

The Swedish Seafood Group includes several leading suppliers of smoked salmon and rainbow trout.

Smoked salmon from Halmstadiax, another firm based in southern Sweden, is available as whole sides. Yedo AB of Grythyttan specialises in producing quality smoked "rainbow salmon" products.

● Further information from the Swedish Trade Council, P.O. Box 5513, S-114 85 Stockholm, Sweden. Telex 19620 export s.



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MB-60	60 x 150	4.5	10	10
MB-70	70 x 150	5.5	10	10
MB-80	80 x 150	6.5	10	10
MB-90	90 x 150	7.5	10	10
MB-100	100 x 150	8.5	10	10



Tough fender with reinforced rope eyes

Item	Dimensions (mm)	Weight (kg)	Quantity per container	MO. (mm)
FD-100	100 x 100	1.5	10	10
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FD-200	200 x 200	3.5	10	10
FD-250	250 x 250	4.5	10	10
FD-300	300 x 300	5.5	10	10
FD-350	350 x 350	6.5	10	10
FD-400	400 x 400	7.5	10	10
FD-450	450 x 450	8.5	10	10



Heavy-duty marker buoy with reinforced rope eye

Item	Dimensions (mm)	Weight (kg)	Quantity per container	MO. (mm)
MB-100	100 x 100	1.5	10	10
MB-150	150 x 150	2.5	10	10
MB-200	200 x 200	3.5	10	10
MB-250	250 x 250	4.5	10	10
MB-300	300 x 300	5.5	10	10
MB-350	350 x 350	6.5	10	10
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Ewomatic air stream spreads feed to the cages

IT IS labour saving, feed losses are very low and it has several advantages over systems that transport feed in a water stream. So says Ewos about its Ewomatic centralised feeding system for fish farms. The system is now in full commercial use on nine salmon and rainbow trout farms in Finland, Norway, Scotland and Sweden following extensive development testing.

All but one of the fish farms that have chosen the Ewomatic system so far employ floating cage units. The exception is a large land-based smolt plant near Bergen, Norway, which has some 52 fish rearing tanks.

The characteristic feature of the system is that the feed is transported in an air stream from a central storage and dosing unit out to the distribution valves which are mounted close to the fish cages, tanks or ponds.

The system

As shown in the diagram, the Ewomatic feeding system consists of: (1) a storage container for the feed, (2) dust separator and fan, (3) feeder (dosing unit), (4) compressor and air valve, (5) feed distribution valves, (6) hoses for air-transported feed, and (7) a control unit.

Describing the system during a recent FFI visit to the Ewos AB headquarters in Sodertälje, product development engineer Jan-Olof Sanno said the Ewomatic system is unique.

"It is the only system as far as we know that uses a single hose and air distribution," he said. "Air distribution is particularly suitable for countries that suffer from freezing. Unlike systems using water distribution in the diagram the Ewomatic system does not freeze up."

The system is normally fed from two storage silos, each filled with feed of a

different size. Ewos recommends that elevators be installed for loading the silos with feed, claiming that far too much crushing and dust formation takes place when the feed is blown into the silos from bulk trucks.

There is one feeder unit for each silo. Each feeder is mounted on the lower part of the dust separator, which removes dust from the stored feed by means of a small fan. The feeder consists of a wheel with 12, 24 or 36 cells according to its size.

Feed pellets from the silo are fed through the dust separator and into the feeder. The powerful air stream then drives the feed out of the feeder, through the single hose and into the distribution valves near the cages, tanks or ponds. The special compressor used is of the low-pressure, high-volume type.

The valves have various numbers of outlets (four, five or ten) according to the size of the plant. They can

be used as distributors to other valves as well as to the desired fish rearing facility.

The Ewomatic's computerised control unit determines which enclosure is supplied and how much feed each one shall receive. The size of the feedings is based on constant volume per unit time.

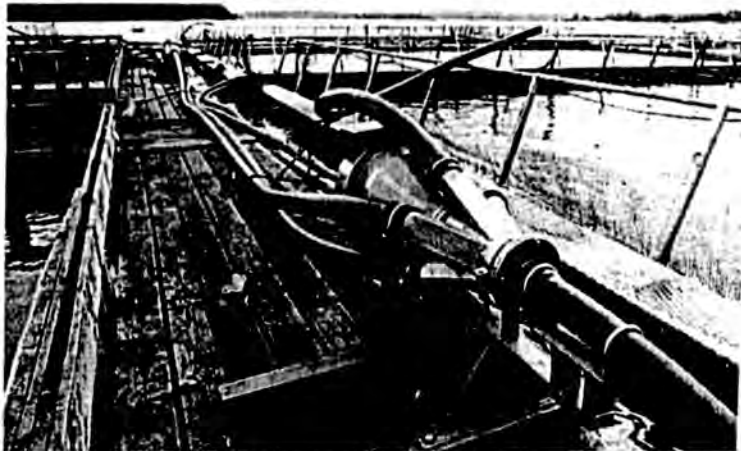
Varied

Its control unit regulates a timer so that the feeding size can be varied. The claimed accuracy on each individual feeding is plus or minus two per cent, while the dust per 100 metres of hose has been measured at just 0.1-0.3 per cent depending on feed quality. These features have been tested at the Agricultural Research Institute in Uppsala, Sweden.

Amount and frequency of feeding in each enclosure can be automatically controlled according to water temperature, and the system will work to a curve created from the manufacturer's feed tables and entered into the computer.

The computer is said to be easy to use, even by people with little experience, and it can give the farmer much useful information on the status of the entire farm as

An Ewos feed distribution valve on a floating cage farm. The single hose in the foreground delivers the feed from the land-based part of the Ewomatic system.

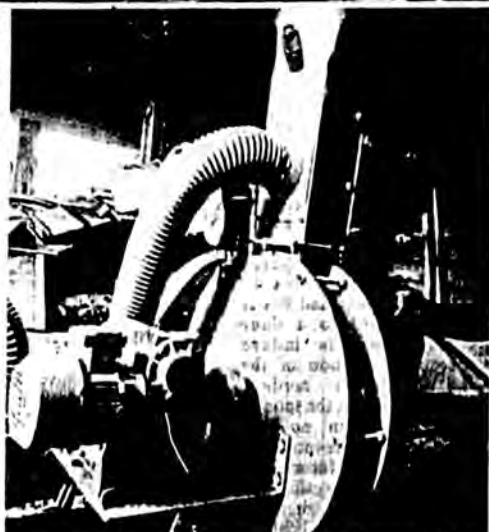


well as that of each individual cage or tank. This includes the number of fish, average weight of each fish, total weight, feed consumption, feed conversion factor, feed in store and so on. All information can be readily obtained as hard copy from the printer.

Hose length

Maximum length of hose that can be used in the Ewomatic feeding system is about 600 metres, making it suitable for cage farms some 400 metres from shore. This is claimed to be about 150 metres further than can be achieved by systems using feed distribution by water.

Alternatively, the complete Ewomatic plant can be installed on a raft next to the cages, which may then be located in more exposed positions.



The Ewos dosing unit, or feeder, which is mounted on the underside of each storage silo after the dust separator.

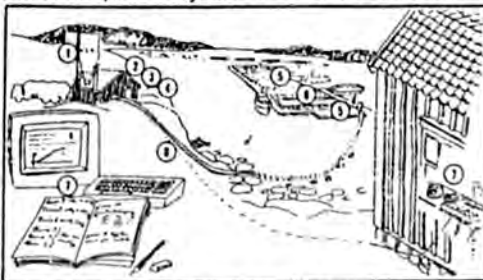


Diagram of the Ewomatic fish feeding system.



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Light controls spawning in sea bass

THE SEA BASS (*Dicentrarchus labrax*), or the bar, levrek, loup, lubina, robalo or spigola as it is variously known in the countries bordering the Mediterranean and north-east Atlantic, is arguably the most sought-after food fish both in the fish market and the restaurant.

Although its range extends from Norway in the north to the northern seaboard of Africa in southern Europe, harvests from commercial fisheries are restricted, especially with regard to the overall tonnage landed but also in the seasonality of the supplies.

At present, the total catch of sea bass only amounts to 8500 metric tons and this is usually limited to a short period during the inshore spawning migration of the fish which in northern Europe occurs in the spring.

This catch in no way meets the ever-increasing market demands for sea bass and consequently this fish commands very high prices at first sale. At Christmas and on other festive occasions in some of the Mediterranean countries, market prices may reach £20 a kilo although normally the price is £8-10 a kilo. Prices, however, are often three or four times these figures in restaurants, thus placing the sea bass among the most expensive of all food fish.

The high value of the sea bass, its well defined and buoyant market position and the restrictions in its supply have stimulated much interest in the farming of this fish. At present,

by Niall Bromage, Manuel Carrillo and Sylvia Zanuy

however, primarily as a result of the difficulties in providing supplies of fry of good quality or viability for growing-on farms, but also because of the slow growth of the older fish up to table-size, production has been severely limited.

Total farmed production for sea bass only amounts to a few hundred tons; a little more if extensive operations like valliculture in Italy are included.

Not likely

Although there have been suggestions that farmed production could reach 27,000 tons (combined sea bass and bream estimate made by the FAO/UNDP Aquaculture Development and Co-ordination Programme; see *FFI*, November 1987) there is little likelihood at present of such estimates ever being achieved.

Losses of fry due to spinal and swim bladder abnormalities, both thought to be related to broodstock husbandry and nutrition, together with the restricted seasonal spawning of the fish and consequent availability of fry, have all served to constrain developments in the farming of this species.

It is for this reason that a collaborative project started over two years ago involving

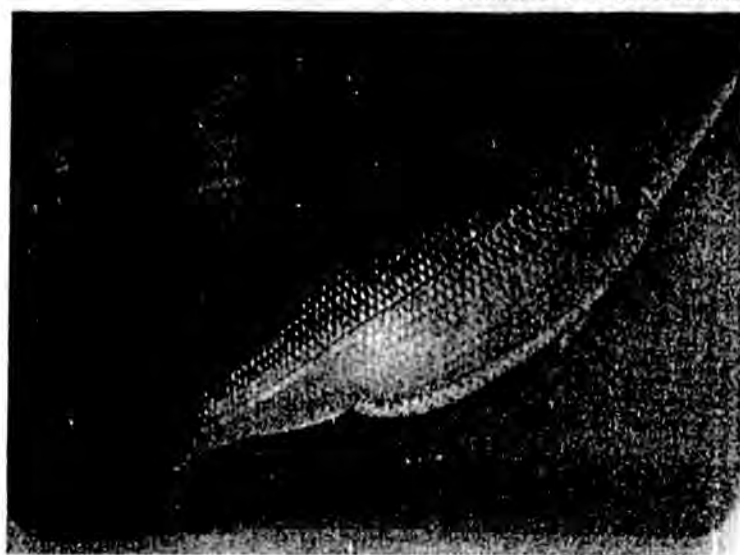
a team of scientists under the direction of Manuel Carrillo and Sylvia Zanuy at the Spanish government's Institute of Acuicultura near Castellon on the east coast of Spain and Niall Bromage's Group at the University of Aston in Birmingham, England.

This project, which is jointly sponsored by the British Council and the Spanish government, aims to understand the mechanisms involved in the control of reproduction in the sea bass. In this way, supplies of good quality eggs and fry will become available to growing-on farms at all times of the year.

Under natural conditions in most European waters sea bass migrate inshore to spawn in February-March and the purpose of the initial series of experiments was to establish that the rate of maturation and timing of spawning could be advanced or delayed by modifications of daylength or photoperiod.

Five large seawater aquaria were set up at the beginning of the 1985/86 spawning season each employing a different combination of artificial daylengths; these have now been running for two reproductive cycles.

Results up to date have been most encouraging. They show clearly that maturation and spawning can be advanced by up to six



Mature sea bass in an anaesthetic solution, awaiting ovarian biopsy and blood sampling.

months using manipulations of photoperiod. More than ten million eggs have been spawned up to the present time with most of the experimental groups of fish producing over 70 per cent of good quality or floating eggs.

In general, the majority of these eggs subsequently developed into normal healthy fry, although possible effects on fry development and viability are being investigated more thoroughly using expanded hatchery facilities.

Important

One important finding of the present investigations is that spawning occurs naturally in the tanks as a result of photoperiodic advancement. This is important because if hormonal injections of HCG, pituitary extract or LHRH-like products (analogues) are used, these can lead to premature release of partially-developed eggs which as a consequence are of poor quality.

In all our experiments, we remove each month a few eggs from each female fish by biopsy to check on their stage of maturation. Special attention is paid to fish as they near completion of maturation for if the eggs are not spawned naturally

then this process must be artificially induced. We use a synthetic analogue of the natural hormones LHRH.

Providing the eggs have reached the final stages of maturation, then the eggs released by LHRH induction are of similar quality to those produced naturally. Eggs which have completed final maturation but are not spawned, either naturally or by hormonal induction, are likely to undergo atresia or resorption of their stores of yolk.

At present LHRH induction has only been necessary for a few fish, the remainder spawning naturally in response to the altered photoperiod regimes. Individual fish have also been shown to produce several batches of eggs, further testimony that the sequence of changes induced by altered photoperiod is a natural one for, although there are disagreements among scientists, we believe that the sea bass naturally produces a series of batches of eggs.

Aside from on-going trials involving photoperiod, we are also investigating the importance of salinity and water temperature as supplementary influences in the control of maturation. Work from the Spanish laboratory has shown that female fish do not complete maturation

if the water becomes too brackish.

Temperatures in excess of 17 deg. C have also been shown to inhibit maturation. The effects of temperature may assume a greater significance if spawning is advanced photoperiodically into the summer, for at this time of the year, ambient sea temperatures in the Mediterranean often exceed 25 deg. C.

Trash fish

A further important area of interest for us is the nutrient requirements of the broodstock. At present most cultured stocks of sea bass are fed on trash fish, a diet which shows considerable variation both in nutrient composition and quality.

Ultimately, the successful production by hatcheries of sufficient quantities of healthy eggs and fry will depend on the formulation and fabrication of an appropriate broodstock diet.

Research into the nutritional requirements of sea bass must go hand in hand with developments in broodstock management if the farmed production of this species is ever to match either demand or the projected European production figures.

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FISH VET'S DIARY

by Dr. Ronald J. Roberts,
Director, Institute of Aquaculture,
University of Stirling, Scotland.

Aquaculture and slime bacteria

THE MYXOBACTERIA or slime bacteria represent a serious disease problem which is unique to the fish farmer. Chicken farmers, or pig farmers have never heard of them, and the human bacteriology specialist, while he may have heard of *Aeromonas* and has certainly heard of *Vibrio* and *Clostridia*, again has no interface with these problem bacteria.

The slime bacteria are, as the name suggests, found in the surface mucus of fish, but they are also found in other aquatic locations — in muds and in waters surrounding cages for example, in both fresh and salt water.

Because they are only a serious problem in the relatively new fish farming industry and not in other farming processes, little was known about them until recently and we still cannot be certain in assigning names to the individual species. Indeed the term myxobacteria, while a useful and necessary catch-all for them, is actually illegitimate.

The two groups commonly involved in disease are the *Flexibacter* and *Cytophaga* groups of myxobacteria, and we have known of *Flexibacter columnaris* and its involvement in columnaris disease since the 1920s. The key characteristic in relation to columnaris disease is high temperature — it always seems to affect heat stressed fish.

The other myxobacterial disease we have a long and at times acrimoniously generated body of information about is "bacterial gill

disease", the result of growth of bacteria within the extra mucus secreted on the gills of young fish following irritation, from silt or other water solids.

This disease was long thought to be of nutritional origin, but in fact two conditions with similar pathology, and outcome — pantothenic acid deficiency, and bacterial gill disease were being confused, on all sides.

These two conditions are known, and regularly dealt with by the farmer, by improving the environment, and, in the case of bacterial gill disease, using a surfactant in the water the wash away the mucus and the bacteria which have accumulated.

We are now coming to recognise, in our clinical work, however, more and more involvements of these nuisance bacteria in a wide range of other conditions. It seems that as sites become more intensively used, so the problem gets worse.

Any situation where temperatures go particularly low, and suspended solid levels, or ammonia or other dissolved irritants are high, seems to encourage the occurrence of what we know as "coldwater disease" a disfiguring ulcerative disease where thickened plaques of asbestos-like skin erode down to result in loss of tail or fins, or production of large white skin ulcers. One particular myxobacteria — *Cytophaga psychrophila* is generally associated with this condition but it is unlikely to be the only one.

But the most worrying of all of the myxobacterial problems for me, is the emergence of what looks like a new one, and one which seems to produce high mortalities without external lesions. We have been getting a few cases recently, from various sources, of heavy mortalities in young marine farmed fish, especially salmon, with a very obvious and generalised invasive myxobacterial infection, involving the growth of the bacteria in all organs.

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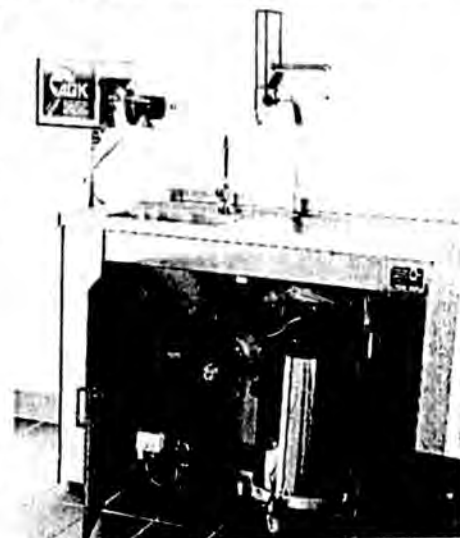
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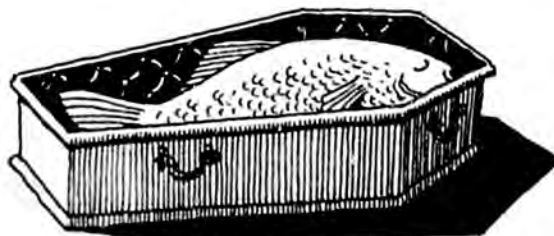


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Hatcheries and other stock enhancement projects ensure that the sturgeon continues to provide its valuable eggs for the caviare trade.



How Russia saved the Volga sturgeon

"EACH of the 50 palace fishermen in Rybinsk has a duty to deliver every day 30 sturgeons to the palace: a total of 1500." This edict of Tsar Alexei Mikhailovich, issued in 1672, is striking not so much because of the great quantities of delicacy fish brought to the Tsar's table and not because in those days the flesh of the sturgeon was scarcely considered a delicacy. What it shows is that sturgeon were caught just 400 km north of Moscow.

The position as regards stocks of Russian sturgeon, and also other varieties of this fish, was assessed at the time as either dramatic or tragic, depending on availability.

Since then, in just a few centuries, German sturgeon (Baltic Sea) and Adriatic sturgeon (Mediterranean) have virtually vanished. Populations of common sturgeon and Black Sea sturgeon are also nearing extinction. The fate of the Russian sturgeon (Caspian population) has,

Fifteen hatcheries produce 100 million fry a year, writes NIKOLI GERASIMOV

been looking up. We know of its existence in Central Russia only from historical documents dating back several centuries and from some geographical names.

An example is the River Osyotr. Flowing 300 km from Moscow, its course takes it past modern industrial centres, and today it may seem oddly named, for Osyotr means "sturgeon".

But today there is no threat that the Russian sturgeon will share the fate of other sturgeon populations.

The Caspian Sea, or

rather the lower reaches of rivers flowing into it, is now the only place anywhere in the world where the catching of such surviving fish species as sturgeon, starred sturgeon and great sturgeon has preserved its commercial importance.

The trip from Astrakhan by high-speed motorboat to the first fisheries takes an hour and a half, so there is time to look around. After the first ten km, the three km wide Volga divides into several branches. The landscape tends to be monotonous — water, reeds and steppe merging with the skyline.

The sea is still 200 km away, but we are already pulling in to the bank, where there are a number of fishermen's houses surrounded by nets drying in the wind.

Beacon

Long ago there was a beacon here, at Devyataya Ognevka. Now this is one of the numerous places where sturgeon can be caught in the arms of the Volga delta.

In the fishermen's 13-strong team some of the crew take a 250 metre sweep-net on a river barge to midstream while others pull it by steel cable and an electric winch. The sweep-net is lowered from the river barge bit by bit into the water, and the current carries it swiftly away. Moving in a semi-circle, the barge approaches the bank, and the fish moving upstream find themselves trapped.

In about a quarter of an hour, 40-60 fish weighing from ten to 60 kg are lifted from the water and loaded into ten metre long boats filled with river water seeping through holes in the bottom. After that the laden boats are towed to floating caviare factories and within a few more hours the fish are sent to Astrakhan processing plants.

The Devyataya Ognevka fishermen work a ten hour shift and lift the sweep-net 12-15 times a shift. Then other take over. Fishing continues for virtually as long as fish are moving in the water.

Each spring sturgeons move up-river to spawning

grounds, and a large number do not make it. The way is barred by the dam of the Volzhskaya (Volga) hydro-electric station. Further upstream there are half-a-dozen similar barriers which the fish cannot negotiate.

As a result of man's activity, more than 50 per cent of sturgeon spawning grounds are out of reach beyond the hydro-electric dam.

"Consequently, a few decades ago sturgeon catches began to drop sharply," Vladimir Ivanov, director of the Caspian Research Institute of Fisheries, told me. "Attempts were made to use a fish ladder to help some of the sturgeon get over the dam, but this proved ineffective. The construction of a by-pass canal to enable the fish to get round the dam and move upstream was also unsuccessful."

"The sturgeon would not move along the artificial bed — the current speed there was different from what they were accustomed to on their way to spawning in high water." Looking back, the Institute's director points out that 20 years ago the state of the sturgeon population was not at all good. The only solution was to set up hatcheries. Today there are 15 in the Volga delta, producing 100 million sturgeon fry a year.

Decreased

But hatcheries alone could not improve the situation sufficiently to continue commercial fishing for sturgeon without risk.

In the 1930s, the flow of the Volga and other rivers into the Caspian decreased, as a result of which the sea level fell by two metres. This adversely affected the sturgeon's habitat at sea, which is where the fish grow, the weight increasing with the number of roes. In the late 1970s, the level began rising again despite intensive intake for the needs of industry and agriculture. Vladimir Ivanov believes that over the next few decades there will be no further drop in the Caspian Sea level.

Measures taken to protect the basin of the Volga and Ural rivers — the two main arteries flowing into the Caspian Sea — helped solve the problem. Now there are no grounds for apprehension; the river is quite clean. It is



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Black gold from the Volga.



Volga fishermen haul in another huge beluga...



...and this is how it started. Beluga fry in a hatchery.

worth noting that one of the artificial spawning grounds of the greater sturgeon — the largest freshwater fish — is 200 metres from the spillway of the giant Volga Tractor Plant.

In the Volga delta, rice plantations were considerably reduced because chemical fertilisers and chemical pest or weed killers were entering the water from there. A ban placed on any sturgeon fishing in the Caspian Sea in 1962 was vital to the protection of the sturgeon population. Today the fry can develop undisturbed.

"Of course," the director said, "agricultural enterprises and fish farms were against such a ban, but changes were essential. This package of measures enabled us not only to preserve the population but to maintain sturgeon fishing at quite a high level. And half the sturgeons now caught have been artificially bred."

Is the future so cloudless, in view of the fact that on the way to the spawning grounds about 40 per cent of the sturgeon are caught?

Viable level

Is there a threat of genetic degeneration of the sturgeon, bearing in mind that in the past this fish moved to spawning grounds lying 2000 km away from the Caspian?

There seems to be no reason for anxiety, however, Mr. Ivanov says. Fishermen stick to the scientists' recommendations in determining the size of the catch which, he believes, is quite admissible for maintaining the population at a viable level. Also, as experiments have shown, the fish try to spawn where they were born, and today half the fry are released into river deltas.

At present there are 15 floating and four stationary caviare processing plants operating on the Volga and Ural rivers, the live fish being delivered there directly after the catch. They produce about 20,000 metric tons of black caviare, which constitutes 90 per cent of the world's entire caviare output (the remaining ten per cent is produced by Iran and Canada).

Today, the experts point out, the sturgeon population in the Caspian is as high as in olden times. But there must be no violation of the balance between the catching and the breeding of fish. There could be a risk of this because of the great demand for sturgeon flesh and caviare.

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Sweden in farming

Kuwait tries Ewos Triflex cages for rearing bream

Report
by Tom
Wray

THE Ewos Triflex cage system, which makes fish farming possible in more open and rough seas and has already proved itself in rainbow trout and Atlantic salmon farms in Denmark, Iceland and Norway, is now being used by the Kuwait Institute for Scientific Research (KISR) to rear bream.

This institute is the principal government research establishment in Kuwait and provides research and development support to Kuwaiti industry and other government organisations. It is also charged with developing national manpower in the research programmes under its mandate.

The institute encompasses five research divisions dealing with food resources, environment, engineering, petroleum and economics, and employs 978 technical staff.

The Mariculture and Fisheries Department of the Food Resources Division carries out research on capture fisheries, oceanography, marine biology and aquaculture. From its modest initial programme of work in 1967, done by a nucleus of four staff members, the department has expanded substan-

tially and now employs 90 staff and implements about six to ten projects yearly.

Main objective of the aquaculture programme is to increase the local supply of prime fresh fish by controlled production of selected local and imported species and to assist in the development of a local aquaculture industry.

During 1977-80, the department tested the suitability of six species for long term research and development. These were mullet (*Liza macrolepis*), grouper (*Epinephelus tauvina*), two species of bream (*Acanthopagrus cuvieri* and *A. latus*), tilapia (*Oreochromis aureus* and *O. spilargenteus*) and rabbit fish (*Siganus oramin*). Based on screening results, research after 1980 was concentrated on bream (*A. cuvieri*), grouper and the two tilapia species.

Since then, economically viable commercial technologies have been elaborated for hatchery and cage production of bream.

However, problems were encountered in the utilisation of conventional wooden cages for bream production due to the absence of suitable protected sites and variations in wood quality and treatment. The life of such cages in the absence of a protective breakwater did not exceed one year, said Dr. Mohammad Saif Abdullah, manager of the Mariculture and Fisheries Department.

The addition of a floating tyre breakwater improved the situation considerably at one site, but capital and maintenance costs were too high and reduced the profit margin. In most available sites, sharp variations in wind direction, wave height and period ruled against the use of wooden cages with floating breakwater.

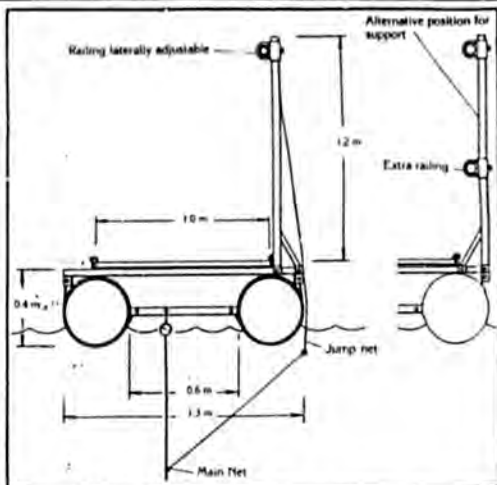
It was decided, therefore, to carry out pilot production tests using cages with flexible rubber pontoon frames.

The Ewos Triflex 600 cage was selected and three were purchased from Ewos, assembled and stocked with 90,000 50 g bream in August 1987.

Jens Eriksson, Ewos International's regional sales manager, who went to Kuwait to help with the assembly, reports that this was accomplished using just one spanner and a rubber hammer. And every single bolt fitted without being forced.

The weather in the Gulf can get quite nasty at times and sure enough, shortly after the Triflex cages were installed, a heavy storm blew up. According to Mr. Eriksson, it was one of the heaviest storms ever experienced in the area and lasted for days. Wave heights reached 6-9 ft, but the Triflex cages and their fish continued to thrive despite their exposed position some three to four km from land.

The idea for the Ewos Triflex cage came from the oil industry, where inflatable collars are used to contain oil spills. The flexible tubular design is claimed to overcome the enormous stresses and strains imposed by wave action. This is because the cage does not



A cross-section of the Triflex cage showing the main components.

resist the sea but rides with it.

According to Ewos, the big advantage of the Triflex cage has over other flexible collar types is that it forms a proper working platform and is not too big to be easily managed. There are three models in the standard range: the Triflex 600, the 1400 and the 1860, these numbers referring to the respective rearing volume in cubic metres.

All Triflex models feature high buoyancy — eight tons for the 600 cu. metre cage and 11 tons for the larger ones — and the high stability is provided by the twin booms. Walkways can be fitted to each section of the booms, and consist of strong galvanised steel grating sections each of which is hinged at one side and can be easily lifted.

The booms themselves are made from wear and weather-resistant reinforced rubber material for high durability under tough conditions. The pontoons are inflated to 0.6 bar, and even the compressor adapter is

supplied with the kit of parts.

The low packing volume of the Ewos Triflex cage means low freight cost, and as indicated earlier, it is easy to assemble. There is also claimed to be virtually no wear on links and connections due to the fact that rubber is used instead of metal. Maintenance required is minimal, and the cage has a low towing resistance.

For safe anchorage, the Triflex cage must be moored in all six corners, says Ewos. The company adds that the total flexibility and the low weight of the cage means low strain in the moorings. This enables smaller anchors and ropes to be used.

The cage can be supplied with fenders along the pontoon sides to avoid damage in connection with mooring.

Jens Eriksson reveals that there is considerable interest from other Arab countries in the Ewos Triflex cage system, which is also continuing to attract more northerly fish farmers following its success in Denmark and Iceland.

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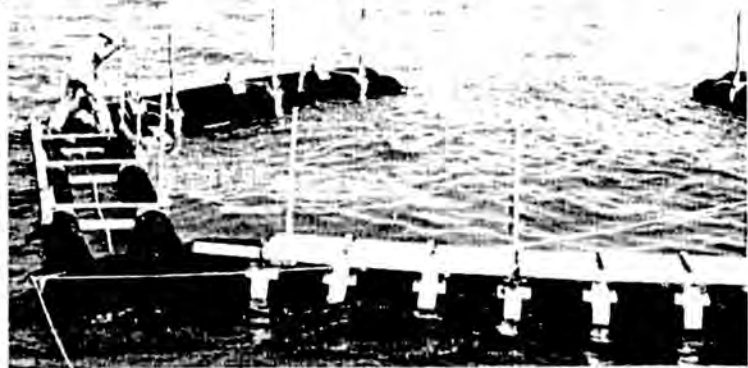
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One of the Triflex cages nearing assembly. Note the wide flexible rubber twin booms and steel walkways.

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SWEDEN'S Food Technology Company AB (FTC) claims to have achieved "dramatic success" in Norway with its salmon processing system and, when FFI was in Sweden in October, was negotiating to deliver a complete plant to Japan.

According to FTC's Jan Soederlind, the company has captured 95 per cent of the Norwegian market with its complete salmon processing line, which includes filleting through to slicing with "emphasis on quality and yield control".

The company claims that its TAF Anatomic filleting machine is more precise and therefore more yield efficient than filleting by knife. The machine, which is powered by a 1.5 kW electric motor and weighs 510 kg, has a capacity of up to 30 salmon a minute in the weight range of one to six kilos.

Conveyor

The fish are put into the machine and carried to the cutters by conveyor belts which are supported by an automatic centre adjusting mechanism. This centres the fish in the machine. Two 600 mm diameter stainless steel blades cut the salmon into three pieces: two fillets, and one centre bone.

Clearance of the blades can be adjusted to the size of the fish, and this is claimed to result in high yield and good-looking sides of salmon. The two sides leave the machine skin side down and the centre bone from a special opening on the side.

Two bone trimmer's are also part of the FTC salmon processing system. These are the Whizard Model 620 bone trimmer and the Model 1500Z belly bone trimmer.

The 1500Z features a lightweight, adjustable depth action. These are claimed to result in maximum processing ability and excellent yield with emphasis on safety.

According to FTC, the all-automatic CSS-29 has a precision close to that of manual skinning. The fillet is placed on the machine's belt conveyor skin side down. The special knife (adjustable to skin thickness) performs a stroking action, resulting in "excellent skinning with the highest yield". The partitioned retaining roller presses the fillet flat and feeds the skin into the cutting part without any losses.

Built in stainless steel and aluminium, the CSS-29 skinner is powered by a 1.25 kW electric motor and has a capacity of 30-120 fillets a minute. As well as salmon, the machine is claimed to be suitable for skinning a range of other fish species including cod, halibut, sole, seabream and tilapia.

Mr. Soederlind revealed that some Norwegian salgauges preset for accuracy and uniformity. It is claimed to remove the bones leaving the surface of the fillet smooth and attractive.

In the FTC system, the salmon sides are injected with a saturated salt solution to achieve the correct Na Cl content. This operation also increases the moisture content slightly, and is said to produce a more succulent product.

Another machine in the FTC salmon processing system is the CSS-29 skinner

which features three partitioned retaining rollers and a special band with stroking mon processors are selling the skins to China, where they are tanned and turned into luxury leather goods such as handbags and footwear.

Automatic

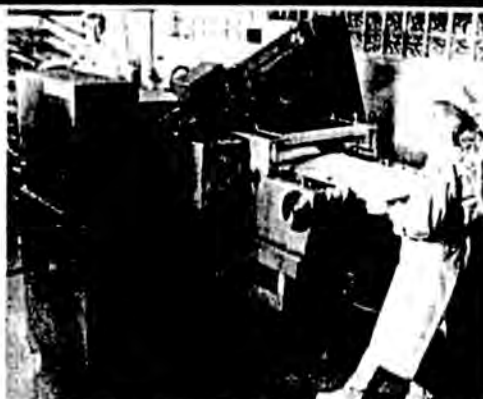
Also offered as part of the FTC package is the SSC smoke tunnel, which is made by Alpas. This machine features sensor climatic control. For optimum desired quality the process is fully automatic, incorporating a process control unit to con-

trol the climate in the smoking tunnel.

A printout gives the operator continuous information on salmon condition. The complete functions include hot and cold smoking, chilling and cleaning.

FTC also supplies on-rail trolleys for the smoker, each one having a capacity of 12 sq. m. The special tilt design is claimed to give maximum drying and smoking efficiency and is easy to clean.

The Swedish company's 'One-All' Model BL 25-500 slicer is also part of its salmon processing package. This device slices fresh, chilled, smoked and pickled (gravlax) salmon in a tem-



FTC's 'One-All' salmon slicer, "the new way of slicing".

perature range of 0-5 deg. C. No crust or pre-freezing is claimed to be necessary beforehand.

The machine slices salmon at an angle of 25 degrees. Interleaving is not needed because slices can be easily separated after slicing.

Capacity is about three or four salmon sides a minute. Yield is claimed to be up to 99 per cent.

The machine has a slicing width of 500 mm, and will produce slice thicknesses down to 2.5 mm though 3.5 mm is recommended. The speeds of the knife blades, pusher and conveyor belt can be varied, and there is an adjustable product guide.

● Further information from FTC AB, P.O. Box 3026, S-17203 Sundbyberg, Sweden. Telex 11683 FTCS.

HWA Announces a Major Programme

in Shrimp Aquaculture Consultancy

The growth in investment and profits from shrimp aquaculture has been a noteworthy feature in Taiwan, Philippines, Indonesia, and Thailand. This interest has resulted in varying levels of investment in various countries around the world. The main disadvantage has been the lack of technical back up needed to convert the investments into the projected profits.

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Grow nearer the market

WHY not move fish farms closer to the huge markets of New York and Washington? The idea is appealing but there are some biological ifs and buts. The climate is not perfect for salmon farming with the cold winters and, worst of all, the forbiddingly high water temperatures in the summer.

Marson Aquaculture Investment says it is overcoming these climatic disadvantages by establishing a salmon farm on land in which the water to the tanks will not only be heated in winter by cooling water from a nearby power plant but be cooled in summer by well water.

The design of this facility has been made by Marson Biosystem AB, a Swedish company specialising in intensive fish farming. Marson is also to undertake the erection of this advanced fish farming facility.

The farm will have its own smelt production facilities and will be capable of producing yearly some 400 metric tons of salmon ranging in size from six to eight pounds in weight. Also part of the facility will be a packing line for fresh fish as well as a smoking plant.

Intensive fish farming in clean, treated water with the perfect environment of temperature and oxygen is the ultimate for profitable production of fish, says Marson Biosystem.

Scientist retires

PETER Wood, director at the Fisheries Laboratory, Burnham-on-Crouch in England since 1972 has retired after serving 33 years as a senior scientist.

Mr. Wood first joined the laboratory at Burnham in 1954 and studied shellfish microbiology. It was his pioneering research which helped introduce to Britain purification plants for oysters, using ultra violet light to irradiate and sterilise seawater.

PRODUCT NEWS

Canvas brailer

ONE OF the problems in harvesting salmon and other fish from cages is the damage sometimes caused by the netting of the brailers.

One way of overcoming this is to pump the fish, but pump systems are expensive and complicated for the smaller farmer.

Another solution shown at the big US Fish Expo exhibition in Seattle at the end of October is a brailer bag made of canvas.

Quality improved

This has been developed by the Canvas Shop in Homer, Alaska, to give salmon fishermen a brailer that is said to be not only easier to handle and easier to clean, but improves the quality of fish landed by eliminating damage from net meshes.

The standard No Mar Brailer Bag holds 1000 lb of fish, but FFI was told by the Canvas Shop that they can be custom made in various sizes.

● Further information from the Canvas Shop, 2559 Kachemak Drive, Homer, Alaska 99603.

Irish cage system finds BC market

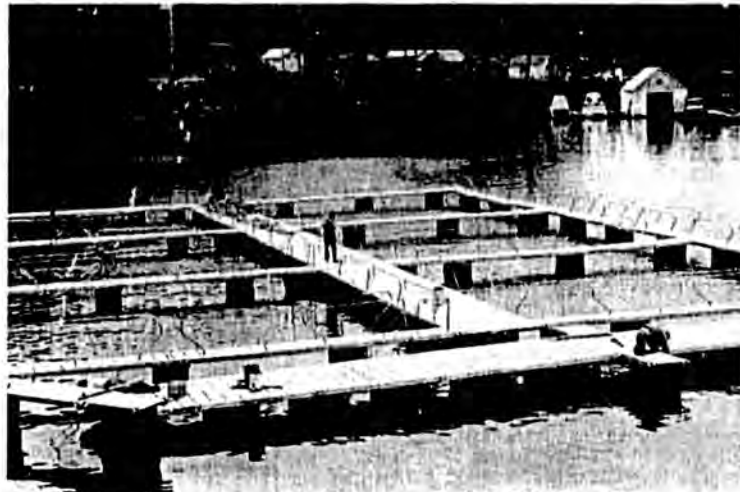
A SUCCESSFUL development in international technology transfer links the talents of a growing Canadian company with Irish expertise in cages for exposed sites to provide sturdy farm structures in British Columbia.

In 1986 Turmec Engineering of Ireland teamed up with Aqua-Can Enterprises of Port Moody in BC to extend the market for its Wavemaster line to the expanding aquaculture industry on the Pacific rim of North America.

Aqua-Can president Ann Levi-Lloyd told FFI that, before reaching an agreement with Turmec, she led a world-wide search for fish cage technologies. With production manager Jean-Paul Philippon, she worked on several different cage types before deciding to transfer Wavemaster technology to Canadian conditions.

"We chose Wavemaster cages because we saw them as the most efficient way of rearing salmon and sea-grown trout," she said. "The durability of the cages, which are made of high-strength steel with long life assured by hot-dip galvanising, and the safe working conditions provided by the non-slip decking, combine to give the best cage system appropriate to fish farming conditions in Canada."

"With over 20 years of experience in speciality metals fabrication work and a personal background which includes critical welding at nuclear power plants, Mr. Philippon was well prepared to begin fabrication of the metal cages."



Wavemaster cages under construction in British Columbia.

Modular, flexible and shown to be able to offer safe and stable working surfaces, the Wavemaster cages could also be provided at a price that gave a cost-effective system.

According to Ms Levi-Lloyd, the cages also incorporate many innovations farmers have asked for, and workers report that they like the way the cages work.

"The extra buoyancy which keeps the workers out of the water even in choppy conditions, or when pallets of feed are loaded on the deck, are welcome features," she added. "And farm workers say they appreciate details such as curved net hooks which assist in hauling nets up for changing and ensure that predator nets are held securely in place."

But probably the most popular innovation on the Canadian Wavemaster cages

is the circular stamped "sure-grip" decking.

"While lending further strength to the system," she said, "it is a welcome relief from the jagged teeth of expanded metal decks. It also allows many of the modular extras such as net handling winches, diving ladders and handrails to plug into the decking wherever they are needed."

Wavemaster systems were designed by Turmec with special hinges to allow the cages to ride the wave, current and tidal actions. As FFI reported in its special feature on Ireland last year, the system was put through an exhaustive development and testing programme before going into commercial use.

The structural strength and safety of the cages were initially demonstrated in waters off the west coast of Ireland.

Canadian Wavemasters

are now being demonstrated on the west coast of Vancouver Island, and tested at an exposed site in the Strait of Georgia.

The same rigorous process of market research, testing and development has been applied to work on a smaller (6 x 6 metres, expandable up to 9 x 9 metres) single cage for treating, grading, transporting and harvesting fish.

It has also helped develop three sizes of net washers, the largest of them able to handle giant sea cage nets.

Another new product under development is a large, modular floating work station. And a giant Wavemaster cage for very exposed sites is under prototype testing.

In British Columbia, Aqua-Can Enterprises made and installed more than 30 cages in the first six months in production, and is moving to larger facilities to meet future production needs.

Sounds 'call' fish to feed

SCIENTISTS in Japan are experimenting with "sonic farming", in which fish are attracted by sounds broadcast in a bay at feeding time. Though free to swim out to sea, many fish stay permanently in the bay, it is reported.

Scientists at Saiki on the Pacific coast of Kyushu island have persuaded Red Sea bream to huddle round a food trough at the sound of the synthesiser.

Akira Yasumura, director of the publicly-funded mariculture experimental station, said the method could prove commercially viable.

His institute raises bream from eggs and releases them into a small coastal area enclosed by nets when they reach 12 mm in length.

"Then we condition the fish acoustically for between

30 and 60 days, combining sound waves and feeding until they reach 10 cm in length," said Mr. Yasumura.

"When they have learnt the sound waves and are conditioned to respond, we release them into the ranch."

The 'ranch' is a bay which has no barriers to keep the fish inside. They are free to swim out to sea, and many of them do. But an estimated 20 per cent, are 'pl' in the bay by the synthesised beeps in E, broadcast by two solar-powered buoys moored in the bay.

"We feed them six times a day between 7 am and 5 pm. We emit the sound for about eight minutes, in the middle of which feed is released for about one minute," said Mr. Yasumura. "After a year, they are commercially saleable and we can harvest them."

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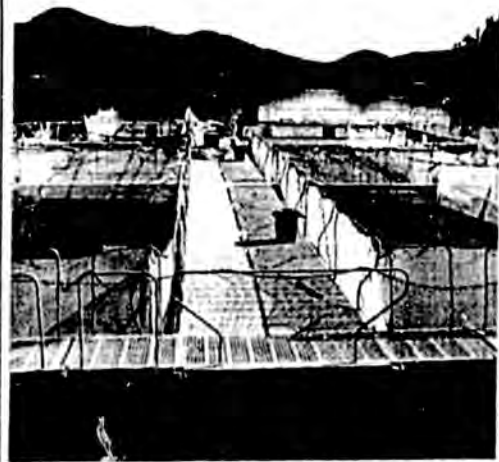
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Sturdy platforms and wide central walkways are features of the cages.

Mytilus for mussels

THE Italian firm Team Automazioni used the Nantes International fish exhibition to introduce its new Mytilus machine to French mussel growers.

This machine selects, cleans and grades mussels and leaves them ready for packaging.

According to the firm, the

machine's in-built motor allows it to be used aboard a boat as well as ashore.

There are two models available. The Mytilus 10 which can handle 100 kilos an hour, and the Mytilus 20 able to handle 2000 kilos.

● Further information from Team Automazioni, Via Garganelli 20, 40065 Pionoro (BO), Italy.

Farm courses in Florida

A SHORT course on marine shrimp farming is being offered by Coastal Science and Engineering (CS & E) at the Nova University Oceanographic Center in Dania, Florida, from April 7-15.

This hands-on course covers several topics important to successful shrimp farming, including training in maturation, hatchery, growout techniques, shrimp marketing and start-up financing.

A similar course on freshwater shrimp farming is scheduled for May 9-14.

For more information on this course and other aquaculture courses offered by CS & E, contact Dr. Bart Baca, Coastal Science and Engineering, P.O. Box 8056, Columbia, South Carolina 29202, Telex 858649 CSE CLB UD.

Raceway system for brine shrimp

NEWS from San Francisco Bay Brand Inc. of California, USA, describing the operation of an intensive brine shrimp culturing unit at its San Diego facility was not received by FFI when it was put out in November 1986. That is a pity, writes technical editor Tom Wray, for it contained some interesting details about the company's scale of operation.

It stated that for the first time, on a commercially scaled size, intensive culturing of artemia (brine shrimp) biomass in a completely enclosed raceway system had been accomplished under the

direction of Andy Schmidt at the company's San Diego Brine Shrimp Inc. subsidiary.

The system includes eight separate raceways, each containing 1500 gallons of water

and maintained with a "unique" combination of biological and mechanical filtration.

"Repeated cultures have been hatched from our quality Artemia cysts and grown to full adult size," reports Mr. Schmidt. "This project has been in operation since the beginning of 1986 and has permitted us to perfect both the biological and mechanical process as well

as formulate the necessary feed to assure adequate growth and nourishment balance in the adult Artemia."

According to Mr. Schmidt, the implications of this project are far reaching for both the tropical hobbyist market as well as for the developing mariculture market around the world. By duplicating the system, at whatever scale is required, live brine shrimp can be brought within easy access of any market or major user.

Concurrently with the development at its San Diego operation, San Francisco Bay Brand also acquired the pilot artemia extensive culture operation begun two years previously by Algatex Inc. on a 40-acre site in Salton City, California.

Says Mr. Schmidt: "The unique combination of climate and ready availability of quality saline water that exist in this area has provided an opportunity to develop and perfect techniques for the management and growth of artemia in a natural setting — but one that can be easily monitored and controlled."

Trading under the name Artemia from the Sea, this operation is presently providing brine shrimp to the Southern California aquatic market and is an important back-up course for the nationwide market when occasional weather conditions make harvesting on the San Francisco Bay ponds impossible.

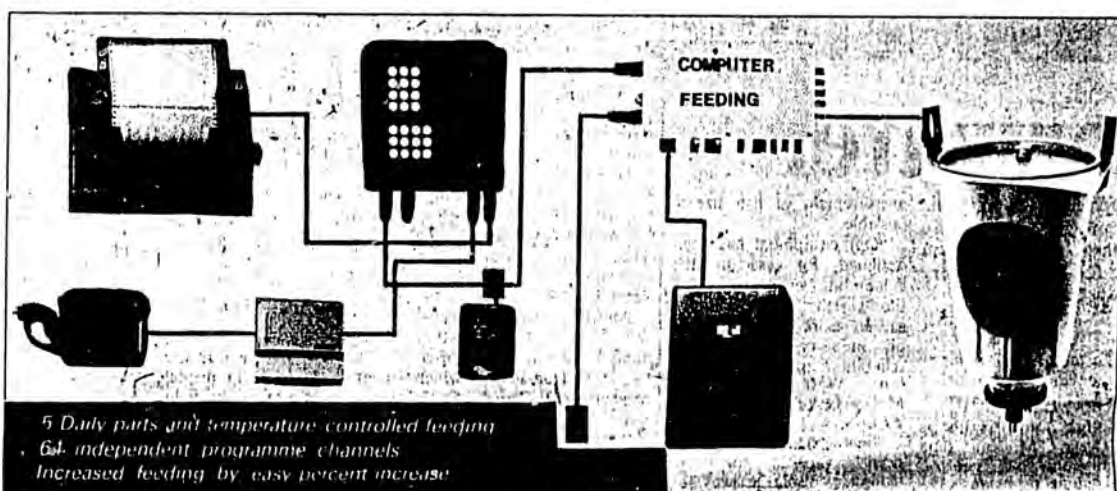
Mr. Schmidt pointed out to FFI that San Francisco Bay Brand Inc. remains the world's largest provider of artemia.

In addition to the recently established intensive and extensive culturing of brine shrimp described above, the firm harvests from the solar salt system in the San Francisco Bay well over a million tons of brine shrimp each year!

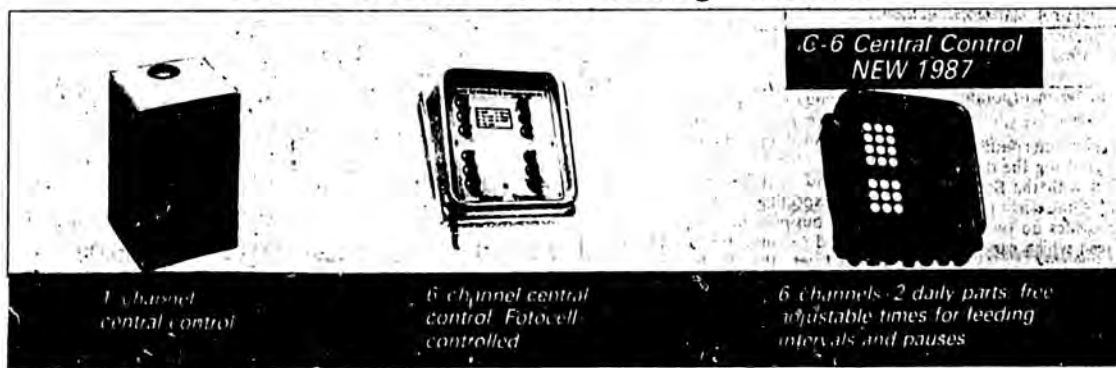
It operates in northern and southern California, and is also one of the primary harvesters of artemia cysts from the Great Salt Lake in Utah.

For further information from San Francisco Bay Brand Inc., 8239 Enterprise Drive, Newark, California 94560, USA. Telex: 5101000165 BayBrand.

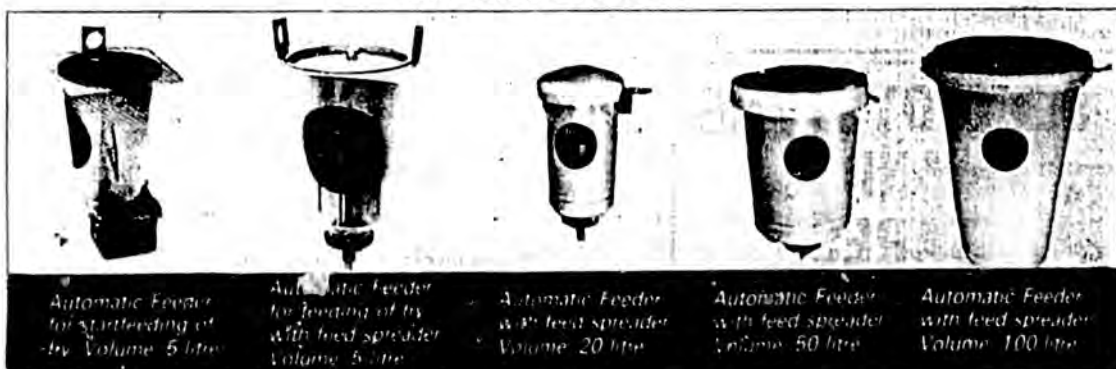
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Plans for USSR

SEA FARM A/S, one of Norway's top companies in the production of salmon smolts as well as in the supply of equipment for aquaculture, is reported to be planning a joint venture in the Soviet Far East.

This would be in association with a Soviet enterprise and would involve smolts and on-grown fish.

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Better sell with a soft-shell

A soft-shell crawfish industry is developing in Louisiana alongside traditional hard-shell crawfish production. The soft-shell product commands a far higher price on the US domestic market.

In September last year, producers formed the Louisiana Soft-shell Crawfish Farmers Association to co-ordinate research and improve output.

A computer simulation programme dealing with the economics of soft-shell crawfish rearing is being made available by the Louisiana Co-operative Extension Service.

According to the president of the new association, John Cooper Fore, some 60 farms are currently in operation. The number of producers is

expected to rise to 800 within the next few years.

At present, the wholesale price of soft crawfish is about \$8.50 a lb, compared with \$0.60 obtained for hard-shell. But this high return may drop as production increases.

Soft-shell farmers obtain their growing stocks from the 135,000 acres of existing crawfish ponds. But they have some difficulty in getting what they need.

While the hard-shell industry keeps crawfish alive for only two days after capture, soft-shell producers must maintain them for between 30 and 50 days until they shed their shells.

Much of the research, which has so far gone into soft-shell rearing, has been done by Dr. Dudley Culley, at the Louisiana State University Agricultural Center in Baton Rouge. He says at the present time most

producers are novices with little aquaculture experience.

One of the problems is that moulting rates may vary between one and five per cent. Crawfish require careful handling to prevent mortality after they are put into trays.

Meanwhile, the Louisiana Co-operative Extension Service reports that in 1987 about 20,000 lb of soft-shell crawfish were marketed in the United States.

Canada helps Pakistan farms

A NEW Directorate of Fisheries has been set up in the North West Frontier Province (NWFP) of Pakistan and a fish hatchery on 90 acres of land is being established in Peshawar with finance loaned by the Canadian government and the Asian Development Bank.

NWFP Minister for Agriculture, Forests, Animal Husbandry, Fisheries & Co-operatives Mian Jamal Shah Kakakhel said that warmwater fish like grass and silver carp, rahu and mohni would be hatched which would eventually make NWFP self-sufficient in fish.

He added that 25 demonstration fish farms would be developed. Also 25 warmwater small

farms have been established in the private sector in NWFP. These farms are selling their products and have proved a commercial success, tempting others to enter the business.

Two coldwater trout hatcheries at Shinoo in Kaghan Valley and at Madyan in Swat District are doing good business while a third has recently been commissioned in Dubair.

Salmon farm in a ship

A FRENCH and a Norwegian company are reported to be planning a large project to grow salmon in a ship off the Brittany coast, north of Brest.

According to Norinform, a second-hand 100,000 tons deadweight ship is being converted to provide on-growing tanks with a capacity of 70,000 cubic metres. Yearly production is estimated at 3000 metric tons and the sea farm is expected to start operating about June.

It will be run by a company called Salmor SA, with a French concern having a 51 per cent interest and the Norwegian company Scanfarm 49 per cent.

Seawater is to be pumped to the tanks from a depth of 20 metres.

Abalone spread

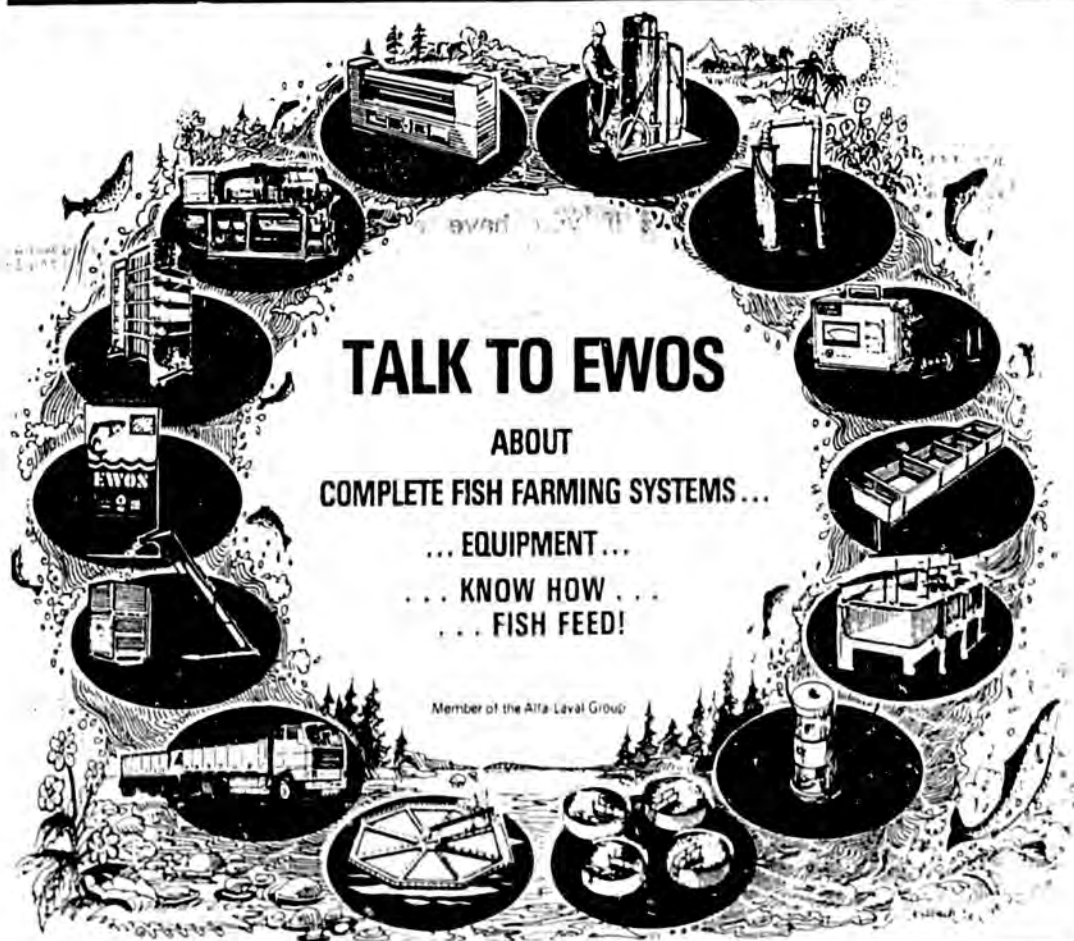
POTENTIALLY, if not actually, the largest abalone farming operation in the world, Abalone Resources Inc., with its operations based in the Morro Bay areas of California, is attracting interest with its technology and expertise in the farming of the prized California red abalone.

While not tied to *Haliotis rufescens* on a world-wide basis, the same principles apply to the farming of most species of abalone and potential joint venture operations are under consideration in Australia, New Zealand and Mexico.

This is not to imply that any arrangements are finalised but it does indicate the future thrust of the company in its aim to become the world's foremost grower and marketer of abalone.

In Mexico, the favoured species will be the pink abalone or *Haliotis corrugata*, a species more tolerant of the warmer Mexican water.

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Algae Bloom!

(The Blob that Killed the North Sea)

by Buck Jenkins

April in the Northern Hemisphere heralds the spring thaw, and thoughts turn longingly towards May, when new life springs forth with vigor. For Norwegians, there will be a certain nervousness as their "Day of Days," Syttende Mai, draws near—especially for those who live on the southern coasts or who make their living from fish farming. They wait to see if the disaster of 1988 will recur—a drama with the flavor of an early Japanese flick that would have a title something like "The Blob that Ate New York," only this blob sucked life from the North Sea, destroying everything in its path.

The spring of 1988 was an unusually warm and sunny one in Scandinavia—a phenomenon that brings with it a sense of well-being. On May 9 at a fish farm in the Gullmarfjord on the west coast of Sweden, abnormal behavior among the caged rainbow trout was observed. By May 11, most of these fish were dead.

On May 14, the same abnormal behavior was noticed by fish farmers at Hamborgsund and Arendal. Mortality among wild fish was also reported along the west coast of Sweden. By May 17, fish farms along the south coast of Norway as far west as Lindesnes had lost most of their fish. On May 23-24, a "massive fish kill" occurred at four Atlantic salmon farms in the Flekkefjord area.

The Norwegian scientific community began a major campaign to determine the cause of these deaths

Last May, Scandinavian fish farmers noticed abnormal behavior by their fish. Several days later they were dead. This was the first clue anyone had of the deadly blob that was threatening all marine life in the North Sea.

among caged and wild fish. A tide of algae measuring six miles wide and 30 meters deep was monitored. It was identified as *Chrysochromulina Polylepis*, a single-celled organism releasing a hitherto unknown toxin. Where the algae concentration reached its peak, most marine life perished. The tide was being pushed by wind and currents westward along Norway's coast.

Fish farms near Gothenburg, Sweden, were towed into the nearby river and the affected fish recovered within two hours. The Norwegian Fish Farmers Association took its cue from the Swedes and mounted a massive towing operation. Every conceivable sort of sea-going vessel was used, including tugs, ferries and supply ships.

Coast Guard and research vessels, with aircraft and satellite aid, monitored the algae front. As the tide advanced, they advised fish farmers when to tow the huge fish pens, measuring 100 meter across, into the inner fjords. In two weeks, 120 fish pens were moved to safety.

Odd Ustad, spokesman for the Norwegian Fish Farmers Association, called the rescue operation "the largest of its kind in the world" and pronounced it "a great success."

Although the farmed fish escaped, other marine life did not. The seabirds' hatching season was at its height, and there were heavy losses of birds along the south coast. The Purple Snail has virtually disappeared from some affected areas, and no one knows yet whether this disappearance is temporary or permanent.

As far as is known, most wild fish escaped because they were able to swim away from the algae tide—or bloom. However, fish that were biologically programmed to remain in certain areas (such as cod fingerlings which instinctively hide in shallow, rock-sheltered areas) were nearly decimated. Similarly, animals living on soft or sandy sea bottoms could escape the toxin by burrowing, whereas animals living on hard sea bottoms and unable to move quickly, such as the Purple Snail, would be killed in great numbers.

By June 15, the invasion of the killer algae was over, but the work of analyzing and diagnosing the significance of this potential disaster had just begun. Clearly many people would do much complicated scientific work and many experts would make pronouncements. What was the cause of the bloom? Was Norwe-

gian fish farming threatened? Were there steps which could be taken to prevent future emergencies? In November 1988 I traveled to Norway to learn what was being done to throw light on these and other significant questions. As might have been predicted, there were wildly divergent views.

En route to Oslo, I thumbed through *Scanorama*, the in-flight magazine for SAS. One article jumped out at me: "Dawn of Doomsday." The article covered more than the disastrous bloom of *Chrysochromulina polylepis*. It also discussed other major eruptions in the biological life of the Baltic and North Seas: the recent death of seals from a virus resembling the distemper-virus; the invasion of other seals into the vacated territory; massive increases of starfish along the Norwegian coast, etc. The author of "Doomsday" (Tony Samstag, a free lance journalist living in Oslo) spoke of definite links between these biological oddities and the contemporary increase of pollutants into the North and Baltic Seas from human, agricultural and industrial waste.

At the opposite end of the spectrum was a short interview I conducted by telephone with Odd Ustad, public relations manager of the Norwegian Fish Farmers Sales Organization located in Trondheim. Ustad stated categorically that the recent algae bloom was "no problem" for the Norwegian fishing industry. He pointed out that the loss of 500 tons was only .06 percent of the total production of farmed fish in Norway. While this loss was catastrophic to the individual farmers involved (fewer than 10), insurance helped to cover the loss to some extent.

Ustad went on to describe the entire algae bloom situation as a tempest in a teapot. "After all," he continued, "algae blooms are common all over the world. British Columbia, Chile and Scotland experienced similar algae invasions in 1986." He also said that algae blooms are so common in Japan that Japanese fish farmers routinely relocate their fish farms in summer—he felt that some such relocation system would have to become part of Norwegian fish farming in the future.

This extreme of perspective gave me an idea of what was involved. I was now ready to interview scientists. My first interview was with Dr. Bjarne Underdal, professor of the Department of Food Hygiene at the Norwegian College of Veterinary Medicine. Dr. Underdal agreed with Odd Ustad that algae blooms are quite common in nature—he even said that there is a Biblical reference to "red tide," which could very well have been an algae bloom.

Underdal explained how algae blooms occur. Algae are forms of single-celled plants which live by

Algae blooms are common all over the world. British Columbia, Chile, Japan and Scotland experienced similar algae invasions in 1988. Even the Biblical reference to a "red tide" in Exodus may well have been an algae bloom.

consuming the fragments of waste produced by sea creatures. Algae usually exist in off-shore environments where upwelling currents stir up sea bottoms, bringing massive amounts of fragments of dead bodies and waste products of sea animals to the surface.

Very often in nature the presence of a plentiful food supply triggers a rapid reproduction (which in the case of the algae is cell division); thus a "bloom" or efflorescence of algae can result. Conditions for such a bloom were especially favorable in the spring of 1988 because the sun shone a great deal more than normal.

One of the mysteries surrounding the "*Chrysochromulina* disaster" concerned the exact process by which the algae destroyed marine organisms. One report I had read before coming to Norway asserted that the algae clogged the gills of fish, suffocating them. Another report said that the algae bloom harbored a virus or bacteria which attacked the fish and other organisms, producing a fatal disease. Dr. Underdal, who was personally in-

volved in many of the experiments conducted to determine the cause of death of the marine organisms, was eminently qualified to isolate the real cause—a toxin produced by the heavily concentrated algae.

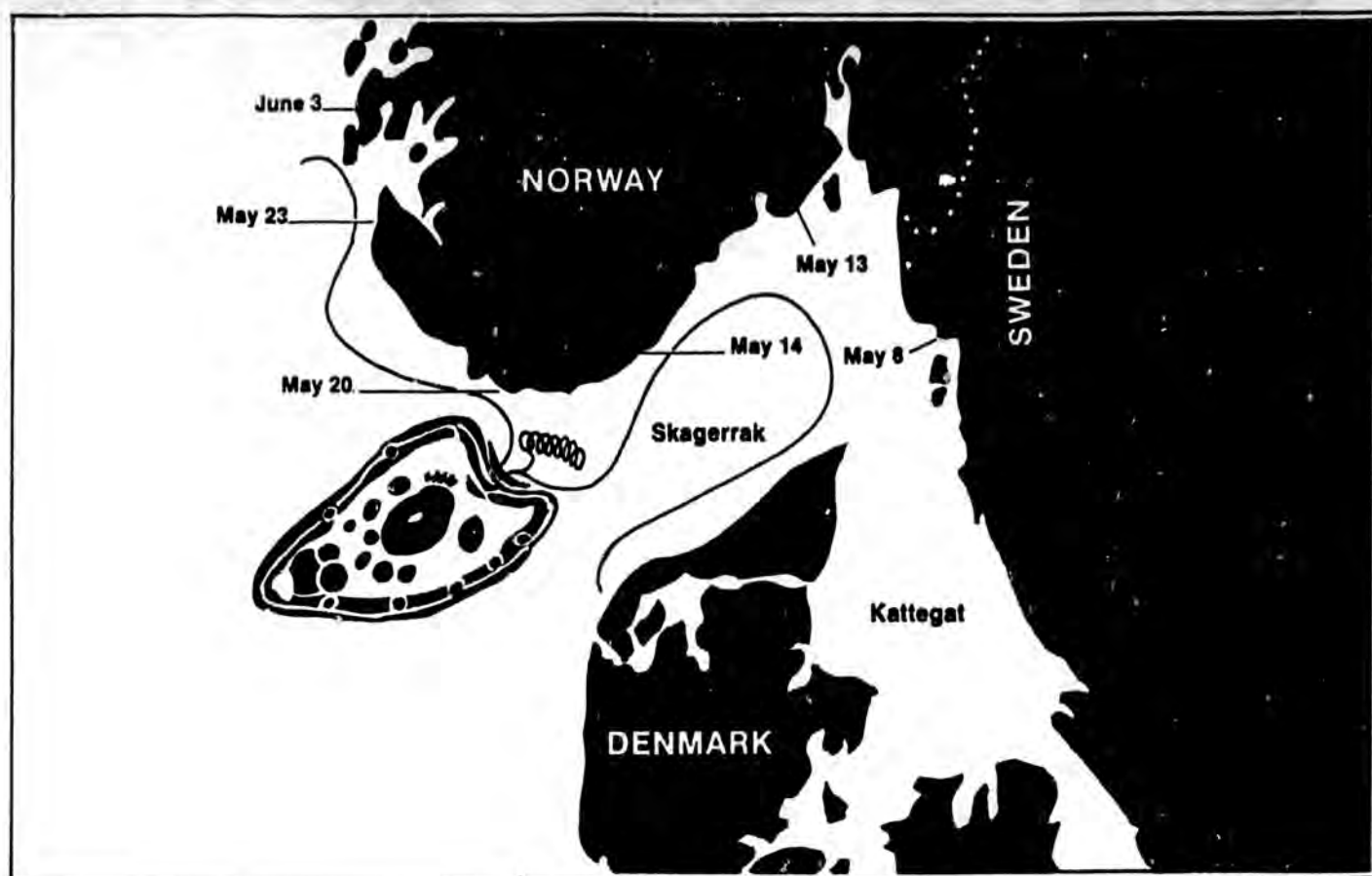
The experiments established that for some unknown reason the *Chrysochromulina polylepis* algae were producing a deadly toxin which attacked three groups of cells in fish and other marine organisms, destroying their ability to perform necessary body functions and killing toxified victims rather quickly. Dr. Underdal said that the toxin simultaneously damaged cells responsible for digestion, the production of hemoglobin, and the regulation of salt in the body. (These salt-regulating glands are located in the gills, a fact which might have led to the appearance of organisms being choked to death.)

Dr. Underdal (as well as Odd Ustad) wanted one point specifically stressed. In no way does the toxin produced by *Chrysochromulina* become stored in the flesh of the organism; thus the meat of farmed salmon and trout which were towed away from the algae bloom was in no way affected.

Even though the process by which this algae bloom killed fish and other organisms had been isolated (although as of this writing the exact chemical structure of the toxin was still a matter of conjecture), I still needed a lot more information. For this, I turned to Bjørn R. Braaten, research manager for Aquaculture at NIVA (the Norwegian Institute for Water Research). Braaten had some opinions about the significance of last summer's "algae disaster."

Like other scientists I interviewed, he stressed that algae blooms (and occasionally toxic ones) have been around a long time and are a routine part of nature's overall process, which is often marked by large seasonal variations—what some people might refer to as "disasters," such as the periodic collapse of entire species for brief periods of time.

Without the existence of fish farming along the Norwegian coast, the existence of an ecological disaster could have gone undetected. The death of 500 tons of farmed fish was a sure indication of the presence of an environmental problem in the region. In the past, even the massive



death of many marine organisms in the region might have been chalked up to unknown sources. Although Ustad had pronounced the algae bloom "not a major problem" for the fish farming industry, Braaten observed that the toxin produced by *Chrysochromulina polylepis* had disastrous effects on many other organisms.

Still, Braaten expressed concern over a couple of salient points concerning this spring's outburst of *Chrysochromulina polylepis*. Although this particular species of algae has been known to scientists since 1960, this spring's bloom was the first known example of this particular algae producing toxin. Braaten said that algae are toxic and non-toxic at different times, and the reason for this difference is not understood. He offered the theory that possibly the algae were being disturbed by some environmental irritant and produced the toxin in self-defense.

A second point which he discussed was that the very size and duration of the bloom argued for the presence of an immense concentra-

tion of nutrients. These nutrients had to contain large amounts of nitrogen and phosphorus, which are supplied by run-off from the land. In recent years, these elements have greatly increased because of pollution of the North Sea, the Skagerrak, the Kattegat and the Baltic Sea by human waste and fertilizer contained in the run-offs. However, Braaten said, it was difficult for a scientist to draw an unqualifiedly positive correlation between increased pollution of the sea and this spring's large algae bloom.

Unqualified correlation or not, the algae bloom has made many people increasingly aware of the complexities of the ecological process and the dangers of upsetting it with more and more pollution. Fish farms themselves, because of their tremendous concentration of fish in small areas, may be contributing to the pollution problem. One Oslo source who wishes to remain unidentified said some government officials were considering refusing permits to new fish farms, and oth-

The one-celled algae *C. polylepis* extended its toxic tentacles into the North Sea areas known as Kattegat and Skagerrak last summer. The dates on the map shows the movement of the algae tide.

continued on page 33.



Fish farms like the one pictured above were towed to the safety of fjords to escape the algae tide. Photo by Robert Paulson.

ers were suggesting it might be wise to reduce the number of fish farms (presently 700).

Europe, too, is beginning to act. Recently there was a conference in Brussels with the title, "EEC Workshop of Eutrophication and Algal Blooms in the North Sea Coastal Zones, the Baltic and Adjacent Areas." At the 1987 North Sea conference in London, the countries surrounding the North Sea pledged to halve their 1985 levels of environmental toxins and nutrient discharges by 1995. Norway pledged to do this by 1992. Fortunately or unfortunately, Norwegian discharges make up only 3 percent of the total. This demonstrates the necessity of international cooperation in solving the pollution problem.

Another positive result of the algae bloom was the announcement by Norsk Hydro, the world's largest producer of complex fertiliz-

ers, that it would begin trials of a phosphate-free fertilizer. It is also developing a low-phosphate fertilizer.

Norway, with the most to lose if pollution isn't stopped, is again leading the way and setting the standard. In a recent Norwegian opinion poll, more than 97 percent of those questioned said that they would like to see their government focus more on environmental measures, and 85 percent were willing to pay what this would cost.

The Norwegian Council for Scientific and Industrial Research (NTNF) is already intensifying research into sea and fjord pollution with the aim of developing technology which can be used for environmental surveillance of the sea and fjords.

With this resolve, perhaps the spectre of "the blob that ate the coast of Norway" can be kept at bay. □



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SUBSTITUTE SENATE JOINT MEMORIAL NO. 8014

State of Washington 51st Legislature 1989 Regular Session
by Committee on Environment and Natural Resources (originally
sponsored by Senators Benitz, Metcalf, Moore, Barr and Vognild)

Read first time 3/1/89.

1 TO THE HONORABLE GEORGE BUSH, PRESIDENT OF THE UNITED STATES, AND
2 TO THE PRESIDENT OF THE SENATE AND THE SPEAKER OF THE HOUSE OF
3 REPRESENTATIVES, AND TO THE SENATE AND HOUSE OF REPRESENTATIVES OF
4 THE UNITED STATES, IN CONGRESS ASSEMBLED:

5 We, your Memorialists, the Senate and House of Representatives of
6 the State of Washington, in legislative session assembled,
7 respectfully represent and petition as follows:

8 WHEREAS, Fishing for steelhead and other trout has traditionally
9 been a major source of recreation available to citizens of many
10 states but particularly appreciated in Washington state; and

11 WHEREAS, The special significance of steelhead trout to
12 Washington citizens is reflected in its historical protection as a
13 game fish and designation as the official state fish; and

14 WHEREAS, Hunting for deer and elk is a major recreational
15 activity available to citizens of many states; and

16 WHEREAS, Steelhead and other trout, deer, and elk all provide a
17 food resource for all Washington citizens; and

18 WHEREAS, It has been recognized across the nation that the
19 commercial sale of these recreational resources should be prohibited.
20 The commercialization of these resources, as population increases,
21 results in pressure on these resources beyond levels the resources
22 can bear. Additionally, it has become recognized that the economic
23 value of these resources to the state and citizens is far greater if
24 they are reserved for recreational and personal consumption use;

25 NOW, THEREFORE, Your Memorialists respectfully pray that the
26 United States Congress pass federal laws guaranteeing the
27 decommercialization of steelhead and other trout, elk, and deer while
28 allowing the sale only from registered or licensed aquatic fish farms
29 and game production facilities.

30 BE IT RESOLVED, That the Washington State Legislature fully

1 supports our congressional delegation as they take on the task of
2 securing the passage of such legislation;

3 BE IT FURTHER RESOLVED, That copies of this Memorial be
4 immediately transmitted to the Honorable George Bush, President of
5 the United States, the President of the United States Senate, the
6 Speaker of the House of Representatives, and each member of Congress
7 from the State of Washington.

LETTERS

The Fisherman welcomes letters to the editor. Letters must be signed and should be brief, if possible.

UFAWU stand on fish farms needs to be toughened

In a recent editorial entitled "Can the UFAWU represent salmon farm workers?" (April 21, 1989) union policy was outlined with respect to aquaculture — no ban on fish farming but strict regulations. Your position is reasonable and takes into consideration that workers in this industry require safe working conditions and decent wages.

However, it has now become apparent that salmon farming has become an even bigger problem than most had predicted in terms of most disposal, industrial plastic garbage, destruction of marine wildlife, water pollution, antibiotics, price wars, fish escape-ment and numerous other problems.

The union's decision to embrace a "regulated" aquaculture industry does not take into account the burden that must be shouldered by the residents of the many communities that have to live with and pay for (through taxation) this new industry.

Our communities have lost funding in other areas, such as recycling, parks development and education as public money and expertise are poured into this industry.

We then must live with the mess created by people who don't care about local concerns and values and think that all you have to do is wave money in people's faces and they will swallow anything.

Both levels of government seem completely disinterested in regulating this industry. The new waste management laws for fish farms are not even worth the paper they are printed on. This industry is, and will continue to be, "self-regulating."

This industry has little respect for existing laws like the Fish and Wildlife Act or the Pest Control Products Act, so there is every possibility that new laws will be ignored as well.

In the wake of falling farm fish prices, many people are asking questions concerning the viability of fish farming. But regardless whether or not fish farming is sustainable or must continue to be subsidized by the public, there is no question the industry will continue to impact negatively on coastal communities.

The use of the biocide Nuvan 500 in Scotland to control sea lice is just one indication of what we can expect to see here if it hasn't already been used.

It is becoming more and more obvious that the economic benefits are confined to the fish farming industry while we must pay the social/economic and environmental costs borne out over the long term. Under these circumstances, phasing out fish farming during the next five years is becoming a more appealing and realistic alternative. Then we can get on with the real job at hand — rehabilitation and conservation of wild salmon stocks.

We would be pleased to present a slide show documenting industry abuses.

Claire Heffernan,

Citizens for Aquaculture Regulations,
POWELL RIVER

The Fisherman
(B.C.)

6/23/89

Don W. Collinsworth, Commissioner

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Alaska Department of Fish & Game

NEWS

FOR IMMEDIATE RELEASE

March 1, 1989

ALASKA CONCERNED ABOUT NEW FINFISH VIRUS

Juneau...Fishery pathologists in the Fisheries Rehabilitation, Enhancement, and Development (FRED) Division of the Alaska Department of Fish and Game (ADF&G) are very concerned about the discovery in the State of Washington of Viral Hemorrhagic Septicemia (VHS), a fish virus that has not occurred before in North America.

Recently, a VHS virus was identified in spawning coho and chinook salmon in two hatcheries in the State of Washington: the Glenwood Springs Hatchery on Orcas Island and the Makah Hatchery operated by the U.S. Fish and Wildlife Service near Neah Bay. All fish in these hatcheries were destroyed, and the facilities have been quarantined in order to prevent the spread of this virus.

VHS, first discovered in 1938 in Europe, causes disease primarily in rainbow trout in both fresh and salt water. Other fish shown to be susceptible include Atlantic salmon, brook trout, golden trout, rainbow trout-coho salmon hybrids, and goldfish. Transmission is by contact with other infected fish or contaminated waters. VHS has not been detected in North America despite extensive disease monitoring. VHS is capable of causing severe mortalities in older, larger fish, while Infectious Hematopoietic Necrosis Virus (IHNV), indigenous to wild Alaskan sockeye salmon, typically kills fry and juveniles. As with other viral diseases, there is no treatment for VHS except prevention.

Dr. Ted Meyers, Principal Pathologist for the FRED Division, has found no evidence of VHS disease in Alaskan

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salmon stocks. According to Dr. Robert Burkett, Chief of Technology and Development for the FRED Division of ADF&G, Alaska maintains the best possible protection against invasion of exotic fish diseases because it prohibits the importation of any finfish into the state. "The most important thing was done ten years ago when regulations were established prohibiting import of finfish," Burkett says.

Dr. Meyers has been in contact with investigators performing the VHS identification and survey work at the Sand Point U.S. Fish and Wildlife Service Fish Pathology Laboratory in Seattle. Dr. Meyers will be travelling to the Seattle Laboratory to monitor the progress of the investigations and to determine the extent of the VHS problem in Washington and the Pacific Northwest. FRED Division pathologists will continue to monitor Alaskan salmonid stocks for IHNV using procedures that would detect other viruses as well, including VHS.

As a result of the potential risk to Alaskan stocks, the Commissioner of ADF&G, Don Collinsworth, is calling for the immediate formation of a Pacific Coastal Task Force composed of state and provincial representatives from Alaska, Washington, Oregon, Idaho, California, and British Columbia, with appropriate representatives from state, federal, tribal, and private industry, to investigate the risk of spreading VHS from infected hatcheries in Washington State and to develop effective control methods to contain this disease.

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by Jack Broom
Times staff reporter

A potentially lethal fish virus that prompted biologists to destroy 3.8 million fish and eggs in two Washington hatcheries last week may also have infected wild salmon and trout and could spread like a plague, experts say.

"This is classed as an emergency disease. It's not to be taken lightly," said Jerry Grover, an associate manager in the U.S. Fish and Wildlife Service's regional office in Portland.

Thousands of wild salmon, trout and other species will be gathered in the next few weeks from areas around the two hatcheries where the virus was recently detected.

Biologists fear that viral hemorrhagic septicemia (VHS), never before seen in North

STEELHEAD RUN SUFFERS

■ An early count of fish at the locks is "terrible." Northwest, B 5.

America, may have the potential to spread rapidly in Northwest hatcheries, net pens and fish populations in open waters.

"Right now there's about a 50-50 chance" that the virus has infected fish in the wild, said Ray Brunson, a fish pathologist for the Fish and Wildlife Service.

The virus, known as VHS, is not regarded as dangerous to humans, even if people eat fish that have been infected.

Biologists say VHS may be far more dangerous to steelhead, a form of trout, than to salmon, but the extent of the danger to both species is not yet known.

In Europe, where VHS has been detected previously, coho salmon have been observed to carry the virus and suffer no ill effects, said Larry Peck, head of salmon-culture operations for the state Department of Fisheries. But Peck said that is no

Please see **FISH** on A 6

'An emergency disease' Lethal virus may have infected wild salmon and trout, biologists say

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The Seattle Times 2/28/89

FOR YOUR INFORMATION FROM SENATOR JAY KERTULA 2/28/89

Virus called 'emergency'

FISH

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guarantee that Pacific salmon would survive the infection.

In recent laboratory tests on trout here, about 70 percent died after being injected with large doses of the virus.

The presence of VHS was discovered in routine tests at the state's Glenwood Springs Hatchery on Orcas Island and the federally run Makah National Fish Hatchery on the Olympic Peninsula.

Although the virus itself had not killed any fish at those facilities, all fish and eggs at both hatcheries were intentionally killed to prevent its spread. Workers killed the fish by adding chlorine to the water or by turning off the fresh-water supply, causing the fish to die from lack of oxygen.

Yesterday, workers were still killing the last of the fish and putting them into trenches to be buried.

The next step is to determine whether fish outside the hatcheries have the infection.

"We're setting up a very aggressive sampling schedule," Peck said.

He said crews will use nets, lines, traps and electric-shock devices to gather fish from streams and open water near the two hatcheries.

After the fish are caught, it will take two weeks to test them for the virus.

Peck would not speculate on the chance that the virus is now in wild fish, but he said it's possible that salmon returning from the ocean brought the virus into the two hatcheries.

No one knows how the virus got to this country, Peck said. "If

anyone had a guess at this point," he said, "it would be just speculation."

Opponents of net-pen salmon raising believe, however, that the importation of Atlantic salmon eggs to the state is the most likely cause.

"It could have come over as infected Atlantic salmon eggs, and Pacific salmon could have picked it up from them. I think that's the most probable cause," said L. Joe Miller, president of the Marine Environmental Consortium.

Miller said his organization will ask at a public hearing tomorrow for a moratorium on new net-pen permits until the cause and extent of the disease are known.

It is impossible to determine how much damage the virus could do to fish populations here because so little is known about its effects, particularly on salmon.

In Europe, where the virus has been detected mainly in trout, it was responsible for killing 80 percent to 90 percent of the trout in a certain confined area, Grover said.

The ability of the disease to spread quickly among fish poses great concern to commercial operators raising salmon in net pens.

"We're cooperating with the state Department of Fisheries in its investigation," said Haavard Rabben, general manager of Global Aqua USA, which raises Atlantic salmon in floating net pens in Puget Sound.

Eggs and fry used by Global Aqua are routinely tested for many diseases and have never tested positive for VHS, Rabben said. But he said if the virus is in wild fish in Puget Sound, it could spread to his fish.

Brunson said the fish kill hurt the morale of hatchery workers. "They've invested a lot of their effort and their heart in trying to rear fish, and then we call them and tell them to kill them," he said.

The number of fish destroyed last week represented only about 1 percent of the fish raised in state, federal and tribal hatcheries in Washington state, but there is deep concern over whether the

disease will be found elsewhere.

"It was discovered in routine sampling at Glenwood Springs, and we know we've transferred fish in and out of that facility to and from other hatcheries," said Tony Floor, state fisheries spokesman.

But Peck said no eggs or fish were transferred out of the Glenwood Springs hatchery last year because egg samples from returning adult fish showed that some type of virus was present. "We knew we had some type of problem. We didn't know what it was, but we red-flagged that facility," he said.

Peck said it is too early to gauge the extent of the threat to the state's 30 major salmon hatcheries, but he said additional tests are being done at each site.

More than 327 million fish were released last year from state, tribal and cooperative hatcheries. The smaller federal fisheries program released 60 million fish last year in Washington, Oregon and Idaho.

Grover said the fish destroyed at the Makah hatchery represented "a substantial portion of our total production" in the Northwest. He said fish raised on the Olympic Peninsula are considered particularly valuable because they are close to the ocean and usually have a good survival rate when released.

DAVID J. PHILLIPS