

SCOMM

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SENATE LABOR & COMMERCE COMMITTEE

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Senator Jack Coghill

Dick -

Thought you would
be interested in the enclosed.

I'm very supportive of your
position. Good luck.

Katie Hurley

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 1988." 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-

involved 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.

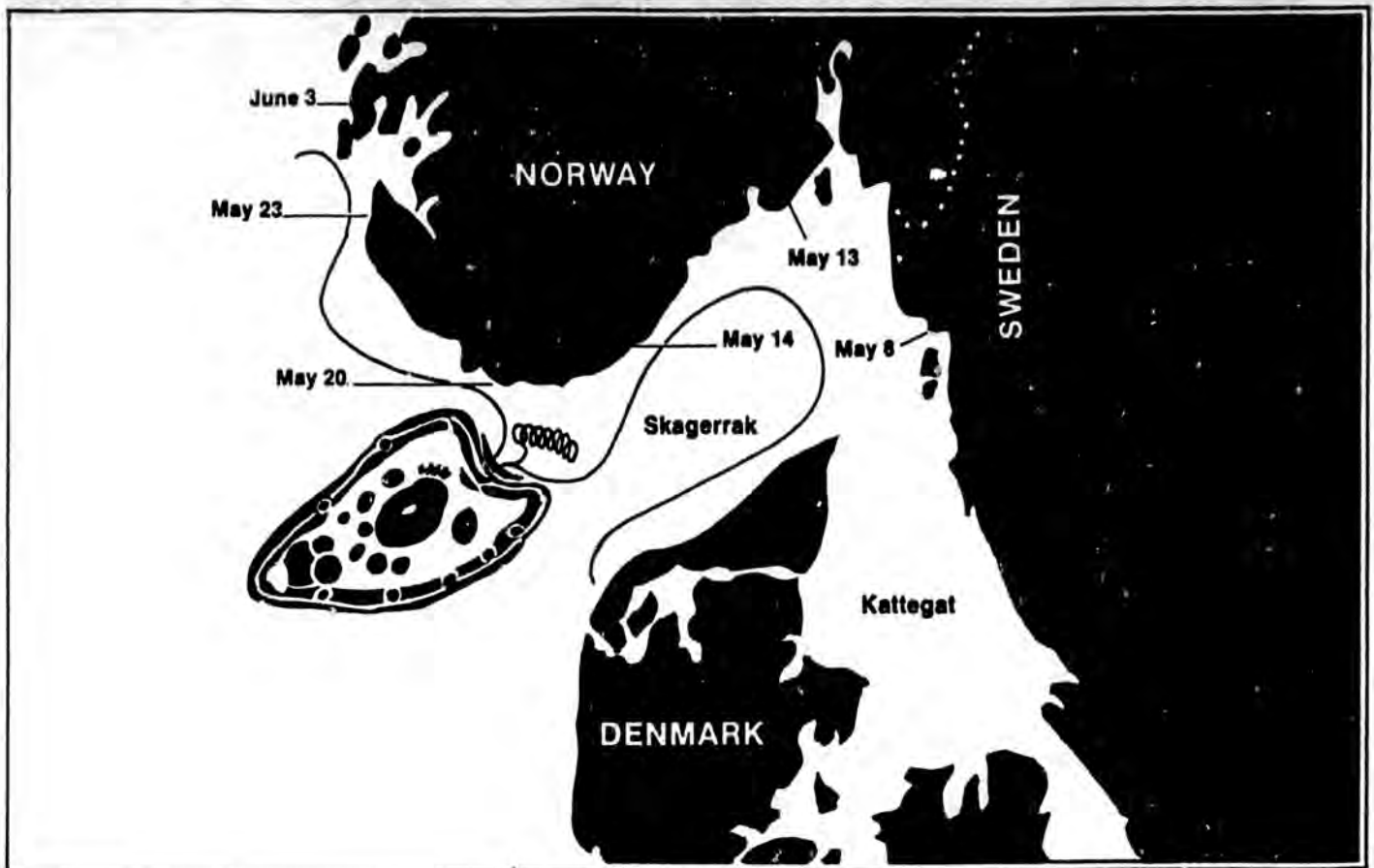
The experiments established that for some unknown reason the *Chrysochromulina polylepis* algae were producing a deadly toxin which attacked three groups of cells in fish and other marine organisms, destroying their ability to perform necessary body functions and killing toxified victims rather quickly. 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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WASHINGTON STATE SENATE

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- For Your Information
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From:

Senator Jack Metcalf
202 Institutions Building
Olympia, Washington 98504
(206) 786-7618

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 escapement 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

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.

* * * * *

by Jack Broom
Times staff reporter

A potentially lethal fish virus that prompted biologists to destroy 38 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

Lethal virus may have infected wild salmon and trout, biologists say

'An emergency disease'

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The Seattle Times 2/28/89

FOR YOUR INFORMATION FROM SENATOR JAY KERTTULA 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.



Virus threatens state's salmon and steelhead hatcheries

By Jane Hadley and George Foster
P-I Reporters

State and federal biologists have destroyed almost 4 million fish and eggs at two Washington state hatcheries because some of the fish were infected with a fatal

viral disease that has never before occurred in North America.

The hatcheries have been quarantined, but the virus may already have spread into valuable Pacific salmon and steelhead stocks, alarmed fisheries experts say. The disease has previously infected European commercial

trout operations.

"The worse-case scenario is that every hatchery would become infected," Joseph Blum, director of the Washington state Department of Fisheries, said yesterday.

"The hatchery world throughout the U.S. has been put on alert. The word is out and traveling

quickly," said David Klinger, a spokesman for the U.S. Fish and Wildlife Service's regional headquarters in Portland.

The virus, which cannot be treated and is always fatal to infected fish, poses no risk to human health, even if a contaminated fish is eaten, according to

the state fisheries department. Two hatcheries, the Makah Hatchery near Neah Bay and the Glenwood Springs Hatchery on Orcas Island, are being disinfected. No fish or eggs can enter or leave the facility, said Klinger.

Coho, chum, fall chinook, and steelhead were destroyed.

The virus first showed up in December at Glenwood Springs, a joint private-state salmon rearing operation.

A short time later the virus appeared at the U.S. Fish and Wildlife Service's Makah Hatch-

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Virus: Threat to hatcheries

From Page 1

ery on the Olympic Peninsula. But the virus was not positively diagnosed until last week.

The disease, called viral hemorrhagic septicemia or "VHS," has previously been reported only in continental Europe, where it has caused "significant fisheries losses" at commercial trout operations, according to the fisheries department.

Blum said a little over 300 million young fish and 60 million eggs are produced annually in the state. The fish and eggs destroyed this week would amount to about 1 percent of that.

"Obviously, it's a significant number of fish," said Klinger. And the Makah hatchery fish also are considered especially valuable because the hatchery is so close to the open ocean that the fish have a very high survival rate, he said. But the possibility that the disease might spread to other hatcheries is now the main worry.

Glenn Yokoyama, manager of the University of Washington's fish hatchery on Portage Bay, said if fish and eggs were transferred into or out of the infected hatcheries after the virus discovered but before the quarantine was put into effect, it would heighten the chances the disease would spread.

Bob Byrne, a spokesman for the state Department of Wildlife, said department biologists are concerned that the virus will

"The likelihood of this virus showing up someplace else at some point is pretty high," he said.

Top fish disease experts throughout the Northwest met in Medford, Ore., this week to discuss the virus and other matters, according to the state fisheries department.

The disease causes the blood-forming tissues of the kidneys to degenerate.

The disease could have been introduced by certain fish species, or by ships or travelers carrying contaminated water.

"The possibilities are bilge water from vessels or that people who travel worldwide pick it up on their boots, or that other fish could have it," Blum said. "My understanding from our technical folks is that black sea bass are a carrier. Atlantic salmon have been known to have it."

The new disease may well fan the flames of the controversy over salmon net pens and other aquaculture operations in the state. Opponents have insisted that net pens pose the risk of introducing new fish diseases, while supporters have downplayed the risk. The favored fish at net pen operations is the Atlantic salmon.

The state has 13 net pen operations, most of which raise Atlantic salmon, and a number of new ones are proposed.

Hatcheries in this state have been plagued by a virus for many years known as IHN. Since 1982 the UW's hatchery has had to test each egg and young salmon individually for the presence of IHN.

Senator Eliason

The latest round in the aquaculture battle

OLYMPIA — For 25 years Washington has been edging slowly into aquaculture, seeking to turn Puget Sound and adjoining saltwater areas into a fish farm, enhancing production of seaweed, mussels, oysters, clams and fish, particularly salmon. It sounds like the perfect economic development: exploiting the state's relatively pure waters to create businesses and jobs. Unlike so many industrial endeavors, aquaculture would seem to demand clean waters, protecting the environment rather than degrading it.



Mike Layton

Commentary

For some, reminiscent of the success of Japan, Scandinavia, and other places, the process has been too slow, plagued by bureaucracy and selfish waterfront property owners.

For others, including some scientists and the upland dwellers, it's grown too fast and already is creating problems that will only get worse.

The battle has been fought in many small areas, usually in county courthouses and between neighbors seeking to exploit the potential resources or raising alarms about unsightly oyster rafts and salmon pens.

The focus of the fight now is on the state Shoreline Hearings Board.

The board is reviewing Skagit County's refusal to allow a salmon net pen operation just south of Hope Island, a state park and prime sports salmon area, by a consortium of three Indian tribes called the Skagit System Cooperative.

The tribes propose to install 20 pens

behind log booms enclosing an area 480 feet by 100 feet. There would be three blinking navigation lights and boats hauling 10 to 12 workers back and forth. The pens would produce some 500,000 pounds of salmon a year.

Skagit County long ago designated the area as "natural," meaning no commercial development. The county's brief to the Shorelines Board says the Skagit River estuary is the "least disturbed, and most diverse and biologically productive, of all major estuaries of Puget Sound."

The area is home and nursery to a broad complex of biologically sensitive creatures. Pens, the county says, "would be an unsightly blemish on a currently pristine shoreline, reducing enjoyment of the residents and their property values."

But there is more to it than offending the people who can't afford waterfront homes. It also would conflict with the hundreds of salmon fishermen who delight in the area.

Objections are growing to the idea of concentrating so many fish in one spot. Large amounts of fish waste not only pollute the water, but penned fish also are susceptible to epidemics of diseases and parasites. Finally, there is the matter, still only barely understood by scientists, of "genetic pollution" from inbred hatchery and pen fish mixing with wild salmon.

That fear is enhanced by the importation of Atlantic salmon. They're less stressful and thus survive better in pens, but when they escape and breed with the stronger wild salmon, they degrade the race. They also might bring disease that the native salmon can't resist.

Pen opponents' arguments were bolstered yesterday by testimony before the board from

Svein Mehli, a smiling, boyish-faced biologist who directs Norway's nature management program. He was brought here by Skagit County at the suggestion of Canadian fishermen who are even more alarmed than Skagit's waterfront owners at the prospect of corrupting the blood lines of Fraser River and other salmon.

Salmon farming started in the 1960s in Norway, Mehli said, and was first licensed in 1973.

Now 728 fish farms along the nation's 57,000 miles of coastline will produce 70,000 tons of salmon this year; only 1,600 tons come from wild stocks.

But during the years since that beginning, Norwegians have learned that net pens don't work well in estuaries where parasites dwell in brackish waters. They've found that diseases proliferate in the pens, Mehli said, and they're fearful that "if we go on mixing the populations, we will destroy the natural stocks in the long run."

Salmon smolts (baby fish) imported from Scotland escaped pens in Norwegian waters, carrying diseases with them, Mehli said.

John Woodring, a lawyer for the tribes, cross-examined Mehli and read to him state aquaculture regulations under which Washington quarantines and inspects imported fish.

That's good, Mehli said, "but I would still have concern. Certifying fish are free of one disease is better, but you may not be certifying for diseases you're not aware of."

It probably will be several months before a decision is handed down. But the mere fact of the dispute is another warning that man tinkers with the natural environment at his own peril and at risk to the other creatures with which he shares Earth and its waters.

■ Mike Layton is a P-I columnist in Olympia.

The recent articles commenting on the success of Norway's fin fish farming industry have ignored the high price that Norway has paid in fish diseases that have ravaged their industry and destroyed thirty of their wild salmon rivers, and the very real fears their scientists have concerning genetic pollution of their wild stocks of salmon.

Norwegian salmon farmers, in the business for twenty years, find themselves continually fighting new diseases that have required the slaughter of tons of pen-farmed salmon. A group of farmers, who lost their harvest either to furunculosis (a disease that kills 60% of affected stocks) or to government control of diseased fish, is suing the Norwegian government for \$25 million dollars. Farmers themselves are demanding that 100 more fish veterinarians specializing in disease control be hired before anymore fish farm permits are issued. . . those in addition to 60 fish disease specialists and nearly 150 fish veterinarians already working around the country.

Norway's use of antibiotics for controlling these diseases rose over 170% last year to reach 48 tons. This is more than the amount used for animal husbandry and humans combined. With our focus on health and nutrition how does this use of such large quantities of antibiotics affect our view of pen farmed salmon? Scientists have expressed concerns of effects on the food chain and the increase of human resistance to antibiotics.

Last summer in Norway 5,000 farmed salmon infected with the deadly furunculosis escaped into their waters. Despite their best efforts to blockade and capture the sick fish, an infected fish was found in one of their rivers. "If the disease spreads to natural stock, the situation may be out of control in Norway," their scientists warned. Studies by three Norwegian fish biologists conclude that disease in farms can

lead to higher infection rates of wild stocks in the vicinity of the net pens even if the disease itself may already exist in the natural stocks.

The fish farm disease that kills wild salmon in rivers and has destroyed 30 wild salmon rivers in Norway is *Gryodactylus salaris*, a parasite that entered Norway via infected smolts from Sweden. The only way to clean up the rivers is by the use of a chemical called rotenone. Unfortunately along with killing the parasite, it also kills every other

living thing in the river, including wild salmon. A top Norwegian scientist says, "I feel we are on a sharp edge with diseases. If we have the *Gryodactylus salaris* in more rivers we may just accept our wild salmon is extinct."

It has recently been suggested that one of the reasons that Alaskans might be interested in a pilot project in salt water would be to assess the probability of fish escaping. We don't have to experiment. . . it is documented. At least 13% of farmed salmon escape and there are occasionally very large numbers that escape. For instance, this last December in Jarvis Inlet, B.C. an estimated 300,000 fish escaped from their pens in winter storms and residents reported many net pens floating up and down the coast. Also, in Washington State, commercial fishermen have reported substantial numbers of escaped farmed salmon in their catches. Should these escapes concern Alaskans?

Svein Mehli, head of Norway's Directorate for Nature Management, which is responsible for protection of wild salmon, appeared in Washington State on December 14 as an expert witness on fish disease and genetic pollution. He testified that up to 40% of the fish in many of their rivers is now of farmed stock origin and says they are very concerned about the genetic effects of farmed salmon on wild stocks. "We are very afraid it could affect their ability to migrate," he said. Three major fisheries institutes in Norway have reported that escaped farmed salmon do spawn in rivers. In order to combat this threat, Norway has implemented new zoning regulations this year. . . **no salmon farms will be located within 20 kilometers of salmon rivers and entire fjords will be closed to farming where salmon rivers are present.**

In Alaska, using indigenous species that would take at least three generations to tame (until they had lost their basic will to survive in the wild) and the resulting genetic pollution from escaped fish could pose the same threat. Although the magnitude of that threat would be related to the population size and density in individual streams, spawning escaped salmon would still be a danger, especially in streams with small populations.

Alaskans who imagine that we could control diseases better than other countries because we have a large hatchery system and would not be forced to import eggs or smolts need to examine the situation in Washington State

areas have overturned strict fish regulations banning the importation of foreign stocks at the economic pressure of fish farmers who find that native wild stocks are slow to domesticate and growth rates are not rapid. The already domesticated Atlantic salmon is the economic savior of fish farmers. Fish biologists were mystified at the reversal of their regulations and a Canadian biologist wrote that his government was playing "Russian Roulette with our wild fish stocks." That same economic pressure forced Norway to lift their ban on importation and the result was the *Gryodactylus salaris* parasite that has caused such a tragedy in their country. Acquisition of eggs or smolts from hatcheries or river systems is also a major public policy issue for Alaskans to consider. The only experimental on-land tank farm in Alaska acquired its eggs from a northern sport fish hatchery. . . that may be fine as long as the public, through the Board of Fish process, has an opportunity to comment. The demand for eggs in British Columbia has created conflicts between sport and commercial fishermen and fish farmers.

In Washington, a local fish farmer is now suing in U.S. District Court alleging that foreign national interests, primarily Norwegian, have made an attempt to monopolize the commercial farming industry in his state. 80% to 95% of the fin fish farming industry in both Washington and British Columbia is owned by Norwegian Corporations. Could Alaska escape such a fate? It's doubtful.

There seems to be a plentiful supply of pen-raised salmon these days. . . it's starting to go into freezers in Europe as well as being sold fresh. Alaska is presently the world leader in ocean ranching. The State's hatchery programs are responsible for at least 80 million dollars in resident income and 2300 resident jobs.

Last year's mariculture legislation, which addressed shellfish and aquatic plant farming, also called for an Alaska Mariculture Task Force to study the issues relating to fin fish farming (especially, salmon pen rearing). We believe that this Task Force should be funded now to give all concerned parties and the Legislature an approved forum in which to study and assess the impacts of fin fish farming on Alaska. Alaska contains 48% of the wild salmon in the world. . . we should not let the winds of economic development sway our way of thinking. It is imperative that we fully understand the consequences of our actions and protect the future of our uni-

information, contact UFA's office in Juneau at 586-2820 or 1-800-478-FISH. *

Editor's Note: This article was provided by the United Fishermen of Alaska, Mariculture Committee. For more

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

NOTE: "thank yous"
Some nice _____
coming in from _____
fishing groups



CORDOVA DISTRICT FISHERMEN UNITED

P.O. Box 939

Cordova, Alaska 99574

(907) 424-3447

January 24, 1990

Senator Dick Eliason
P.O. Box 143
Sitka, Alaska 99835

Dear Senator Eliason:

We are writing to express our deepest appreciation of your efforts in regard to the Finfish Farming issue. Your contribution to the discussion of this issue has stopped this state from making a costly blunder. You have saved the coastal communities from this unneeded, and potentially very destructive, development.

We support your SB397 and were very pleased to see the long list of co-sponsors. We hope that the list of co-sponsors signals that a consensus has formed in the senate on this issue.

We are ready and willing to assist you at any time to assure the speedy passage of SB397.

We would like to say thank you again and we look forward to working with you in the future.

On behalf of the
CORDOVA DISTRICT FISHERMEN UNITED
Board of Directors,

Chris Nerison
Seine Division

From the Office of

SENATOR DICK ELIASON

FISH FARM

JOAN LUKASIK
in Washington

referred
by ROBERT PEGUES

Atty & biologist
eager to do anti-f.f.
work

Senate Resources Committee

Senator Bettye Fahrenkamp, Chairman
Senator Jay Kerttula, Vice Chairman
Senator Dick Ellason
Senator Steve Frank
Senator Rick Halford
Senator Arliss Sturgulewski
Senator Fred Zharoff



P.O. Box V
Juneau, Alaska 99811
(907) 465-4907

January 19, 1990

The Honorable Steve Cowper
Governor of Alaska
P.O. Box A
Juneau, Ak 99811

Dear Governor Cowper:

We are concerned that delays in the issuance of aquatic farming permits could prevent successful applicants in Southeast Alaska from planting a crop during 1990. More than 50 persons nominated areas for aquatic farms in Southeast during the initial filing period under the provisions of legislation approved by the legislature nearly two years ago.

As you are aware, the failure to fund a fiscal note for the enabling legislation (Senate Bill 514) delayed the program for an entire year. Since the legislation initiates a new approach to planning for development in state tideland, it is understandable that it would take time for the agencies to get a program off the ground.

Apparently many of the applications did not contain adequate information and had to be sent back for additional work. This has further delayed implementation. While these delays have some validity, they are embarrassing to the legislature and administration.

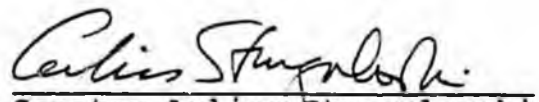
Our goal has been to help the shellfish farming industry develop in a manner that protects other values, not to stop it dead in its tracks. Shellfish farmers point out that there have been no new shellfish farming permits issued for the past two years, and now they are going to miss most or all of the 1990 growing season to boot. Applicants in Southcentral are still awaiting the opportunity to submit an application.


Page 2
January 19, 1990
Governor Cowper


The permitting process should not be cut short by any means, but if there is a way to get the wheels of the permitting program moving a little faster, it still may be possible to complete the Southeast opening by early spring. Thank you for your assistance.

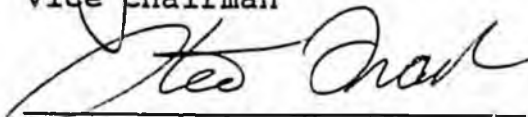
Sincerely,



Senator Bettye Fahrenkamp
Chairman

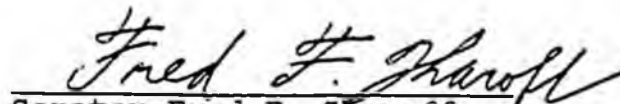

Senator Arliss Sturgulewski


Senator Jalmar M. Kerttula
Vice Chairman


Senator Dick Eliason


Senator Steve Frank


Senator Rick Halford


Senator Fred F. Zharoff

cc: Commissioner Gorsuch
Commissioner Collinsworth
Commissioner Kelso
Mr. Bob Grogan, OGC

mtg.
8:30
Thurs.

p. 15 d. \$500,000 figure for cost of state regu
Assumes about 10-15 farms
" 5 extra state employees

Canada has 70 farms now

Brent says fish farming in AK will be Mom & Pop.
Nonregions won't come in & invest big \$
farms here.

B

Department of Law

TO: Hon. Don Collinsworth
Commissioner
Dept. of Fish & Game ;

DATE August 15, 1989
FILE NO: 221-88-0958
TEL NO: 465-3600
SUBJECT: DeNardo v. State:
unsuccessful challenge
to fish farming moratorium

FROM: ^{LIS}
Larri Irene Spengler
Assistant Attorney General
Natural Resources--Juneau

State Superior Court Judge Rene Gonzalez has refused to rule against the moratorium on commercial finfish farming, and has granted the state's motion for summary judgment in DeNardo v. State, 3AN-88-6467 Civil. Mr. DeNardo, representing himself, had challenged the moratorium on equal protection, interstate commerce, and privileges and immunities grounds. A copy of the order awarding the state summary judgment is enclosed. If you have any questions, please do not hesitate to call.

LIS:dml
Enclosure
cc w/enc.:

~~Honorable Dick Eliason~~
P.O. Box 143
Sitka, AK 99835

Norman Cohen, Deputy Commissioner
Department of Fish and Game

Brian Allee, Director
FRED Division
Department of Fish and Game

Denby Lloyd, Special Staff Assistant
Office of the Governor

Steve White
Assistant Attorney General
Juneau AGO

G. Thomas Koester (for newsletter)
Assistant Attorney General
Juneau AGO

Lance Nelson
Bonnie Harris
Liza McCracken
Anchorage AGO

RECEIVED

THIRD JUDICIAL DISTRICT AT ANCHORAGE

AUG 11 1989

AM
7:39

DANIEL DENARDO,)	
)	
Plaintiff,)	
)	
vs.)	Case No. 3AN-88-6467 Civil
)	
STATE OF ALASKA)	
)	
Defendant.)	
_____)	

ORDER

This case came on to be considered on Plaintiff DeNardo's motion for summary judgment seeking a ruling that the legislative moratorium on most commercial finfish farming through July 1, 1990 (Chapter 70, SLA 1987, extended by Section 21, Chapter 145, SLA 1988) is unconstitutional, and with the State's cross-motion for summary judgment seeking the opposite ruling.

This court having considered the pleadings and memoranda of the parties, and otherwise being fully informed,

IT IS HEREBY ORDERED that Plaintiff's motion for summary judgment is DENIED and Defendant's cross-motion for summary judgment is GRANTED.

The State has placed a moratorium on most commercial finfish farming until July 1, 1990 to allow study of the impact of finfish farming on Alaska's fishery resource. Section 20, ch. 145, SLA 1988. Plaintiff argues that the State's moratorium on commercial fish farming is a protectionist measure violative of

the commerce, privileges and immunities and equal protection clauses of the United States Constitution. On the other hand, the State contends that none of these clauses have been violated and seeks summary judgment.

Plaintiff asserts that by not allowing commercial finfish farming in Alaska, the State is denying him the right to enter into interstate commerce in competition with other states and foreign countries. This, Plaintiff states, also gives an unfair advantage to commercial fishermen by reducing competition.

The State responds that, among other reasons, the commerce and privilege and immunities clauses have not been violated since both Alaska residents and residents of the other states are being treated equally, and Plaintiff is an Alaska resident regardless. There has been no burden placed on interstate commerce. Hughes v. Oklahoma, 441 U.S. 322 (1979).

The privileges and immunities clause, even if applicable in this case, is not violated.

Equal protection principles have similarly not been violated. Plaintiff has not alleged involvement of a suspicious classification or fundamental right in this case. He complains of economic regulation. Mere economic regulation is subject to the low rational basis level of scrutiny. The State's desire to conduct studies on the impact of finfish farming on Alaska's fishery resources is certainly reasonable and a rational basis for the moratorium.

For the above stated reasons, Plaintiff DeNardo's motion for

summary judgment is DENIED and the State's cross-motion for
summary judgment is GRANTED in accordance with this order.

DATED this 8th day of August, 1989.


Rene J. Gonzalez,
Superior Court Judge

I certify that on 8-9-89
a copy of the above was mailed to each
of the following at their addresses of
record:

P. Mulder Denardo
Loengler (AHG)
Secretary/Deputy Clerk

1 IN THE SUPERIOR COURT FOR THE STATE OF ALASKA

2 THIRD JUDICIAL DISTRICT AT ANCHORAGE

3 DANIEL DENARDO, .)
 4 Plaintiff,)
 5 vs.) 3AN-88-6467 Civil
 6 STATE OF ALASKA,)
 7 Defendant.)
 8 _____)

9 MOTION FOR ATTORNEYS FEES

10 Under Alaska Civil Rule 82, the state requests reasonable
 11 attorneys fees be awarded in its favor in this case, based on at
 12 least 3 hours expended and \$90.00 per hour (which totals \$270.00).
 13 This motion is supported by the accompanying affidavit of Larri
 14 Irene Spengler.

15 DATED: August 15, 1989

16 DOUGLAS B. BAILY
 17 ATTORNEY GENERAL

18 by Larri Irene Spengler
 19 Larri Irene Spengler
 20 Assistant Attorney General

21 This is to certify that on this date a copy
 22 of the foregoing is being mailed to the
 23 following plaintiff:

24 Mr. Daniel DeNardo
 25 P.O. Box 10062
 26 Anchorage, AK 99510

27 Dorian L. Morris 8-15-89
 28 Dorian L. Morris Date

ATTORNEY GENERAL, STATE OF ALASKA
 STATE CAPITOL
 P.O. BOX K, JUNEAU, ALASKA 99811
 PHONE 465-3600

1 IN THE SUPERIOR COURT FOR THE STATE OF ALASKA

2 THIRD JUDICIAL DISTRICT AT ANCHORAGE

3 DANIEL DENARDO,)
 4)
 Plaintiff,)
 5)
 vs.) 3AN-88-6467 Civil
 6)
 STATE OF ALASKA,)
 7)
 Defendant.)
 8)

9 AFFIDAVIT OF LARRI IRENE SPENGLER

10 STATE OF ALASKA)
) ss.
 11 FIRST JUDICIAL DISTRICT)

12 LARRI IRENE SPENGLER, being duly sworn, states:

13 1. I am the Assistant Attorney General handling this
 14 case presently.

15 2. Attached is the computer printout showing the time
 16 I expended on this case, at least 3 hours.

17 3. The Department of Law calculates hourly rates for
 18 attorneys in my position as \$90.00 per hour.

19 4. The number of hours at a minimum spent by me, 3 x
 20 \$90.00 = \$270.00.

21 Larri Irene Spengler
 22 Larri Irene Spengler
 Assistant Attorney General

23 SUBSCRIBED AND SWORN TO before me this 15th day of
 24 August, 1989.

25 Dorian L. Morris
 26 Notary Public, State of Alaska
 My commission expires: 3-28-91

ATTORNEY GENERAL, STATE OF ALASKA
 STATE CAPITOL
 P.O. BOX K, JUNEAU, ALASKA 99811
 PHONE 465-3600

LEGAL SERVICES RE: (221880958)

COURT CASE NUMBER 3AN886467

DANIEL DENARDO V ST (DEEL JUDGHT - SALMON FARMING)

DATE	ATTY	SERVICES	HOURS	AMOUNT
88/10/21	2309	PREPARE MOTIONS/RESPONSES - OPPOSITION TO SUMMARY JUDGMENT.	1.00	90.00
88/10/25	2309	PREPARE MOTIONS/RESPONSES - SUMMARY JUDGMENT.	2.00	180.00
TOTAL ATTORNEY SERVICE HOURS:			3.00	
TOTAL ATTORNEY SERVICE FEES:				270.00
MATTER TOTAL				270.00

CAUTION: THIS STATEMENT MAY CONTAIN CONFIDENTIAL ATTORNEY WORK
PRODUCT. PUBLIC REQUESTS FOR THIS INFORMATION SHOULD BE REVIEWED
BY THE BILLING ATTORNEY BEFORE ANY ACTIVITY DESCRIPTION INFORMATION
IS RELEASED.

THIRD JUDICIAL DISTRICT AT ANCHORAGE

3 DANIEL DENARDO, .)
 4 Plaintiff,)
 5 vs.) 3AN-88-6467 Civil
 6 STATE OF ALASKA,)
 7 Defendant.)
 8 _____)

ORDER

IT IS ORDERED that the State of Alaska is awarded attorney's fees in the amount of \$_____.

DATED: _____.

 Rene J. Gonzales
 Superior Court Judge

ATTORNEY GENERAL, STATE OF ALASKA
 STATE CAPITOL
 P.O. BOX K, JUNEAU, ALASKA 99811
 PHONE 465-3600

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ISSUER
SEA/941 LOSCALZO MICHAEL (MGL)
SUBJECT
SALMON

DATE
89-08-09

=> HAM.PEERS PEERS DETLEV DKP HAM1530
--- RECEIVED FROM HAM.PEERS/SIEG DE(040)303-2992 89-08-09 15.22

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|-----------------|------------------------------|---------|
| -> USA.HODGEJO | HODGE JOHN | VAN/953 |
| -> USA.DUMASBE | DUMAS BERNIE (TFC MGR VAN) | VAN/953 |
| -> USA.LOSCALZO | LOSALZO MICHAEL (MGL) | SEA/941 |
| -> USA.CROLLARD | CROLLARD BRAD | SEA/941 |
| -> USA.KNAPP | KNAPP PREBEN (PK) | OAK/902 |
| -> USA.BARRAGAN | BARRAGAN MICHELLE (MRB) | OAK/902 |
| -> HAM.SCHACHT | SCHACHT HORST-JOACHIM (OTTO) | HAM1530 |
| -> HAM.PEERS | PEERS DETLEV DKP | HAM1530 |
| -> HAM.GAYL | GAYL CHRISTOPH V. (CVG) | HAM1530 |
| -> HAM.SIEG | SIEG SUSAN (SIE) | HAM1530 |
| -> HAM.KOLARCZY | KOLARCZYK INGEBORG | HAM1530 |

READ THE FLWG NEWS IN A GERMAN NEWSPAPER OF TODAY:
===== (IN FREE TRANSLATION:):

SALMONBREEDERS ARE DESPERATE: TOXIC ALGAE KILLING SALMON

OSLO
MORE THAN 400 TONS OF SALMON AND OTHER FISH WERE KILLED BY TOXIC ALGAE (VALUE: APPROX 5 MILLION DEUTSCHMARKS).
SINCE LAST WEEK A REAL TRAGEDY IS RUNNING ITS COURSE IN THE WEST-NORWEGIAN FJORDS: THE ALGAE "PRYMNESIUM PARVUM" KEEPS EXPANDING MORE AND MORE SUFFOCATING ALL FISHES WITH ITS POISON.

DURING THE ALGAE DISASTER IN 1988 THE NORWEGIANS SAVED THEIR SALMON STOCK BY DRAGGING THE FISHCAGES INTO THE BACK OF THE FJORDS, WHERE THE SALT CONTENT OF THE WATER IS LOWER. AND IT IS THE PRESENTLY RAMPANT ALGAE THAT PREFERABLY SPREADS IN WATER WITH LOW SALT CONTENT.

THE CHIEF OF THE FISHERY BOARD, SVEIN MUNKEJORD: " THERE IS NO WAY TO MOVE THE FISH CAGES.....!"

ARTICLE FROM "HAMBURGER ABENDBLATT"

RGDS CHRISTIAN MUELLER
(TRAINEE IN 153 NPC)

This is about 7% of total.
(7)

STEPHEN LAPOSKI
OYSTERS 'N SUCH
P.O. Box 1471
PETERSBURG, AK.
99833

I

SEPT. 17, 1989

Dear Mrs. Barleson:

I object! I submit this application, and another \$50.00 fee, under protest. You may not be aware, nor even care, that I've been submitting applications and fees to state and federal agencies since 1982 for my right to attempt to raise oysters in Orangethorpe Narrows. I have been in compliance of regulations under three governors. One bureaucratic agency alone has me making application, writing letters, making phone calls, or paying fees across several desks. I have, or must, communicate regularly with these individuals within one bureaucracy, i.e.,

II

Mar Winegar, Linda Adamchak, Andrew
Pekovich, Paula Burgess, Bob Palmer,
Cristi Herren, J. B. Willis, Joan Gilbertson,
and Janet Burleson.

I am not an Exxon, APC, Ketchikan
Pulp or even a Mom & Pop operation;
I am by myself! I have done my
paperwork and paid my fees. I'd just
like to have the time to go out in
the tidal muck and care for my baby
oysters. When are you people going to
help small businesses instead of
creating obstacle after obstacle?
The state may say that they are in
a "crunch"; I've tightened my belt
to the last hole. And I haven't sold
an oyster, yet. By the way, has the

state looked ahead to see who might want to buy an Alaska oyster @ .45¢ a piece when they can buy one in Seattle for .25¢? (Of course, ours are much superior, but the market doesn't know that.) So far, this looks like a local business that will be saturated in no time.

On another matter, pertaining to the new regulations that went into effect on July 1, 1989, which gave me preference rights to tidelands, I submitted my request the first week in August. Are you looking for a loophole to get around that request, or will you try to help me in that regard?

I am looking forward to some

IV

Positive communication from your
office soon.

Sincerely,
Stephen Laporte

cc: Gov. Steve Cooper
Sen. Dick Eliason
Sen. Lloyd Jones
Rep. Robin Taylor
Rep. Cheri Davis
Rep. Ben Grussendorf

P.S. - Excuse my candidness but I
must say it like it is.

State of Alaska
Application for Aquatic Farm Permits

A. APPLICANT INFORMATION

1. STEPHEN LAPOSKI
 Name _____
P.O. Box 1471
 Mailing Address _____
PETERSBURG, AK. 99833
 City State Zip Code _____
(MESSAGE) 772-3381
 Phone _____

2. OYSTERS 'n SUCH
 Business Name (if different than above) _____
 Business Address _____
SAWT
 City State Zip Code _____
 Phone _____

3. _____
 Authorized Agent (if applicable) _____
 Address _____
 City State Zip Code _____
 Phone _____

B. GENERAL INFORMATION

1. Provide a brief description of the facility and your overall proposal. Include upland, tideland, and submerged land facilities. FACILITY ALREADY IN PLACE. I AM IN COMPLIANCE AND HAVE BEEN FOR OVER 5 YEARS. YOU SHOULD HAVE A COMPLETE FILE ON THIS EXISTING OYSTER FARM.

2. Housing on state lands can only be approved if site development requires daily attention at the time housing begins, if personnel cannot reasonably commute by road or boat, and no suitable private lands are available for rent or sale (see 11 AAC 63.040(a)).

Does your proposal include caretaker housing on state land or water? Yes ___ No

If yes, please describe why onsite housing is necessary.

N.A.

3. a) Do you currently own or lease upland property adjacent to, or near the proposed farm site? Yes No ___

b) Are you applying for a preference right under 11 AAC 63.040(b)? Yes No ___

c) Do you agree to contain your aquatic farm support facilities (storage, dwellings, etc.) on these privately owned or leased lands? Yes No ___

* If yes, attach a copy of the ownership deed or lease agreement. *PATENT APPLICATION SUBMITTED.

4. In order to process your application, we need to know who owns the adjacent lands. Please provide the names and addresses of the landowners of adjacent uplands and tidelands.

Uplands
STATE OF ALASKA

Tidelands
STATE

C. PROJECT LOCATION

1. Is the Project on: (please mark with ✓)
 * State Land _____ Federal Land _____ * Private Land, ✓ PATENT APPLIED FOR Municipal Land _____
 HOMESITE
2. Attach a topographic map (U.S.G.S. Scale 1: 63,360) and nautical chart to this application that show the site location boundaries and general area. Clearly indicate the site location and identify the map and chart reference number.
3. Township 100 S. Range 79 E. Meridian CR Section 34 Longitude _____ Latitude _____
4. Number of acres of state land applied for: Uplands _____ Tidelands 2

D. FARM DEVELOPMENT AND OPERATING PLAN

1. Species to be raised:

Species	Annual Production Goal	
	maximum	minimum
a <u>CROSSOSTREA GIGAS</u>	<u>300,000</u>	<u>100,000</u>
b _____	_____	_____
c _____	_____	_____

2. Please provide a timetable showing approximate dates for installation of spat collection gear, placement of production and support facilities, date of first sale, and a schedule for reaching expected maximum production. If you plan to operate at this site less than year round, please include your operating schedule.
 Note: You may submit both a minimum and maximum development goal if you are uncertain about your construction schedule. Reasonable use of the site must be proposed.

WHO CAN PREDICT OPTIMUM CONDITIONS IN S.E. ALASKA?
I'VE ALREADY LOST MY FIRST CROP OF 100,000 BECAUSE OF CHALLENGES
SUCH AS WEATHER, BIOLOGICAL AND HUMAN ERROR.

3. Donor Stock WESTCOTT BAY, FRIDAY HARBOR, WA.
 a. What is the source of the donor stock for your farm? ALASQUETTA ISLAND, B.C. CANADA
 b. If you plan to capture wild stock, please identify your proposed capture location.*

* Please be advised that other permits and authorizations are required from the Department of Fish and Game, and possibly the Commercial Fisheries Entry Commission for capture of wild stock.

E. SITE PLAN & PHYSICAL DESCRIPTION

1. Provide a site plan drawn to scale (no less than 1" = 50') which shows the layout, location, and dimensions of the following (a sample site plan is provided on page 6 for your reference).
- The rafts or other production facilities employed (please include size and number).
 - Anchoring systems and shoreties.
 - Docks, upland dwellings, floating structures associated with caretaker facilities
 - The location of waters, including any drinking water wells or other drinking water system sources, fresh water(s), and salt water, within 200 feet of the proposed wastewater disposal system.
 - Wastewater disposal systems, including both sewage and greywater discharge points (e.g. greywater means domestic wastewater from laundry, kitchen etc., which does not contain human waste).
 - Solid waste storage and disposal sites (note: you are encouraged to use existing permitted sites for the disposal of solid wastes).
 - Roads or air strips.
 - Other upland or tideland facilities at the site associated with the farming operation.
 - Fuel and chemical storage.
 - Properties referenced in #4 and #5 of Section B.
 - The boundary of the farm area which is located on state lands, including tide and submerged lands.

2. Attach a cross sectional diagram of the proposed facilities, and identify the construction materials. (Diagrams prepared for the Corps of Engineers permits are acceptable.)
3. On the site plan, draw lines and identify the tide level at the following stages:
 - Mean Lower Low Water (MLLW)
 - Mean Higher High Water (MHHW)
 - Mean High Water (MHW)
4. On the site plan, diagram the prevailing direction of the surface water flows at the ebb and flood tides.
5. What is the maximum surface tidal current speed at ebb tide? 1K At flood tide? 5K Did you estimate or measure the speed? HISTORICAL ESTIMATE.
6. What is the water depth at the site of culture gear at MLLW? 0

F. SITE SUITABILITY

1. Physical and Biological Characteristics

- a. Provide any information you may have regarding tidal flushing, water temperature, salinity, and turbidity/sedimentation at the site. Include the dates these data were recorded.

TIDE FLUSHES OUT TO SUMNER STRAITS & IN TO GREEN ROCKS
(MOUNT NEARROWS) BACK & FORTH; TEMP. NORMALLY IS 45°F TO 55°F
DEPENDENT ON RAIN, WEATHER ETC.; SAND & GRAVEL BOTTOM OVERLAIN WITH
OF BLUE CLAY/MUD; CLEAR WATER, NORMAL FRESHWATER RUN-OFF.
 the bottom type composition at the site (if more than one type, indicate percent).

mud rock gravel eelgrass ?

other: SEE ABOVE

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

S.E. FREEZING UNLIKELY BUT POSSIBLE SKIN ICE; PROTECTED
AREA NORMALLY FROM WINDS & STORMS.

- d. Do anadromous fish (e.g. salmon) use any streams in the area for spawning? yes no
 If yes, indicate which streams are used and label them as such on the site plan.

BLIND SLOUGH ABOUT A MILE AWAY; CRUSTAL LAKE HATCHERY.

- e. Is the target species naturally present in the area? yes no
 If yes, describe abundance and condition.

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

COVER OF VEXAR MESH OVER RAFTS OF TRAYS.

- g. Indicate which of the above responses in Section F are based upon on-site investigations by circling the corresponding letter: a, b, c, d, e.

EXPERIENCE!

G. WATER QUALITY

Note to Applicant: Sewage or industrial discharge(s) may accumulate in or harm the growth or consumptive use of your shellfish product. Oysters, mussels and scallops are filter feeders and may accumulate fecal coliform bacteria and associated pathogens from sewage discharges. If a caretaker facility is needed for the site, and its discharge is located near the culturing operation, there may be a risk of contamination. To ensure that your growing area can be certified by DEC, the department has developed the following requirements for those aquatic farms where a sewage discharge is necessary. 1) Discharges must meet water quality standards (18 AAC 70), wastewater disposal regulations (18 AAC 72), and requirements of the National Shellfish Sanitation Program (incorporated by reference in 18 AAC 34.170). 2) No sewage discharge will be allowed within 300 feet from the boundary of an approved growing area (the boundary encompasses the entire growing area). 3) Outhouse and septic systems must maintain a minimum 100 foot horizontal separation distance from surface waters and a minimum 4 foot vertical separation distance from the high ground water table. The department will require a waste discharge permit and system plan review for all sewage discharges. Additional information may be required by the DEC depending on the type and complexity of wastewater system proposed. After review of application materials, the DEC may decide it is not necessary to issue a waste discharge permit for facilities generating very small daily volumes of sewage and greywater.

1. Wastewater Discharge and System Plan Review

a) Is there is a floathome, dwelling or upland caretaker's facility proposed for the site? Yes No

b) Will wastewater be discharged from any of these facilities? Yes No

If yes, please provide the following information.

GRAYWATER ONLY

• What are the daily maximum and average discharge volumes? Maximum 5 GAL. Average 2 GAL.

PLEASE SUBMIT THE FOLLOWING INFORMATION ON SEPARATE PAGES

(Contact the Department of Environmental Conservation to determine submittal requirements for your specific proposal.)

- Wastewater system design plans consisting of reports and/or drawings that clearly and legibly depict the design, type, and volume of discharge. (Design plans may require preparation by a registered engineer.)
- A description of proposed and existing wastewater treatment works, disposal systems, or sewers.
- Sufficient soils and topographic information to allow evaluation of the soil type, absorption area, depth to water table and impervious surfaces, and topography, if treatment or disposal (other than a conventional on-lot soil absorption system) is into or onto land or subsurface land.

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

If you answered yes to the above, identify:

• The type of previous use (e.g. mine, village, seafood processor) _____

• The last known date of use _____ *N.A.*

• The distance from site of previous use to your project site _____

3. Are there any current potential sources of human or industrial pollution in the area? (For example, sewage outfalls, industrial transfer facilities or upland operations, boat harbors, etc.) yes no

If yes, please describe:

• The type of discharge(s) _____ *N.A.*

• The location and distance from your site _____

• The name of the discharger(s), if known _____

4. Are you aware of any other planned development in the general area of your proposed farm? yes no . If yes, please describe them. *OTHER HOMESITES!*

H. CURRENT LAND USE

Are there any other human uses of the project site and the surrounding area such as commercial development, mining, timber harvest or transfer, sheltered anchorage, subsistence, recreation, commercial fishing, sport fishing, or residential use, etc? Yes ___ No

If yes, please describe.

NORMAL SPORT & COMMERCIAL FISHING AT BLIND
SLOUGH AREA.

Certification Statement

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

Stephen Lepore
Signature of Applicant or Agent

9/15/89
Date

October 29, 1989

Senator Richard Eliason
P.O. Box 143
Sitka, Alaska 99835

Dear Senator Eliason:

I was pleased to read your articles opposing fin-fish farming in Alaska in the S.E. Log and the Alaska Fishermans Journal... and I was concerned to see Bettye Fahrenkamp's article pushing fin-fish farming in the November issue.

Thank you for your letter of May 4, 1989 with the enclosure of a copy of Senate Bill No. 195. You also mentioned the State Forestry Practices Act which I hope has been revised, and also that the Tongass Reform Bill in its final state really has some teeth in it as to salmon habitat protection.

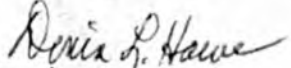
Last week in Friday Harbor, WA. we attended a lecture by Dr. James Crutchfield, Prof. Emeritus of the Univ. of Wash. and the Fisheries Research Institute, an economist with world wide experience in fisheries economy. After the lecture I had a chance to talk to him briefly. I said, "We have in Alaska a number of politicians who are bent on getting fin-fish farming started in Alaska because it would bring so much money into the state and many more jobs." Crutchfield answered, "No way. The money will go out of the state to the big corporations sponsoring the farms, and they are not labor intensive. The best thing Alaska can do is to protect their salmon habitat."

I wish the governor would get someone like Crutchfield on his committee to study Fin-fish farming in Alaska.

Various clippings enclosed.

Best wishes for the up-coming Legislative Session.

Sincerely,


Doris L. Howe
Box 67
Gustavus, Alaska 99826

Fishing industry must regulate itself to survive its ups and downs

By FRANK LEEMING

The fishing industry, prone to self destruction and wild ups and downs, must regulate itself if it is to survive, an expert said in Friday Harbor last week.

James Crutchfield, professor emeritus at the University of Washington and a marine environment consultant, said external efforts to regulate fishing — particularly by government — have failed.

Often "it has been perverted by politics," Crutchfield told a Centennial Series lecture at San Juan Community Theater.

DESPITE ALL ITS troubles, the fishing industry has grown explosively in the last decade.

Washington has been a leader in the growth, although only 10 percent of the catch by the state's fishermen is caught in state waters. Most fish are caught in Alaska, Hawaii and other distant water fisheries.

Crutchfield said his research showed the region's great cod fishery, which began in the mid-1800s, peaked in 1905. The salmon fishery on the Columbia River peaked in 1883. Fishing in Puget Sound peaked in 1910. And fishing in Alaska peaked in 1935 — until recently. Now the Alaskan fishery is back to record levels — and no one is sure why.

Several factors have played a part in the remarkable turnaround, Crutchfield said.

The biggest was the Magnuson Act of 1976 which extended U.S. control of its territorial waters to 200 miles. Another was the skill with which Americans took over the fishing fleets from foreign nations.

"In 1980, two million metric tons of fish were taken out of the Bering Sea and Gulf of Alaska," Crutchfield said. "Only two percent was taken by U.S. fishermen."

"By 1988, we caught all that, and had 70 percent of all the processing."

THE TURNAROUND BEGAN when U.S. trawlers were converted so they could put out nets to be picked up by foreign processing ships. In one year 121 joint-venture boats hauled in 1.4 million metric tons of fish.

Since then, joint ventures have almost disappeared because of an American ascendancy in operating fac-



Frank Leeming photo

tory trawlers. From one U.S. factory ship in 1980, the number jumped to 43 in 1987. There will be 63 next year capable of processing 500 million metric tons, virtually all the fish U.S. fishermen can catch.

Financing the conversion was provided by Japanese, whose own fleet was being shoved out of the rich fishing grounds.

Crutchfield said it is ironic that such prejudice exists among U.S. fishermen toward the Japanese, who buy 70 percent of the U.S. product.

Because of vicious in-fighting among fishermen and poor regulation of the fishery, the quality of the catch is deteriorating and the stock of fish is endangered. The Japanese are actively seeking to replace American fish with farmed fish from Chile and Europe, he said.

Fishermen "have never gotten out in front of the elephant," Crutchfield went on. "They always prefer to follow with the shovel" and a disaster always takes place.

He cited the local urchin fishery as an example. Left to themselves, more than 100 boats picked the islands clean and virtually destroyed the fishery. With proper regulation or self control, the fishery could have provided steady

Jim is a Professor Emeritus in the Department of Economics, the Graduate School of Public Affairs, and the Institute for Marine Studies at the University of Washington. He received his Ph. D. in Economics from the University of California, Berkeley. He has extensive national and international work experience and is the author of innumerable publications concerning the economics of water-resources, fisheries, and other natural resource systems.

5215 E Harbor Dr. Friday Harbor, WA 98252 [24-378-2389]

employment for 20 to 25 boats.

In 1988, Crutchfield said the state's fishing industry had 1,500 boats with 8,100 skippers and fishermen. Their catch was worth \$1.2 billion.

More important, the industry generated another 35,000 jobs in support fields, such as handling moorage, repairing and supplying vessels, and processing the catch.

The decade-long effort to rebuild the industry has been enormously successful, but has exhausted most areas of growth potential, Crutchfield said. "From now on it means wise allocation and utilization of a relatively stable fishery" will be required.

That won't be easy. There is so much bickering within the industry.

Fishermen have not come to grips with the overcapacity in their industry. Results include short seasons, too many boats and thousands of employees.

"If this industry ever goes down the tubes, we're going to see a real disaster in Washington and Alaska," he said.

The public should realize it owns the

fisheries. They do not belong to government or the fishermen. The public should demand proper management of the resource.

What can the public do? Crutchfield was asked.

"I don't know," he said.

On other topics, Crutchfield said:

■ If Japan successfully finds other markets to fill its demands, the U.S. industry will be forced to turn to the U.S. market. It would have to clean up the act if it is to succeed against the beef and chicken markets, he said.

■ U.S. fish-processing facilities are far behind their foreign competitors. One reason: They offer no incentives to fishermen. "Once a fish is dead, there isn't much you can do with it," Crutchfield said, explaining why processors need to convince fishermen how important it is to maintain the quality of their catch.

■ The Puget Sound is not a good place for farming fin fish, such as salmon. It is excellent for shellfish, such as oysters. He does not see much growth in fin-fish farming in the sound.

Sea farmers caught in Catch-22 between progress, fear

By WILLIAM RICE

It's a glorious day on Puget Sound, sunny, 70-ish, with a light breeze. Nature is doing her thing.

Man is doing his thing, too: On the shore of the Olympic Peninsula, ugly exhaust billows from the smokestack of a paper mill. On the water a disabled oil tanker, the *Exxon Philadelphia*, is moored. Off-kilter, supported by tugs, the ship looks like a wounded prizefighter surrounded by handlers.

IN CONTRAST, a low structure, only a few hundred feet from the tanker, appears benign. It is part of a four-acre network of low, 50-foot-square pens anchored in the harbor.

Made of mesh netting that goes to a depth of 20 feet, these pens are home to a middle-sized city of salmon at various stages of development on their path to dinner plates in American restaurants and homes.

It's calm, too, except when someone launches a serving of fish-meal pellets into a pen and the hungry salmon set the water to a roll.

"Aquatic fields," says Dr. John Forster, the British scientist who directs Sea Farm Washington for its Norwegian owners. "A different way of growing things for people to eat."

A romantic concept, farming the sea. Since the 1960s, aquaculture has been presented as a futuristic alternative to land farming and a pristine industry that would inspire cleaning up polluted waters.

It's a practical - if sometimes tricky - concept. According to Forster, fish farms now provide 12 percent by volume and 24 percent by value of the

As I See It

Comment by interested citizens

world's yearly catch.

But people are increasingly wary of those who promise to improve on Mother Nature's ways of producing food for human consumption.

Along this sound, a forest-lined, stunningly beautiful body of water where nature-related activities such as hiking and boating are ingrained in the lifestyle, diverse groups are using this wariness as a defensive shield to divert promises of plentiful fish and economic profit for the state.

THEY INCLUDE commercial fishermen (who worry that a ready supply of farmed fish will reduce prices for their catch), Native Americans (some of whom farm fish themselves) and anti-development shoreline property owners known locally as Nimby (Not In My Back Yard).

Commercial fishermen and Native Americans oppose increased aquaculture. The Nimby faction, not content with a stalemate, has raised specters of pollution, pestilence and aesthetic obscenity with the evident goal of permanently sinking aquaculture in Puget Sound.

The charges concern disease in fish (a virus called VHS, viral hemorrhagic septicemia), disease from fish (the possibility that antibiotics in fish feed may leave residues in human consumers or make infectious bacteria control-resis-

stant) and water pollution from fish feces.

To further complicate the issue, the fish farmers are raising salmon. The majestic wild salmon is a symbol of the Pacific Northwest to which local residents have great attachment. (It's difficult, for instance, to imagine Southerners getting so worked up over catfish.)

There is antagonism to shellfish and seaweed farming, too; but these products don't provoke the ire directed at the Atlantic salmon transplanted to Pacific waters by Sea Farm and other producers.

DOCILE, RELATIVELY easy to raise and mild-tasting, Atlantic salmon are much better suited to farm life than their wild Pacific cousins. But they have received a frosty reception from local gourmets, who claim only wild salmon are fit to eat and express fears the Atlantic interlopers will escape from their pens and interbreed with the wild species.

Andy Fernanco, a spokesman for Skagit Indian Foods, says the tribe worries about a possible proliferation of hatcheries because "we believe that through benign neglect, the authorities will let the wild runs disappear. As we see it, the issue is to set limits and moratoriums."

Moratoriums are a political reality. Although the federal and state governments continue to support aquaculture, four counties bordering on the sound have banned construction of any new aquaculture sites.

Sea Farm's Forster, a low-key scientist who has become the industry's point-person in this

struggle, is eager to respond to the opponents.

He points out that the state's Department of Fisheries found no traces of VHS virus in the net-pen salmon farms, that there is no evidence to show "cultured fish have ever spread any disease to a wild population," and he cites Washington Fish Growers' statistics that "only 2.4 percent of all fish feed used in Puget Sound contains antibiotics."

He and the trade association emphatically deny there is any drug residue in pen-raised salmon meat.

TURNING TO THE racial-purity issue, he explains Pacific salmon don't like Atlantic salmon any better than Pacific Coast gourmets. The two have yet to interbreed.

Give us just 100 of the sound's 3 million surface acres, Forster says, and the fish growers will match the volume of imported farmed salmon now coming into the country.

But first, the aquaculturists need a green light.

This won't come easily as long as people are swayed by testimony, such as that from a Norwegian scientist, that the state's inspection and quarantine program for incoming fish could be flawed because "you may not be certifying for diseases you are not aware of."

That's Catch-22, and in tandem with Nimby and the fears of fishermen, it may be enough to keep this infant American industry in swaddling clothes for the rest of the century.

Reprinted from July 25, 1989 issue of the "Chicago Tribune."

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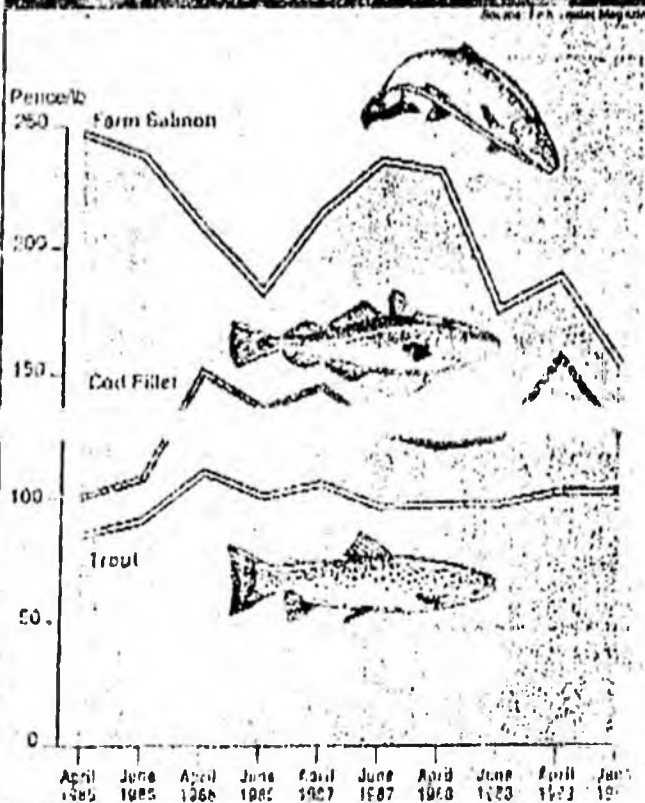
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CITY 2



David Windmill with a blue fish farm specimen at Loch Eive

The lobbering salmon



Salmon prices take a battering

Don't tell your mother-in-law that you ate a silly old trout. Silly old salmon could soon be a far more appropriate term of abuse as booming production and wage price controls transform the prized fish from a rare delicacy to a everyday snack.

Ever since Roman times, salmon has been known as "the king of fish" and the "fish of kings" by British eaters and authors since at least the beginning of the 16th century. Lately its royal scales have been on a downward slide. The fish is so popular, it is now being eaten by the masses. It is so cheap, it is being eaten by the masses. It is so cheap, it is being eaten by the masses.

The big companies involved, notably Dooner's McConnell Salmon subsidiary and Unilever's Marine Harvest, are crying "foul" at the way Norway's producers are allegedly dumping shoals of salmon below cost on the European market.

Many housewives who, a few years ago, might have contemplated splashing out on fresh or smoked salmon once or twice a year for special occasions, are now popping into the supermarket once or twice a week for a fish which has recently seen its retail price oscillating from just under £3 a pound at some outlets to £5.25 a pound for a salmon joint from

by Robert Tyerman

Marks & Spencer (where relative fish pricing has yet to reflect the wholesale trend).

Five years ago, fresh salmon was being sold wholesale at Billingsgate fish market at prices ranging from £1.90 to £3 a pound—compared with £1 or less for cod and under 50p for trout. This autumn, salmon has been knocked down to between £1 and £2 a pound, while cod has ranged from £1 to £1.79 and trout has fetched £1. In some cases, wholesale salmon prices are 50 per cent down on a year ago.

In a saga that mirrors trends elsewhere in Europe's food industries, factory farming techniques have revolutionised salmon production over the past decade. As prices have fallen, in cash and even more in real terms, competition has been growing as the sea 20 and 25 per cent.

In response, with grants and loans from such bodies as the Highlands and Islands Development Board in Scotland, United Kingdom salmon production has soared. Salmon cages have proliferated in Highland Lochs until now, according to board spokesman Ian Fleming, some £20 million has recently been handed over to 68 fish farms in the region. The industry now accounts directly for 1,335 full-time and 418 part-time jobs and 5,000 indirect jobs in an area where alternative employment is scarce.

Last year, the Scottish salmon industry produced 1.2 million tonnes. This year the figure should exceed 30,000 tonnes and the aim is to boost that to 53,000 tonnes by 1991. Unfortunately, others have the same idea.

In 1988 the European Economic Community consumed

about 100,000 tonnes of salmon. Most was imported from Norway, not yet a full EEC member, which produced 29,000 tonnes. There are no official EEC price controls on salmon, though there is a duty of 2 per cent on non-community imports. (With classic Brussels logic, the duty on trout is 12 per cent.)

But this year the Norwegians are going for a massive production increase of 20,000 tonnes. This is enough to absorb the entire internal growth of the EEC. The Norwegians are going for a massive production increase of 20,000 tonnes. This is enough to absorb the entire internal growth of the EEC.

Price reductions forced by Norwegian competition are expected to slash overall industry receipts by £5 million to £9 million—at a time when storms have destroyed £6 million worth of fish and all sea treatment has added £11 million to costs.

McConnell Salmon and other British suppliers insist that the Norwegian government has not met its obligations. Norway has cut its guaranteed minimum price to the market to between £1.14 and £1.30 a pound. But McConnell's own analysis of Norwegian salmon production last year showed that the average cost of production was no less than £1.84 a pound, against Scottish break-even costs ranging from £1.40 to £1.70 a pound.

Their critics, however, point to the fact that many of Norway's near 200 fish farms are situated in the fjords, such as the Bergen and Christiania, and that the state boards which act as intermediaries between the producer and the market place are

compensating a largesse that makes even the Highlands and Islands Development Board look stingy by comparison.

David Windmill, managing director of McConnell Salmon, points out that the Norwegians, with a guaranteed minimum price, are in a position to respond to political pressure on their home market.

Windmill points to hopes of an EEC-sponsored programme to subsidise the production of young half farmed salmon at a cost of up to £30 million. But the Norwegians have been tardy in co-operating with any culling proposals. The industry has also been lobbying for a full Common Agricultural Policy-style system of reference prices—though the CAP has hardly proved a particularly brilliant mechanism for curbing over-production of other foodstuffs.

A renewed export drive is another play. The Scottish Salmon Growers Association, which levies £3 million a year from the industry for marketing, is aiming to boost exports to the United States (against Canadian competition), France and other markets.

Unilever's Marine Harvest, which already exports 52 per cent of production (8,500 tonnes), now has two sales managers in the United States and one in Japan. The company has just launched its first TV advertising campaign for branded fresh salmon.

At home, the salmon industry believes that, in the long-term, marketing can spread the taste for salmon even wider. "A few years ago," says William Crowe of the SSGA, "we would like to see the market for salmon expand to include the whole of the United Kingdom."

Additives to the Environment of Net-Pen Reared Fish
Pacific Marine Fisheries Commission 42nd Annual Meeting
Seattle, Washington, October 16-18, 1989

PH D Arthur H. Whiteley and Annamarie Johnstone

We have been asked to address our remarks to the matter of additives to the environment of net-pen reared fish. In this particular forum, we assume the emphasis should be on additives that may have an impact on humans when these fish come to market, rather than the impact on the plant and animal communities in the natural environment, though these are not wholly separable.

By its very nature, net-pen rearing of salmon requires the use of numerous chemicals, sometimes in large amounts, some used in the fresh water hatcheries to produce the fry and smolts, some used in the grow-out period in the marine pens, and others used during processing of the fish for the market. Partial lists are shown in Table 1, compiled from Austin and Austin, 1987, from a 1988 report for the Nature Conservancy Council by the University of Stirling, and from other sources.

The lists include chemicals used in salmon and in other forms of fish culture, both in this country and in foreign countries. Inasmuch as farmed fish are imported from some of these other countries, inclusion of these chemicals in the lists may be relevant to the matter of seafood surveillance in the United States marketplace.

Chemotherapeutics. The most relevant additives for present purposes are antibiotics and therapeutants used to control bacterial diseases. Because of stress, disease may cause losses of 30-40%, sometimes higher. Diseases in salmon farms include *Vibrio anguillarum* (vibriosis), *Aeromonas salmonicida* (furunculosis), *Aeromonas hydrophila* (hemorrhagic septicemia), *Yersenia ruckeri* (red mouth), *Vibrio salmonicida* (Hitra disease), *Renibacterium salmonarum* (bacterial kidney disease). To combat these diseases, medicated food containing antibiotics is supplied. In Washington, the FDA approved antibiotics and therapeutants are oxytetracycline (OTC), Romet 30 (sulfadimethoxine and orhomeprim) and sulfamerazine. In addition, Tribissen (sulfadiazine and trimethoprim) is used in Norway and Scotland, and in British Columbia erythromycin is used to control BKD. In Japanese fish culture a wide variety of antibiotics has been used, but has recently restricted the use of chemotherapeutics in cultured fish (Aoki, 1988, pers. comm).

In the US, Norway, BC and Scotland, doses of drugs are as indicated in Table 1B. It is anecdotal, however, that additional amounts of antibiotics are used by farmers, who may mix the drugs with feed and binders. Control of use of antibiotics in Norway and Scotland is regulated by veterinarians, and this is supposed to be the case in B.C. In the British Isles it is apparently easy to find legal loopholes to permit other antibiotics and doses to be used (Austin and Austin, 1987). In Washington fish farmers are supposed to notify the Department of Fisheries if they use antibiotics, but veterinarian supervision is not required. Generally approval exists for only therapeutic use of these

drugs. Nonetheless they often are used prophylactically inasmuch as sick fish may not take the medicated food.

There appears to be no medical or public health supervision or regulation here, or in the other fish farming countries, on the use of antibiotics and chemotherapeutics other than the requirement of FDA approval of the three drugs and their dosages. There appears to be no monitoring by agencies of the use of these drugs or their persistence in marketed fish.

The amounts of drugs used are enormous. In Norway last year, 48 metric tons (105,000 lbs) of OTC alone were used - more than in animal husbandry and human health uses combined (Mehli, 1988, pers. comm. and press accounts). This figure has grown from 13,691 lbs in 1984 (Midtlyng, 1985). The 1984 figure for Tribissen, nitrofurazolidon and sulfamerazin is 30,204 lbs (Midtlyng, 1985). Comparable figures for British Columbia and Washington are not at hand. Assuming the dosages cited earlier for the 13 Washington pens, calculation leads to a first approximation of about one ton of OTC, a figure similar to that given by a Washington fish pen operator (Dr. A. Bill, 1989, pers. comm.).

The relevant issue here is "Do these uses affect man?" Consumers clearly would be exposed to residual antibiotics in the fish meat. Because of the potential for these residues producing a serious problem in public health, Japan has recently restricted the use of chemotherapeutics, and does not allow cultured fish to move to market if residual drugs can be detected in fish meat (Aoki, 1988, pers. comm.). The potential for adverse effects has been emphasized by Austin (1988, conference in Vancouver, B.C.; Austin and Austin, 1987). The current regulations for control of such residues are based on admittedly minimal research. The FDA requires a 21 day withdrawal period after the last medicated feeding of OTC and 42 days for Romet 30 before slaughtering for the market. In B.C. the withdrawal period is 42 days, and in Norway 61 days. Very few data exist for measurement of persistence of these drugs in fish flesh after feeding. McCracken et al (1976) measured the presence of trimethoprim in trout muscle 77 days after medication; Salte and Liestøl (1983) calculated that the withholding period for trout receiving OTC should be 100 days at winter temperatures, and for Romet 30 they recommended withdrawal periods of 60 days, above 10°C. All authors emphasize that temperature is a seriously complicating factor - residues of Romet 30 persisted for several months in fish at colder temperatures, leading Salte and Liestøl to recommend using the component drugs only in summer. Clearly these limited data do not support the FDA regulation of 21 days. New, more refined measurements of drug residues in salmon coming to market clearly are needed - a recurrent theme of the Austins. Some of these measurements are being made now at the University of British Columbia by McErlane et al. (1989), and Grondel et al. (1987) have published a pharmacokinetic analysis of OTC distribution in carp. In the absence of more detailed studies, humans ingesting farmed salmon may be receiving subtherapeutic doses of antibiotics. One would like to see regulations established for testing the product, by agencies, as it comes to market to ensure the absence of detectable residues. Methods used should be such as those approved by the National Committee for Clinical Laboratory Standards

used by the Clinical Laboratories, Laboratory Medicine, University Hospital, University of Washington.

The issue extends beyond the limits of the penned salmon. Much of the antibiotic fed escapes into the fluid environment and, notably, into the sediments that accumulate beneath the pens (Jacobsen and Berglund, 1988), where it may be exposed to native fish, shellfish, and other indigenous species, thus providing another avenue to humans who may catch and consume these forms.

The medical consequences of the mis-administration of antibiotics are numerous, and are well discussed in such modern treatises as Goodman and Gilman (1985) and Kucers and Bennett (1987). A number of them are antigenic and elicit immunological hypersensitivity responses; some have toxic effects in various tissues varying with the physiological and health state of the person; some particularly should be avoided during pregnancy; tetracyclines lead to discoloration of infants' teeth and may interfere with bone growth; some, notably the tetracyclines, may lead to the development of superinfections by resistant strains of bacteria; they may interfere with the normal immune response; and the breakdown products of antibiotics, including OTC, can be toxic particularly in individuals with compromised livers. Basically, it is poor medical practice to ingest unneeded antibiotics or deteriorating antibiotics.

Another cluster of problems associated with use and misuse of antibiotics is the generation of strains of pathogenic bacteria that have resistance to the drugs. Such strains have now appeared in essentially all fish culture communities that have been adequately tested. Mostly the resistance factors are carried on R plasmids, which also usually are found to carry resistance determinants for 1 to 8 additional antibiotics, thus showing multiple drug resistance. In high proportions, these R plasmids are transferable to other bacteria, and thus drug-resistance may be disseminated to other ecosystems. Studies at the Centers for Disease Control have shown that outbreaks of salmonellosis could be traced to drug-resistant *Salmonella* derived through the foodchain back to land farms associated with agricultural antimicrobial use (Cohen and Tauxe, 1986). It is prudent to evaluate the possibility for a similar generation of R plasmids in fish farms and their dissemination to human populations in the marketplace. When drug-sensitive populations of pathogens are replaced by drug-resistant populations, then treatment of the affected fish becomes ineffective, and, if the R plasmids are in human pathogens, treatment of patients would be adversely affected. Particularly, it is a general principle that medically important antibiotics, including oxytetracycline, the sulfas and erythromycin, should be restricted in their nonmedical uses to minimize R plasmid selection and transmission.

When antimicrobials are used in fish farms near commercial or recreational shellfish beds, there is the further potential for drug-resistant organisms to be concentrated by the shellfish, through filtration, and thus enter human populations.

Food additives. The dry pellets, fed to the penned fish in the marine environment, contain fish meal, grains, fish oils and carbohydrates, supplemented by minerals and vitamins as indicated in Table 2. While these additives have no direct human import, it is reported that planktonic blooms of

the ichthyotoxic dinoflagellate, *Gyrodinium aureolum*, were enhanced by the biotin in fish farm wastes (Turner et al., 1984). These blooms cause mortalities to cultured fish, and, unfortunately, to wild fish as well (Bullock et al., 1985).

Pigment is added to the feed to produce a colored flesh in farmed salmon, inasmuch as the color of wild salmon flesh is derived from natural food organisms. In Great Britain, the carotenoid canthaxanthin, an analog of astaxanthin common in natural food organisms, is used in the form of carophyll red. It is stated in a report from the University of Stirling that this use is banned in the US because of possible carcinogenic properties of canthaxanthin (NCC Report, 1988). To date a petition for its use has not been submitted to the FDA (FDA, Seattle Office, 1989). A petition is presently under consideration for use of astaxanthin as a colorant. A main local supplier adds canthaxanthin as a colorant. There clearly are gray areas here where research and regulation is sorely needed.

Many wild fish are rich in omega 3, polyunsaturated fatty acids. A higher ratio of omega 3/omega 6 fatty acids is believed favorable for maintaining low cholesterol levels in humans. Cultured fish and other sea foods, because of their artificial diets, may have low levels of omega 3 fatty acids, and thus unfavorable ratios of omega 3/omega 6 (Suzuki et al., 1986; Chanmugam et al., 1986). Consequently, individuals eating farmed salmon in the expectation of gaining this supplement will typically be erring, unless the farmer has specifically added it as a dietary supplement and indicated this in marketing. The dry pellets supplied locally generally do not have omega 3 acids added as a supplement (Moore-Clark Co., 1989, pers. comm.) because these are contained in the fish oils of the fish meal used.

Moist pellets, which are more commonly fed during the hatchery phases of salmon farming, are derived from fish meal that is pasteurized, combined with additives, and frozen. However, moist pellets used in some fish farms in Puget Sound contained *Salmonella* spp. (Draft PEIS, WDF, p. 116, 1989). Moist pellets used in British Columbia have been found to contain *Salmonella* (Kelly, 1988, pers. comm.; Babink, 1988, pers. comm.). In these cases it is unclear whether the pathogens had survived the pasteurization, or had appeared subsequently. These pathogens can persist for a period of time in marine waters, are harbored by fish in polluted waters, without harm to them (Buttiaux, 1963). Marine shellfish can concentrate *Salmonella* and transmit them to humans. There is, therefore, a potential for fish culture to join animal husbandry as a mode for affecting humans in the manner described by Cohen and Tauxe (1986).

Hormones. At this time, hormones are being used in B.C., experimentally and perhaps to an extent in actual culture, to control the sex, size and behavior of penned salmon, both *Oncorhynchus* spp. and *Salmo salar*. Gonadotropin, gonadotropin releasing factor and analogs, and antiestrogens have been used in adult females to modify spawning. Androgens and estrogens are used to cause feminization, and, in combination with other techniques, to produce triploid and tetraploid stocks for production of sterile salmon. A review is provided by Donaldson (1986).

In general, these treatments are used on egg-producing females or on eggs and sperm, and the likelihood of carry-over of hormones to adult, marketable fish is tiny. Anabolic steroids including methyl testosterone,

thyroid hormones, somatotropins, certain pituitary hormones can be used to accelerate growth in juveniles and the timing of smoltification (Donaldson, 1986). If these hormones, or androgens and estrogens, were used for growth acceleration or other effects on near-harvest adults, then there would be cause for concern to human consumers.

Pesticides. A remarkable list of agents are or have been used in salmon culture. Examples are: formalin, malachite green, acriflavin, Nuvan, Neguvon, Chloramine T, MS222, copper sulfate, tributyltin, diquat, in addition to the chemotherapeutics. Some are used in Scotland and Norway which apparently are not used, or not permitted, in the U.S. and B.C. Lists are incorporated into Table 1 of this presentation.

Treatment of salmon lice (*Lepeophtherius salmonis*). These copepod ectoparasites pose a severe problem for adult penned fish in Scotland and Norway. In Europe, organophosphate pesticides (Nuvan^R (dichlorvos; Scotland) and Neguvon^R (trichlorfon which forms dichlorvos; Norway) are primarily used. Fish are treated by immersion in a concentration of 1 ppm for 1 hr, as needed. In 1984 39,600 lbs of Neguvon were used in Norway (Midtlyng, 1985). They are inhibitors of acetylcholinesterase activity in the cholinergic nervous system. These agents not only kill fish lice, but other crustacea in the environment as well, including commercially important species such as crabs, lobsters and mussels (Egidius and Moster, 1987), and they cause potentially serious problems to the treated fish (Davies and McKie, 1987; NCC Report, 1988). These agents are restricted by the EPA in the U.S. (Seattle EPA Office, 1989). In Washington, the carbamate Sevin^R (carbaryl) has been suggested for use for treatment of salmon lice, and it is used in oyster culture for controlling ghost shrimp. Sevin, also, is an inhibitor of acetylcholinesterase. Sevin has recently been restricted in parts of the United States, and its discharge is regulated by an NPDES permit. BRAVO (chlorothalonil), a fungicide has been suggested for and used recently on fishpen nets, a use banned by EPA because it is a class B carcinogen (EPA, Seattle, 1989).

Disinfectants and Antifoulants. Formalin and malachite green have been used for control of ectoparasites and fungi, usually in the fresh water phases of farming. Malachite green, a potential teratogen (NCC Report, 1988), is now banned. MS-222 is used under certain conditions for anaesthesia, but with a 21-day withdrawal period for clearance from tissues. Hatchery ponds are sterilized with chlorine.

To prevent fouling of nets by growth of algae and encrusting invertebrates, fish farmers have treated nets and pen structures with the antifouling agent, tributyltin (TBT). This substance, at exceedingly low concentrations, has a variety of adverse effects on marine invertebrates and perhaps on vertebrates (Bailey, D.S., 1987). When, in 1987, farmed salmon appeared in the Seattle markets carrying substantial amounts of TBT in their flesh, the state enacted a law prohibiting this use and partially eliminating it from use on boats. A similar law exists in the national statutes, in Great Britain and other parts of Europe. Despite this ban, a Canadian Governmental memorandum on August 11, 1988, titled "Private Salmon Hatcheries and Netpen Facilities, Some Serious Concerns" indicates that 25% of BC pens are still treated with unregistered boat hull paints, sometimes including TBT, which liberate

large quantities of particulate paint into the water, sometimes onto oyster beds, thus creating potential hazards for two kinds of aquacultured products.

If antifoulant is used on nets now, usually it is copper-based. Copper and other heavy metals are highly toxic to many marine invertebrates. Standards for permissible amounts of copper in farmed fish flesh appear to be lacking.

Summary. There are a number of chemicals and additives used in net pen culture now that have the potential for adverse human impact. Often these are used at the discretion only of the user, and with little or no external monitoring. There appears to be little or no input into this regulation by public health agencies.

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Table 1
Chemicals Used in Net Pen Culture of Fish
 (From Austin and Austin, 1986; The Nature Conservancy
 Report, Scotland, 1988; and other sources)

Chemotherapeutics

Oxytetracycline	Streptomycin
Romet 30 ^R (sulfadimethoxine and orthomeprim)	Sulfisoxazole
Sulfamerazine	Kanamycin
Tribrissen ^R (trimethoprim)	Fumequine
Erythromycin	Chloramphenicol
Penicillin G	Chloramine T
Oxolinic acid	Acriflavin
Minocycline	Acetic acid
Clindamycin	Formalin
Kitasamycin	Malachite green
Rifampicin	Iodine
Hyamine 3500	Iodophor
Copper sulfate	Benzalkonium
	Nitrofurantoin

Pesticides

Dichlorvos (Nuvan^R, an organophosphate)
 Trichlorfon (Neguvon^R, an organophosphate)
 Carbaryl (Sevin, a carbamate; used in oyster culture)
 Diquat

Antifoulants and Disinfectants

Tributyl tin - now banned
 Copper paint
 Bitumen
 Chlorine
 Chlorothalonil

Anaesthetics

MS-222 (tricaine methane-sulfonate)
 Benzocaine
 Carbon dioxide

Food additives

Colorants-canthaxanthan
 Minerals
 Vitamins
 Omega 3 fatty acids

Table 1B
Doses of Antimicrobials Commonly Used in Salmon Net-pen Culture

Antimicrobial	Dose, mg/kg of fish/day	Days of Treatment
Oxytetracycline	75	10
Romet 30	50	5
Sulfamerazine	220	14
Tribrissen	30	10
Erythromycin	10-25, or unspecified	4-21

These regimens are repeated 2 or 3 times a year

Table 2
Mineral and Vitamin Food Additives
in Salmon Pellets
(Data from Nature Conservancy Council Report 1988, and
Moore-Clark Analysis)

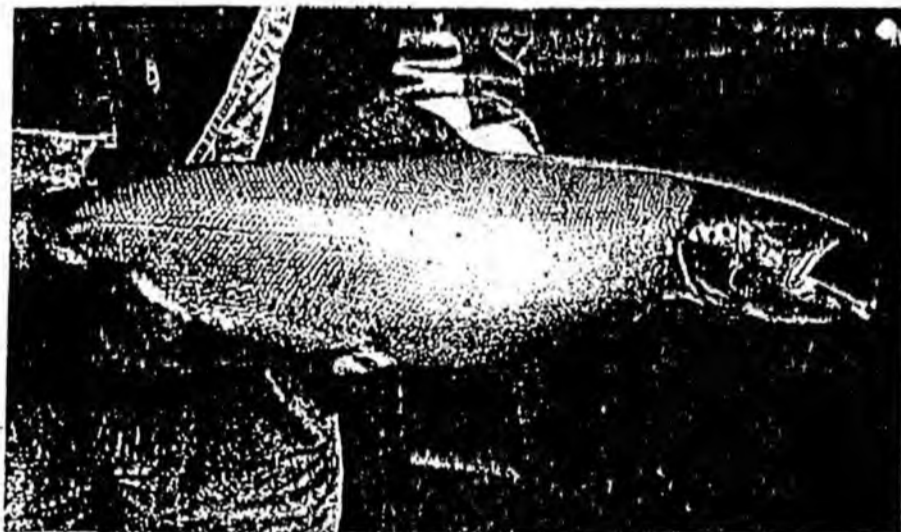
Minerals

Calcium phosphate
Magnesium sulfate
Sodium Chloride
Potassium chloride
Iron sulfate
Zinc sulfate
Copper sulfate
Manganese sulfate
Cobalt sulfate
Chromium chloride
Ethylenediamine dihydroiodide
Selenium

Vitamins

Thiamine hydrochloride
Riboflavin
Calcium pantothenate
Niacin
Pyridoxine hydrochloride
Biotin
Folic acid
Cyanocobalamin
Inositol
Ascorbic acid
Choline chorlide
Menadione
alpha tocopherol acetate
p-aminobenzoic acid
Retinol acetate
Vitamin A
Vitamin B12
Vitamn D3
BHA-BHT, antioxidant

SALMON BREEDING



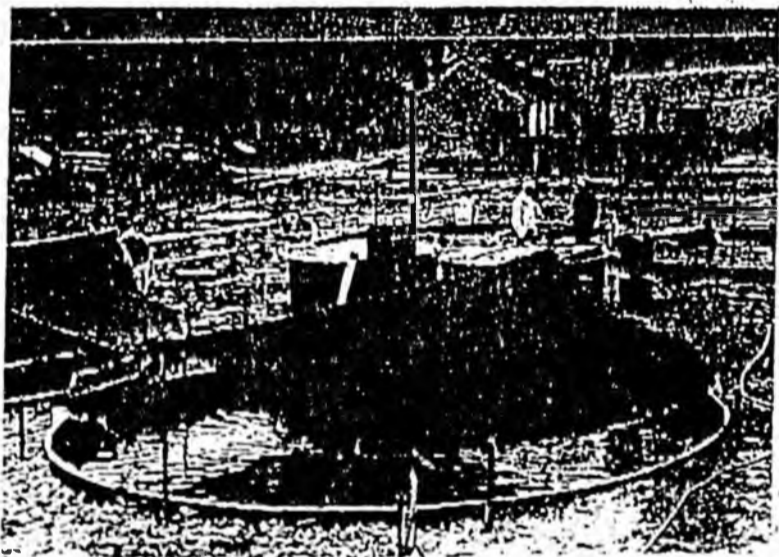
AMERICAN IMPORT

Sidney Vines explains how the landlocked salmon from Maine may soon be providing good sport in British stillwaters

In the green and lovely valleys of south Gwent, a few miles north-west of the Severn Bridge, a small fish farm is breeding landlocked salmon. It is possible that in a few years this fish will be established in stillwaters in the British Isles, rivalling the ubiquitous rainbow trout in popularity.

Benedictine monk they were also to be found in Lake Geneva in Switzerland in 1588, though they disappeared from there long ago.

I am lucky enough to write with personal experience of fishing trips to Maine in 1984 and again in 1987. It is a state as large as England, thinly populated, of low hills and



Of the same species as the Atlantic salmon, the landlock (above) averages 2 1/2 lb in the wild and makes for excellent fishing and eating. The first farm to import its eggs to Britain is in south Gwent (left)

The landlocked salmon originates from the state of Maine, on the northeastern seaboard of the United States. Some say that it is a survivor of the last Ice Age 12,000 years ago, others think that it is a hybrid of Atlantic salmon, introduced through the state's lakes, by the Government for their hatchery programmes. According to a 2000

survey of hundreds of lakes averaging about 12 square miles. Some of its rivers and streams are as big as the Rhine, others are more like the rocky streams of Devon. In winter the ice on the lakes is 4ft thick, however the surface water temperature can reach 75°F in summer.

The landlocked salmon is to be found in virtually all of Maine's many lakes. Natural spawning is

supplemented by a Federal hatchery at a place called Grand Lake Stream. About the size of a soccer pitch, it stocks the lakes and streams of Maine and exports eggs to many parts of the world - though not, until now, to Europe. The fish have adapted well in Argentina.

The landlock is of the species *Salmo salar*, like the Atlantic salmon. In the wilds of Maine it averages 2 1/2 lb and for its size it is a magnificent sporting fish - a fine fighter and highly acrobatic. It is unmistakably a salmon in appearance and delicious to eat.

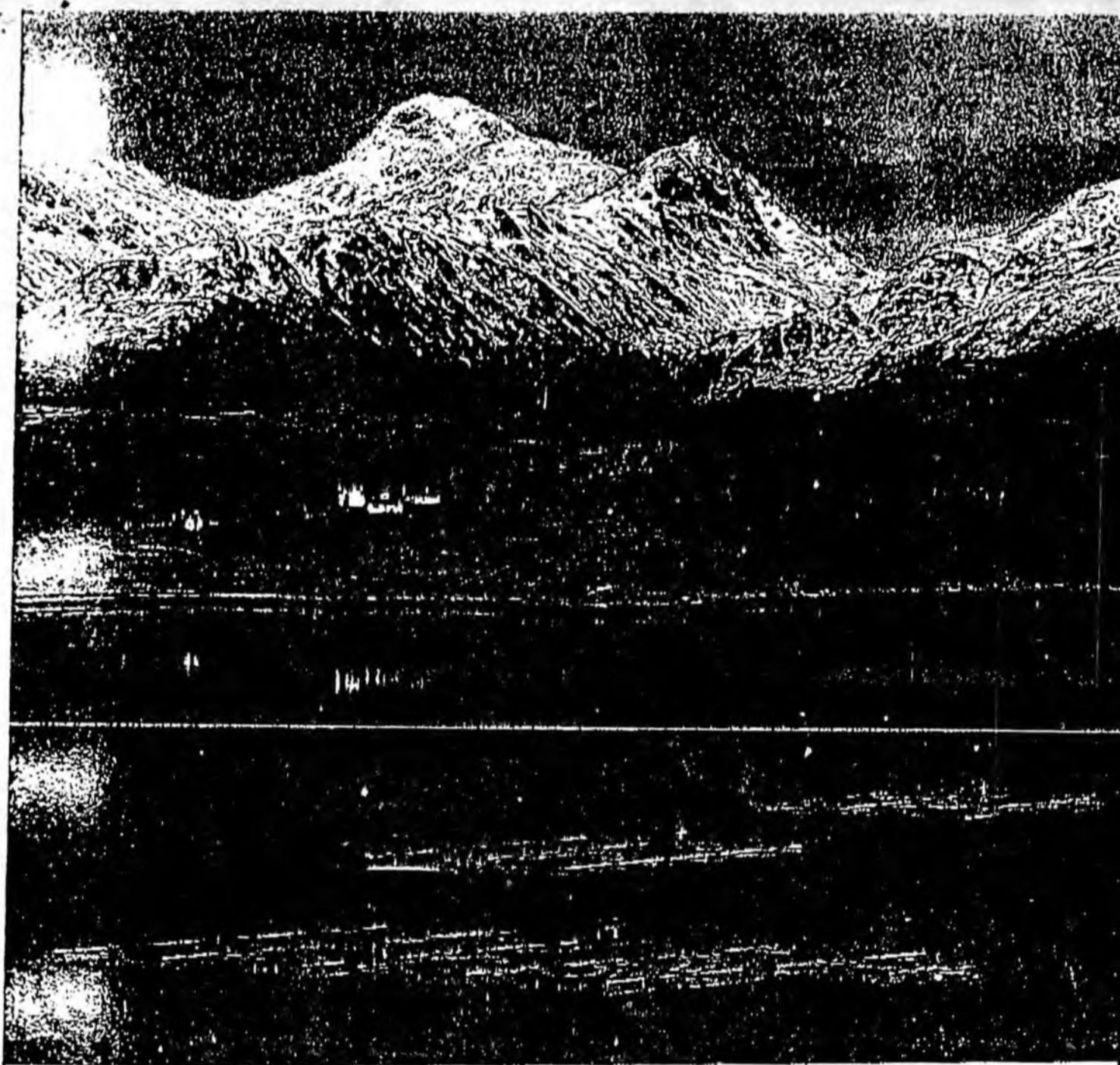
During my 1984 visit, in May, soon after what is known as 'ice out', we mostly trolled streamer flies (to resemble a smelt) a few inches below the surface. More skilful was some good wet fly fishing in Grand Lake Stream, where, one evening, the water boiled with leaping fish - a sight to thrill any fisherman - and I took three salmon on a Frank Sawyer nymph and, incidentally, fell in.

McClane's *New Standard Fishing Encyclopedia*, the bible of all US fishermen, states: 'Few fishermen have yet discovered the thrilling contest when a landlocked salmon takes a small dry fly; yet this fish rises gracefully and accepts such insect imitations readily. Patterns on size 16 and 18 hooks are effective on many streams and on nearly all lakes when the surface is smooth.'

The landlock gives fine sport in the wilds of Maine, where the fishing is free. It is a different matter in Britain, where economics are more relevant. For the magic word 'salmon' to attract fishermen, it will have to imply, in my opinion, fish of a weight of at least 5 lb. No fish farm has difficulty in producing them to this size or more.

Landlocked Salmon (Europe) Ltd owns a farm in Gwent. It has successfully passed through a five-year development period during which Hugh Horrex, the managing director, had to satisfy strict anti-disease requirements before being licensed by the Ministry of Agriculture, Fisheries and Food to import eggs from Maine. In order to receive a guarantee from the US federal authorities under the Diseases of Fish Act, he had to land a fish farm with a 'swallow hole', which is the reason why he left his usual base in Ayrville and established himself in south Gwent.

I have seen many water systems on fish farms but never anything like the swallow hole here. Pure



progressively increase with successive generations until eventually it matches that of the native fish. This is exactly what you would find if hoarding to a path has a genetically inherited component which can be eliminated by selection," Professor Wilkins says.

Some fishermen have called for changes to fish farming legislation. They would like to see all farms using fish native to the rivers which surround the sea close to where their fish are anchored. This was the case with Clew Bay fish which were reared in the storm of February 1988. They had been bred by the Salmon Research Trust of Ireland on the Burrenhoole river which runs into the bay. Those that survived at sea were the run up river in July and August. They were caught in traps and...

...one of the scientists explains. "This is...

In Loch Sunart, Argyll, 'floating islands' betray the presence of cages beneath. In the shelter of the loch, only the fiercest weather can damage them but, a sitting target for poachers, their security is a prime consideration. Fish that escape raiders' nets can cause havoc with native populations.

our policy with all escaped farmed fish. The fish from the wrecked cages were in poor condition and we want only the best to breed. Last year and the year before we also had to deal with farm escapees. These were of Scottish or Norwegian strains, we don't want them to cross with the Burrenhoole fish."

But the general adoption of a 'local fish only' rule would have a disastrous effect on the economies of fish farming in areas with a high gillnet rate. Because the average size of fish would be smaller, more smolts would have to be bought at around £1 each for every tonne of fish produced, adding about £750-80 per cent to its cost. Professor Wilkins is working on another solution - the production of the sterile triploid salmon which, of course, would eliminate the possibility of interbreeding with wild fish.

A triploid salmon is produced by fertilising a salmon egg to a shock...

shortly after fertilisation has taken place. The shock, which is usually heat or cold, prevents the second chromosome from the mother from being discarded, as is normally the case, so that the young fish which hatches has three sets of chromosomes, two from its mother and one from its father; a triploid rather than the normal diploid.

"All triploid females are sterile," Professor Wilkins says, "and so are most of the males. This solves the problem of early sexual maturity for the fish farmer. He doesn't have to fish gillnets after a year - the triploids often grow bigger and more vigorously than their normal counterparts." Consequently, triploids could be more profitable than normal fish. They are not available in most producing countries - new technology could not only give the industry a boost, but at the same time help to preserve the native stocks.

SALMON
T A S T I N G



... water emerges from a hill-side, is channelled via a holding pool through the fish farm, then babbles happily over pebbles in a stream about 10ft wide for 100 yards until it comes to an area of tangled rocks measuring approximately 20 square yards, where it tumbles into the ground. It is ... Welsh Water has tried to find out where it re-emerges but has failed. The small hole allows no chance for any fish to escape. 'In any case,' says Mr Horrex, 'all our fish have been bred as sterile triploids' (see page 15).

Fish tanks are sunk 4ft into the ground. The water is introduced at an angle so that it circulates and the fish are forced to swim against it, as they would in a river. Each tank is covered by a raised tented green plastic cover to give the fish a feeling of security. They feed, according to Mr Horrex, more readily than the sea-run Atlantic salmon, which is a lazy feeder.

The fish will reach 4-5lb in two years and in another six months will double their weight, but Mr Horrex plans either to sell eggs for other fish farms to bring on, or one-year-old smolts to fisheries. In a fishery they would be kept in floating cages in lakes and fed for a year or 18 months until the fishery owner wished to release them.

There are snags. Because salmon do not co-habit particularly well with rainbows, they need a lake to themselves. The Ministry will only permit them to be stocked into lakes where there is no chance of them escaping. Although in Maine they have shown themselves capable of withstanding extremes of temperature, I am doubtful of their ability to do well in the waters of southern England. Mr Horrex is planning to export eggs to Switzerland and Austria, where the mountain water should be ideal.

Finally there is the question of cost. Some fisheries charge £35 a day for large rainbows, will they get £50 a day for salmon? A good beat for salmon in Scotland can now cost £150 a day, while landlock, which is not as official, the chance of which is much better.

Landlocked salmon may well succeed, for two reasons, provided they are only stocked into confined stillwaters, they can do no harm to the environment nor would they be a cause of genetic pollution. Better still, the more popular they become, the less will be the poaching pressure on the wild sea-run Atlantic salmon.

WILD TALK

Kathryn McWhirter and a panel of tasters prefer the wild to the farmed sides of salmon, both poached and smoked

Wild salmon or farmed? A glance at the fishmonger's slab should tell you which is which if you know what to look for. But once it is poached or smoked, can you tell at first bite? Is wild salmon worth the extra expense?

We asked Beth Coventry, chef of Greens Restaurant and Oyster Bar in Duke Street, St James's, London to buy and simply poach examples of various types of salmon, and our tasting panel sampled them 'blind', unaware of which was Scotch wild, Scotch farmed, Canadian and Norwegian farmed. My fellow tasters were Kevin Kennedy, chef-patron of the Boulestin Restaurant in London, Fay Maschler and Owen Rossen, restaurant and food writers for the *Evening Standard*, Didier Garnier, managing director of the St Quentin Group of restaurants and brasseries, Avril Stubbs of Alan Crompton-Bair Associates, who organised the event, and Louise Abbott, deputy editor of *Country Times and Landscape*.

On this showing, we felt almost unanimously that the wild salmon was worth a premium. Quite how big that premium is, however, depends on the time of year - prices of wild salmon are fairly wild themselves in the early months of the year. Our sample, bought from the market in late March at trade prices, cost £5.80 per pound, and the price had been £6.50 per pound a few weeks before. In contrast, the Canadian salmon was £1.00 per pound, and the Norwegian and Scotch farmed salmon £2.75. The price of wild fish may seem absurdly uncompetitive, looked at from another angle, however, it is the quality of Scotch wild salmon with which the other sources have to compete.

Salmon farms try, as far as possible, to mimic the natural life cycle of a wild fish, and many begin by taking advantage of the wild salmon's tendency to return to the river of its birth to spawn.

In Scotland, most hatcheries are based on a particular river, and each autumn may select its wild salmon as brood stock for the coming year. In November or December, the eggs and milt are gently massaged out of the fish by hand, mixed together and left to hatch in freshwater tanks. The young fish will emerge around April and by June begin to feed, becoming brown-speckled for camouflage. By the following spring, some will have turned silver-blue in readiness, they imagine, for their migration to the sea. Those which are not released are then transferred in controlled tanks to vast cages in the sea lochs. By the following summer, a proportion of the young salmon are ready to spawn, and some of these are harvested as grilse. Both wild and farmed grilse are good value at 20p-30p less per pound than their elders, with softer, lighter, more succulent flesh. The majority of farmed fish are kept for another winter to be sold as salmon.

It is during their development in the sea cages that differences emerge between the farmed salmon of Scotland and Norway. Norwegian sea farms are tucked away in quiet fjords, untroubled by tides and currents. Scottish farms are more exposed, out on the west coast, with very little between them and America. With a seven-knot tide coming up the cages twice a day, the fish have to swim to stand still, and the exercised muscle of Scottish farmed salmon develops a less fatty, firmer texture than the Norwegian. The Norwegian fish

Trying to Lure Back Seafood

Pollution, Prices Take Their Toll; Can Ads Help?

By MICHELE MANGES

Staff Reporter of THE WALL STREET JOURNAL

Facing its first slump in years, the seafood industry is looking for some new hooks to catch customers.

Scared by reports of contamination and turned off by high prices, consumers have cut back on eating fish for the first time since 1982. In an attempt to reverse the trend, the industry plans to overhaul seafood-inspection programs and launch a \$6.5 million advertising campaign.

In addition, retailers have begun offering products and services that make it easier for shoppers to prepare fish at home. Some stores have even installed video monitors to demonstrate how to clean and cook their specials. Trade groups are promoting new fish-eating options—like dogfish, fish breakfast sausage and even tuna hot dogs, which aren't supposed to taste fishy.

American Taste Buds

Still, battling the tide will be tough. For one thing, seafood has never been terribly popular in this country; Americans consume about five times more chicken, the nation's No. 1 meat, than seafood. Furthermore, seafood is costlier than most other meats and is getting more so: Fish prices have jumped more than 25% in the past three years. "If it costs 59 cents for the chicken special compared to a \$4-a-pound fillet of fish, which one would you buy?" asks Ken Coons, executive director of the New England Fisheries Development Association, a trade group in Boston.

And the three oil spills this past weekend are sure to aggravate concerns about water pollution and its effect on fish and shellfish.

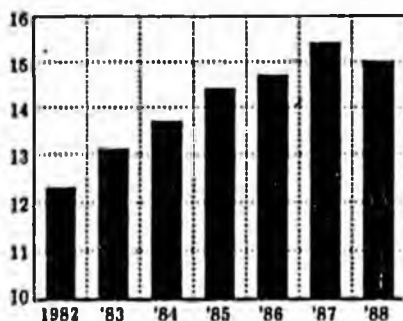
When Americans started shunning beef for food with a more healthful image, seafood sales surged. From 1983 to 1987, dollar sales jumped 30% to \$7.53 billion, according to Packaged Facts Inc., a New York market-research firm. Seafood also benefited from its tie in with the yuppie habit of buying pricey gourmet foods. And another plus came from publicity about fish oil and its presumed heart benefits.

But last year, the trend reversed. Even though dollar sales were up 5%, seafood consumption slipped to 15 pounds a person from 15.4 pounds in 1987. Before that, per capita consumption had risen steadily from 12.3 pounds in 1982. While high prices are partly to blame, the drop can be linked equally to safety questions.

Last August, several national magazines ran cover stories on America's polluted oceans. Television stations in several coastal states aired highly publicized series proclaiming the dangers of eating

Have the Tides Changed?

U.S. annual per capita consumption of seafood, in pounds



Source: National Oceanic and Atmospheric Administration

Retail sales of seafood

Year	SALES (billions of dollars)	PERCENTAGE CHANGE
1983	\$5.79	—
1984	5.98	3.3%
1985	6.33	5.9
1986	6.95	9.8
1987	7.53	8.3
1988	7.90	4.9

Source: Packaged Facts Inc.

Consumer and environmental groups added to the negative publicity. During the height of the coastal medical-waste scare, a full-page ad for the Oceanic Society featured a red snapper on a plate, garnished with lemon wedges—and skewered with a hypodermic needle.

The seafood industry contends that the worry over tainted fish is overblown. Some 65% of the seafood consumed in this country is imported, making U.S. pollution less relevant, trade groups say. Moreover, most fish is caught far off the coast, where waters generally are cleaner, they add.

But the safety issue is still a major concern. So the National Marine Fisheries Service, in conjunction with other government and industry groups, is conducting a study to develop new seafood-inspection procedures. Currently, seafood-processing plants and products are monitored sporadically by a hodgepodge of agencies with overlapping jurisdictions. Under a proposed system, seafood would be inspected more often, using a method much like the one for beef and poultry. And future inspections would be overseen by just one agency.

But the Fisheries Service doesn't expect to complete its study until December 1990, and then the new system would have to get approval from Congress.

In the meantime, other action is being taken. This August, the National Seafood Promotional Council will attempt to tackle a less serious fear but one that nevertheless hinders sales: cooking seafood at home. It seems that consumers feel so uncomfortable about storing, cleaning and preparing fish that two-thirds of seafood is eaten in restaurants.

"People think that cooking fish is a big chore. They don't want to deal with bones and scales," says Thomas P. Jones, executive director of the promotional group. "What they don't realize is that you can broil a piece of fish faster than it takes to cook most pasta dishes."

To educate consumers, the council is launching a \$6.5 million print and television ad campaign and will offer free "Fish and Seafood Made Easy" cookbooks. In one 30-second spot, an animated, bespectacled "spokesfish" chides viewers for not eating enough seafood. "Too much trouble you say!" he grumbles. "That's an old fish

interviewing the spokesfish. (Originally the spokesfish was to be called the Sturgeon General, but the name was dropped after Surgeon General C. Everett Koop refused to give his stamp of approval.)

Other seafood associations are doing their bit. The Rhode Island Seafood Council has a toll-free number that shoppers can call with questions about how to fix seafood.

New Tricks for Dogfish

Several organizations, such as the New England Fisheries Development Association, are trying to promote lesser known and less expensive species. Working with several universities, the New England group is trying to develop new products made from dogfish, a type of sand shark often used as fertilizer, and skate, an airplane-shaped fish used mainly as lobster bait. The group also sends recipes to newspaper and magazine food editors or gives samples to chefs who want to serve new, unusual menu items.

So far, retailers' efforts to net more seafood customers have been the most noticeable. Hoping that consumers will feel better knowing where their fish is coming from, some retailers are turning to branded seafood, such as Foley Fish, marketed by M.F. Foley Inc., a third-generation fish processor in Boston.

Grocers also are concentrating on preparation and presentation. In the past, most fish was sold pretty much the way it came out of the water. But now, prepared seafood is the fastest-growing segment of grocery-store fish departments, says Nancy Hasselback, publisher of Seafood Business, a bimonthly trade magazine in Seattle. In addition to selling more marinated, seasoned or stuffed seafood, a growing number of retailers are setting up steamers to cook lobster or shrimp right in the store.

"We've realized that the most important thing in seafood marketing is making your product user-friendly," says Peter Gryska, seafood-marketing manager at H.B. Bull Grocery Co., a chain based in San Antonio, Texas. "When you have a whole fish staring at you—head, eyes, gills—you're not going to think of that as dinner."

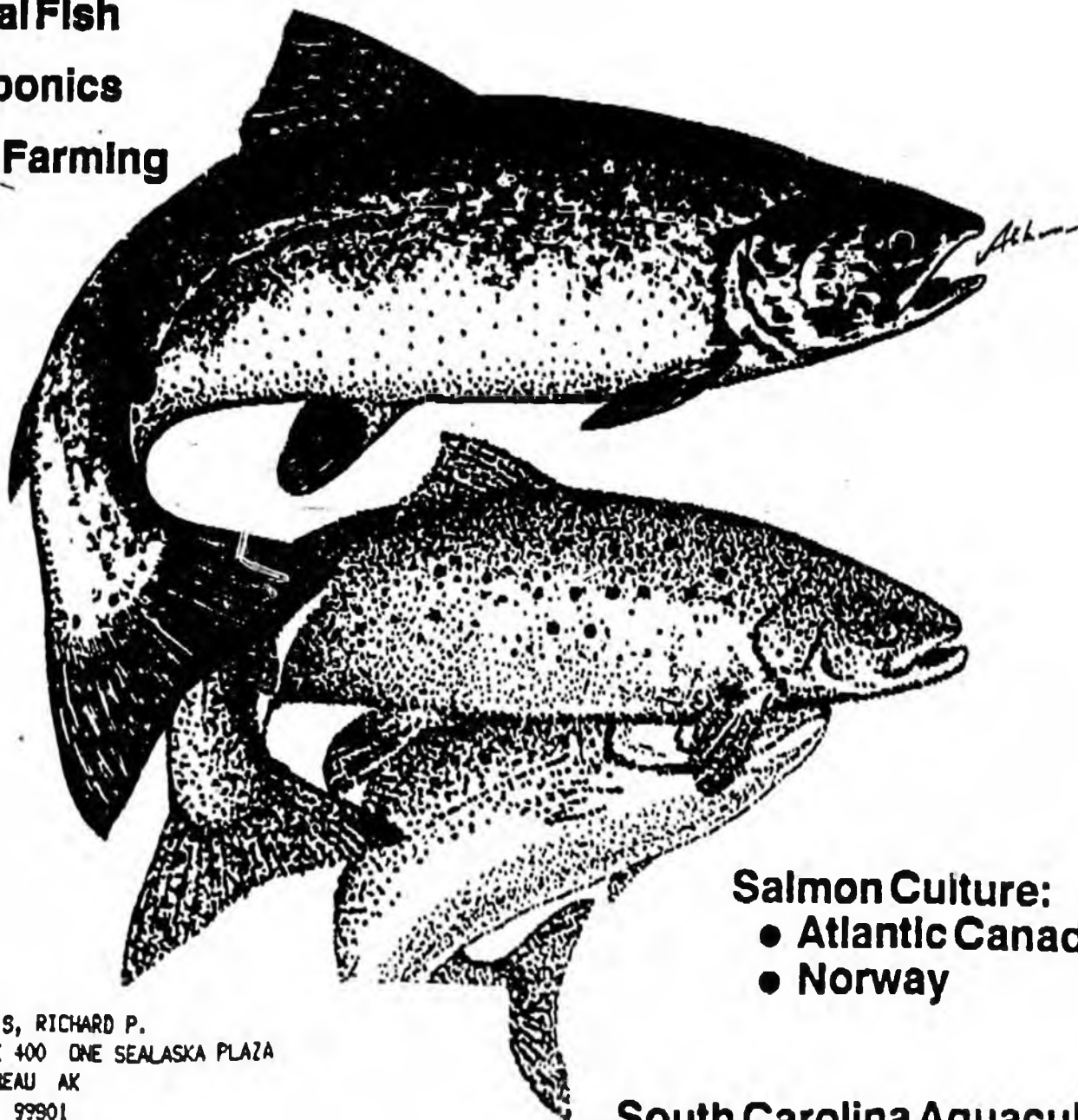
Consumers

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Tropical Fish
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September, 1989

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Salmon Culture:
● Atlantic Canada
● Norway

South Carolina Aquaculture

the economics of

Salmon

farming in the Bay of Fundy

Text by Dave Aiken

Photography by Bill McMullon

The Atlantic salmon has always been "The King of Salmon" in the Maritime provinces of Canada. From the prehistoric Algonkian Indian fishermen to the modern farmer growing salmon in sea cages in the Bay of Fundy, *Salmo salar* has been a potent economic force.

The upscale Canadian market for Atlantic salmon was once supplied by Maritime fishermen who netted the noble fish when they returned to their ancestral rivers to spawn. But the numbers of wild fish eventually declined to dangerous levels, and the federal government was forced to end the commercial harvest. That shut off domestic sources of *Salmo salar*, and for the first time in history Maritimers had to go offshore for their Atlantic salmon.

Then in 1978 Dr. Arnold Sutterlin, a research scientist with the Canadian Department of Fisheries and Oceans, convinced federal, provincial and private interests to test his theory that Atlantic salmon could be farmed in sea cages in the southern Bay of Fundy. Earlier attempts by others had been terminated by "superchill," literally the freezing to death of salmon that occurs when the temperature of seawater declines to minus 0.7°C.

But Sutterlin insisted this was not an insurmountable problem. He knew that temperatures in the open Bay of

Continues...



Fundy remained comfortably above the lethal level throughout the winter, and that lethal chilling probably occurred only in the shallow and protected coves and inlets around the perimeter of the Bay. Unfortunately, it was those coves and inlets that offered the protection required for salmon sea cages. The terrible winter gales and intimidating seas of the open Bay of Fundy would make short work of salmon cage designs available in those days, and therein lay the conundrum: in the open Bay where the salmon could survive, their cages could not. In protected coves where the cages could survive, the salmon could not.

Sutterlin and his colleagues focused on the Fundy Isles region in the southwestern Bay of Fundy. Here a string of islands form a broken barrier between the fearsome open water of the Bay of Fundy and the sheltered, shallower and significantly cooler water of Passamaquoddy Bay. Among the islands powerful tidal currents surged twice a day, driven by tides with a vertical range of more than eight meters. Here coves, inlets and channels offered protection from winter gales and destructive seas, protected sites where water temperatures were moderated

by warmer water from the adjacent Bay of Fundy.

In one of these, on the outer coast of Deer Island, eastern Canada's first commercial sea cage salmon farm was established in 1978. With technical expertise and funding from the federal and provincial (New Brunswick) governments, and other contributions from a private company, 3,800 salmon smolt were stocked in a 12-meter octagonal cage similar to those used in Norway.

As the winter of 1978 deepened and seawater temperatures in many areas sank below the lethal level, the team watched their livestock not only survive but grow. The following autumn 6.3 metric tons of prime Atlantic salmon were harvested from the cages, establishing the validity of Sutterlin's theory and the viability of net pen salmon culture in the southern Bay of Fundy.

History

From that modest harvest in 1979 the industry has grown at an impressive rate, roughly doubling its harvest in each successive year. There are now 44 approved cage sites and roughly 40 active farms scattered throughout the Fundy Isles region of New Brunswick

from Grand Manan northeastward past St. George and Beaver Harbour.

The development of the industry on the Atlantic coast contrasts sharply with the history of the "BC" industry on Canada's west coast. The Pacific industry has been heavy on promotion and a bit light on performance; the Atlantic industry, on the other hand, has developed quietly but steadily, building on performance rather than promotion. Where the Pacific industry leaned toward public companies and venture capital, the Atlantic industry developed through small partnerships and more conventional financing. Where the Pacific industry focused on coho and chinook salmon — both difficult species to cultivate — the east coast industry farmed the cooperative and dependable Atlantic salmon.

Sutterlin's group provided the inspiration and basic technology for Fundy salmon farms, but several other factors combined to make the industry what it is today. Take smolt, for example. To run a salmon farm you must have smolt, and to have smolt you must have broodstock; the well known chicken-and-egg situation. Fortunately the federal government had been producing smolt for years to enhance wild stocks, and they annually produced a small surplus that could be

The Deer Island Story

To start a new industry you must have good timing, the required resources, and dedicated people. This is a story about two such dedicated people.

To those of us who knew and worked with them in the late 1970s, Arnold Sutterlin and Eugene Henderson were that rarest of species — dedicated government scientists with a vision. Aquaculture was not a household word in those days. In government research circles it was not even a popular word, but to "Arnie" and "Gene" it mattered not. They were determined to prove that salmon could be overwintered in the Bay of Fundy and that a viable salmon culture industry could be established in the area. A site was carefully selected on the outer side of Deer

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Arnold Sutterlin (right) and Eugene Henderson, part of a team that in the late 1970s helped make Bay of Fundy salmon farming a reality, discuss old times at the second St. Andrews Atlantic Aquaculture Fair. Sutterlin was honored with the "Aquaculturist of the Year" award in recognition of his early contributions to the local salmon industry.

Deer Island Story

(from previous page)

Island, one of the Fundy Isles that rim the western side of the Bay of Fundy, the "Deer Island Project" was born, and the rest, as they say, is history. Their vision and hard work helped establish an industry that last year grossed about \$40 million in direct sales and employed about 170 people.

Sutterlin and Henderson were the quintessential match of opposing personalities. Sutterlin was a free spirit whose creative mind could never fully accept the constraints of bureaucracy with its penchant for detailed reporting of minutiae and endless forms filed in triplicate. Henderson, in contrast, was a detail man, patient and meticulous. Sutterlin was the one who cut the swath but it was Henderson who gathered, bundled and stacked. Together they accomplished much more than the simple sum of their labors.

It also helped that both could endure long hours and hard physical work, a trait that was put to the test during the long summer days of 1978 when those first cages were being prepared for the crucial test — a winter on the fringe of the notorious Bay of Fundy.

As a government scientist Sutterlin was expected to focus on commercial species, but his naturally curious nature frequently diverted him to such esoterica as hagfish, sea cucumbers and tomcod, none of which appeared on any list of government research priorities. Chafing for the freedom to pursue his inclinations, he left the government in September of 1978, and was soon exploring the wonders of mussel farming, trout farming, lobster holding systems, and marine fish farming.

Sutterlin's departure from government research came just as his Deer Island project was heading into its first crucial winter, and it left the project without a chief scientist. Typically, Gene Henderson took control of everything from animal husbandry, food preparation and on-site data collection to searching for a source of funds to carry them through the following summer. Salvation finally came

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Harvesting Atlantic salmon from sea cages in the Bay of Fundy is cold, wet and hazardous. Late in the year winter gales sweep the cage sites and walkways become ice-coated from freezing spray.

used to start the industry. However, the fact that it was a *small* surplus prevented the industry from expanding prematurely; there simply weren't enough fish available in the early years to support a reckless expansion.

Site limitation was another factor. The threat of superchill and an early uncertainty about many otherwise suitable farm locations restrained development. So did the ultraconservative financial community, which wasn't eager to advance large sums of money on an unproven enterprise that, even if successful, would operate with a negative cash flow for two or three years.

Finally, there was the moratorium. Just as salmon fever was about to erupt among Bay of Fundy entrepreneurs, the Province of New Brunswick clapped a moratorium on new leases. That lasted for two long years during which world production of farmed salmon soared and market pressures finally came to bear. The moratorium was lifted early this year, but the signs of softening world prices were unmistakable for astute observers.

Industry Profile

In 1987 there were 28 active farms in the Fundy Isles region with fish in 525

cages, 447 of which contained salmon for market. An additional 13 held broodstock salmon (11 additional cages contained rainbow trout and 54 were empty). From these 447 "production" cages roughly 341 thousand salmon were harvested, and their value was approximately US\$12-14 million. The 1988 harvest was close to 3,600 mt, worth roughly US\$32 million.

The industry in 1937 consisted of a high proportion of small operations. Only ten percent had more than 50 cages in the water (the largest had 70), and nearly half were operating with fewer than 8 cages, each containing an average of 2900 fish. A medium sized Fundy salmon farm in that year had 24 cages in the water and employed ten people, three of which worked part-time. A farm of this size could have annual sales of approximately one million US dollars, and required roughly US\$480,000 in working capital.

Fundy salmon farming is now a maturing industry that has been in operation long enough to generate reliable numbers on capital and operating costs, equipment and employment requirements, and revenue expectations. It is also possible at this point to estimate the auxiliary benefits, the general economic well-being that surrounds a viable and growing industry. Information of this type is seldom available on a new industry, yet it is extremely valuable for individuals contemplating entry to the industry. It is also useful for the financial institutions that are asked to provide funds to the industry,

The work of G. Henderson and Arnis Sutterlin has been recognized for their contributions to the development of the salmon industry in the Bay of Fundy, New Brunswick. Their people were involved in the early stages of the project. G. Henderson, and Arnis Sutterlin, made significant contributions to the industry. It is a tribute to their hard work and dedication that it could be said that the industry would have been delayed for years, if indeed it developed at all. For his contributions G. Henderson was formally honored in 1981 through a presentation at the Regional Fish Health Workshop in Halifax, Nova Scotia. This year Arnis Sutterlin's contributions were similarly recognized through the Best "Aquaculturist of the Year" award presented at the Atlantic Aquaculture Fair, an annual event at St. Andrews, New Brunswick.

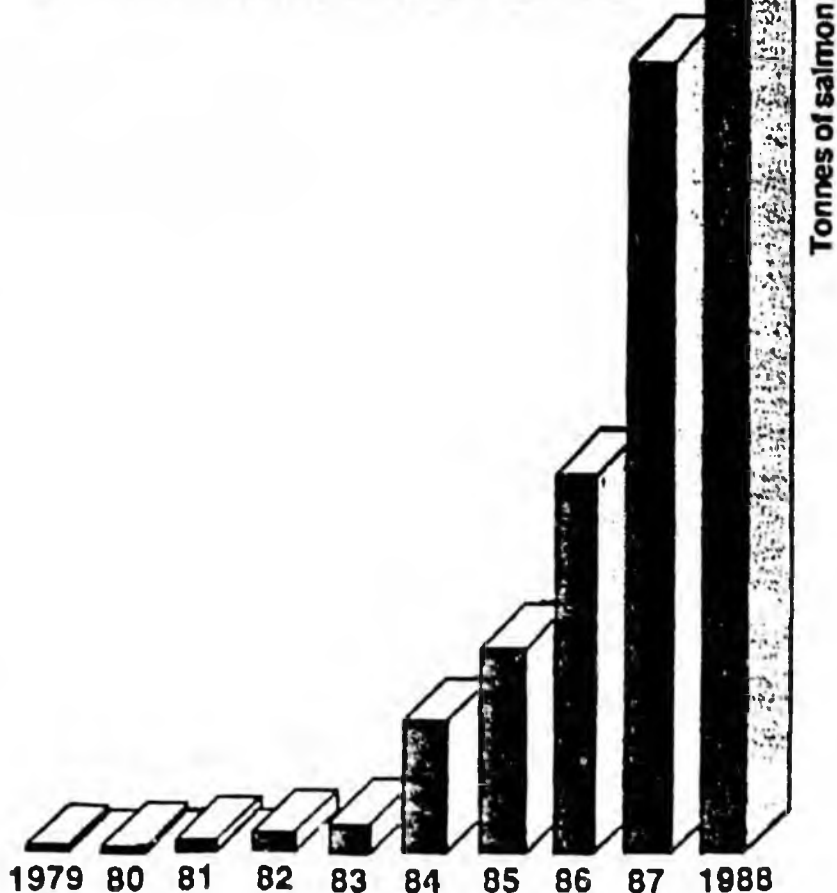
G. Henderson retired last year from the government service to manage the industry's Salmonid Demonstration and Development Farm in New Brunswick, and has since been appointed General Manager of the New Brunswick Salmon Growers Association. He continues to be an avid supporter of the Fundy industry. Arnis Sutterlin eventually followed the Trans Canada Highway east to Newfoundland, where he coordinated a government study on the feasibility of salmon culture. At the moment he is the manager of the Bay D'Espoir Salmon Hatchery, which supplies smolt to the salmon farms in Newfoundland.

Typically, neither Sutterlin nor Henderson has profited financially from the industry that developed from their dedication and hard work, and neither seems the least disturbed by that fact. Apparently it is sufficient that the cages are there, the fish are growing, and that each autumn and winter tonnes of the finest salmon available in the world are harvested from the Fundy Isles region of the Bay of Fundy, a place that Sutterlin and Henderson helped put on the map. •

Historical production of salmon from farms in the Bay of Fundy, New Brunswick.

Year	Farms	Tonnes	US/Kg	US000
1979	1	6.3	6.20	39
1980	2	11.3	5.80	66
1981	4	20.8	6.00	125
1982	5	38.1	6.60	252
1983	5	68.0	7.95	540
1984	10	222.2	9.25	2,058
1985	20	349.2	9.60	3,358
1986	29	634.9	10.16	6,462
1987	34	1315.2	11.20	14,732
1988	34	3600*	8.00*	28,800*

*Estimated from fish in water and market indications.



Market crisis

As world production soars the market for salmon softens and prices plunge, bringing chaos to the British Columbia industry and the promise of big changes in the global picture.

The fact that it was inevitable in no way softened the impact of this summer's precipitous decline in world salmon prices.

Fingers seem to be pointing toward Norway as the cause of the price slide, but in fact Norway is only a part of the underlying problem — the incredible explosion in salmon production world-wide. Chile, Iceland, and the Faroe Islands have come on stream as significant producers, augmenting the major production increases that have occurred among most of the established producer countries. This year the world-wide supply of farmed salmon was expected to jump 60-80% over last year's already impressive output, while market growth was expected to slow to 40-50%.

At the forefront of the crisis was Norway. Last year Norwegian farms produced 89,000 mt. Spectacular as that was, they projected a major increase to 120,000 mt for this year. Spectacular as that was, it proved to be too low and had to be revised upward to 150,000 mt when a mild winter combined with increased survival produced a better than average crop. Shortly after that prices began to slide, squeezing profit margins and triggering a cascade of reactions that included early harvesting by cash-starved farmers, further price depression and finally intervention by financial institutions.

Norway's influence in the industry is not restricted to the production of salmon. Norwegian banks have been active in financing salmon enterprises outside of Norway, and the industry in British Columbia is indebted to Norwegian banks to the tune of an estimated C\$70 million.

The price for chinook on the Seattle market tumbled from US\$9.90 a kilo in April to only US\$5.05 a kilo by the end of June, and B.C. salmon farming concerns — the majority of whom will bring their first major harvest to

Continued next page...

to entrepreneurs who might consider becoming involved on the support side, and to governments that are trying to keep the new developments in proper perspective.

Recognizing this, federal and New Brunswick provincial governments jointly commissioned a detailed economic study of the Fundy industry by Flander-Good Associates. Their analysis, published in 1988, provided an excellent overview of the industry through 1987. The following economic profile draws heavily on their findings. All values are expressed in United States dollars, assuming the Canadian dollar to be worth US\$ 0.80.

Economics

The new salmon farmer, stocking his cages with smolt for the first time, faces 18-20 months without income while the livestock grow to harvestable size. During this period the fish must be fed and maintained, so a significant amount of working capital will be required. To operate through the second year a line of credit approaching \$600 thousand might be required.

The farmer starting with 8 cages of 2500 smolt each and expanding to 24 cages within three years can incur a loss of \$254 thousand in the first year, but harvesting late in the second year combined with income tax adjustment from the first year should produce substantial earnings. By year-5 gross earnings should be stabilizing at nearly a million dollars a year with after-tax profits of roughly \$250 thousand.

Profitability will continue at this level unless conditions change and if there is a change, profitability will be altered according to the relative sensitivity of different components of the culture system. For example, the economic viability of salmon farming is considered *highly sensitive* to changes in the selling price and mortality rate of fish, *moderately sensitive* to changes in feed costs, and *relatively insensitive* to changes in smolt costs.

● **Selling Price.** In 1987 the standard sale price was \$10.55 per kilo. In 1988 market pressures forced this down to \$8.80 per kilo, resulting in a 35% decline in annual net income. This degree of change indicates the system is relatively sensitive to changes in selling price.

Under these conditions cash flow for a new farm becomes slightly negative in the second and third years of operation. If the selling price were to drift down to only \$7.00 per kg, net income would be reduced by 70%, producing a strongly negative cash flow in years 2 and 3, and delaying payment of income tax to the fifth year. This situation would greatly increase the amount of financing needed to provide adequate working capital.

● **Mortality.** The current standard is 16% mortality from stocking to harvest. If this were to increase to 25%, net income would decline by 18%. However, reducing the mortality rate to 10% (a realistic expectation) would increase annual net income by 12%.

● **Feed Costs.** At the 1987 price of 72 cents per kg, fish feed consumed more than 30% of annual operating costs. However, if the feed price were to increase to 90 cents per kg (a 25% increase), net income would be depressed by 8%, suggesting the salmon culture system is moderately sensitive to changes in feed costs. Fortunately, the feed industry is highly competitive and prices have remained stable for the past three years.

● **Smolt Costs.** The annual purchase of 30,000 smolt (12 cages at 2,500 per cage) at the 1987 price of \$2.40 per fish represented 15% of annual operating costs. In 1988 the price rose to \$2.80, and in 1989 to \$3.20. At \$3.20 per fish, net income declines by only 5%. An increase to \$4.00 (23% of operating costs) would produce only a 23% decline in net income, so salmon cage culture can be considered relatively insensitive to changes in smolt prices.

Capital Costs

The capital cost of establishing a 24-cage salmon farm in the Bay of Fundy in 1987 varied from \$215 thousand to almost \$600 thousand depending on the type and size of cage selected. Over a ten year period the total capital requirement, including replacement of equipment, could range from \$400 thousand to almost a million dollars. These costs are made up of everything

Prices (previous page)

market this year — could see only darkness at the end of the tunnel. For those farms still struggling to recoup their heavy initial investment, the prognosis was not good.

Hardy Sea Farms Inc. was one of the first to go, with control being assumed by a subsidiary of Bergen Bank. Others would follow, and the net result will likely be a major restructuring of salmon companies in B.C. The general feeling is that a lot of assets will change hands as a result of the current squeeze, but there is not likely to be any significant reduction in total production capacity.

One positive thing that may come out of the current crisis is a revamping of the B.C. industry's marketing procedures, which to date have been less than satisfactory. European producers have developed sophisticated marketing and distribution systems to cope with the nuances of the export trade. Norway, for example, funnels fish from its 300 farmers through a single export agency, but B.C. farmers have been selling their product through a six-city United States distribution network that was geared to an annual 3-month wild fishery. This, in the opinion of some, is largely responsible for the magnitude of the current problem in B.C.

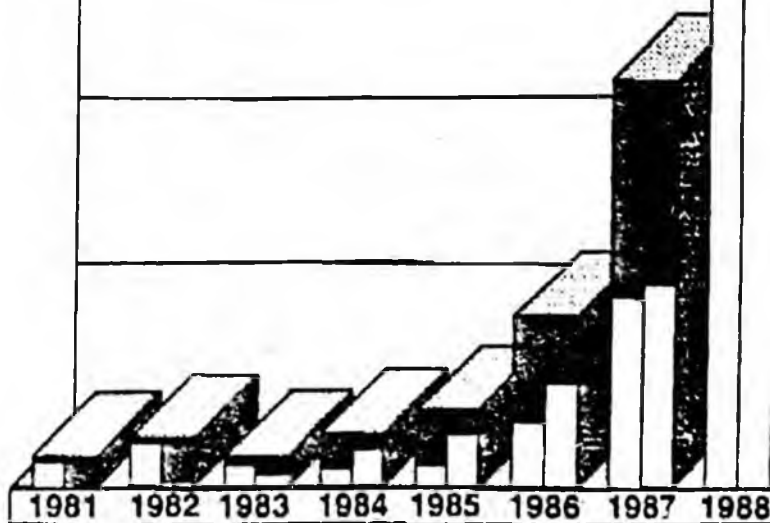
Meanwhile, the Norwegians are making some adjustments of their own that are contributing to the evolution of the global industry. Recognizing the difficulty of competing effectively on the North American market, the Norwegians have set their sights on Japan, the world's largest consumer of salmon. In addition, Norway will probably freeze a large part of this year's production, making it more attractive for the European market.

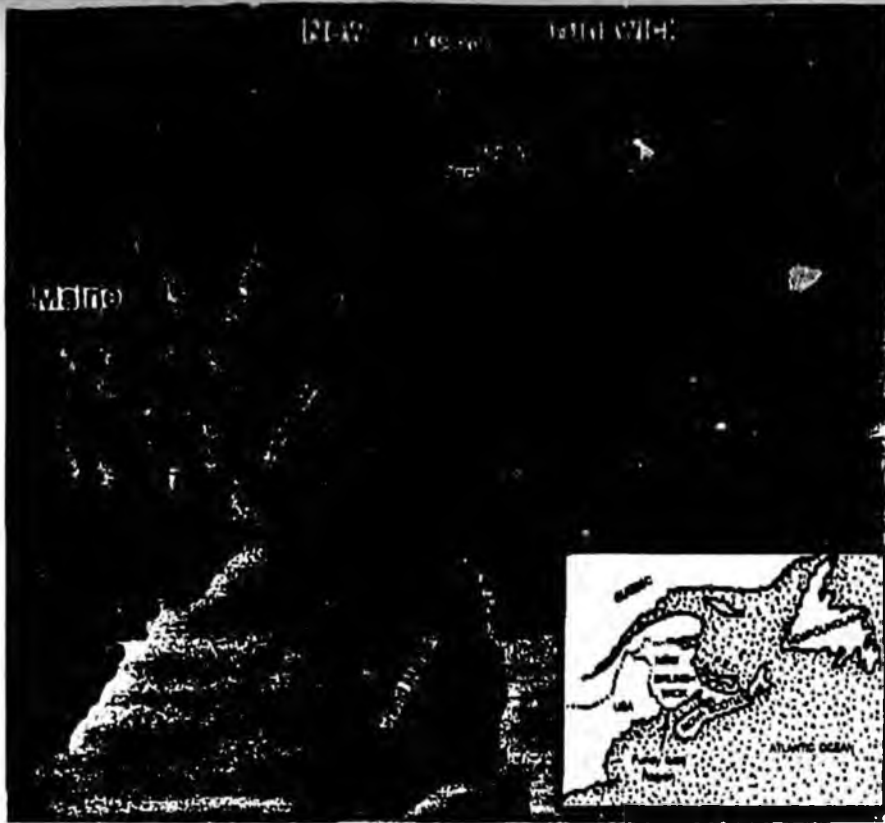
Whatever the outcome — and there are several major players still to be heard from — it is clear that the character of the global marketplace for salmon is undergoing major change, and the capture fishery will probably be affected as profoundly as the culture fishery. In short, the salmon industry has become a full fledged, highly competitive global industry, and those who hope to survive had better recognize that fact and adjust to it. ●

Ten year production history from salmon farms in British Columbia (Pacific) and the Bay of Fundy (Atlantic)

YEAR	Production (MT)			Value US\$000
	B.C.	N.B.	TOTAL	
1979	41	6	47	165
1980	157	11	168	784
1981	176	21	197	913
1982	273	38	311	1,161
1983	128	68	196	1,108
1984	107	222	329	2,620
1985	120	349	469	4,014
1986	397	635	1,032	8,782
1987	1,200	1,315	2,515	19,932
1988	6,000*	3,600*	9,600*	85,000*

*Unofficial figures





from cages and predator nets to moorings, boats and buildings.

Simple wood-frame rectangular net pens can be constructed for as little as \$3,200 but the life expectancy of these cages is only five years. The octagonal Malloch cage (designed by pioneer salmon farmer John Malloch), was an early favorite in the Fundy Isles region. A complete Malloch pen constructed of local spruce timber and equipped with a predator net could be floated for roughly \$4,800.

Many of the farms are changing to larger and more expensive plastic or galvanized steel cages. A heavy duty

galvanized cage almost 12 meters on a side has a volume of nearly 545 cubic meters and, at 8 mt of fish per cage, will hold livestock conservatively valued at \$65,000. These cages will last at least 15 years but are correspondingly more expensive (\$10-\$15 thousand). Some farmers have switched to a 23-meter circular plastic cage and others have replaced their Mallochs with a 12 x 12 meter cage constructed of PVC. These will carry 20% more smolt than the Malloch but they also cost considerably more (over \$7000).



Cages in the Fundy industry carry two types of net: a livestock net that has a mesh of 28-33 mm, and a heavy predator net with a mesh of 20 cm to keep seals and cormorants out of the cage. Nets can vary in price from \$800 to \$2400 depending on size, material and coating, and nets for the average sea cage cost \$3,500 - \$4,000 in 1987. Moorings to secure the cages and boats to service the facility add another \$24-32 thousand.

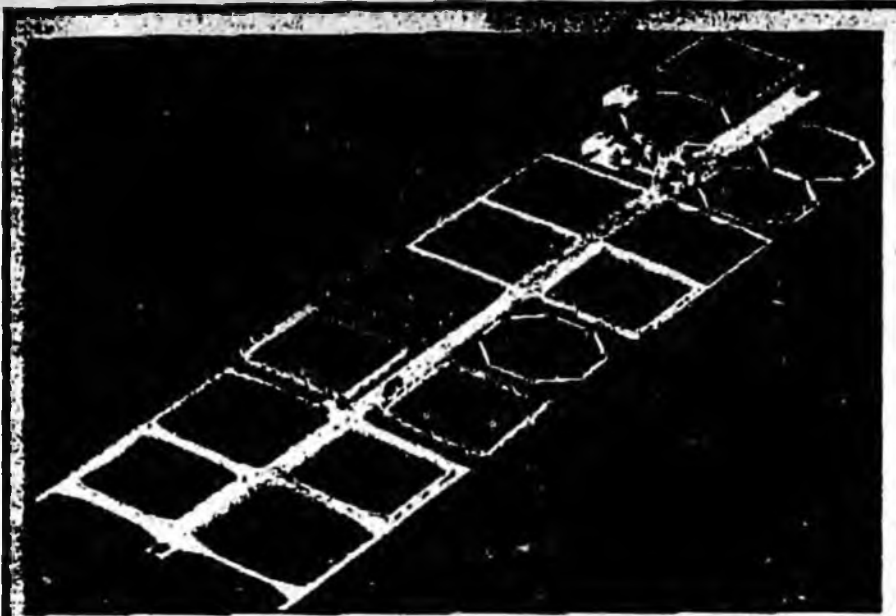
Operating Costs

Annual operating expense for smolt, feed, labor, insurance and other items on a 24-cage farm ran close to \$475 thousand in 1987. Roughly 15% of the total was spent to purchase smolt (\$70 to \$75 thousand).

Food for the growing salmon is a major expense, upwards of \$146,000 for a 24-cage farm in 1987, or 31% of total operating expense. In the Fundy industry 80% of the feed has been a moist formulation supplied by a local manufacturer, who delivered 6 days a week for 73-77 cents per kg. Feed conversion ratio over the 18-month growout period has been running at 1.5 to 2.0 kg of food supplied for each kg of fish produced (often called FCR and expressed as 2:1 or simply 2), which at 1987 prices represented an annual feed cost of \$3.23 per fish.

The 24-cage Fundy farm requires a full-time manager, four to six full time employees and one to three part-time employees. Average wage for laborers in 1987 was \$6.54 per hour, but ancillary costs increased the wage burden to an average of \$7.38 per hour, or \$15,360 per person-year. The full-time manager cost approximately \$32 thousand per year, raising total employment to approximately \$145 thousand, or 31% of total operating costs.

The Fundy Isles region in the vicinity of St. George, New Brunswick. Myriad small islands provide a barrier against the tumultuous winter seas of the open Bay of Fundy, while providing access to the more moderate water temperature from the Bay. Currents associated with tidal amplitudes of 8-9 meters surge past the cages four times each day, assuring abundant oxygen, pure water and Atlantic salmon of the highest quality.



Salmonid Demonstration Farm

Extension services and training facilities are extremely important in agriculture and aquaculture, especially when the technology is new or there are a lot of new entrants to the industry. Agriculture has developed an excellent extension capability in North America, but services have been much more limited in aquaculture.

The Fundy Isles salmon farming industry got a major jump on this problem with the establishment, in 1985-86, of a commercial scale experimental salmon farm in the heart of the Fundy Isles industry.

The farm was funded by the federal government, and its experimental program was developed annually with approval from a steering committee that consisted of representatives from industry and the federal and provincial governments. Early trials focused on diet formulation, broodstock development and on ways to improve the rate of growth. Data developed at the Farm served, in a way, as a standard against which all farms in the Fundy Isles region could measure their own achievements.

The Demonstration Farm also became an important element in the Salmon Genetics Research Program, a joint scientific program of the Atlantic Salmon Federation, through its research facilities near St. Andrews, and the local federal laboratory (the Biological Station). This program is

involved in the development of four strains of Atlantic salmon, two for sea ranching and two for cage culture.

Unfortunately, federal funding expired this spring, and since then a lot of local effort has been expended just trying to secure a future for the Demonstration Farm. Ownership has been assumed by the New Brunswick Salmon Growers Association, but most of the equipment is still owned by the federal Department of Fisheries and Oceans. That Department and the NBSGA signed an agreement to keep the Farm operating (some 20,000 smolt are in the water) on a temporary basis, hopefully until some long term funding arrangement can be developed.

As part of the upheaval the Farm lost its existing water site and was forced to relocate to a new site almost a kilometer away from its land-based facilities. Gene Henderson, general manager of the Demonstration Farm, was recently appointed general manager of the New Brunswick Salmon Growers Association, and it will be his responsibility to deal with the many problems currently facing the facility.

The major concern behind all the maneuvering is the possibility that an important facility for technology transfer and training in the science and art of salmon farming will be lost to the Atlantic region. ●

Many farms in the Bay of Fundy carry some insurance against loss. Insurance of livestock without superchill coverage typically costs about 5% of the covered value and averages about \$20 thousand. In addition there are costs for processing and marketing the product, typically about \$58 thousand. Fuel costs will be roughly \$13 thousand, and electricity can add up to a surprising amount in such an operation. The ice used to quick-chill salmon at harvest costs only \$1.60 per kg, but since 5 mt are required for each cage harvested, a 24-cage farm would spend more than \$2 thousand on ice each year.

Revenues

Salmon farms derive revenues from two major sources: marketing of fish and sale of eggs. Each broodstock female can produce 275-365 eggs per kilo of fish weight, and the assumed industry average is 10,000 eggs per female. In 1987, green eggs were worth 6-7 cents each, which means each broodstock female was expected to produce \$600-700 worth of eggs. The total broodstock inventory in 1987 probably produced 17 million eggs, worth more than a million dollars. In 1988 nearly 26 million eggs were anticipated, and these should have brought in nearly \$1.7 million.

At harvest the average salmon weighs just over 3.6 kg but may range from just under 2 kg to well over 5 kg. Smaller salmon (less than 3.2 kg) often sell for less than the standard price, and those heavier than 5 kg often command a premium. For the average 24-cage farm at full production in 1987, harvesting 12 "standard" cages of fish per year, revenues should have approximated 970 thousand U.S. dollars, or more than \$80 thousand per cage.

Spinoff

A major industry requires a variety of products and services, and these are usually supplied by individuals and small companies in the area. Sometimes the total economic benefit from this spinoff can equal the direct employment and operating revenues from the major industry. Fundy salmon farming has spun off three obvious satellites: smolt production



Walter Balasluk and George Wolf of Jall Island Salmon Ltd. pack freshly harvested Atlantic salmon for shipment to market. The fish are dressed, washed and quick-chilled to 0°C, packed in styrofoam containers that contain about 27 kg, and loaded on refrigerated trucks for the 7 hour trip to Boston (or same-day air shipment to Canadian markets). Until 1987, 80% of the harvest stayed in Canada, but the majority of the harvest now goes to consumers in the United States.

(hatcheries), feed manufacturers and equipment manufacturers.

The industry was severely restrained in the early days by a shortage of smolt, but private industry rallied, and in 1987 over 900 thousand smolt were made available by eight private, one non-commercial and two federal hatcheries. Sea Farm Canada, with three hatcheries, was the largest supplier of smolt in an industry that employed more than 40 persons and paid more than \$600 thousand in wages. In spite of the expanded capacity the industry has never had enough smolt to service the demand (the 1989 shortfall was 250-300,000

smolt). Within the industry there is concern that the loss of one of the three major suppliers could create havoc within the industry.

In the feed industry alone 40 person years of employment and over a half-million dollars in wages could be attributed to the salmon industry in 1987. Cage fabrication added another 4 person years and \$50 thousand in wages, and miscellaneous related activities (moorings, packing boxes, flotation, marketing services) added another 70 person years and \$390 thousand in wages. All told the ancillary industries employed 114 persons in 1987 and paid out \$1.56 million in wages.

Future

Although some 40 sites are currently occupied in the Fundy Isles region, surveys indicate the entire Bay of Fundy offers no more than 60-70 sites that have the necessary protection from storms and access to safe winter water temperature. The Bay of Fundy salmon industry is therefore site-limited by current technology, but even 60-70 sites could theoretically

produce 12,600 mt annually which, at current prices, should be worth more than US\$ 100 million, a significant infusion of cash for an area that has been economically depressed.

Alternatives to the current site limitations are being examined. Land-based farms are one solution and open water cage systems are another, but both are costly alternatives. In the end the profit margin will determine the extent of innovation the industry can tolerate.

The 1989 harvest from the southern Bay of Fundy should approach 4100 mt but a major increase is expected in 1990 (2.2 million smolt stocked in 1989 should yield upwards of 7,500 mt in 1990). However, the value of the harvest in future years will depend on how the world market develops. There seems little question the industry is in for a period of instability and adjustment, out of which should emerge a different but stronger industry in which ownership is more consolidated, the profit margin is narrower, farming operations are more efficient and the market is more effectively exploited. ●

Dave Aiken and P.W.G. (Bill) McMullon are with the Canadian Department of Fisheries and Oceans at St. Andrews, New Brunswick.



Bill McMullon has been photographing Canadian fisheries and aquaculture developments for years. His work appears frequently in this magazine.

Norway

The Norwegian Fisheries Industry from Capture to Cultivation

by Bjarne Mark Eidem

Some years ago an old fisherman I know in Northern Norway went into aquaculture. In explaining his reasons for going into this new field he said, "We have harvested the sea for thousands of years; now the time has come to plant some seeds."

The fishing industry is really no further advanced than were the hunters and gatherers of a thousand years ago, moving from one area to the next, harvesting the natural crop where they found it, hunting animals in the forest.

We Norwegians are relative latecomers to the field of aquaculture. Two years ago I visited China and was very impressed with what I saw. The aquaculture tradition there is thousands of years old, whereas in Norway we more or less stumbled into this field during my children's lifetime.

But we have made important advances in aquaculture in the relatively short time we have been active. We have invested great sums of money, and we have reaped the profits of this investment. And yet, what we have seen so far is only the beginning.

I want to briefly describe the development of aquaculture in Norway, a modern industrial nation with long traditions in conventional capture fisheries, and then tell you about the difficulties we have encountered,

how we have tried to solve our problems, and what we are thinking about doing in the future. I will also look briefly at market development and the prospects for farmed salmon, since this has become a major concern, as you will see.

Aquaculture development

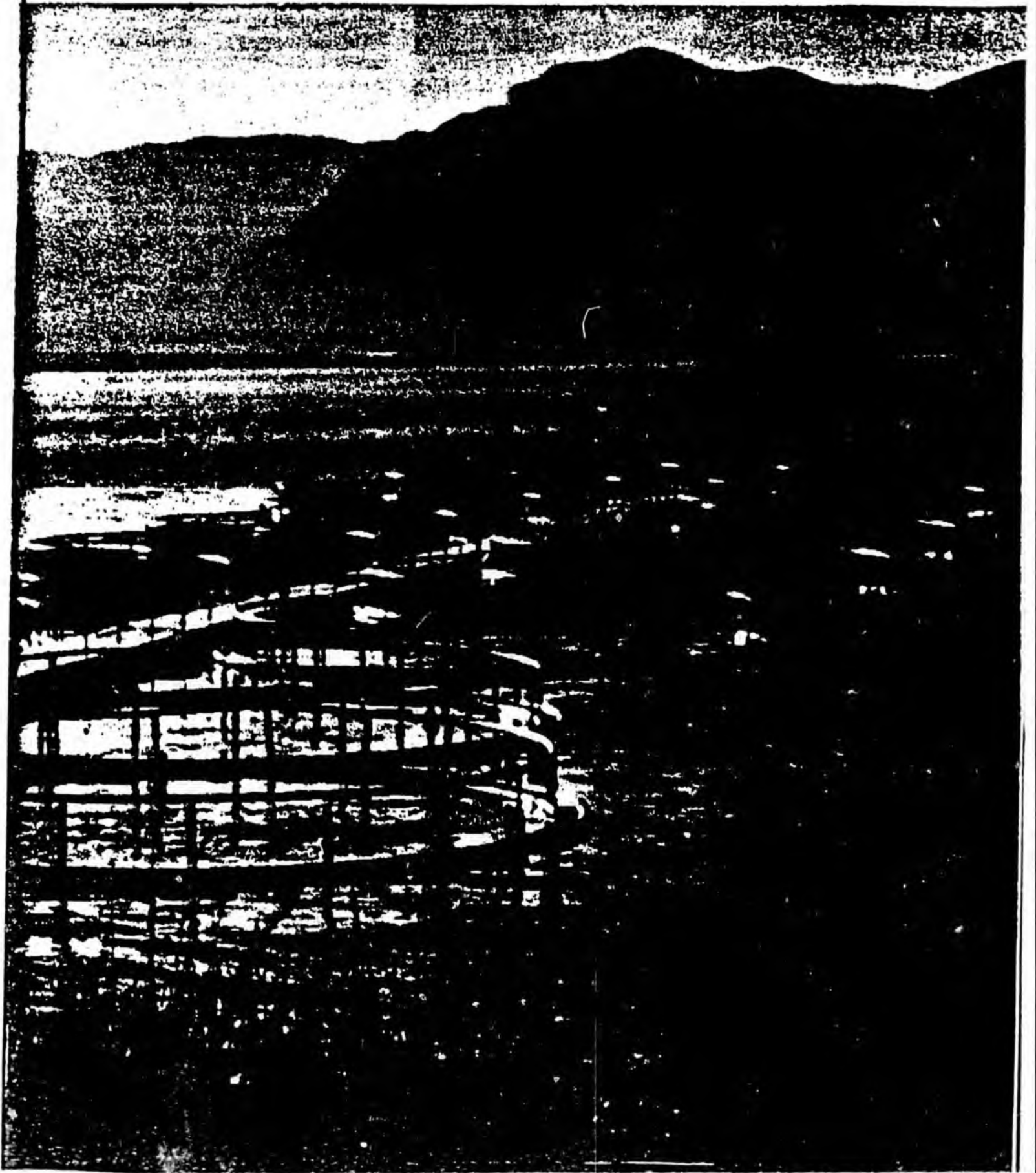
Not even the most optimistic Norwegian aquaculture pioneer envisioned the fantastic development that would occur in the industry. In the beginning they were viewed with skepticism, particularly by financial institutions.

Incontrovertible signs of success did not appear until the 1980s. Production in 1979 was only about 4,000 metric tons; nine years later, in 1988, it was 18 times that, and the growth continues.

Salmon and trout farming is an important growth industry in Norway, and it has definite political objectives at the regional and national level (e.g. contributing to employment in rural and coastal areas). The export value of farmed salmon and trout in 1988 was more than 4.0 billion NOK, or about US\$ 615 million. The industry employs about 5,000 people directly, and as many more in related sectors.



All photographs in this article courtesy of the Marketing Council for Norwegian Salmon





Today there are some 667 hatcheries—with a total capacity of about 217 million smolt per year—and 786 grow-out farms, with a total production volume of about 6 million cubic meters. It is a bit difficult to estimate the total production capacity, since this depends on the stocking density, but experts we have consulted suggest some 200,000 metric tons per year.

Advantages

Norwegian success in salmon farming has surprised some people because Norwegians do not have a long history as fish farmers. Some Norwegians along rivers have been releasing smolt for decades, but more for

sport fishing than as an industrial enterprise.

The following competitive advantages have been identified as having helped Norway become the leading producer of farmed salmon in the world:

- A long coastline with fjords and islands that protect fishfarms from heavy weather;
- Good quality seawater at the optimum temperature for salmon, trout, halibut, wolffish and other coldwater species (the Gulf Stream ensures relatively warm and stable temperatures along the entire coast);
- Sufficient freshwater for production of Atlantic salmon smolt;
- Sufficient fish byproducts from the traditional fish industry to provide raw materials, for the fish feed industry (protein of marine origin is required for the production of a well balanced diet);
- Excellent infrastructure along the coast;
- Experience in research, production and trade in Atlantic salmon. Norwegian research has focussed on genetics, fish-feed, and diseases.

Legal framework

The Ministry of Fisheries exercises legal and administrative control over the fish farming industry, through its regional offices, which are under the jurisdiction of the Director of Fisheries.

A legal framework for the salmon farming industry was introduced in 1973 with the establishment of the first bill governing the production of aquaculture products. The system introduced with that bill was retained in the temporary act of 1981, and also in the new permanent Act Relating to the Breeding of Fish, Shellfish etc. which was passed in 1985, and which today regulates the industry.

The licensing system is the main instrument used by the authorities to maintain the fish farming industry as a profitable and viable regional industry. The system limits the maximum size of each farm, as well as the maximum number of permits given for fish farming. The number of permits has been strictly limited, but there has been considerable pressure to liberalize this (it should be noted that this limitation applies mostly to farms growing salmon and trout. For other species, a much more liberal attitude has been adopted).

In 1987, the Ministry of Fisheries issued a Parliamentary Report on Aquaculture, which provided the first broad overview of the policies. The main objectives for the industry are closely related to the major political objectives: employment, balanced regional settlement, agricultural, fisheries and industrial activities. We have learned three things from our experience with these regulations. Firstly, the rapid growth of the industry generated an overwhelming number of applications for permits, and our administrative apparatus was unable to handle them efficiently. This led to a serious delay in reviewing applications and necessitated new and more efficient ways of handling the applications.

Secondly, there were instances where different interests conflicted: economic, environmental, transportation, fishing, recreation, etc. This conflict is perhaps the most difficult to deal with, but it is also of great importance, as it involves a balanced development of different activities in our society.

Finally, we need more knowledge about this industry and about the consequences of a large scale operation. The need for more research in fields related to aquaculture is urgent. Industrial-scale aquaculture requires an advanced level of both technical and

organizational knowledge, and we realize that more work is needed in this field.

Production

Norwegian salmon farming has grown along a rising curve that has been broken only once. This break (in 1987) was due to factors we can explain, and if we look at the growth of the industry in a longer perspective, that brief stagnation is insignificant. The forecasts published by the Fish Farmers' Association early this year are optimistic, but we see no reason to revise the projections at this point, especially concerning the next two years.

Our expectations for the Norwegian salmon farming industry up to 1995 are shown in the accompanying graph. The basis for this prediction is, of course, the number of smolt set out in the grow-out pens. In 1988 we saw a record number set out, over 70 million smolt, so that at the present time we have about 80 million fish in the sea cages. This crop will reach harvesting size in late 1989 and early 1990, and should bring 1989 production to about 120,000 metric tons, and 1990 production to about 160,000 metric tons. In addition, we expect to harvest about 5,000 mt of large trout.

Problems

In the past two years, certain events have occurred that indicate continuing unrestricted expansion of the salmon farming industry is unlikely.

Disease. Intensive cultivation always increases the likelihood of disease, and new diseases were both feared and expected. In 1985 the first major disease to hit the industry was "Hitra disease," otherwise known as "coldwater vibriosis," caused by the bacterium *Vibrio salmonicida*.

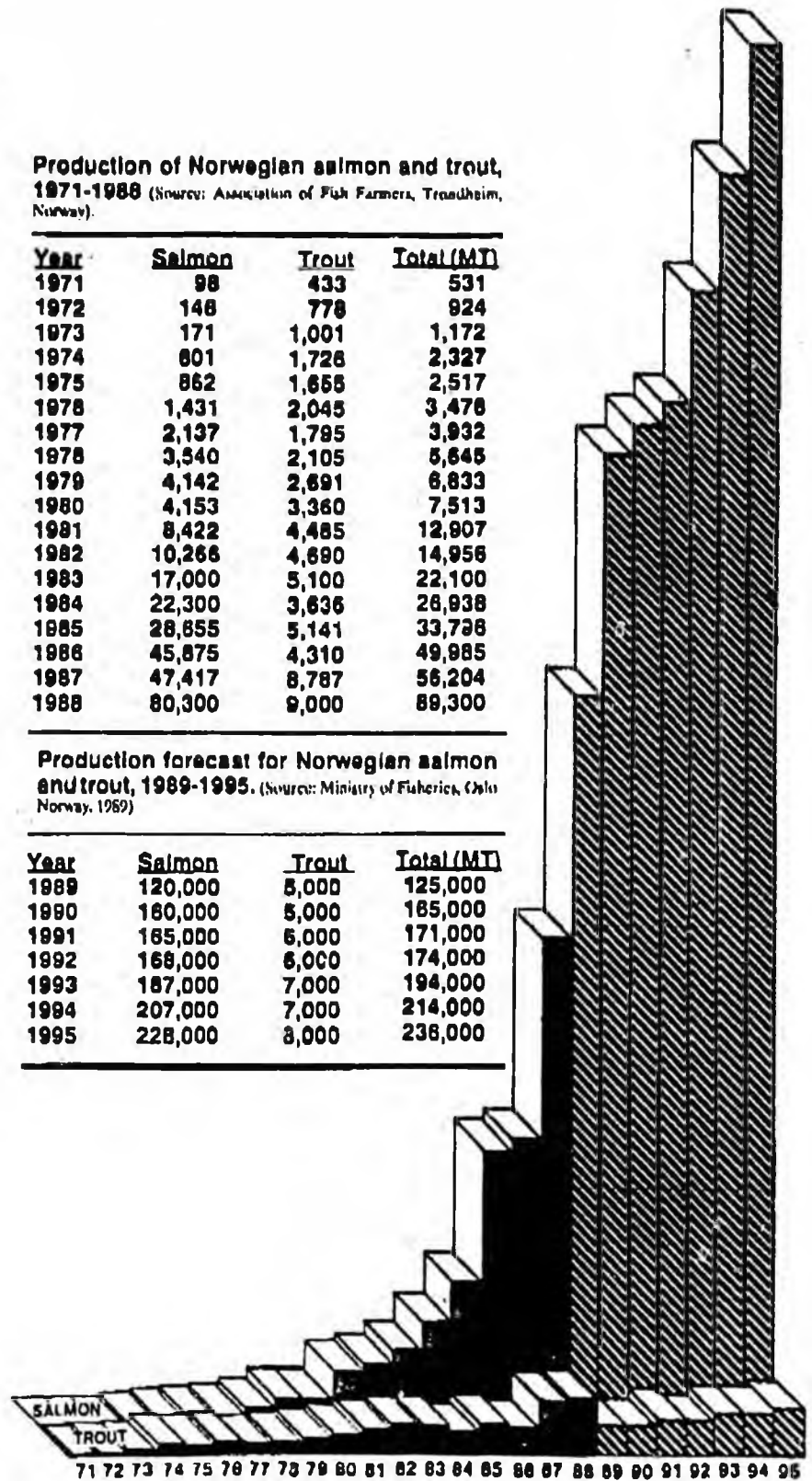
This disease forced some farmers to slaughter all their livestock just on suspicion of the disease. It also caused the premature marketing of perhaps 8,000-10,000 metric tons of relatively small salmon in 1986. This in turn reduced the 1987 production. Researchers have now developed a vaccine, and results so far are encouraging. In essence we feel that with proper farm management, Hitra disease can be controlled.

Production of Norwegian salmon and trout, 1971-1988 (Source: Association of Fish Farmers, Trondheim, Norway).

Year	Salmon	Trout	Total (MT)
1971	98	433	531
1972	148	778	924
1973	171	1,001	1,172
1974	601	1,726	2,327
1975	862	1,655	2,517
1976	1,431	2,045	3,476
1977	2,137	1,795	3,932
1978	3,540	2,105	5,645
1979	4,142	2,691	6,833
1980	4,153	3,360	7,513
1981	8,422	4,485	12,907
1982	10,266	4,690	14,956
1983	17,000	5,100	22,100
1984	22,300	3,636	26,936
1985	28,655	5,141	33,796
1986	45,875	4,310	49,985
1987	47,417	8,787	56,204
1988	80,300	9,000	89,300

Production forecast for Norwegian salmon and trout, 1989-1995. (Source: Ministry of Fisheries, Oslo Norway, 1989)

Year	Salmon	Trout	Total (MT)
1989	120,000	5,000	125,000
1990	160,000	5,000	165,000
1991	165,000	5,000	171,000
1992	168,000	6,000	174,000
1993	187,000	7,000	194,000
1994	207,000	7,000	214,000
1995	228,000	8,000	236,000



Continued on page 65

We have encountered other diseases as well. BKD, IPN, furunculosis and others. While they are all a serious threat to the industry, we believe that we are now able to manage the disease problem. In general, we have upgraded our awareness of disease, and we have upgraded the capability of the institutions that have been established to deal with disease.

Health control on fish farms is under the jurisdiction of the Veterinarian General. The main strategy is to prevent the spread of communicable diseases through close monitoring of farms and strict enforcement of rules, particularly in relation to hatcheries. In spite of this, various diseases have occurred.

When an outbreak is noted, the farmers are required to contact the veterinarian authorities for permission to administer antibiotics. No fish treated with antibiotics may be harvested until nine weeks after treatment has ceased. This is to ensure that no antibiotics are passed on to the consumer.

All our efforts so far have been directed at disease control, and only recently have we instituted programs for disease prevention. With the development of new vaccines, and with the incorporation of a disease prevention program we feel confident that disease problems will be controlled.

Environmental Problems. Last year, we experienced what many thought would be the ultimate catastrophe: a full fledged algal bloom in Skagerak and along our southern coast. But as soon as fish started dying, farmers started moving their pens away from the affected areas. Through a superb effort by the salmon farmers' organization and the authorities, almost all the farms were saved. Only some 500 metric tons of salmon were lost, or about 0.6% of our total 1988 production.

However, this incident served as a warning that we must pay much closer attention to the marine environment. Partly as a consequence, the authorities and the salmon farmers' organization have established a round-the-clock surveillance and warning system, which warns about algae, oil spills etc. and also about changes in temperature, weather, and other factors which are important to the salmon farmer. The system is based on a complex network of buoys, satellites, and earth stations which monitor our area.

I would like to point out that it is not enough to be informed about these disasters when they develop. We must also try to prevent the pollution of our

marine environment as well as our air and our soil.

Competition. We now see massive investments in the salmon farming industry in countries such as Scotland, Ireland, Iceland, the Faeroes, Canada, USA, Chile, Australia, and New Zealand. Others are sure to follow. As a curious example, a joint venture is now being set up in East Asia between a Norwegian company and the Soviet Union, on Soviet soil.

Norway is concerned about this competition. In Chile, production costs per kg are reportedly about \$0.50 below what they are in Norway, and transportation costs from Chile to the west coast of the United States are about equal to those from Norway to the U.S. East Coast. Canada is coming onstream now with high quality salmon, both Pacific and Atlantic, at production costs about the same as those in Norway, but with the U.S. market at its doorstep. So in the North American market, we see Norway being squeezed on both sides, to the south and to the North, and possibly losing market shares rapidly over the next two to five years. However, there is still room for considerable expansion in the North American market.

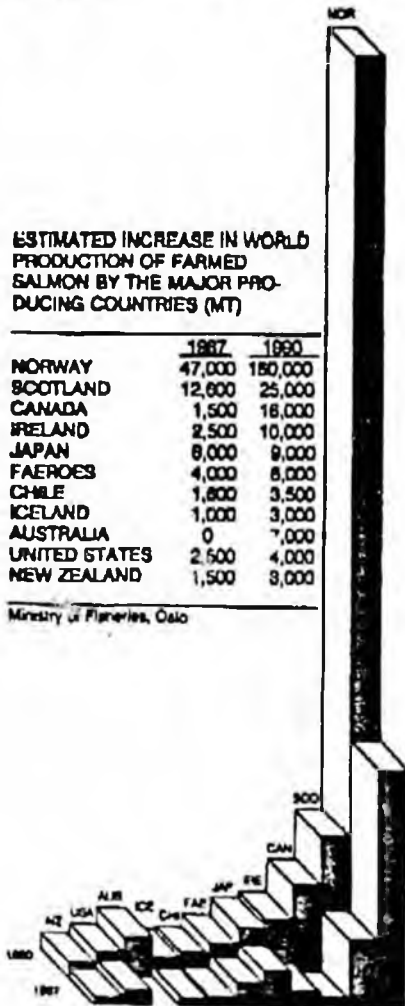
In Europe, Norway is still competitive with regard to quality and the costs of production and transporta-

The harvesting process combines hard physical labor (*below*) with mechanization (*facing page, top*) to move the fish rapidly from cage site to processing plant.

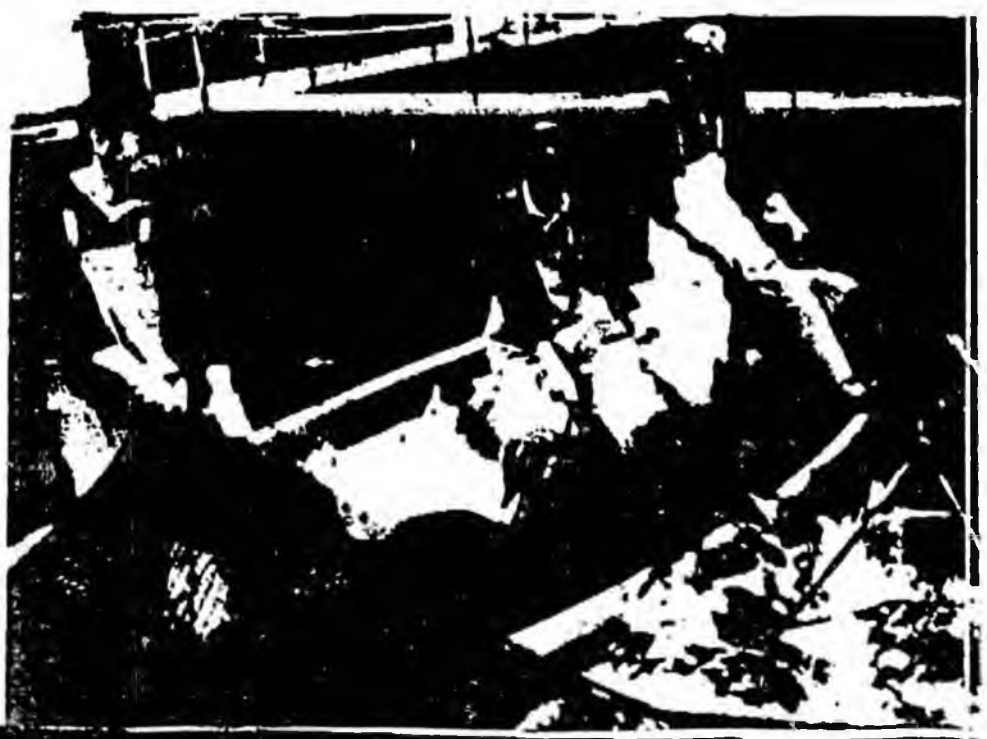
ESTIMATED INCREASE IN WORLD PRODUCTION OF FARMED SALMON BY THE MAJOR PRODUCING COUNTRIES (MT)

	1987	1990
NORWAY	47,000	150,000
SCOTLAND	12,600	25,000
CANADA	1,500	18,000
IRELAND	2,500	10,000
JAPAN	8,000	9,000
FAEROES	4,000	8,000
CHILE	1,800	3,500
ICELAND	1,000	3,000
AUSTRALIA	0	7,000
UNITED STATES	2,500	4,000
NEW ZEALAND	1,500	3,000

Ministry of Fisheries, Oslo



WORLD AQUACULTURE, Vol. 20(3)





tion but we are facing serious challenges from within the Common Market. Producers in Scotland, Iceland, and the Faeroes are giving us a hard fight for the market, and I fear that our market shares will decline.

Market Saturation? In preparing this paper we searched in vain for authoritative figures on the future demand for farmed salmon. Perhaps most people in the industry feel that demand will be limited only by supply. We have attempted to estimate the market for farmed Atlantic salmon, and the figures are, I think, rather astounding. Still there are those who believe the market is even larger than we estimated (*see figure, overleaf*).

But an enormous increase in market demand will not come about by itself. A considerable effort both in terms of promotion and product development will be needed.

It should be pointed out that product development within the salmon industry has been practically non-exis-

tent. The salmon farming industry has supplied just a few simple products: fresh whole salmon, frozen whole salmon, and smoked salmon. The industry has had no need to come up with a more varied assortment, but we believe this will be necessary in the future, particularly to utilize more profitably the lower quality fish.

The future

Norwegian salmon farming will face a number of challenges in the future.

While we in Norway are relatively optimistic about the market prospects, we also realize that the worldwide increase in production and resulting competition will force prices down. To meet this challenge, we must improve the economic performance of our industry, the quality of our product, and our product development. To hold our own, we are planning to double our research and development efforts. In fact the

government contribution to research more than doubled between 1985 and 1989.

We expect that Norwegian salmon farming companies will enter into joint-venture operations in other countries. Indeed, some Norwegian companies have already started operations abroad. According to a survey taken at the beginning of 1987, Norwegian companies were involved in 72 foreign operations in 15 countries, and this number has increased since the survey was completed. Norwegian companies have been particularly active in Canada.

We also expect there will be developments in sea ranching, or as we call it, "culture-based fisheries." We know that the Japanese have been experimenting with salmon sea ranching for some time, and our good neighbors to the west, the Islanders, have also looked into it. Salmon sea ranching is still experimental, but we hope to



Great care is taken to ensure delivery of pre-quality product, everything from the careful removal of small bones from a fillet (left) to rapid processing and chilling of the havy product before ship. Salmon that meet standards of super quality are identified with a golden tag, a consumer's assurance of quality (facing page).

move into the commercial phase very soon.

New species

Norwegian scientists have for some time been working on species other than salmon and trout. By the early 1990s, we expect that production will take off, and by 1995, farmed fish will become an important factor in our international high quality markets, particularly in the fresh fish markets.

Among the species we are working with at the moment are cod, halibut, turbot, wolffish, Arctic charr, oyster, mussels, and scallop. By the end of 1988, 420 permits had been granted for production of species other than salmon and trout. For many of these species, difficulties in fry production has been the major obstacle to success.

The most promising new species is cod. This is also the species with which we are closest to commercial operation. In 1987, we produced roughly a million cod fry, from which about 500 metric tons of cod were expected by late 1988. However, some problems developed, and the 1988 production was not that high. By the mid-1990s we expect that our farmed cod production will be 10,000 - 20,000 mt. In other words, cod is becoming a major factor in the development of Norwegian aquaculture.

For the other species, it is too early to estimate production figures, but we expect that Arctic charr and turbot will become commercially viable very soon.

In summary, the Norwegian salmon farming industry has undergone explosive development, particularly in the last six to seven years. In 1988, about one-third of the value of our fish exports came from aquaculture and the shift from capture to culture fisheries is therefore very much a reality in Norway.

However, the Norwegian aquaculture industry is facing increasingly difficult times because of the expanding competition. We expect that as more producers enter the market, prices will decline. In fact, we saw the first signs of this in 1988. As a result the focus of the industry will shift to the economics of production.

Health and environmental considerations will also play an increasingly important role in the industry's development. Soon we will have to be more concerned with margins that originate from efficiency of operation. When this happens, we expect the Norwegian industry to fall behind its competitors, because of the structure of our industry. We also expect that farming companies will want to establish operations in other countries to achieve the necessary economics of scale, proximity to market, and lower production costs.

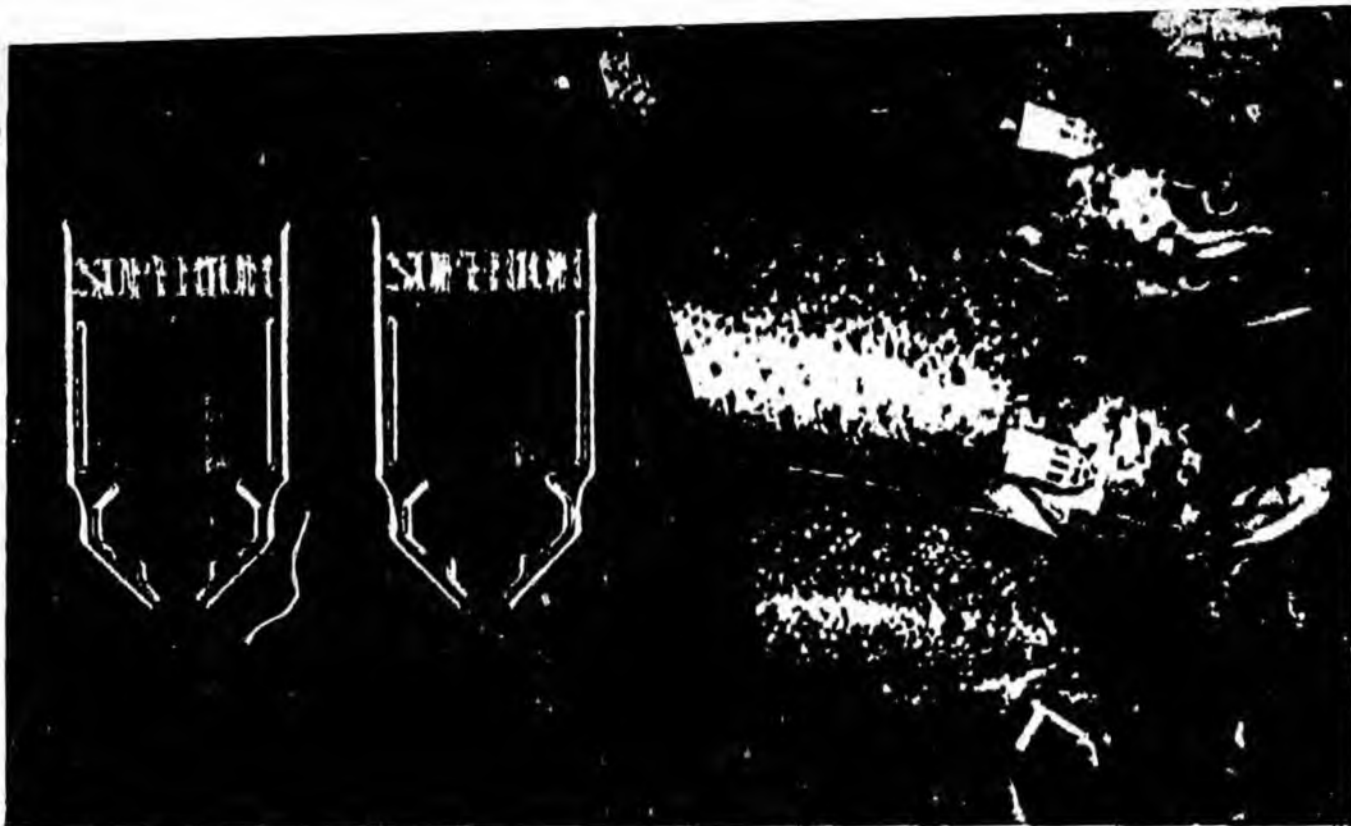
Problems such as disease and pollution have already affected the Norwegian industry, and may continue to do so. As the industry develops, and requires greater emphasis on good management, we will see problems of another nature emerge. So far, the economics of Norwegian salmon farming have been good, but we do

ESTIMATED MARKET FOR ATLANTIC SALMON BY THE YEAR 2000 (in MT).

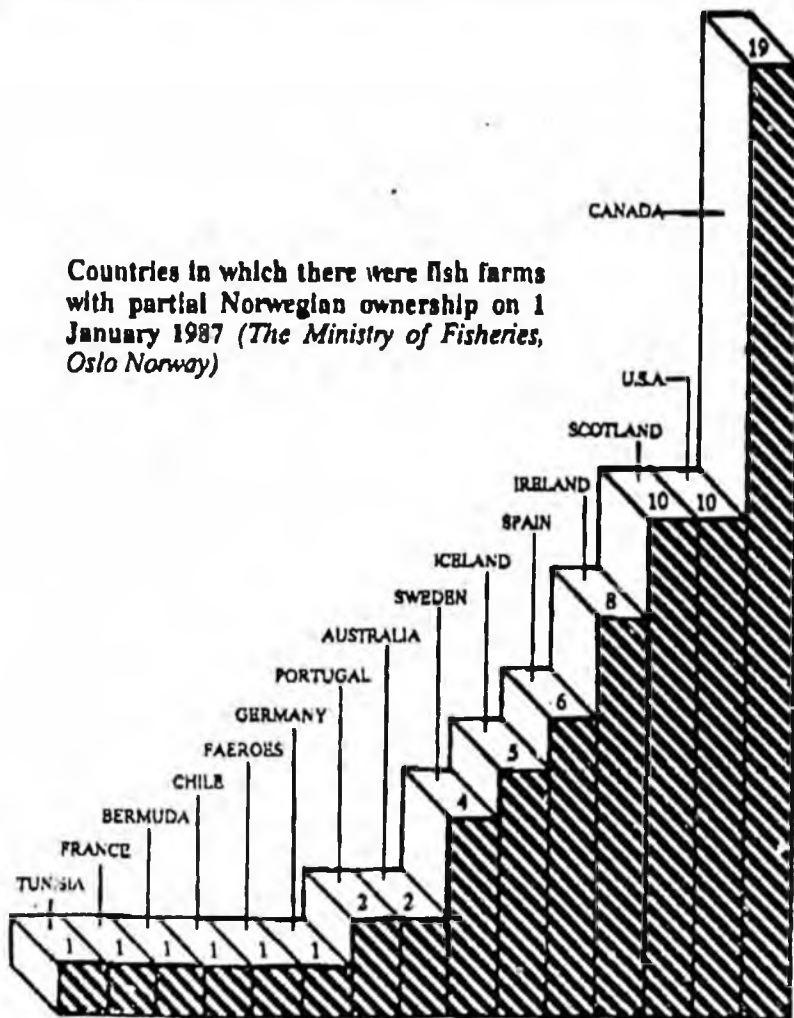
EEC	140,000
North America	75,000
Asia	70,000
Scandinavia	25,000
W. Europe	20,000
E. Europe	10,000
Latin America	8,000
Africa	4,000
Australia/Oceania	3,000
Total	355,000

Source: E. Hempel, Oslo Norway





Countries in which there were fish farms with partial Norwegian ownership on 1 January 1987 (*The Ministry of Fisheries, Oslo Norway*)



expect that harder times will force a restructuring of the industry, and the adoption of alternate methods of farming, such as land or sea-based closed systems. Norway has developed the technology for this on a large scale, and we expect to see the results of this soon.

Finally, we hope that Norway will continue to be among the leaders in the farming of such new species as cod, turbot, Arctic charr, halibut and lobster.

We have a deep belief in aquaculture as a future growth industry. I personally believe that it will, over the decades, become a substantial supplement to our traditional fishing industry as a source of animal protein. We see this as a natural development of the fisheries industry as we move from capture to cultivation. ●

Bjarne Mark Eidem is the Minister of Fisheries for Norway. This article is a distillation of his keynote address at the opening session of Aquaculture '89 in Los Angeles California, February 1989.



Senate Rules Committee

24 cages x 2900 fish =
69,600

8.5 worker

8,188 fish per worker

gross - \$ 1,000,000 = \$14.40/fish

Working Capital - \$ 480,000

\$14.40/fish

5lb ave fish 288/lb

Suterman's departure from government research came just as his Deer Island project was heading into its first crucial winter, and it left the project without a chief scientist. Typically, Gene Henderson took control of everything from animal husbandry, food preparation and on-site data collection to searching for a source of funds to carry them through the following summer. Salvation finally came

Continued next page

figures just
dont seem
right



sea cages, 447 of which contained salmon for market. An additional 13 held broodstock salmon (11 additional cages contained rainbow trout and 54 were empty). From these 447 "production" cages roughly 341 thousand salmon were harvested, and their value was approximately US\$12-14 million. The 1988 harvest was close to 3,600 mt, worth roughly US\$32 million.

The industry in 1987 consisted of a high proportion of small operations. Only ten percent had more than 50 cages in the water (the largest had 70), and nearly half were operating with fewer than 8 cages, each containing an average of 2900 fish. A medium sized Fundy salmon farm in that year had 24 cages in the water and employed ten people, three of which worked part-time. A farm of this size could have annual sales of approximately one million US dollars, and required roughly US\$480,000 in working capital.

Fundy salmon farming is now a maturing industry that has been in operation long enough to generate numbers on capital and g costs, equipment and tent requirements, and xpectations. It is also possible point to estimate the benefits, the general well-being that surrounds a growing industry. Informa-type is seldom available on istry, yet it is extremely valuable individuals contemplating ie industry. It is also useful rancial institutions that are rovide funds to the industry,

Salmon

Farming in Canada

I. The Pacific Coast

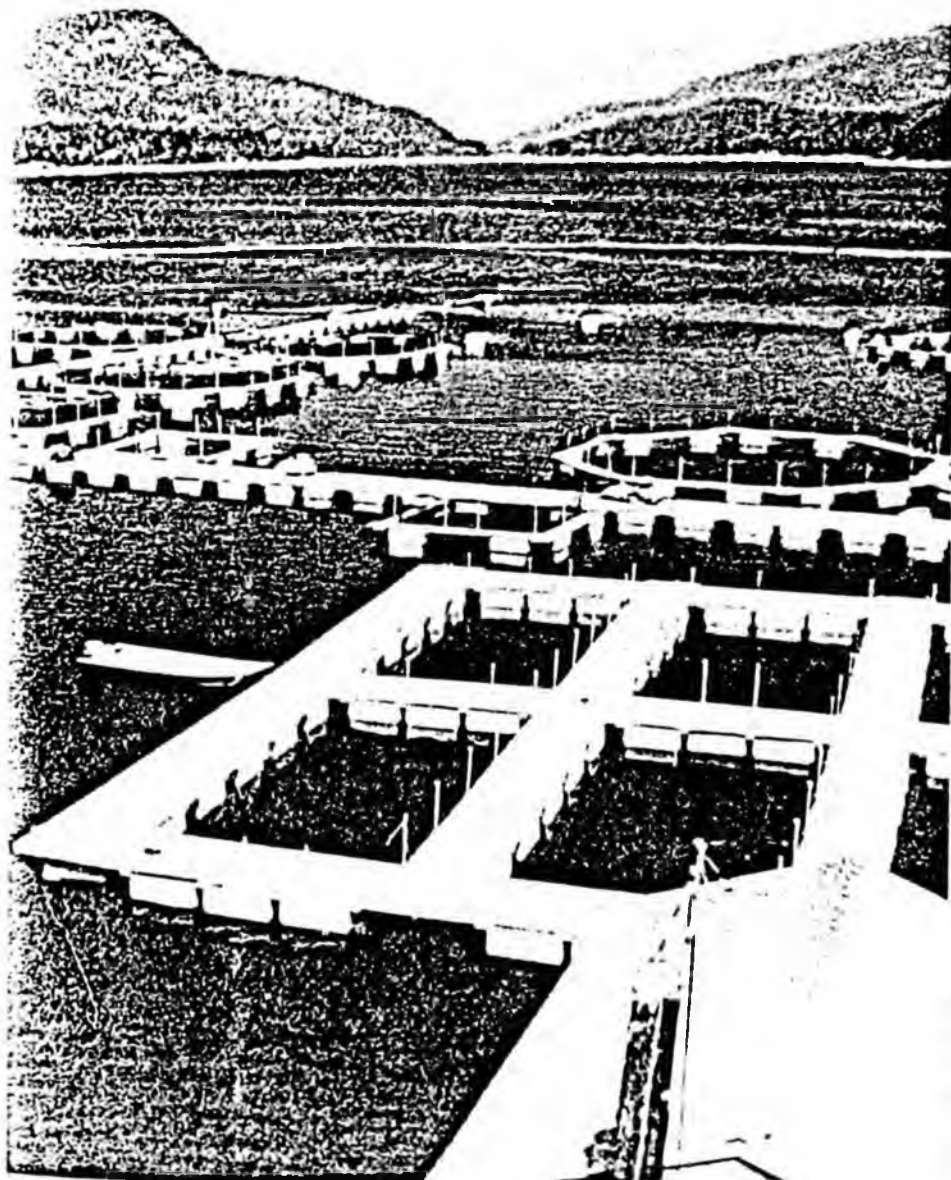
by *Dave Aiken*

Salmon farming has developed rapidly on the Atlantic and Pacific coasts of Canada, bringing investment and employment to areas badly in need of both. In a two-part series we take an in depth look at the past, the present and the future of this industry in Canada.

Salmon farming is booming on Canada's two coasts, bringing the promise of economic rejuvenation on the one hand and the reality of resource conflict on the other.

The boom has infused economically stagnant areas with impressive amounts of cash—upwards of a hundred million Canadian dollars projected for 1989—and alternative forms of employment, everything from direct involvement in the production and growout of fish to full and part-time employment in the many new service and manufacturing activities that provision an industry of this type.

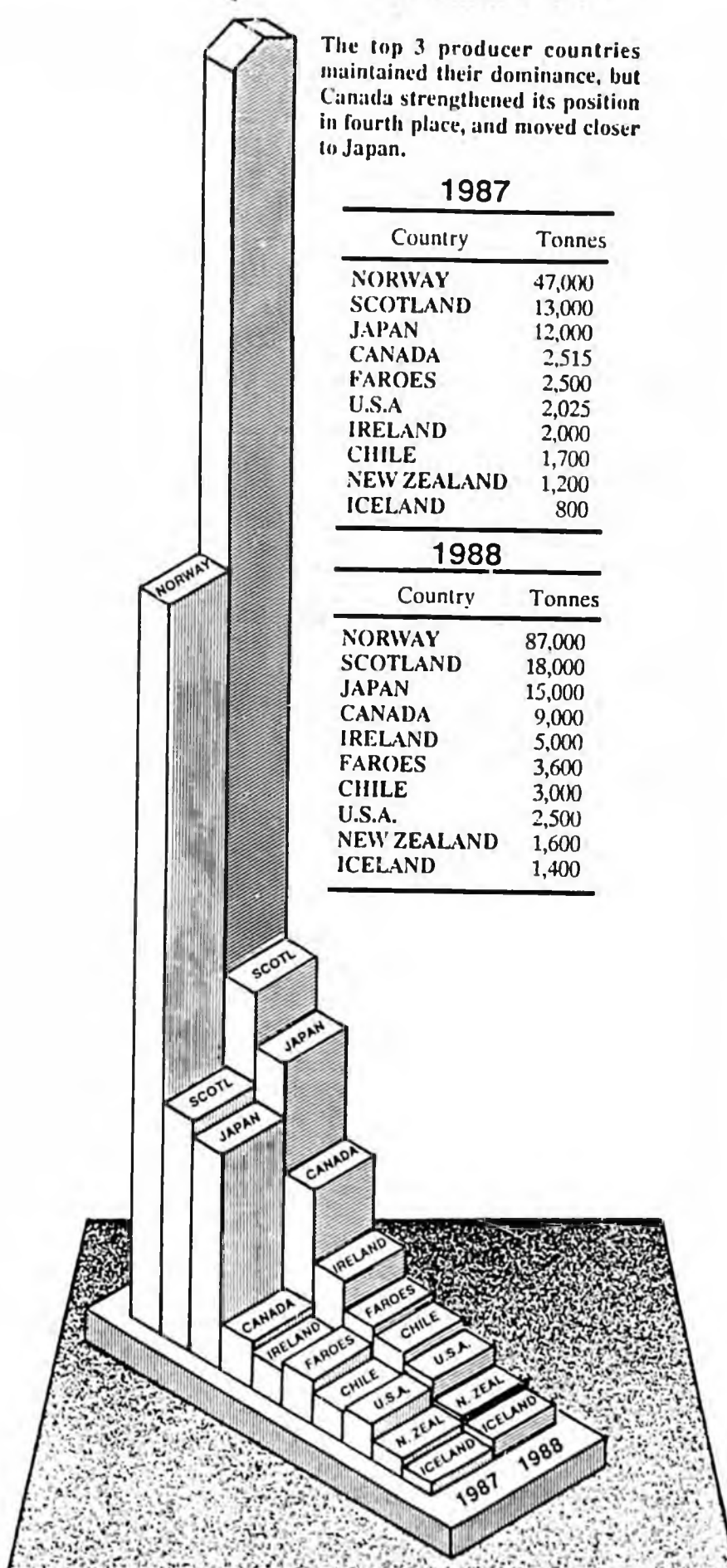
Actually, it's misleading to speak of the Canadian salmon farming industry. There are really two industries, one on the Pacific coast, the other on the Atlantic coast. Both are relatively new industries that grow salmon in net pens, but that's where the similarities end. The aquatic, sociological and





Top 10 producers of farmed salmon in 1987 and 1988.

The top 3 producer countries maintained their dominance, but Canada strengthened its position in fourth place, and moved closer to Japan.



1987

Country	Tonnes
NORWAY	47,000
SCOTLAND	13,000
JAPAN	12,000
CANADA	2,515
FAROEES	2,500
U.S.A	2,025
IRELAND	2,000
CHILE	1,700
NEW ZEALAND	1,200
ICELAND	800

1988

Country	Tonnes
NORWAY	87,000
SCOTLAND	18,000
JAPAN	15,000
CANADA	9,000
IRELAND	5,000
FAROEES	3,600
CHILE	3,000
U.S.A.	2,500
NEW ZEALAND	1,600
ICELAND	1,400

World Perspective

In terms of world salmon farming, Canada is emerging as an important player. Only two years ago the production statistics placed Canada fourth in the world in total weight produced, but clearly one of the "also-rans" clustered well back of the "Big Three" – Norway, Scotland and Japan.

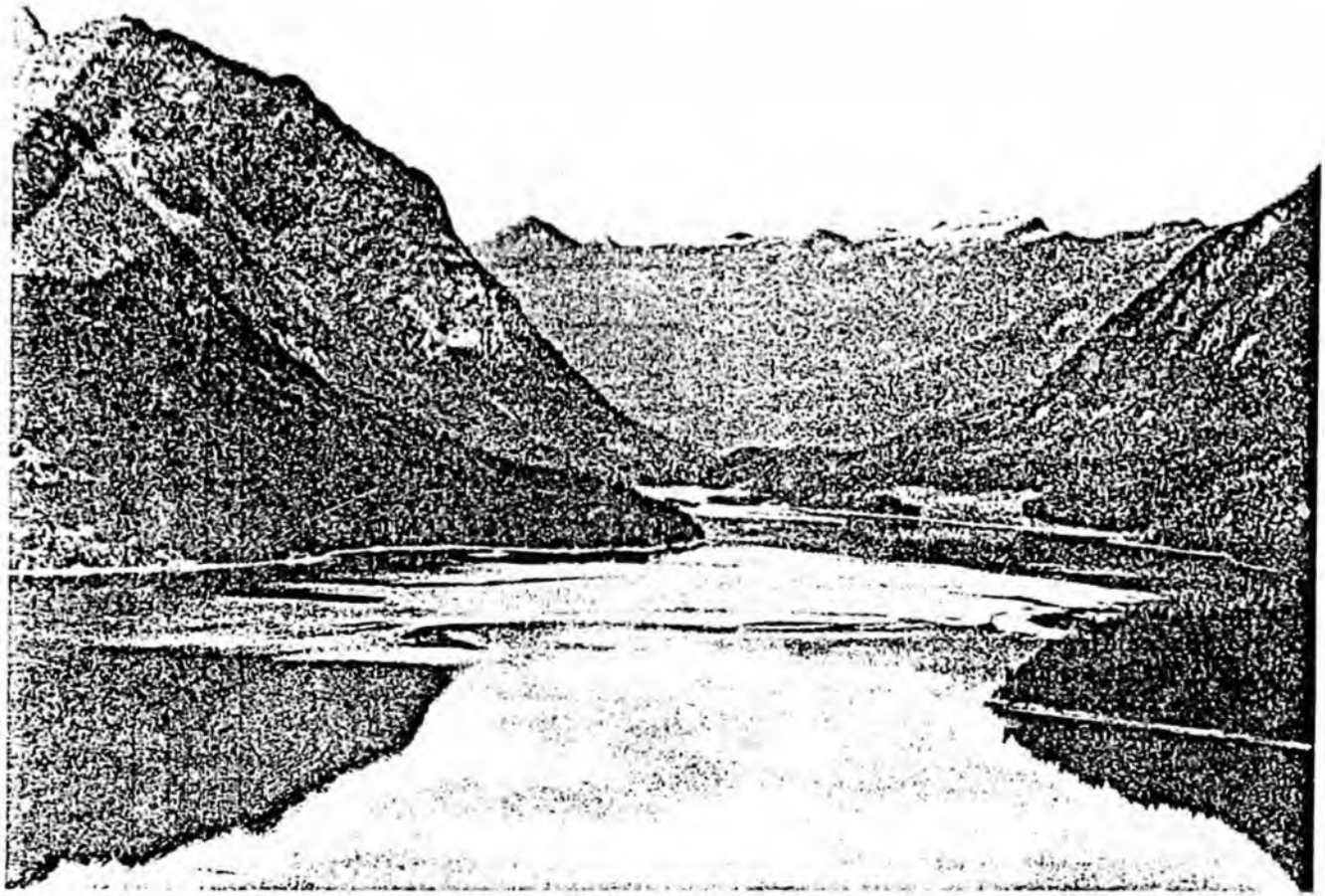
In the 1988 statistics Canada is still ranked fourth, but the large gap between the Big Three and everyone else has disappeared. Japan's lead over Canada has been reduced, and unless there are unanticipated changes in world market conditions, or some serious disruption in Canadian production, this trend will likely continue.

The Big Three

World production of farmed salmon has been dominated by three countries: Norway, Scotland and Japan. Between them they produced more than 80% of the world's supply of farmed salmon in 1988.

Just as the Big Three dominated world production, Norway has dominated production by the Big Three. In each of the last two years, Norway has produced nearly 70% of the combined output of these three countries. More important, Norway expects its own production to increase roughly 20% this year to some 100,000 mt. Historically this represents an order of magnitude increase in production every 6-7 years (Norway passed the 1,000 mt mark in 1976, and 10,000 mt in 1982).

Current projections within the industry suggest a doubling of world production of farmed salmon by 1995, or an additional 100,000 mt on the world market. Two aspects of this scenario cause concern: is the world supply of fish meal adequate to provide fish feed for that level of production at acceptable cost, and what impact will this level of produc-



Many of the British Columbia salmon farms are in gorgeous but remote settings in fjords, miles from the open ocean (and, in many cases, road and rail service).

Developments in Norway

The Norwegian Fish Farmers' Sales Organization estimates the world market can absorb 125,000 mt of Norwegian salmon in 1989, worth US\$600-800 million. Norway's principal market is the EC, which takes 70% of Norwegian farmed salmon. France was the major market last year, consuming 18,700 mt, followed by Denmark (14,000 mt) and the United States (10,000 mt).

Although Japan is the largest salmon market in the world, Norway exported only 2,500 mt to

Japan in 1988, and most of that was fresh product. The Norwegian Export Council feels that the frozen product market has even greater potential. The Japanese imported 120,000 mt of frozen salmon last year, and Norwegians hope to eventually corner at least 30,000 mt of that. One reason for the attraction of frozen salmon is delivery cost. Air freight costs from Norway to Japan run close to US\$2.40 per kilo of fresh salmon, but the frozen product can be shipped for less than US\$0.20. The

potential of the Japanese market has stimulated a marketing push in Norway. The Marketing Council for Farmed Fish has budgeted US\$8 million, a large proportion of which will be directed at Japan. In addition, the Fish Farmers' Sales Organization has allocated funds from its own budget for a sales drive in Japan.

Norwegian exporters have found that small organizational units are ineffective in the world market because they tend toward internal competition and duplication of marketing

effort. They are therefore realigning into larger units that present a more uniform front on the world market. In this way they hope to offset the power of Japanese importers who have wielded considerable influence over prices.

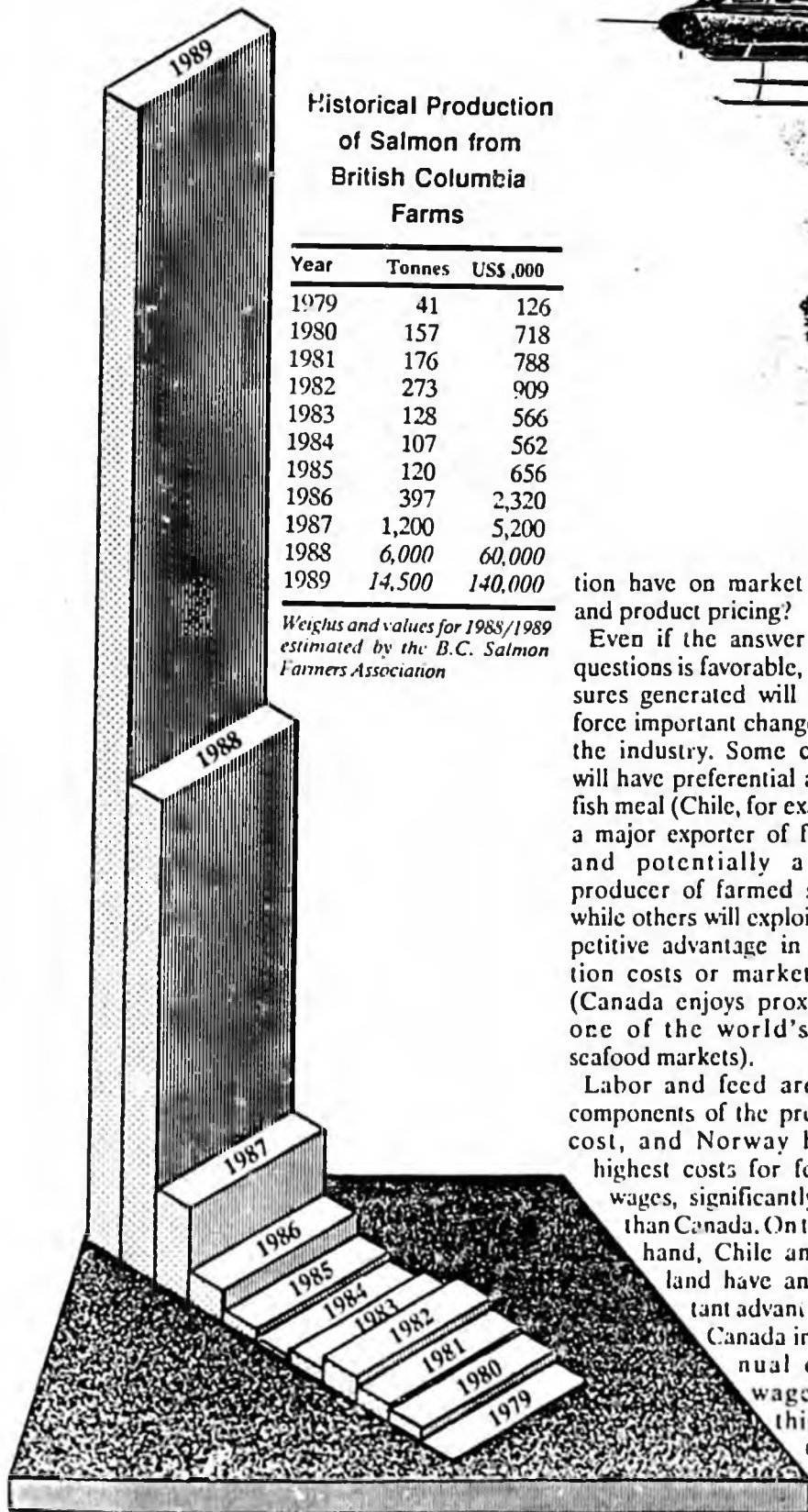
Production

Estimates from the Norwegian industry suggest that the production of farmed salmon in 1989 will be 50% higher than in 1988 due to heavy stocking of

Continued =>

Because of the remoteness of many British Columbia salmon farms, helicopters, fixed-wing aircraft and special live-well boats are used to transport smolts for stocking.

Wm. Penzill



Historical Production of Salmon from British Columbia Farms

Year	Tonnes	US\$, 000
1979	41	126
1980	157	718
1981	176	788
1982	273	909
1983	128	566
1984	107	562
1985	120	656
1986	397	2,320
1987	1,200	5,200
1988	6,000	60,000
1989	14,500	140,000

Weights and values for 1988/1989 estimated by the B.C. Salmon Farmers Association

tion have on market demand and product pricing?

Even if the answer to both questions is favorable, the pressures generated will certainly force important changes within the industry. Some countries will have preferential access to fish meal (Chile, for example, is a major exporter of fish meal and potentially a major producer of farmed salmon), while others will exploit a competitive advantage in production costs or market access (Canada enjoys proximity to one of the world's major seafood markets).

Labor and feed are major components of the production cost, and Norway has the highest costs for feed and wages, significantly higher than Canada. On the other hand, Chile and Scotland have an important advantage over Canada in the annual cost of wages. At this point Canada

is producing a kilo of salmon at lower cost than Norway but at greater cost than either Chile or Scotland.

Prices for fresh salmon may ultimately decline in response to the burgeoning supply, forcing innovative product development and considerable streamlining of production systems. Existing operations should be able to survive price declines of 20% or more, but the rate of industry expansion would slow considerably and new farms still attempting to absorb the heavy initial investment would be under great pressure.

Despite its relatively more expensive labor costs, the Canadian industry appears to be in a good position to weather the period of adjustment that undoubtedly lies ahead. This is an industry whose success depends upon delivery of a quality product, (which means it must be delivered *quickly*). The Canadian industry has the shortest delivery distance of any country hoping to supply the huge United States market, and salmon harvested from Canadian net pens are among the finest in the world.

In addition, the Pacific Canadian industry can ship farmed salmon to Japan more cheaply than Norway,

which gives the Canadian industry a slight competitive advantage in that huge market as well. When the dust settles it may be the developing Chilean industry, not the European industry, that sets the pace and provides the challenge for Canadian salmon farmers.

The Pacific Industry

The Pacific or "BC" salmon farming industry, as it is often called, is located on Vancouver Island and the mainland north of Vancouver. In 1988 approximately 125 farms in this area had fish in the water, up from only ten farms just four years earlier. Interestingly enough, the production capacity

of the BC industry in 1988 was estimated at 21,000 mt, three to four times the estimated actual production, meaning that existing facilities are only partially utilized. Unlike the Atlantic coast of Canada, which has a relatively small number of cage sites, the coastal environment of British Columbia offers an unlimited number of sites that are suitable for salmon farming. In terms of site availability and water quality, B.C. is at least as good as Norway, and may be even better.

Many of the existing B.C. salmon farms are located in remote areas, remote in the sense that they lack road access and electrical service, and therefore generate their own electrical power and receive supplies by air or water from population centers to

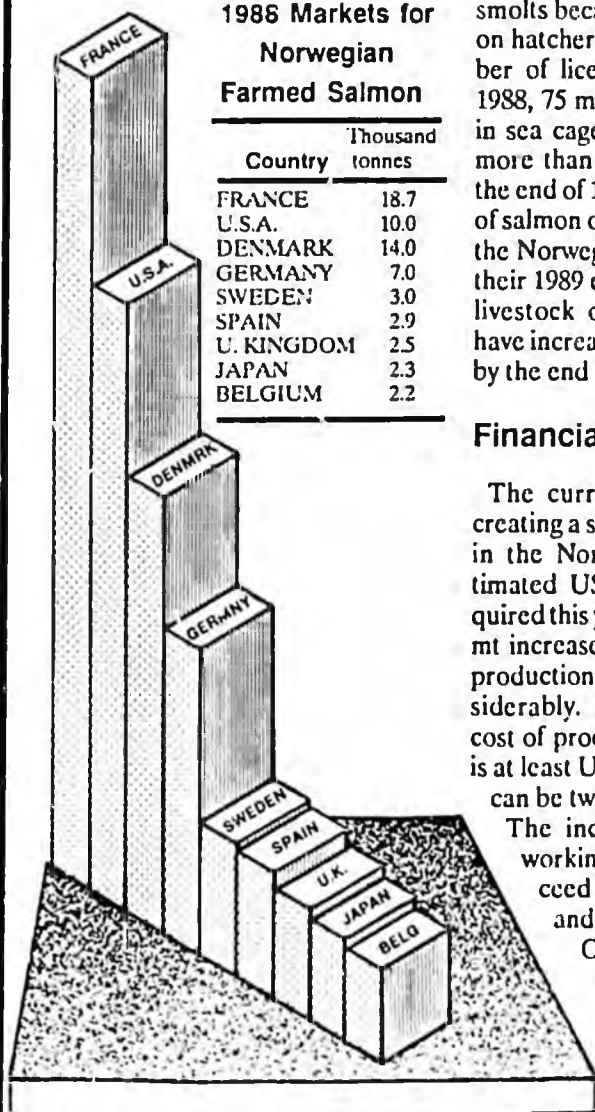
the south. The Sunshine Coast, a major salmon farming area, consists of sinuous fjord-like bays and inlets that reach well inland. In eastern Canada such areas would be unsuitable for salmon farming because in winter the water would chill below the lethal level. In British Columbia the pacifying influence of the Pacific moderates the temperature and eliminates the danger of either ice or superchill, opening many thousands of hectares to farm development.

However, the B.C. coastline is not without hazard or problem. At the entrance to an otherwise deep fjord there is typically a shallow shelf that restricts water exchange and the scouring action of a running tide, reducing the carrying capacity in terms of farms and fish. Certain parts

Norway (continued)

1988 Markets for Norwegian Farmed Salmon

Country	Thousand tonnes
FRANCE	18.7
U.S.A.	10.0
DENMARK	14.0
GERMANY	7.0
SWEDEN	3.0
SPAIN	2.9
U. KINGDOM	2.5
JAPAN	2.3
BELGIUM	2.2



smolts in 1987 and 1988. Until 1985 the industry was chronically short of smolts because of license restrictions on hatcheries. In 1985 a record number of licenses were issued, and in 1988, 75 million smolts were stocked in sea cages for growout, 20 million more than had been anticipated. At the end of 1988 there were 113,000 mt of salmon on Norwegian farms, and if the Norwegians succeed in exporting their 1989 estimate of 125,000 mt, the livestock on Norwegian farms will have increased to a total of 179,000 mt by the end of 1989.

Financial Crunch

The current rate of expansion is creating a shortage of working capital in the Norwegian industry. An estimated US\$320 million will be required this year just to raise the 66,000 mt increase in livestock. In addition, production costs have increased considerably. In southern Norway the cost of producing one kilo of salmon is at least US\$4.00, and in the north it can be two to three times higher.

The increased requirement for working capital in 1989 may exceed the increase in income, and the Fish Farmers' Sales Organization calculates the credit required to relieve the shortage in working capital from 1989 through 1992

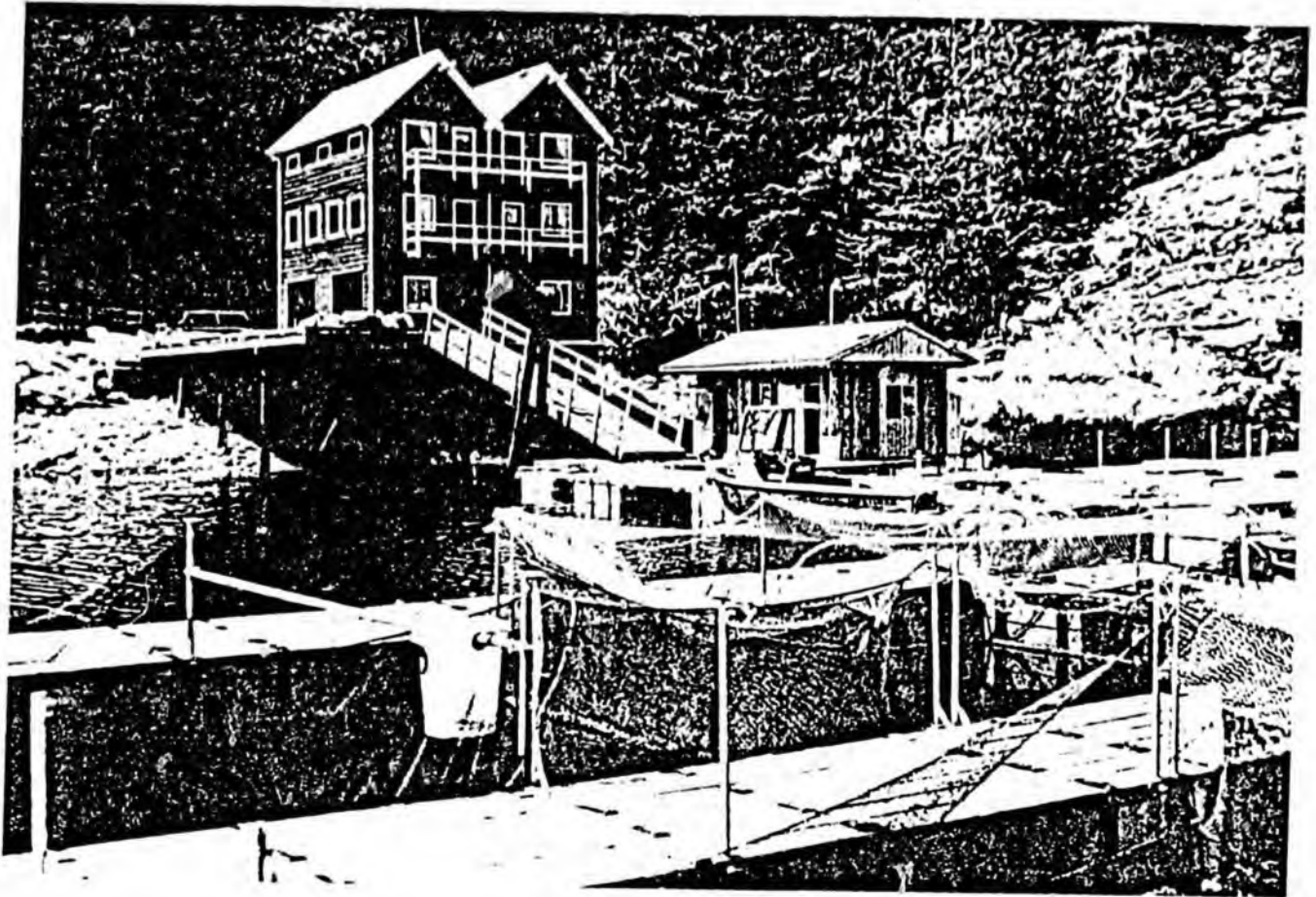
will be US\$6.4, 7.2, 3.0 and 9.6 billion dollars, respectively. Farmers and exporters may therefore be approaching a period of financial stress, and banks have already taken possession of farms that ran short last year.

To finance their purchase of fish feed many farms have had to accelerate their harvesting schedule, upsetting the market. The quantity of salmon harvested in the last quarter of 1988 caused average prices to fall by US\$0.65 during the year.

The problem may be made more acute by the large number of smolts transferred to net pens in the last two years. This spring, additional space will be required for the stocking of more smolts, and this may cause premature harvesting, further depressing the market with salmon weighing less than 2 kilos.

This August, unsold salmon from the 1987 year class will reach maturity, deteriorate in quality and lose their export value, precipitating another crisis. One solution is to freeze these fish (thus the push to open the Japanese frozen-product market), but frozen storage is expensive and the exporters would suffer financially if the storage period was protracted by depressed demand or excessive supply.

Information provided by Tore Saetremyr, Commercial Officer, Canadian Embassy, Oslo.



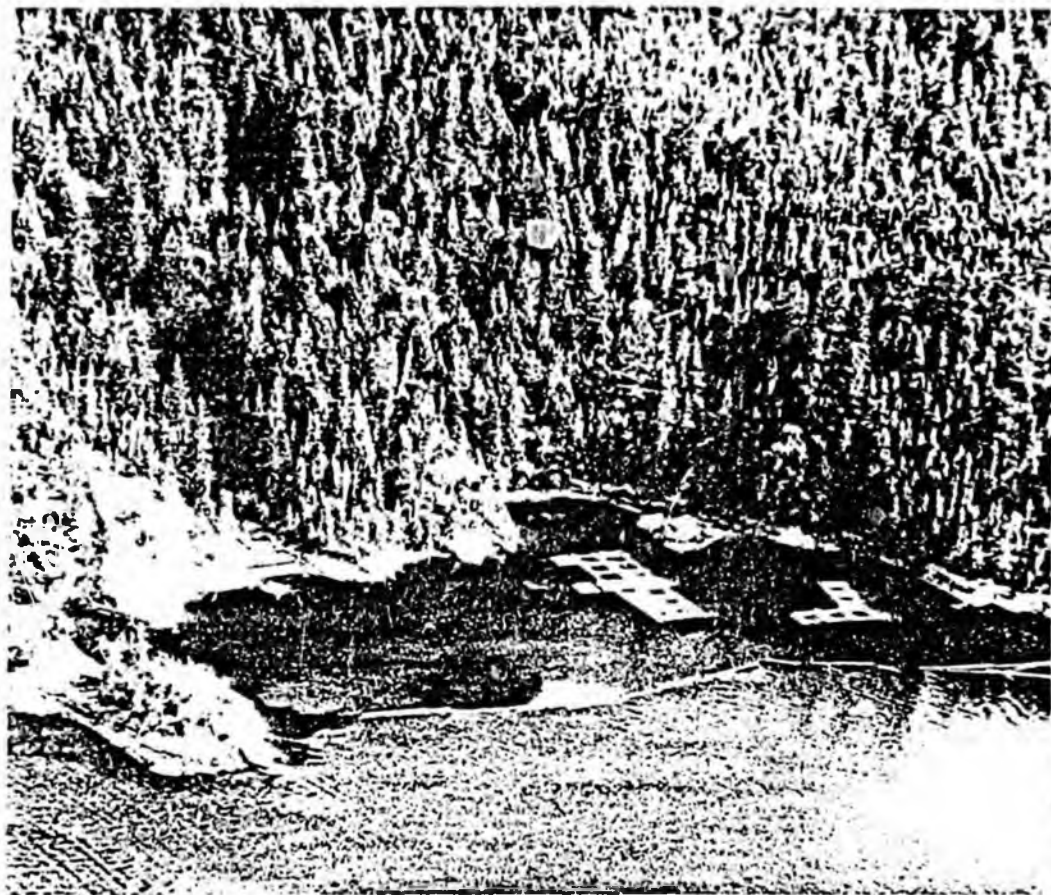


of this magnificent environment are also subject to periodic algal blooms which can wipe out cages of valuable fish. And finally—as always in Canada—there is the threat of winter storms. The generally benign (by Canadian standards) winter climate of the B.C. coast occasionally generates a shocker. One of these, sporting winds in the vicinity of 160 km/h, devastated several farms last January, farms that seemed safely tucked away in Jervis Inlet, a long, narrow body of water running inland north of Sechart. The wind whipped up three metre waves and drove the chill factor down to minus 55°C.

Finally, there is the exquisite remoteness of many of these farms. Remote can be pleasant if the city bustle upsets

Facing page: the remote location of many British Columbia salmon farms makes the servicing of sites more difficult and creates a lonely existence for personnel who run the farms. Top, a farm residence provided by the company as a benefit for staff. Below, net repair at a remote site on the west coast of Vancouver Island.

Bill Pennell



you. It generates the minimum amount of user conflict, which is also nice. On the other hand, remoteness raises the cost of doing business, complicates marketing, and narrows the labor pool considerably. Not everyone enjoys being isolated from the rest of civilization, with little but work and wildlife for diversion, and companies are pressed to find and then keep really good farm personnel in remote locations.

History

BC salmon farming started seventeen years ago with a single commercial license, but it wasn't until the mid-1980s that the industry began to expand. Throughout the 1970s and into the early 1980s a small number of farms struggled with serious development problems. Survival and growth rates were well below expected, financing was exceedingly difficult to obtain, and new farms were under capitalized and therefore unable to survive the extended period of negative cash flow that characterizes the start-up period in salmon farming. Furthermore (and partly to avoid the

Many B. C. farms are tucked into bays along the fjords to gain extra protection from the occasional fierce winter storm. *Left: Most of the B.C. salmon farming industry is located on Vancouver Island and the B.C. mainland north of the city of Vancouver*

hazards of negative cash flow) the early industry concentrated on producing pinksize salmon, which has limited appeal in the marketplace.

It wasn't until 1986 that the B.C. industry began to expand in concert with the salmon industry world-wide, but even then there were problems. Pacific salmon (chinook, coho) have not proved as amenable to domestication as their Atlantic cousins. Their requirement for space is much greater (their maximum stocking density appears to be close to 4-8 kg/m³, considerably less than the 15-20 kg/m³ for Atlantics) and they succumb to bacterial kidney disease (BKD) at an alarming rate.

Coho gradually yielded to chinook as the preferred species, and projections for 1989 indicate chinook will comprise some 75% of the B.C. harvest.

The B.C. industry has also showed some interest in importing Atlantics, and the first eggs from B.C. Atlantic salmon stock will come into production this year. As exotics, these are closely regulated because of their possible impact on resident Pacific stocks.

Current Status

Official 1988 production figures for the B.C. industry were not available as this went to press, but preliminary information indicates about 6000 mt of salmon worth roughly US\$60 million. From fish in the water, industry experts project the 1989 harvest at 14,500 mt, hopefully worth more than US\$140 million, although that will depend on market pressures. This production will come from 125-130 operational farms that employ some 800-900 people (the average B.C. farm employs 7 persons, 2 of which work part-time).

Future

Although only 125-130 farms have fish in B.C. waters, there are 178 approved salmon farm tenures and more than 100 additional plans under review. This, and the fact that even the operating farms are producing well below capacity, suggests the B.C. industry is capable of a major increase in production.

Whether that increase occurs will depend to a large extent on two things: (1) the satisfactory resolution of problems that have plagued the B.C. industry to date; and (2) world-wide changes in salmon production and salmon markets, and their consequent impact on both demand and price.

The B.C. industry has struggled with a number of problems during its development, and not all are satisfactorily resolved at this point.

Seedstock supply has been a constraint in the past, but there are now nearly 40 hatcheries in B.C. In 1988, 50 million eggs were obtained from domestic chinook, and the industry is now considered to be self-sufficient.

Public Opposition is a developing problem in B.C., as it is elsewhere in Canada (and the world). In B.C., unionized salmon fishermen have expressed strong opposition to the expansion of sal-

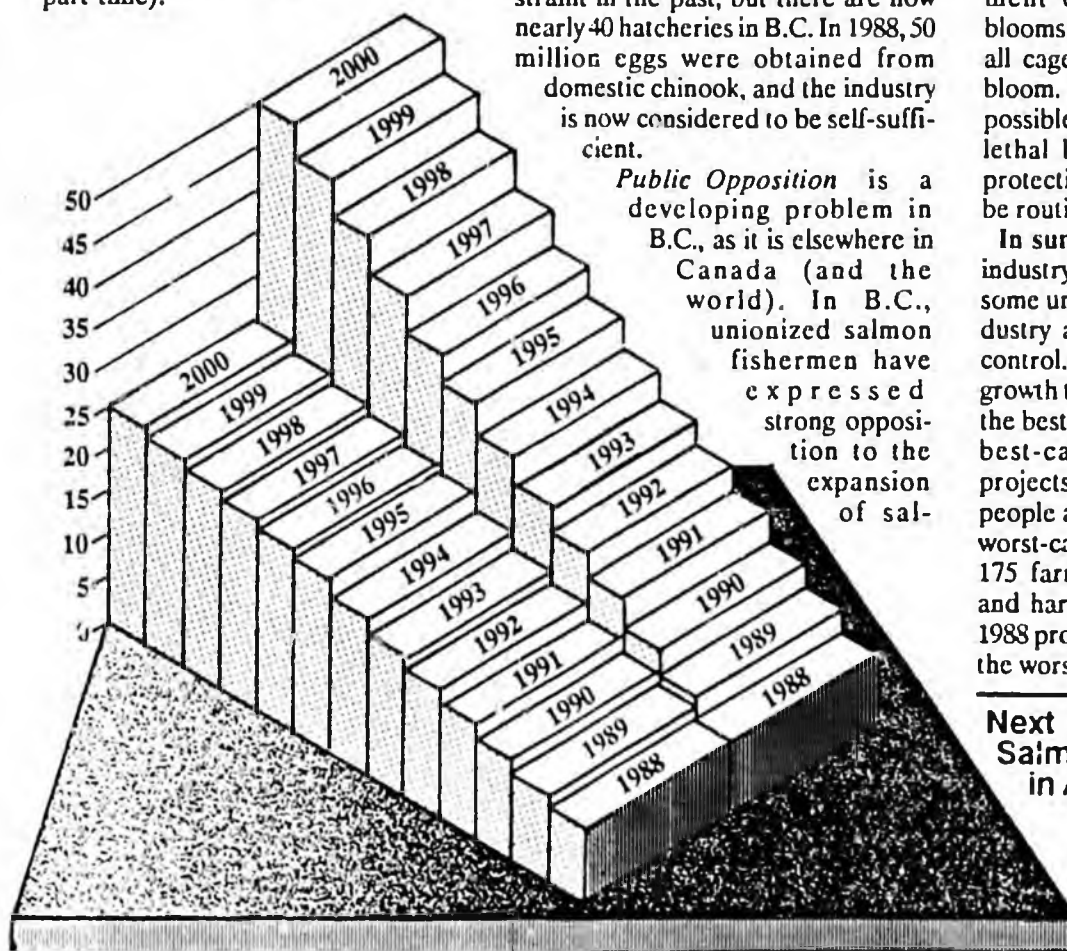
mon farming, citing concerns over the wild gene pool and the spread of disease from domestic to wild salmon. There has also been increasing opposition from local (and often seasonal) residents, upland owners and other users of the coastal marine environment. This latter has been muted somewhat by the general remoteness of the B.C. industry, but it will surely increase if the industry continues to expand.

Mortality of fish in cages (the so-called "inventory shrinkage") has been a nagging problem for the B.C. industry. Pacific salmon have not readily adapted to the constraints of domestication, and have made this point by dying in large numbers. The magnitude of this problem has been reduced by decreasing the stocking density to a fraction of that used with Atlantic salmon.

In addition, the B.C. coastal environment encourages periodic algal blooms of sufficient magnitude to kill all caged fish in the path of such a bloom. Although it may eventually be possible to predict the occurrence of lethal blooms and take evasive or protective action, this is not likely to be routine for several years.

In summary, the future of the B.C. industry depends upon many factors, some under the control of the B.C. industry and others totally beyond its control. Thus projections of industry growth to the year 2000 must allow for the best and worst-case scenario. The best-case scenario for AD 2000 projects 400 farms employing 2,400 people and producing 50,000 mt. The worst-case for the year 2000 projects 175 farms employing 1,050 persons and harvesting 25,000 mt. Given the 1988 production of only 6,000 mt, even the worst-case scenario is impressive.

**Next issue:
Salmon Farming
in Atlantic Canada.**



High and low growth projections for the British Columbia salmon farming industry for the years 1988 through 2000 (thousands of tonnes produced). The high-growth projection assumes a parallel with the Norwegian industry. The low-growth projection assumes continuing difficulty with plankton blooms and other production problems, plus the emergence of market constraints after 1995. [Price Waterhouse study, 1989].



Senate Rules Committee

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14,500 mt - fish

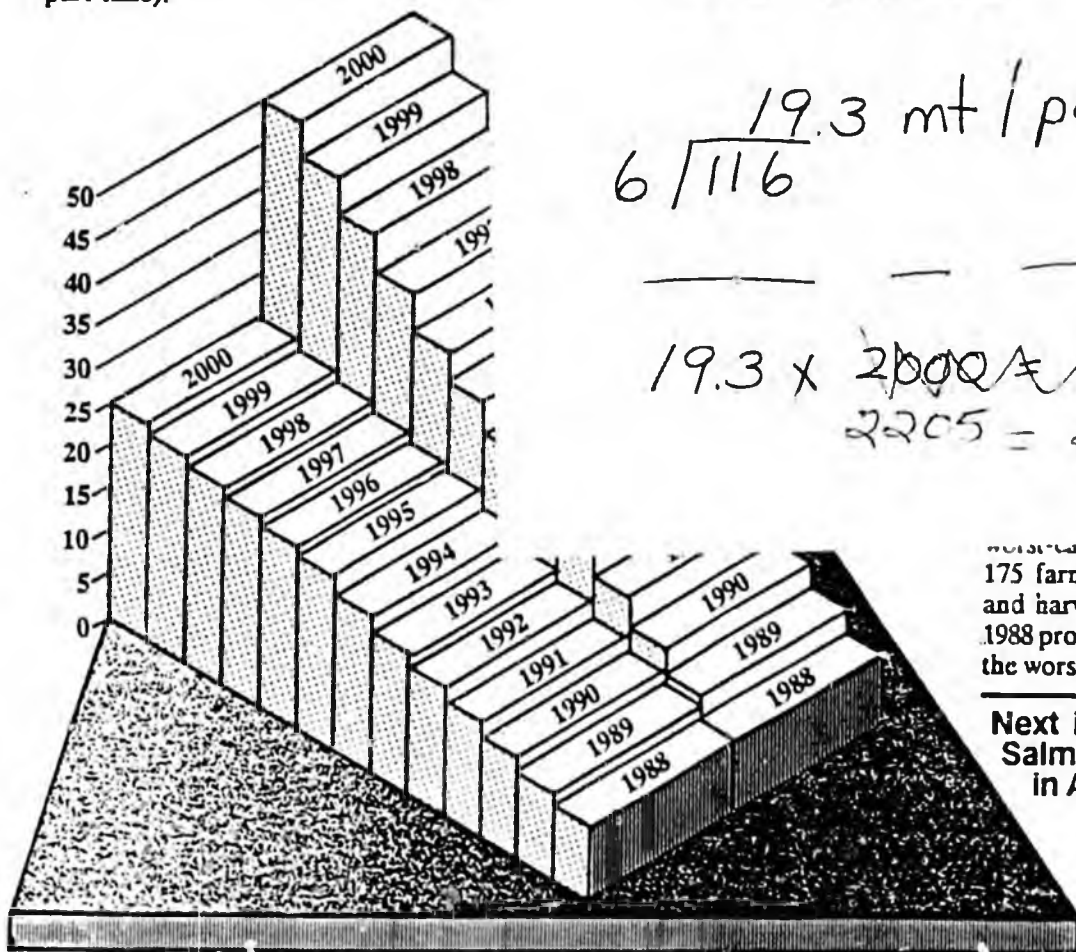
125 farms

7 people / 2-part-time = 6

116 mt / farm
125 $\sqrt{14,500}$

19.3 mt / person (worker)
6 $\sqrt{116}$

19.3 x 2000 = 38,600
2205 = 42,557



Worst-case for the year 2000 projects 175 farms employing 1,050 persons and harvesting 25,000 mt. Given the 1988 production of only 6,000 mt, even the worst-case scenario is impressive.

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SHAKERS

Landlocked Fish Farm Not so Landlocked?

Could a landlocked fish farm be related to the death of 100,000 coho fingerlings in a nearby river? Though the state Dept. of Ecology in Washington isn't exactly saying so, they have noted two "remarkable observations" that come close. The first is that springs lead from the farm's settling pond into the Black River at a location that "looks like

the hottest spot" of the kill, according to deputy director Steve Hunter.

The second is that the aquaculture facility was doing a "drain down" at the time of the fish kills (last August). Hunter said the fish farm discharges several million gallons of water a day into an unlined drainage ditch and settling pond, and that the pond never fills up. No one has been charged, and the coincidence is still just that.

—*Seattle Post-Intelligencer*
Nov. 1, 1989

Want
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ALASKA STATE LEGISLATURE · SENATE

SENATOR RICHARD I. ELIASON

LABOR & COMMERCE COMMITTEE, CHAIRMAN
RESOURCES COMMITTEE
RULES COMMITTEE
SPECIAL COMMITTEE ON HIGH SEAS
SALMON INTERCEPTION
SELECT COMMITTEE ON
LEGISLATIVE ETHICS



*also given
to last
force*

M E M O R A N D U M

TO: Sen. Bettye Fahrenkamp, Chairman
Senate Resources Committee

FROM: Sen. Dick Eliason *Dick Eliason*

DATE: March 16, 1989

RE: SB 195, relating to commercial finfish farming and
aquatic farm and hatchery permits

Unfortunately, I will be out of town on legislative business on Friday, March 17, and will be unable to attend the first hearing on SB 195 (mariculture legislation) scheduled in Senate Resources for Friday afternoon.

I feel that this legislation must be addressed very carefully. Ample opportunity must be afforded for public comment and presentation of scientific information before the Resources Committee determines the best way to handle this issue.

I am sure that you are aware of the growing public interest and concern, in Alaska and elsewhere, relating to finfish farming. The public policy issues and environmental concerns emerging in the controversy over finfish farming require our careful consideration. I have attached a few articles for your information which touch upon some of these matters.

cc: Senate Resources Committee members

Peninsula Clarion

THURSDAY March 2, 1989 Vol. 19, Issue 111 © The Peninsula Clarion/U.S.P.S.

PENINSULA CLARION

Complimentary Copy
For

MEMBERS OF THE LEGISLATURE

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ERA Alaska Airlines
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ALASKA AIRLINES

Borough panel urges fish farming ban

By JON LITTLE
Staff Writer

The borough's Planning Commission urged some observers Monday when it ignored a state agency's request and called on the borough to forbid salmon farming in peninsula waters.

The state currently bans salmon farming, but may someday lift that restriction if studies indicate the practice poses no health risks to

native salmon stocks and other fish.

An amendment was submitted by state Department of Natural Resources officials and other agencies who wanted the borough policy to leave an option for salmon farming in the future.

But the policy supported by the Planning Commission that is set out in a proposed Coastal Management Plan prohibits all

finfish farming within the waters of the Kenai Peninsula Borough.

The DNR wanted the strict policy loosened a little. The agency wanted to continue the ban, but create an option by adding, "until such time as sufficient research, technology and public opinion favor this development."

That is, if the state were to lift its ban, the DNR apparently wanted the borough to be able to follow suit

so it wouldn't but itself off from possible economic development, according to Sylvia Spearow, a borough planner who drafted the Coastal Plan.

Some fears were raised that the amendment would weaken local control on the salmon farming policy, Spearow said.

The seven Planning Commission

See FISH, back page

ALASKA: An OPEC production limit is credited for stabilizing North Slope crude oil prices after months of hefty increases. Page 6.

BUSINESS: High energy efficient houses could be the key in reviving the depressed Alaska building market. Page 8.

NATION: John Tower admits to marital infidelity amidst his vow to keep fighting for Senate confirmation as defense secretary. Page 10.

WORLD: Venezuela death toll keeps climbing as new riots against price increases break out in the western slums of Caracas. Page 12.

Soaring insurance bill slams school district

By MACHELE MARTIN
Staff Writer

The school district's cost for employee health insurance is projected for a 37 percent rise next year and that's one reason district officials are hoping the state Legislature rules out any surprise cuts in funding.

If the state keeps its side of the deal by not tampering with the Foundation Funding formula for local schools, the Kenai Peninsula

said that is why the Anchorage schools have been able to cut their school taxes.

When more students are added to the classroom, it boosts the number of instructional units the formula applies. The formula multiplies a certain dollar amount by the overall number of instructional units to come up with the amount of state funding for each district. On the peninsula, roughly 13 to 17 students equals one in-



...Fish farming

Continued from page 1

members present Monday rejected the amendment in a 3-4 vote, then voted unanimously to accept the Coastal Plan as submitted to them.

"I was real surprised they changed the amendment, I was happy with it," said Sid Cox, a commercial fisherman from Clam Gulch who showed up to testify against salmon farming. "I was stunned to be perfectly honest."

Cox presented a 30-page document he compiled that contains scientific articles and comments from officials involved in salmon farming. He highlighted concerns about the spread of disease through pen-reared salmon and the use of antibiotics and pesticides on

the fish.

The Coastal Plan, which is a list of objectives and policies set by the borough for the development of its coastal region, is still technically in flux. It needs final approval from the Borough Assembly, which follows reviews by separate state and federal agencies.

Salmon farming is also known as "finfish mariculture." Salmon have been raised in floating rectangular pens by Norwegian fishermen for some 18 years. Other countries also allow the practice.

Within the state, some shellfish are raised in underwater farms, and one experimental salmon pen exists near Etolin Island in Southeast Alaska, according to Spearow.

Spearow said she, too, was surprised by the Planning Commission vote but indicated that she was not upset. "If we do feel strongly about finfish farming then we might as well make an absolute statement in our Coastal Plan document," she said.

If the plan makes it through the gauntlet of state and federal review councils with the policy intact, then, "There will be no finfish

farming allowed in the borough," she said.

She said the plan stood a good chance of state and federal acceptance, despite the DNR objections. The borough has worked with officials from the state and federal coastal policy councils in producing the draft plan, Spearow said. "I don't see that we're going to have a problem."

Besides the mariculture issue, some controversy remains over the proposed boundary of the borough coastal zone. The draft plan places everything below the 1,000-foot mark within the borough's coastal zone, which would make the zone stretch from Cook Inlet to the foothills of the Kenai Mountains.

Spearow said she hoped to place the plan in the Assembly packet for its March 21 meeting. Assembly action at that time would issue the draft forward to the state level. The plan would then move on for federal review, and finally return to the Assembly for codification into borough ordinances.

In theory, the coastal plan could be back for Assembly action this fall, Spearow said.

...Insurance bill

Continued from page 1

Great-West, the insurance carrier, is projecting, Swarner said after the meeting.

The district could take bids from other insurance carriers and that's something being considered.

"Any time costs go up like that, you've got to make that an alternative," Sandahl said about switching companies.

But Swarner said increases are occurring nationwide and it's unlikely some carrier is going to be any less. The problem, he said, really rests in the costs of medical care.

Tom Wagoner, chamber member and former Kenai mayor, asked if the employees couldn't begin to share some of the premium costs.

Sandahl said the health insurance premiums are set by contract. The teachers' four-year contract expires at the end of FY 90, and any suggestion to have employees share the cost would be up to negotiations on new contracts.

"We'll open it up for discussion

next year, but let me tell you will be hardball," Sandahl said.

Swarner said any kind of employee payroll deduction benefits would have an immediate savings to the district. If employee dollars deducted be deposited into an account would be used to offset costs for insurance premiums.

Swarner said the district number of insurance claims is 26 percent for unknown reasons.

He said the district brainstormed all it can to cut without cutting benefits. One option under way is the formation of a "wellness" committee.

Various members of labor groups, nurses and administrators work on devising a program to make employees a healthier.

"Without going in and changing the program or employees share the premiums, we've everything we can to cut costs," Swarner said.

Sandahl encouraged business organizations to familiarize themselves with the concerns of the schools and lobby the Legislature for full funding of schools.

...Heart money

Continued from page 1

the funds in the bank until the hospital requests the money. The money will be applied to the cost of the transplant."

The group also stipulated that it would re-evaluate Alexie's progress after six months to see if she were close to her transplant goal. The six-member group will then decide if the money should continue to be reserved for her or donated to someone else.

"If she's not had a transplant and the

money could go to someone else in a life-threatening situation, then we might do that," Swan said. "We've already had two people call up about the money."

Bodle said she felt good about donating the money to someone else.

"It's a good feeling," Bodle said. "Not only for me, but for the donors. I think they'd get a good feeling knowing the money was going to help someone."

Meanwhile, Bodle said she has her good and her bad days.

"I feel pretty good today," she said. "I know I don't have a lot of time left, but I'm going to try to enjoy my days as much as possible."

Carhartt
BROWN DUCK
 Quilt Lined
 Coverall

URGENT!

Mark your calendars! Notify your Members!
Turn out in your area!

We have the opportunity on several dates at several locations to provide citizen input in the development of the Marine Sanctuary designation for Northern Puget Sound and the San Juan Islands.

This new sanctuary plan will set aside certain areas as natural, to be protected from industrial and other exploitation, under provisions of the Marine Sanctuary Law passed by Congress last year.

Thursday, November 8
7 PM

Board of County Commissioners Meeting Room
Courthouse Annex
350 Court Street
Friday Harbor, WA

Friday, November 9
10 AM

Orcas Fire Hall
Eastsound, WA

Monday, November 13
7 PM

City Hall Community Center
Sixth Avenue and Q Street
Anacortes, WA

Tuesday, November 14
7 PM

Island County Courthouse
7th and Main
Coupeville, WA

Wednesday Nov. 15
7PM

John Wayne Marina
Old Blynn Highway
Sequim, WA

Thursday, Nov. 16
7PM

City Council Chambers
540 Water Street
Port Townsend, WA

Friday, Nov. 17
7PM

NOAA Headquarters
Building, 9 Conference Room A
7600 Sand Point Way N.E.
Seattle, WA 98115

**Just Say No to Drugs -
Don't Eat Penned Raised Salmon!**

M.E.C. NEWS

NUMBER 4 • FALL, 1989

A Publication of the Marine Environmental Consortium
P.O. 2638

Friday Harbor, Washington 98250

LEGISLATORS VISIT AQUACULTURE SITES

by

Margaret Johnston

President, Marine Environmental Consortium

Members of the Washington State Legislature's House Fish and Wildlife Committee toured two aquaculture sites October 16th, visiting the salmon pens at Kiket Bay in Skagit County and the mussel growing operation at Penn Cove on Whidbey Island. Representative Harriet Spanel initiated the tour and invited residents in those areas to meet with the committee.

Accompanying the legislators were no fewer than five staff members from interested state agencies and seven aquaculture industry representatives.

MEC was represented by board members Dale Fisher, Dr. Arthur Whiteley, Dr. Anna Marie Johnstone and several others. We were allowed a short 40 minutes to make our concerns about aquaculture siting known to the group.

Last year the House Fish and Wildlife Committee voted our bill, HB 1883, out of committee and may consider other bills on aquaculture when the session begins. In the short time we had we succeeded in letting them know just how strong the opposition to floating aquaculture is in every Puget Sound community where applications for new net pens have been made.

Our 1990 legislative agenda will be discussed at our next meeting where State Representative Harriet Spanel and State Representative Mary Margaret Haugen will be joining us.

If you have suggestions about our legislative initiatives for the 1990 session of the Washington State Legislature, please send them to me or to your MEC Representative.

MEC REPRESENTATIVES MEETING

November 15th

NOAA Headquarters in Seattle,
7600 Sand Point Way N. E., Building
Conference Room, 11 AM.

FRONT LINES: NEWS

FISH FARM IMPLICATED IN CHEHALIS RIVER FISH KILL



Wild salmon found dead in the Chehalis River, August, 1989

Findings of the Washington State Department of Ecology's investigation into the mysterious fish kill on the Chehalis River August 6th were released October 28th, citing pollution from a fish farm as the likely cause.

"The preponderance of evidence is that the fish kill occurred downstream from River Mile 9.2," said DOE deputy director Steve Hunter. That was cited as the starting point for the fish kill, 9.2 miles above where the Black River flows into the Chehalis, just downstream from the point where runoff from a fish farm operated by Global Aqua, Inc. enters the river.

Chemicals had been used to clean tanks at the Global Aqua facility in such a way that they could have concentrated in sufficient strength to kill fish, according to the DOE report. Global Aqua has denied any responsibility for the fish kill.

The Washington Fish Growers Association attacked the state's investigation, saying tests conducted by the aquaculture industry after the fish began to die in the river contra-

dicted that finding. However, the DOE investigation noted the agency had not been able to monitor the industry's tests that were cited as proof the fish farms were not the cause.

Delays on the part of the state in investigating the mysterious fish kill hampered the investigation.

WORLDWIDE GLUT OF FARM SALMON SAVAGES FISH PRICES.

National trade publications and other news sources report a glut of farm salmon, created by substantial production in Chile, Norway, Scotland and Canada, has created a pricing crisis in the Salmon industry.

Industry spokespeople insist the oversupply and price decline is a temporary matter that will be over in a few years. In September, *Seafood Business* reported the aquaculture industry's overstatements and claims

have created widespread distrust "It's no wonder that seafood buyers and investors are leery and confused."

The Vancouver Sun reported 1989 "will be a brutal year for B.C. salmon farms."

Said the Sun "Prices now barely cover the cost of production." By mid August, four B.C. salmon farm operations were in receivership. An industry consultant quoted by the Sun forecast ten per cent of the B.C. salmon farming companies could go under in the next 12 months.

With demand for seafood dropping in the United States, the industry is now planning aggressive marketing campaigns and to produce more expensive products, such as smoked salmon or sturgeon to remain profitable.

Several salmon aquaculture permits that have been issued have not yet been installed in Puget Sound, including a \$12 million Norwegian financed facility west of Port Angeles on the Lyre River which would have been land based, with fish grown in tanks.

MEC'S WHITELEY ADDRESSES PACIFIC STATES FISHERIES COMMISSION

Dr. Arthur Whiteley, University of Washington Professor Emeritus of Marine Biology, was invited to report to the Pacific States Marine Fisheries Commission's 42nd annual meeting in Seattle in October on the additives used in fish farming.

The commission is composed of three representatives from each of the five Pacific Coastal states - California, Alaska, Idaho, Washington and Oregon. Dr. Whiteley said his explanation of the additives and their uses, including substances that artificially color the salmon meat, startled many of the commission members.

The Commission acts as an advisory body to governmental fisheries policy making.

AFLOAT AND ASHORE

State Agencies Press Counties to Support Salmon Net Pen Expansion Plan

Although a number of County Commissioners did not agree there is common ground on net pen aquaculture, the Association of Counties is considering the state's proposal. MEC will monitor the progress of this effort and its impacts on our marine environment.



STATE OF WASHINGTON

October 6, 1989

James A. Metcalf, Executive Director
Washington State Association of Counties
1076 South Franklin
Olympia, WA 98501

Dear Jim:

Thank you for coordinating our gathering on October 3, 1989 with county officials to discuss salmon net pen issues. The session was very productive and promising. This letter is being sent to those in attendance to confirm the matters discussed and to suggest a direction for coordinated action on salmon net pen siting.

Although our discussions were frank and candid, and we understand well the difficult nature of these issues, we were heartened by the encouraging prospect that common ground does exist which may serve as the basis for moving forward to consensus solutions. Specifically there appears to be support for the following general propositions:

1. We ought to clarify state policy on aquaculture and salmon net pens, to clearly define: a) the interests of the State in managing state-owned property and protecting water and aquatic resources; and b) the responsibilities of local governments to exercise land use authority under various state laws, so as to resolve the conflicts that apparently now exist.
2. A properly managed and sited salmon net pen industry can benefit Washington State and local jurisdictions.
3. A state preemptive effort on salmon net pen siting and regulation is an unacceptable option and would only serve to compound an already difficult situation.
4. The state agencies are interested in supporting a net pen industry to be regulated and sited under circumstances that protect water quality and other environmental values. The environmental concerns associated with salmon net pens may be addressed through careful regulation, proper siting, and monitoring.
5. The counties share the state's environmental goals and are vitally interested in maintaining local control over siting decisions. The counties are frustrated by the kind of state review of local decisions that now exists.

Wondering Whatever Happened to the State P.E.I.S. for Salmon Net Pens?

MEC members were among the many individuals who raised serious questions about the adequacy of the state's proposed programmatic environmental impact statement for salmon net pens issued last spring.

Attacked as shallow, incomplete and biased, the P.E.I.S. reportedly has been extensively reworked, and is expected to be released by the first of the year. Stay tuned.

Atlantic Salmon Caught by Puget Sound Anglers

The Seattle Times reported Atlantic Salmon are being caught by sports fishermen in various unlikely locations around Puget Sound, including West Seattle, Bellingham, and two in fresh water streams.

Lee Hoines of the State Dept. of Fisheries is collecting all data on Atlantic Salmon -escapes from fish farms - caught in the state. Muckleshoot tribal biologist Will Sandoval reported fishermen from his tribe have netted a number of Atlantics this year and expressed serious concern that these foreign fish could spread disease or successfully spawn, displacing native salmon.

MEC Grows to 26 Members

It only took a rumor of a salmon pen application to convince some 80 residents of the Eld Inlet area near Olympia to organize and join MEC.

Citizens in other areas have formed action groups and have joined MEC to battle threats to the marine environment. They are - Vashon-Maury Island Citizens, Whiskey Creek Organization on the Olympic Peninsula west of Port Angeles and Colvos Passage Coalition at Gig Harbor.

James A. Metcalf
October 6, 1989
Page two

6. The state agencies and at least some counties are open to exploring alternatives that may lead to a coordinated state/local approach to salmon net pen siting and regulation. That discussion could include representatives from industry, environment, the tribes, upland landowners and other affected interests.

Although many possible solutions were discussed, the state agencies recommend that we include other affected interests in these discussions before developing specific proposals. Many expressed the need to consider our discussion further and to confer with constituents.

Based upon the foregoing the state agencies recommend that a task force reflecting the interests of the state, the local governments, the tribes, environmentalists, the net pen industry, upland landowners and others be formed as soon as possible for the purpose of tapping the community's expertise in this area and forging a consensus based on the best technical information and consistent with the general principles outlined above. Such a consensus should have the result of providing for a viable salmon net pen industry in Washington State with coordinated state/local regulation and proper environmental safeguards.

We would ask that the various county representatives who attended our meeting last week advise you by October 13, 1989 of their interest in participating in such an effort. If the response is positive, a task force will be formed. Because the legislative session is approaching, time is of the essence. We would appreciate everyone's prompt consideration so that we can get moving on this issue.

We look forward to a constructive and positive coordinated effort.

Sincerely,

Brian Boyle
Commissioner of Public Lands

Joe Blum
Director, Department of Fisheries

Chris Gregoire
Director, Department of Ecology

Alan Petubone
Director, Department of Agriculture

c Attached List



Ms. Laura Demeron
 S.E. Alaska Conservation Co.
 P.O. Box 021692
 Juneau, Alaska, 99802

- Camano Cove Association
- Blomquist Beach Association
- Camano Homeowners Association
- Frenchman's Cove Defense Fund
- Griffin Bay Preservation Committee
- Hood Canal Environmental Council
- Holmes Harbor Preservation Association
- Kidlet Bay Org. Vashon
- Oak Bay Coalition
- North Discovery Bay Association
- Save Discovery Bay
- South Point Coalition
- Save Our Shores
- Saratoga Cove Foundation
- Save the San Juans
- Guemes Island Property Owners Association
- Clean Up South Sound - C.U.S.S.
- Lone Rock Defense Fund
- Whiskey Creek Organization
- Eld Inlet Citizens Against Pollution
- Colvos Passage Coalition
- Vashon-Maury Island Citizens
- ORCA
- Yukon Harbor Concerned Citizens
- Save Fort Stevens
- Fern Cove Environmental Council

M.E.C.
MARINE
ENVIRONMENTAL
CONSORTIUM
P.O. BOX 2688
FRIDAY HARBOR, WA 98250

SEAWEED FIRM "RESTRUCTURED"

American Sea Vegetable, the closely held firm that applied in Skagit County to install the world's largest nori seaweed aquaculture operation is being "restructured," according to its president, John Olson.

The original ASV proposal drew national media attention and raised a storm of protest from citizens and environmentalists throughout the northwest from many other parts of the nation when first proposed.

ASV originally sought permits in Burrows Bay and off the northeast shore of Guemes Island for almost 1.7 square miles for its proposed nori cultivation. The Burrows Bay site application was withdrawn and the Guemes proposal eventually reduced to 376 acres in two sections, one on each side of Jack Island, a Nature Conservancy property off the northeast Guemes shore.

ASV operated a "test facility" on the eastern shore of Vashon Island for several years. Aquaculture industry sources indicated the firm's southern Puget Sound operation was not a commercial success.

Mr. Olson was engaged last year by

a Canadian aquaculture firm, Canada West Nori Products, for whom he cultivated nori at Stuart Island that was processed in Victoria.

Canada West president Gordon Smith told MEC that Mr. Olson is no longer associated with his firm. He also stated that his operation is far smaller than the ASV proposal for Washington state, and that he views nori aquaculture as incompatible with settled areas like the ones sought by ASV in Skagit County for nori culture.

Smith said his firm soon will relocate to a remote section of the

west coast of Vancouver Island to minimize use conflicts.

Mr. Olson's partner in ASV, John Merrill, Ph.D., has formed a separate company.

Mr. Olson told MEC that despite the reorganization of his company, the application with Skagit County for a seaweed aquaculture project off Guemes will continue.

As of Nov. 1st, Skagit County's Dept. of Planning and Development has yet to rule whether or not the ASV proposal should be required to prepare a site-specific environmental impact statement for this project.



ASV test farm, Vashon Island, 1987

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF THE COMMISSIONER

STEVE COWPER, GOVERNOR

400 WILLOUGHBY AVE.
JUNEAU, ALASKA 99801-1798
PHONE: (907) 465-2400

April 25, 1989

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

Dear Senator Eliason:

Thank you for sharing with us your interpretation of the legislative intent of AS 41.21.302 which allows aquaculture "facilities" within a marine park. The hearing record did not provide any definition of the intent.

The park regulation has been suspended, in part, because of the many comments and questions which we received. The process may be resumed this fall with additional public and agency participation.

Sincerely,

Lennie Gorsuch
Commissioner

cc: Neil Johannsen, Director
Division of Parks and Outdoor Recreation



MEDIA RELEASE

Alaska Department of Natural Resources

Lennie Gorsuch, Commissioner
400 Willoughby Ave., 5th Floor
Juneau, Alaska 99801
(907) 465-2400

Public Affairs Office
P.O. Box 107005
Anchorage, Alaska 99510
(907) 762-2451

DIVISION OF: Land and Water Management CONTACT: Janet Burleson or
John Thiede
RELEASE DATE: November 27, 1989
SUBJECT: First Aquatic Farm PHONE: 465-3400
Opening Draws 54
Applications

The state's first aquatic farm filing period netted the Department of Natural Resources 54 applications for aquatic farmsites on state tidelands located in Southeast Alaska. The 60-day filing period ended October 30th. Nineteen of the applications were for farms located in the Stikine-Admiralty Island Group; eighteen applications were filed for the Prince of Wales Island area. Six applications were for locations in the Wrangell Narrows, five on Etolin Island and four in Sitka Sound.

"This was the first opportunity for potential aquatic farmers to apply for a farmsite under a law passed by the 1988 legislature" said Gary Gustafson, director of the Division of Land and Water Management. "We are pleased with the response and believe that this fledgling industry is off to a good start" he added.

State agencies are now reviewing the applications. Public notice announcing a 30-day comment period and a hearing about the applications will occur after the first of the year.

. . . More . . .

Aquatic farmers who are awarded permits will be growing shellfish or sea vegetables. A legislative moratorium on finfish farming will continue until July 1, 1990.

The 1988 law requires the Department of Natural Resources to create aquatic farm districts and hold 60-day application filing periods in each district at least once each year. The department will make a decision on when to open the filing period for the districts located in the southcentral area of Alaska sometime in late November or early December.

End # #

Department of Natural Resources
Southeast Region
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OFFICIAL BUSINESS
STATE OF ALASKA
STATE PENALTY FOR
PRIVATE USE



Sen. Richard Eliason
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Juneau, AK 99811