

ALASKA LEGISLATURE SPECIAL COMMITTEE/SUBJECT FILE 8672

1879 SCOMM 75: MARICULTURE (FISH FARMING), 1987-1990

**KODIAK SEINERS ASSOCIATION
P.O. BOX 2399
KODIAK, ALASKA 99615
907/487-4939 907/487-2456**

February 14th, 1990

Dick Eliason
Rm. 417, Capitol
P.O. Box V
Juneau, AK 99811

Dear Mr. Eliason:

The Kodiak Seiners Association supports bills HB 432 and SB 397 that would prohibit fish farming in Alaska. Much has been written in the fishing press on this issue. To avoid redundancy, we agree that the reported health and genetic complications arising in fish farms throughout the world, the potential for dangerous health implications for our presently healthy and abundant natural salmon stocks, and the potential for disruption and degradation of wild salmon markets, are reasons enough to justify the ban.

Taxes on Alaska's natural fisheries resources being the second largest source of revenue for the State, it would be irresponsible to place finfish resources at the risk by their possible exposure to disease-prone farm fish. In addition, were the same State monies that would be needed to fund the development and regulation of fish farming devoted instead to the enhancement of existing hatchery and wild salmon runs, the State would realize a certain and almost immediate revenue gain.

Finfish farming would be a counterproductive graft onto the healthy body of Alaska's natural fisheries.

Sincerely,

Kodiak Seiners Association
Board of Directors:

Eric Manzer
Oliver Holm
Dana Reid
Chip Treinen

Dave Kubiak
Jeff Povelite
Chuck McWethy
Armin Reimnitz

cc: Arliss Sturgulewski
Steve Frank
Bill Hudson
Dick Eliason
Bettye Fahrenkamp
Mike Davis
PWS Seiners Association

Rick Halford
Fred Zharoff
Cliff Davidson
Jalmar Kerttula
Mike Navarre
George Jacko

Gov. Steve Cowper
Bert Sharp
Walt Furnace
Richard Foster
Curt Menard
SE Seiners Association

2 February, 1989

Re: Fin fish farms

Senator Bettye Fahrenkamp
Chair, Senate Resources Committee
P.O. Box V
Juneau, Alaska 99811

Dear Senator Fahrenkamp:

I am a marine biologist, formerly with the Auke Bay Laboratory (NMFS) as a Fisheries Research Biologist. I am not and never have been a commercial fisherman, and there are times when I am not in complete sympathy with their agenda. However, in the case of finfish farming in Alaska, I am entirely in accord with their position.

I don't oppose finfish farming in Alaska because of markets, but because of biology and my deep concern for subsistence and sport fishing here. The concerns about genetics and about disease are valid--in fact I feel they haven't been strongly enough expressed. However, the issues are extremely complex, and it is very hard to express complex issues to the public, and especially to financial interests that do not wish to give them credence.

The scientific evidence of probable harm is strong. The reassurances that no harm will be done should be examined with the same hard nosed skepticism that should have been evidenced when we were assured that oil spills would do little damage (remember the pipeline controversy?) The risks are just too great, no matter what "plans" and assurances are given.

Please reconsider your position on fin fish farming in Alaska. And please remember that biologists in public positions are prevented from speaking out--I can only speak because I no longer work for NMFS. There is plenty of educated opinion out here that fin fish farming is a bad idea.

Thank you for your consideration.

Sincerely,

Natasha I. Calvin
Box 2966
Sitka, Alaska 99835

Nancy J. Hillstrand

Kitoi Bay

Kodiak, Alaska 99697

Greetings honourable Bettye M. Fahrenkamp,

I am a Fisheries biologist/ Culturist for the State of Alaska. I have 12 years of experience in this field.

I am very concerned about ~~fish farming in Alaska~~ and its impact on our healthy productive fish populations.

We have a unique situation in Alaska. Alaskan river systems contain over 60% of all Salmon stocks in the world. We without a doubt must not jeopardize this unique natural wonder for economic gain of select promoters. Senate Bill # 397 and House Bill #432, would help to assure protection of this valuable resource.

The maintenance, and restoration of the chemical, physical, and biological integrity of our waters is the primary building block of our fisheries. Without this our fisheries resource would be jeopardized.

I've traveled to New Zealand and have witnessed the Salmon Farming operations there. I observed farm fish escaping into the oceans with no enforcement oversight. There were continual problems with ocean bottom contamination, and disease had entered into their operations making antibiotics and chemical medications and vitamins an additive to their feeding program. Such would without a doubt be the case in Alaska, where our enforcement over Natural Resources is feeble at best.

Genetics were geared toward selective breeding for docile fast growing fish. I have some photos of some of these sad looking Salmonids, if you would like to see them. These genetic traits would be deleterious to our strong ocean run Salmon.

Lax regulation and oversight to curtail these massive problems of contamination would most likely occur as we have seen this to be human nature.

Ocean run chemically free fish stand on their own merit. To have a fresh ocean run Fish on the market is a market all of its own. In New Zealand farmers admitted that there is no comparison in taste and quality between ocean run and farmed fish. We have the quality product. This will be a specialty item in a comparative market of farm grown, colour added antibiotic filled fish. We must always protect our image of clean fresh wild status, because it is the rare exception and not the rule on Earth and this trait will be a continuing asset in all future dealings of commerce, tourism, and economic well being in the state of Alaska. We have something the rest of the world has lost or destroyed. This is our future Bettye.

The seafood industry is Alaska's largest private basic industry employer, providing nearly 70,000 seasonal jobs which translates to 33,000 direct, indirect and induced year-round jobs. This doesn't include revenues from our giant Sport Fisheries industry which could also be at risk.

This industry is the second largest revenue generator in the state. Fishermen paid \$27 million in fish taxes during 1987, and were the major contributor to the marine fuel tax.

Expenditures in Alaska on goods and services in support of processing and harvesting are nearly \$300 million.

Alaska leads the nation in value of commercial seafood landings. The 1987 Harvest was worth \$1.1 BILLION. In 1987 the wholesale value after primary processing was \$1.9 BILLION. 1988 exceeded this to \$3 BILLION. The Salmon fishery is the most important, bringing in 42% of all harvest income. This fisheries is critically dependent upon protection of stock genetics, disease prevention and wise management. Under no circumstances must we jeopardize this resource.

Fish are a renewable natural resource if managed and protected properly under the Clean Water Act. Prevention of adverse impact will contribute substantially to the health and welfare of this resource and livelihoods directly and indirectly related to and including tourism, Sport, Commercial, and Subsistence fishing for future generations to come.

The future of the quality of our aquatic ecosystem is on the line. Without this quality we question just how long our fisheries and those in harmony with them will continue to last favourably. We have these viable industries which add great revenues to our economic health. Finfish mariculture and these viable industries cannot and should not be allowed to coexist.

With Kind Regards,

Nancy J. H. H. H.

cc: Jalmar Kerttula

Mike Navarre

Walt Furnace

Bill Hudson

Bert M. Sharp

Richard I. Eliason

Steve Frank

Rick Halford

Artiss Sturgulewski

George G. Jacko

Mike Davis

Richard Foster

cc: Fred F. Zaroff

Cliff Davidson

Curt Menard

Paul A. Fischer

C.E. Swackhammer

from Pages

allms around the world to peacefully demonstrate their feelings and to protest, but asserts that an author must be allowed to present his views "without fear of reprisal or reats of death." The letter states, respect and tolerance for the views and opinions of others - no matter how urgent they may be - are the foundation which makes the civilized relations among nations possible."

Other organizations signing the letter: The Authors League of America, Authors Guild, The Dramatists Guild, The Writers Guild of America-East, The Writers Guild of America-West, PEN, American Center, National Writers Union, Washington Independent Writers, Washington Independent Writers Legal Education Fund, Writer's Center, American Association of State Colleges Universities and Council of Writers Organizations."

Members of the Homer Public Library Advisory Board join the ALA and other groups in this protest. If we value our freedom, we must not give in to censorship by intimidation.

Homer Public Library Advisory Board

Firefighters are the best

Dear Editor,
Homer Volunteer Fire Dept. and Friends,
The Homer Volunteer Fire Dept. has again shown its high-quality and professionalism, which we are lucky enough to have on our side, battling a fire in our house last night. We felt that our recognition and thanks for such a fine group of people should be shared with all of Homer. I thank also to Al Kimker who was here to help contain the fire when the firefighters arrived. With all the quick efforts by these people we were able to save most of the house.

personally in such an emergency situation before this, we feel content knowing that with such a great group of professionals and friends, most obstacles can be overcome with only minor setbacks.

Thanks again to everyone who has shared their clothes, compassion and especially concern during this ordeal with us.

Susan Polis and Christie Trujillo

Thanks

Dear Editor,

Homer Loan-A-Seat would like to thank the Kachemak Bay Lions Club for their generous support of our Toddler Car Seat Program. Their donation of \$900 will go toward the purchase of up to 50 new toddler seats for community rental. Without their support, many local families would be unable to protect their children in the car. Please support Lion's Club activities whenever you can. They make a big difference in our community!

Karen Davis

Protect your own

Dear Editor
and Alaskans,

During the past years we had the chance to visit quite a few areas of your magnificent country. We were always overwhelmed by its outstanding beauty and all the hospitality and friendship we found. To us Europeans, it is a true wonder to see and experience the wild mountain ranges, the pristine forests, the rolling tundra, the miles and miles of virgin coastline, the crystal clear lakes and rivers, all populated by a still abundant wildlife that we usually know only from books. Truly your country is one of earth's last jewels and being allowed to experience and enjoy all these wonders must be considered a great luxury.

And yet we hear with great concern, that even your country is about to fall victim to human greed and shortsightedness. Once again industrial development is threatening even the remotest and most important wilderness areas.

That desperately reminds us of our own

peans were still convinced that the unlimited growth of our industrial societies and the ingenuity of human science would solve all our problems. We would all have jobs and be wealthy, have a free medical and educational system and enjoy all the achievements of modern technology. We firmly believed in all these slogans like "progress must go on," "you can't turn the wheels backwards" and "who wants to live in the trees again." Of course the environment would have to suffer a little bit, but we took that into the bargain. So, we carried on and thought "to hell with the do-gooders and bird-watchers."

And now, did we achieve these goals? Well, quite frankly, no. Somehow the biggest problems like the growing unemployment rate, inflation, poverty, increasing criminality and prohibitive taxes are still waiting to be solved and for the few undeniable advantages of progress we now have to pay an immense price. Just a few examples: Our forests are bound to die as already every second tree is dead or diseased; this winter practically all major cities were living under nearly constant smog alerts and people were warned not to let their children play outside because the snow was poisonous; most of our rivers and lakes are just stinking and poisonous sewers (maybe you have noticed that one of our biggest rivers, the Rhine, just recently passed away) and the consequences of the Chernobyl disaster, which wiped out the culture of the Laplanders, are threatening our existence for years to come.

Only now we are beginning to realize, whether we like it or not, we are a part of nature and that the destruction of our environment inevitably leads to our own annihilation. Our present civilization, based largely on reckless exploitation of resources, is now seen to be in a state of disintegration. By now even politicians and high ranking industrial managers are advocating strong measures against pollution. But we taxpayers will now have to spend hundreds of billions of dollars to restore just the most important foundations of human life. We will never be able to restore the environment to a state you are still enjoying in Alaska, but we hope to get back to the state

of pollution we had in the late sixties. most of our natural wonders it will, course, be too late. But we might at least survive.

If we mention our sad experiences it is only because you Alaskans can still avoid the disastrous road leading into a mess of nearly unsolvable problems. All Alaskans must seem to love their country and to be well aware of its richness and outstanding beauty. So there is still some hope that you will handle your country more carefully.

Alaska, with its beautiful wilderness areas, now belongs to the countries most favored by European tourists seeking a lost paradise. During the past five years more than a dozen travel agencies here in Switzerland alone have added Alaska wilderness trips to their program.

But now we are all watching in alarm, even the remote Arctic National Wildlife Refuge is about to be sacrificed to the oil industry, and we can hardly believe that even the important coastal areas like Kachemak Bay with their immense riches of marine life, which support so many jobs in the fishing industry, are threatened too.

Of course, we are well aware that according to the recent study of the U.S. Ministry of Energy, the ever growing want for energy is the reason for opening even parklands and coastal fishing areas to the oil industry. Yet it is widely known and scientifically proven, that tundra and coastal areas are extremely susceptible to industrial impacts, and many accidents on our coasts have shown that a single oil spill can wipe out marine life in a huge area, with usually devastating effects on the local economy. It is also known, that the world's oil reserves are nearing exhaustion and that sooner or later we will all have to find a way of producing energy that is really unharmed to life. It therefore seems unwise to sacrifice Alaska's most beautiful and richest areas, just to secure the oil supply and the abominable waste of energy for another ten or twenty years.

So please take good care of your country, for it is probably the last country which really deserves the title "God's own land."

Martin and Nick Rippmann
Switzerland

North Sea pollution worries fishermen

Los Angeles Times

BONN, West Germany — The North Sea, traditionally one of the richest fishing grounds in the world, faces ecological disaster comparable to "a marine Chernobyl" if industrial, nuclear and agricultural waste dumping is allowed to continue, experts warned this week.

The fears, long voiced by militant ecologists, have become increasingly real for coastal residents in recent weeks: in less than a month, more than 300 seals have been washed up dead on the coasts of West Germany while further north a broad belt of deadly algae has killed all life in large areas off the coast of Norway.

The seals were all found to have died from liver inflammation caused by a herpes-type virus. West German Environment Minister Klaus Toepfer, who visited Sylt Island off northern Germany on Sunday said the deaths were Nature's "alarm bell."

A group of German, Danish and Dutch scientists meets Tuesday and Wednesday in the Baltic harbor city of Kiel, West Germany, to try to determine whether man-made pollution may have contributed to the deaths of the seals by weakening their immune system.

Several of Europe's most polluted rivers, including the



U.S. Department of State

Rhine and the Elbe, flow into the North Sea, where oil and gas extraction also contributes to the problem, along with the dumping of toxic waste.

Norway's fishing industry is facing its worst threat in memory as a broad belt of algae spreads inexorably along the coast, nourished, according to experts, by waste from intensive farming methods, notably fertilizer.

The carpet of yellow-green algae, 12 miles wide and some 60 miles in length, stretches from Bergen in Norway to Gothenburg in Sweden. In some areas, all marine life has disappeared to a depth of up to 30 feet.

More than 1,000 tons of prized cod and salmon plus a wide range of other species have been killed in Norway's waters alone.

Norway pays for economic health

Editor's Note: Articles from the Northern News Service are taken from newspapers from nations around the north, translated and distributed by the Novosti Press Agency in Moscow. The Daily News publishes them to give readers a view of issues peculiar to northern areas and as a view of how the news is reported in other nations.

By **TORSTEIN TENGELESEN**
Northern News Service

The Norwegian economic boom is much touted by the Financial Times, an influential British newspaper. It holds that Brundtland's government, which had taken the reigns in the most deplorable economic conditions since the Depression, was the quickest and most efficient to cope with it among the members of the Organization for Economic Co-operation and Development.

In three years it pulled the balance of payments up from a 40,000 million nKor. deficit to 20,000 million in the black this year. In the past two years inflation plummeted from 10 percent to 4.8 percent. Such encouraging results were due to real growth of production and national export rather than to increased oil prices or exports.

For all that, the Financial Times failed to report as to who had to pay for the economic miracle.

The number of unemployed is rapidly moving toward 200,000, with 4 million able-bodied Norwegians in the country. About 110,000 people are on hospital waiting lists. From 5,000 to 10,000 children cannot be ac-

NORTHERN NEWS

The only way to evade ecological calamities . . . is to stamp out or lessen the sources of the threat. These are, without doubt, the squandering of natural wealth and the careless waste of non-renewable energy sources.

commodated in day-care centers for a lack of facilities. One in 10 high school graduates can hardly read or write, therefore his or her attempts to find a decent job is doomed. According to medical statistics, the deteriorating environment, which is becoming a real health hazard to people, will soon trigger off a 65 percent sickness incidence increase.

The youth crime rate is snowballing as is the number of grave crimes. Norway has never seen such an orgy of bankruptcies. The number of agricultural farms in the provinces is shrinking frighteningly. Finnmark and Nord-Troms provinces have been experiencing the aftermath of unsound fishing policies. Military buildup continues as if there were no relaxation in international relations. The concentration of cars entails excessive pollution.

Norway constantly improves its trade balance and currency situation, fights down inflation, builds up production, exports and volume of business at the stock exchange following an un-

changeable line of our cabinet, which confidently steers toward ecological catastrophe . . . showered with more and more praise from the Financial Times.

Actually, the monied society with rocketing production, efficient stock exchange and such an indicator of success as the Financial Times is sick.

The next 10 to 15 years will tell the graveness of our disease. Many independent international agencies liken the aftermath of the environmental disaster looming large to that of nuclear war.

Over the past 20 years scientists and serious politicians reiterated that the 1990s would offer us the last chance to start readjusting the society, or it would be too late. Quite a number of recent documents unequivocally point to the beginning of an ecological disaster. The last of these documents, named Brundtland paper, urges us to act NOW. The word NOW is put in capitals throughout the text.

Nevertheless the Brundtland cabinet has not come any nearer to implementing

the radical ideas, which had to be carried NOW. On the contrary, they were unanimous about the policy that engendered problems now and then. But there is no putting out burning fuel by adding more fuel.

The only way to evade ecological calamities or at least alleviate the problems is to stamp out or lessen the sources of the threat. These are, without doubt, the squandering of natural wealth and the careless waste of non-renewable energy sources.

A realistic and progressive policy of today's Norway should include the following generally accepted elements:

The present overall consumption of non-renewable fuels (oil, gas and coal) should be cut tenfold within the next seven or eight years.

Norway's agriculture should change over to environmentally benign methods by 1998.

All sorts of fishing and hunting in the Barents Sea should be terminated to make its fish stock a reserve for the coastal fleet.

The present level of military expenditure should be reduced by one third within the next seven or eight years.

At the 1989 elections to the Storting we determined whether we face squarely the hard facts of life, or let our firm leaders continue steering toward ecological hazards.

□ Torstein Tengelesen is a writer for the Norwegian newspaper Framtid Nord.

^{8/68 NF} Mystery virus killing Scandinavian sea life

Scandinavian governments say their southern seas are facing a marine catastrophe because a mysterious virus and a deadly algae are killing off sea life, according to a late-May story in the "London Daily Telegraph."

Danish biologists say their seal population is threatened with extinction, while Swedish scientists report that an invasion of poisonous yellow algae has cleared the country's western coastline of marine life. The ocean off southern Scandinavia is thus rapidly becoming a "dead sea."

"It is a mystery," says Poul Hald Mortensen, spokesman for Denmark's National Reserve Council. "But post mortems seem to show that the adult animals [seals] have all suffered from pneumonia. This seems to have been caused by a strange virus which breaks down their immunity. What worries us is that the virus will spread to the polluted Baltic [Sea] where the seals' immunity capabilities are even worse than here. A spread of the virus there would be an international catastrophe."

Thousands of fish are also washing up dead, the victims of waterborne algae. Chemical fertilizers and non-point specific runoff pollution are thought to be somehow related to the development of the algae and possibly to the immune system problems in the seals, as well. The algae is *Chrysochromulina polylepsis*, which infects seals by forming a slimy mass around marine organisms, preventing them from breathing.

—B.M.

Letters from people
who are not
commercial fishermen

pro-ban refers in files from
Non-commercial fishermen

Fisheries biologist/culturist

Nancy Hillstrand
Kodiak

Marine Biologist / Fisheries
Research Biologist

Natasha Calvin

City of Wrangell - resol. 02-90-341
supporting total loan

City of Tenakee pro SB 397

Processors - Tommy Thompson - Sitka Sound
Shellfish Growers - Benson Sea Farms, Petersburg
Genetics concerns

City of Cordova - resol. 90-18 pro-SB 397

Univ. Professors Dr. Whitely & Johnstone
of Zoology

Sport-fish organizations: Trout Unlimited

Kanai Penn. Boro.

Edna Bay Community Assoc

City of Port Alexander, Craig, Sitka, ~~Ketchikan~~

Local Fish & Game
Advisory
Committee
Hake

Citizens Michael J. Van Note

not a
fisherman?
" ?

John & Katy White - Tenakee

Sport & subsistence users

Conservation / environmental groups
Environmental Lobby
SEACC



House Bill 432
Prohibiting Commercial Fish Farming

My name is Nevette Bowen. I am representing the Southeast Alaska Conservation Council which is made up of 13 member groups from Ketchikan to Yakutat plus over 1000 individual members, including a few oyster farmers.

SEACC solidly supports HB 432 which would prohibit commercial fish farming in Alaska. It is clear to us that the ecological risks and budgetary costs associated with fish farming far outweigh any potential benefits.

Water quality degradation, pollution, genetic alteration, broodstock sources and broodstock control, genetic weakening of wild stocks, spread of disease, impacts of antibiotics and other chemicals on health and the environment, predation by bears, sea lions, birds, otters, etc., land and water use conflicts and the reduced initiative to protect natural fish habitat are all environmental problems that would be created by fish farming.

Upland tank farms and trout farming are not the answer to resolving these problems. The average 200 ton tank farm that employs 3 people uses water at the same rate as the city of Eugene, Oregon and produces the same amount of waste as the cities of Petersburg & Wrangell combined. Where is that volume of water going to come from and more importantly where is it going to go?

Fish disease is commonly spread through water. The deaths of 100,000 coho fry in a Washington state river located near a

landlocked trout farm have been linked to contaminated ground water discharged from the farm. How much is it going to cost the state of Alaska to make sure we don't experience water contamination problems.

SEACC cannot support creating a new industry in Alaska that poses such threats to the environment when the state is not adequately funding regulation and monitoring of the existing hatchery and enhancement program. We concur with the recommendation of the Fin Fish Farming Task Force that the state should conduct a thorough review of fish enhancement activities to determine whether the state's disease and genetic policy is being adhered to. We think such a review would have some eye opening outcomes.

In conclusion SEACC supports passage of HB 432 and urges this committee to get the wheels rolling on a review of the state's genetics policy to see whether or not it is being strictly followed. We also support the recommendation of the Task Force and the American Fisheries Society that calls for establishing wild fishery reserves for the purposes of protecting those stocks for future use.

A LIST OF ECOLOGICAL PROBLEMS ASSOCIATED WITH FISH FARMING

1. Degradation of water quality near marine fish farms from feed, fecal matter, chemicals and other waste products.

Pollutants discharged from a typical fish farm in Washington is equivalent to the discharge of untreated sewage from 5000 people.

2. Groundwater contamination from upland fish farm discharge. Fish diseases are commonly transmitted through water sources, not just contact.

The deaths of 100,000 cohossm in a Washington River located near a landlocked fish farm have been linked to the seepage of water discharge from the farm.
Seattle PI, Nov 1, 1989

3. The extensive use of antibiotics and other medication by fish farms to fight disease pose potential threats to human health and give rise to the development of resistant strains of bacteria.
4. Broodstock ownership, genetic mutations and alterations of broodstock by private businesses would threaten common property ownership of fisheries. Sources of broodstock would be a major concern.
5. Genetic intermingling of wild fish stocks with farmed fish unsuited to survival in the wild could weaken and alter wild fish runs.
6. The spread of disease among wild fish by farmed fish.

Genetics and disease problems at Norwegian fish farms are well known.

Alaska has the healthiest stocks of wild salmon and other wild fish in the world. Commercial, sport and subsistence fisheries depend on the continued health of the State's wild fish resources.

The release of diseased fish by a fish farmer located in a remote, isolated bay would be almost impossible to prevent because enforcement would be costly and not effective.

7. The potential for higher rates of disease infections in wild fish in waters near net pens.

8. Fish farms attract seals, sea lions, birds, otters, bears, and other animals in significant numbers.

There is tremendous pressure for a fish farmer to simply "eliminate" the predators rather than continue to have their profits "eaten" up. Enforcement of the Marine Mammal Protection Act, the Bald Eagle Protection Act and other wildlife conservation measures would be almost impossible due to the isolated location of many fish farms.

9. Land use conflicts over farm siting.

Fish farms are often in conflict with other land uses including: shellfish farms, residential areas, recreation, boat harbors, safe anchorages, sport fishing, subsistence, and high value fish and wildlife areas.

10. The necessary water supply for upland tank farms is enormous and could potentially cause significant use conflicts.

A 200 ton upland tank farm uses 50 cubic feet of water per second, a rate equal to the use of Eugene, Oregon.

11. The Fin Fish Farming Task Force acknowledged that these ecological threats can never be eliminated - only minimized.

Minimizing risks would mean more state regulation which would result in a substantial cost to the state. To allow fish farming would require vast amount of state money, time and personnel.

Fish farms only employ an average of 3 people per farm. Many Alaskans maintain that the risks and costs associated with fish farming ~~do~~ not outweigh the benefits for a few.

MISCELLANEOUS INFORMATION REGARDING THE RISKS ASSOCIATED WITH
FISH FARMING

An October, 1989 research report submitted to Pacific Marine Fisheries Commission (PMFC) by Dr. Arthur Whitely and Annamarie Johnstone presented the following observations:

There is no medical or public health regulation on the use of antibiotics and other medications other than FDA approval of three drugs. There is no monitoring by agencies on these drugs or their persistence in marketed fish.

The amount of drugs used in fish farming is enormous. Norway used 48 metric tons of Oxytetracycline alone in 1989!

No data exists for measuring the length of time antibiotics remain in fish after they have been medicated. Fish in colder temperatures retain residues of antibiotics for longer periods of time.

Thousands of farmed Atlantic salmon have escaped from net pens in Washington State and British Columbia. Hundreds of thousands of farmed Pacific salmon have escaped from pens, especially in British Columbia. Seattle PI, March 5, 1988

In fall of 1989, an algae bloom hit Washington State fish farms causing massive fish die offs, killing up to 80% of the fish at ScanAm Fish Farms, Tilfin Inc and Olympic Sea Farms.

Seattle PI, September 9, 1989 and wire reports

Fishfarms are killing Pacific salmon smolts & fingerlings because they have proven uneconomical to raise. Only Atlantic salmon have proven economical. Testimony of Tim Kennedy at Finfish Farming Task Force meeting, September 1989.

There is a surplus of 100,000 metric tons of salmon on the world market. Supply exceeds demand by about 14%. Finfish Farming Task Force Report, 1989

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



P.O. BOX 143
SITKA, ALASKA 99835
P.O. BOX V
JUNEAU, ALASKA 99811
(907) 465-4916

MEMORANDUM

TO: Senator Dick Eliason

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

DATE: March 7, 1988

RE: Opposition to the pen rearing of salmon

The following communities and organizations have submitted resolutions in opposition to the pen rearing of salmon:

Communities:

Kenai Peninsula Borough
Edna Bay Community, Inc.
City of Port Alexander
City and Borough of Sitka
City of Craig
City of Wrangell
Ketchikan Gateway Borough
Sitka Chamber of Commerce

Organizations:

Craig Fish and Game Advisory
SW Regional Fish and Game
Council
United Fisherman of Alaska
Northern Southeast Regional
Aquaculture Association
Alaska Trollers' Association
Southeast Alaska Conservation
Council
Alaska Environmental Lobby
Seafood Producers Cooperative
Southeast Regional Fish and
Game Council
North Pacific Fisheries Assn.
Cook Inlet Fisheries Coalition
Cordova District Fishermen
United

We have also received many, many letters and public opinion messages statewide in opposition to the pen rearing of salmon.

THE FOLLOWING DOCUMENT MAY NOT FILM
LEGIBLY BECAUSE OF THE POOR QUALITY OF THE
ORIGINAL

RECEIVED FEB 8 1990

John W. Hiltbrand
P.O. Box 472
Homer, Alaska 99603
Jan 29, 1990

Dear Resource Committee Members,

Finfish Farming, whether Shore based or in Ocean Pens, if introduced to Alaskas Economics at this time will be disastrous.

As a Alaskan Sport and Commercial Fisherman for 30 years, when Fin Fish Farming was first introduced my interest was overwhelming. To think I could have it all. Thirty years of fishing the most abundant stocks of Sea life any where in the world. And now, Reap the benefits, and do so in my back yard without dealing with mother nature on such a competitive bases, in addition to Flare openings, 24 hour Halibut openings, 1/2 hour Herring openings, total closures on King and Tanner Crab and many other hardships that the Alaskan Fishing Industries along with the State of Alaska and its Tax payers have had to suffer.

After many hours of research and questioning of people in and out of the Fin Fish Industries I am sorry to say, this is one time I CANT HAVE MY CAKE AND EAT IT TO. Here are some of the examples:

1. ADEC Involvement
 - a. On site Pollution of diseased fish
 - b. Containment of fish waste and discarded feed
 - c. Disposal of fish carcasses at time of brood stock take
 - d. Drainage of circulation waters needed for Tank Farms, and disposal when polluted
 - e. Standard requirements for Fish processing under State Law
2. Alaska Dept of Fish and Game
 - a. Genetic pollution of wild stocks
 - b. Allocation of broodstock
 - c. Full time monitoring of disease control
 - d. The assurance that disease is not transmitted by bird species
3. U.S. Army CORPS
 - a. Protection of Ecosystem
 - b. Protection of Wet Lands

The list could go on One that could choke any Alaskan Mom Pop group desiring to enter into this new Field of Farming. What we are trying to convey and hope you will consider is the direct benefit will again be only for a few, as like Limited Entry. And although Fin Fish Farming might well be a Legacy some Senators would like to add to their collection, to not allow the enactment of State laws Banning Fish Farms, is totally irresponsible to the Tax Payers at this time, and is another burden placed on future generations.

With all the regulations, immense disease and genetic possibilities, high cost of doing business in Alaska, along with unforeseen marketing due to the increasing numbers of turfish farms in the world, less than a handful of farms could survive. Self benefit and profit, as opposed to the risk to the wild stock environment, just doesn't add up.

With such a high level of demand with the States Environment and Natural Resources or all Alaskan user groups, you really have bigger and better things to commit yourselves to achieve.

am in full support of Senate bill number 397, and House Bill Number 432.

Sincerely,

John W. Hillstrand

John W. Hillstrand

cc. Betty Fannerkand
Jalmar Kerttula
Richard I. Eliason
Steve Frank
Dick Halford
Anissa Stungulewski
Fred F. Zaroff
Curt Menard
Cliff Davidson
George G. Jacks
Mike Davis
Richard Foster
Mike Navarre
Walt Furnace
Bill Hudson
Bert M. Sharp

Senator

You could present this as is,
or have it typed - I'll sign it

I enclosed a memo to you
written last year.

Chris appreciate what you
could do to stop a bill that
will legalize salmon mariculture,
the effect of which would lift
the moratorium? Also opposed
to any appropriation that
advances experimentation.

Next, I suppose Acluss will
move to provide electric
blankets for hibernating bears?

Let me know if you reword it,
or edit?

463-3902

Robert Nease

236 3rd Street
Juneau, Alaska 99801

March 13, 1989

The Honorable Richard I. Eliason
Alaska State Senate
Pouch V
Juneau, Alaska 99811

Dear Senator Eliason:

Much has been said about salmon mariculture, pen rearing, fish farming and ocean ranching. I oppose any form of experiment that would pose any threat to the renewable-natural stocks of salmon. I therefore oppose any further appropriation to such an operation taking place on Baranof Island.

I read with interest, the Opinion article in The Anchorage Daily Times, printed-December 13, 1988, by Senator Arliss Sturgulewski. The Senator states that in British Columbia such operations created 570 jobs. She evidently ignores economics over management of Natural Resources. Moreover, the Senator points out that other countries do salmon mariculture--and, I could care less what they do. In those 570 jobs she alludes to, she fails to mention that the reverse is also true. In Alaska, over 30,000 Alaskans are directly affected in the fisheries. A more efficient fish trap, would make our purse seine fleet obsolete. Gillnetters, trawlers as well. A fish pen is a fish trap that was outlawed at Statehood in 1959, (Ordinance No. 3). The Statehood Slogan, (for those that were here in 1958-59) was "With Statehood-the Abolishing of fish traps." There are too many risks:

- We run the risk of man-caused diseases that will afflict our Natural Salmon stocks;
- We run the risk of some biologist transplant

of Atlantic Salmon to our shores;

- the price of Natural Salmon will be driven down by a more efficient fish trap;
- there will be conflicting laws, promulgated regulations and policies than already exist;

Who owns what fish is becoming a big issue. Already, hatchery operators are affecting opening and closure of areas to types of fishery. I admire the Board of Fisheries for their dedication. I also sympathize the seemingly thankless job they must perform in trying to manage the fisheries and people at the same time. I ask that you vote against legalization.

I serve as Chairman of the Fisheries Committee of the Alaska Native Brotherhood, Juneau.

Respectfully submitted,

Robert Willard

463-3902

M E M O R A N D U M

DATE: May 20, 1988
TO: The File
FROM: Robert Willard *RW*
SUBJECT: Mariculture and Similar Proposed
Salmon Enhancement - OPINION

Much has been said of mariculture, pen rearing, ocean ranching, finfish farming, oyster and mussel farms, experimental scallop and giant kelp farms. Others talk of raising shrimp in water heated by geothermal sources.

This opinion addresses salmon and the proposals related to capturing salmon for purposes of raising salmon for market. While concern for salmon is in and of itself-laudatory, it is mariculture that is the focal point here.

Since time memorial, a variety of fish enhancement methods have been attempted. Some of these have been fish weirs, fish ladders, tagging, stream clearing with bulldozers - of rocks, fallen trees and other debris. Later, the advent of fish hatcheries throughout the region. Now, the effort gives way to mariculture.

Mariculture, and other such schemes, should be rejected and barred. Mariculture is nothing but a "get rich quick" scheme to be worked by a handful of people and equipment line necessities from select firms.

The arguments against mariculture far outweigh the reason to create artificial fish. Proponents do not tell you that any salmon raised in pens will be inferior in quality than natural wild salmon. And, therefore cheaper in price. Not to mention that not all that many people would be involved.

Unless and until provided with clear and convincing evidence that concerns that I have, it will never replace the natural stock of salmon. Here now are some of the serious reservations that I have:

- o We would run the risk of transplant of the much inferior Atlantic salmon with a pen, or fish trap, already in place;

- o Mariculture is simply a "get rich scheme" with the least amount of work and participants;
- o With an inferior fish that looks like fish would drive the overall price of real salmon;
- o Pens, or fish traps, created for the process would be unnatural habitat;
- o Pen reared fish would inflict diseases to wandering natural wild salmon;
- o A pen rearing salmon law and its promulgated regulations would interfere with the existent statutes and regulations;
- o Pen rearing or fish trap operations would compete for the same federal, state or private funds as for nat wild stock salmon enhancement;

There is a myriad of fishery laws now in place with the introduction of salmon hatcheries alone. Who owns what will become a big issue soon. Now, mariculture programs look to shellfish, mollusks and aquatic plants as well. Some argue that these projects work in other states. But this is Alaska, not just another state. Fast dollar signs should not shroud our perception of the ever increasing stocks of salmon. Mariculture is unnatural. It should be outlawed. Upon statehood, the people outlawed fish traps. A fish pen is a fish trap by any interpretation.

Robert Willard
Juneau, Alaska

Editor's Note:

Mr. Willard served the Alaska Native Brotherhood's Legislative Affairs Committee and guided Southeast's case on subsistence fish and game laws and regulations.

1989

I called Bob Willard.

ANG does officially
oppose nuclear power devel.

They passed a resolution

2 yrs. ago stating
opposition & this yr.

voted for that resol. to

continue to represent their opinion.

Finfish farming legislation raises questions

This fall I attended the Aquaculture International Conference held in Vancouver, British Columbia and returned home with mixed feelings of excitement and frustration. Worldwide, the aquaculture industry is experiencing explosive growth, particularly in the salmon farming industry in neighboring British Columbia where private investment during the past few years now amounts to hundreds of millions of dollars. The enthusiasm and optimism of Canadian entrepreneurs is contagious. At the same time, I came away with a profound sense of dismay that the opportunity for this type of economic development is not occurring in Alaska.

With our inherently high production costs, we have very few opportunities for renewable resource developments that can be competitive on world markets. Finfish farming is a means of utilizing our comparative advantages of clean marine waters, vast stretches of uninhabited coastline, biological expertise and large public and private salmon hatchery capacity. Recent Alaska Department of Commerce and Economic Development reports have shown that delivered costs for farmed salmon from Alaska could be comparable to those of many competing producers in U.S. and Japanese markets.

Fifteen other countries and numerous states have successfully dealt with the public policy issues surrounding finfish farming. Our own Department of Fish and Game experts tell us that disease and genetic concerns about salmon farming are essentially the same as those in the state's hatchery program and can be addressed via current regulations. Processes for identifying potential sites and resolving user conflicts have been adopted in Washington and British Columbia. (Note that a large salmon farming operation occupies about two acres — surely there is enough room in state waters to accommodate a moderate-sized industry of perhaps 50-100 farms.) Environmentalists worried about water quality and waste sedimentation forget that fish farmers have a powerful



By Arliss Sturgulewski

economic incentive to protect the marine environment.

In large part, organized fishing groups in Alaska have chosen to perceive the inevitable market effects of worldwide farmed salmon production as a threat to their livelihood rather than an opportunity for investment in year-round production capability. Through their cooperatives, fishermen in Alaska could augment their wild catch with farmed fish in the off-season and lock in a position in fast growing fresh salmon markets instead of sitting on the beach and watching their market share steadily decline. According to experts at the Vancouver conference, the U.S. market for fresh and frozen salmon has plenty of room to grow. In 1987, each U.S. citizen consumed 238 pounds of protein but only 15.4 pounds was seafood and less than 3.2 pounds was fresh or frozen salmon. As the president of National Seafoods, the largest seafood processing company in North America stated to the conference, "in the near future, any major fish processing company without an aquaculture card in its hand will find it very difficult to compete." Sales of eggs and smolts from public and private hatcheries to salmon farmers could help make the state's subsidized public and private nonprofit hatchery system, which primarily benefits commercial fishermen, self-sustaining.

By 1987, salmon farming had created 570 direct jobs in British Columbia. It has also resulted in large indirect economic impacts in the seafood processing and support industries — those which supply feed, smolts, equipment, transportation, financing, insurance and various consulting ser-

vices — have spun off of the local salmon farming industry. Direct and indirect employment is expected to grow to 3,500 jobs in British Columbia salmon farming by 1990. These opportunities for economic development do not exist in coastal communities in Alaska.

What future does the commercial fishing industry hold for a Western Alaska village family with five kids and one limited entry permit? How many investment opportunities are available for Southeast native corporations that will create jobs for shareholders once the net operating losses are gone and their timber resource depleted? What kind of precedent do we set when we allow special interest groups to determine the scope of our economic development possibilities? What business do politicians have in limiting private investment opportunities? How can we afford to forego any means of attracting outside capital investment to diversify our economy away from petroleum revenue dependence?

These policy questions are troubling. It is somewhat embarrassing to speak with public officials from other states and countries who have been able to deal with the same issues we are facing and rise above special interest politics to seize the opportunity that aquaculture diversification, particularly finfish farming, presents. Frankly, they are astonished when I tell them about the political situation in Alaska. It is time for the legislature to move ahead on this issue, absent any positive leadership from the governor's office. Our competitiveness in future seafood markets is at stake. We should lift the moratorium on finfish farming and revise the burdensome regulations placed on shellfish farmers. We need to overcome our parochial differences and get on with the responsible development of our marine resources under a reasonable state regulatory regime.

State Senator Arliss Sturgulewski is chairman of the Senate Community and Regional Affairs Committee and the Senate Special Committee on Local and Regional Economic Opportunity.

Robert Clarke

Dick has seen

3121 Nowell Avenue • Juneau, Alaska 99801 • (907) 586-2031

Communication • Public Affairs

March 23, 1990

Senator Richard Eliason

Dear Dick:

Returning this week from COMFISH in Kodiak, I promised to extend regards to you from Jay Hammond, one of the Charter Members of OEKOS.

The enclosed copy of The Ocean Citizen sets out OEKOS agenda and priorities. An alliance of fishermen, scientists educators and consumers formed to prevent destruction of the North Pacific fishery, (and to encourage revival of fisheries devastated elsewhere, we have members in twenty-three states and four countries in just five months of existence.

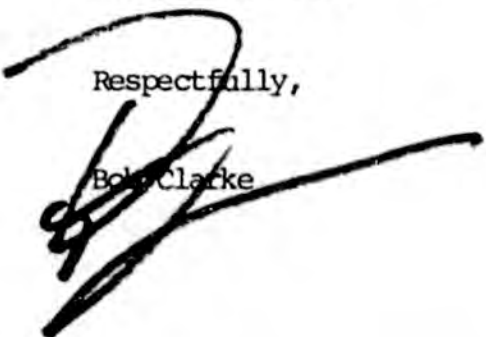
A major concern of OEKOS are the threats inherent in fish pen mariculture on Alaska's natural fish stocks, and the nutritional liabilities of marketing for human consumption a seafood product force-fed a diet constituted largely by drugs, chemicals and effluent waste. (One acre of fish pen salmon can produce sewage equal to the amount generated by a human settlement of 10,000 persons).

We have collected a great deal of scientific data which all but proves the dangers to wild stocks; we are soliciting grant funds and Sponsoring Memberships (see ByLaws) to fund nutritional studies.

The OEKOS interim directors have asked me to meet with you to discuss these objectives, and particularly how the organization may be able to influence and extension of the moratorium now in effect regarding fin fish mariculture in Alaska.

Hope you can find some time for me in the coming days; would be glad to have you over for dinner this weekend or early next week.

Respectfully,


Bob Clarke



The Ocean Citizen

Winter, 1990

Vol. I, No. 1

Certification of Ocean Citizenship

Now Witness All Concerned

*as a Charter Member of OEKOS,
is herewith declared a Constituent for the Natural Ocean
Economy, and is thereby fully entitled to, and responsible
for, those privileges and obligations duly conferred upon
a Citizen of the Ocean Commonwealth.*

Attested to this date, _____

President

Secretary

OEKOS Editorial

The Choice: Problem or Solution

Who speaks for the oceans?

Who speaks for the fish?

As a member of OEKOS, you do!

Oceans are the source of life on our planet, yet they are being destroyed, systematically, in a silent conspiracy of those who profit by that system.

Each year five trillion gallons of human and industrial sewage are added to the trillions upon trillions of toxic poisons already flushed or spilled into our ocean waters. Fisheries off the east, west, and gulf coasts of the U.S. are dying from oxygen depletion and food-chain contamination. Some species have become extinct; others have become harmful to all life.

As the oceans and fisheries die in other parts of the U.S. and the world, pressure increases on the North Pacific waters that are still safe and productive. But as the *Exxon Valdez* disaster demonstrated, the North Pacific fisheries are in danger of the same destruction that killed fisheries elsewhere.

OEKOS is an alliance of fishermen and women, scientists, educators, and consumers, organized in September, 1989, to prevent the destruction of the North Pacific and to initiate the recovery of ailing fisheries elsewhere while there is still time.

OEKOS has members in twenty-three states and four countries who realize that people who are dependent on, and benefit from, the natural ocean economy can no longer ignore this destruction or their individual and collective responsibility to do something about it.

Following a full century of abuse, this is no small challenge. But the profit motive is a formidable force, and supported by the force of public opinion, it cannot fail if all people who profit from a productive North Pacific and from fisheries recovery elsewhere, will assume fair share in this common mission.

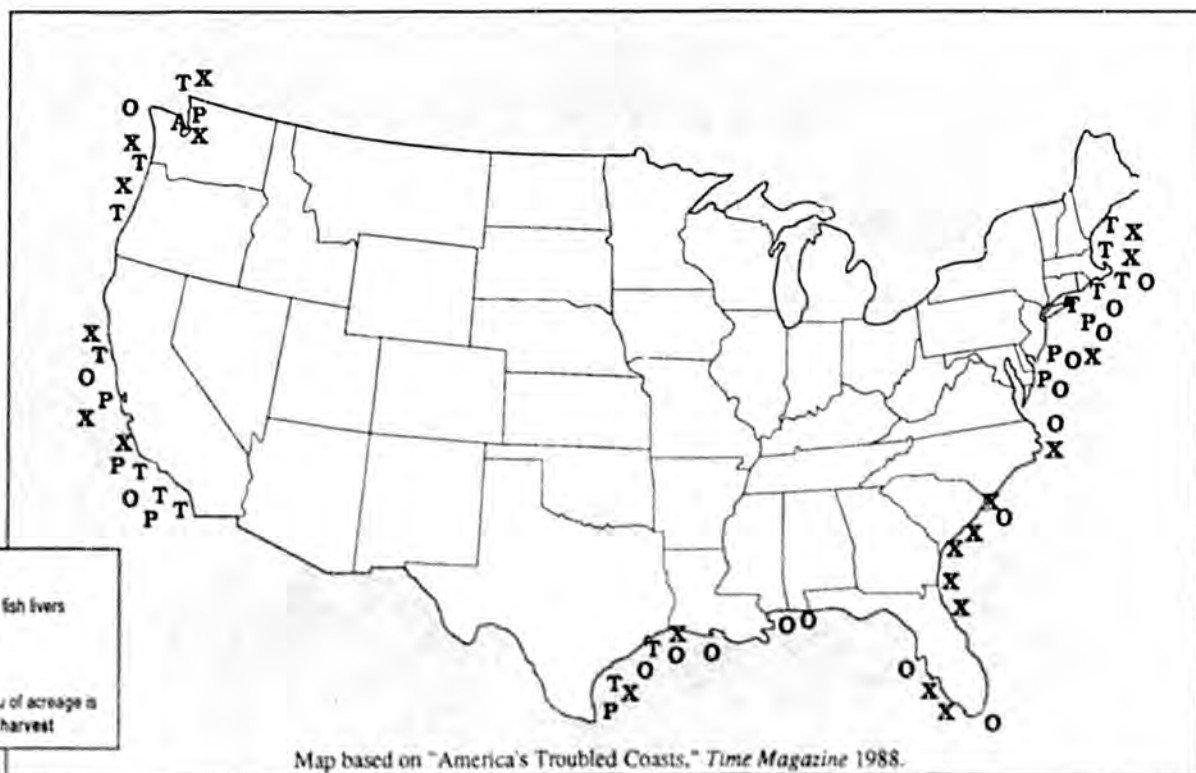
The choice is clear. We either become party to the solution necessary to save our natural ocean economy or we remain silent and become the most obstinate part of the problem.

About the Ocean Citizen

The Ocean Citizen is the official member publication of OEKOS, a not-for-profit corporation chartered in the State of Alaska. The Citizen is published quarterly by OEKOS volunteers, and welcomes comments, criticism, and suggestions from its readers.

*Editorial staff: Lisa Tomrdle, Thom Tomrdle, Hazel Felton, Bob Clarke
Correspondence should be addressed to The Ocean Citizen, P.O. Box 3434, Kenai, Alaska, 99611. Phone 907-283-7800.*

Ocean pollution threatening U.S. fisheries



KEY

- T - High levels of toxic chemicals in fish livers
- P - PCB or pesticide contamination
- O - Areas of oxygen depletion
- X - Areas in which more than one-third of acreage is closed to commercial shell-fish harvest

OEKOS Commemorates

Ocean Science Centennial

Boston scientist discovers ocean pollution in 1890

The 1880s were a time of public health crises. In large cities, epidemics of cholera and typhoid killed massive numbers of people. By 1885, science had generally accepted the fact that water-borne pollutants could cause such disease, but without established scientific criteria, government had no basis to measure water quality, let alone enforce it.

In the absence of funds to produce such criteria, both government and polluters continued to avoid their responsibilities. By 1887, however, the nation's largest manufacturing state could no longer ignore the problem.

The Massachusetts Legislature appropriated funds to a pioneering Sanitary Science Laboratory established at the Massachusetts Institute of Technology (MIT) in Boston, "to determine the effects of population and manufacturing on the waters of the Commonwealth."

It was "history's most thorough analysis of water resources...unsurpassed in scale..." For nearly two years samples were taken from almost every body of water in the state, from the mountains to the seashore. Nearly 100,000 water samples were collected, analyzed, and recorded at MIT.

The Great Sanitary Survey

This project, called the Great Sanitary Survey, was the brainchild of MIT's great water scientists, William Ripley Nichols and Ellen Swallow Richards.

She was shocked to see the strong, unmistakable profile of Massachusetts extending far out into the Atlantic Ocean...a picture of human and industrial wastes polluting the ocean itself.

They had pioneered water pollution analysis with Richards' study "On the Condition of Certain Massachusetts Waters," published in 1873, by the State Board of Health, Lunacy, & Charity.

When funds were appropriated in 1887, Nichols had died and the work was charged to Richards, MIT's first female student, graduate, and faculty member. She personally conducted 40,000 water analyses and recorded the survey's data. Richards then transferred her findings onto a large map of Massachusetts and connected the sites that had similar water content.

OEKOS to hold first Ocean Centennial Conference

This October in Boston, Massachusetts, OEKOS will commemorate three milestone events:

- The World's First Water Purity Tables
- The Nation's First State Water Quality Standards
- Science's Discovery of Ocean Pollution in 1890

More significantly, 1990 marks the 100th anniversary of elected government's first assertion of authority over water pollution.

However, just as today's Clean Water Act exempts sewage and chemical waste from adequate controls, our waters, oceans, and fisheries have been subjected to a full century of progressively systematic destruction. The next century cannot afford a lapse of "institutional memory" that characterized the past.

A disturbing picture emerged.

Richards fully expected to see pollution greatest where population and industry were concentrated. But she was shocked to see the strong, unmistakable profile of Massachusetts extending far out into the Atlantic Ocean! It was, she realized, a picture of human and industrial wastes polluting the ocean itself; wastes traveling by natural and unnatural drainages.

The map, known as the Normal Chlorine Map, was the first scientific evidence of ocean pollution. Her discovery heralded the beginning of the ocean destruction epidemic we know too well today.

First Water Quality Standards

Except for the discovery's influence on the first federal marine pollution laws, it caused little concern. The perception at that time was one of infinite resources within our oceans.

On land, however, the Sanitary Survey had more success. Its findings were the basis for the world's first Water Purity Tables, which Massachusetts adapted to establish the first State Water Quality Standards in the nation. The State Water Quality Laboratory was based in Richards' lab at MIT.

The survey stimulated a great interest in Sanitary Science and Engineering and encouraged the development of systems to handle and treat urban waste. It also advanced two new scientific disciplines. Limnology, the study of inland waters and their composition and a science Richards named Oekology in 1892. The science of interrelationships be-

tween living organisms and their environment is spelled Ecology today.

The survey stimulated a great interest in Sanitary Science and Engineering and encouraged the development of systems to handle and treat urban wastes.

One of Richards' most lasting contributions to ocean science began five years before the survey began. In 1872, while a student, she raised funds from Boston's Women's Education Association and established a laboratory where women could study marine biology. The Summer Seaside Laboratory at Anisquam, Massachusetts was a great success, attracting students from the U.S. and Canada.

In 1887, the laboratory was relocated to an obscure coastal community named at that time Wood's Holl. Although Ellen Swallow Richards' commitment to the 1887 Great Sanitary Survey left her little time for the new facility, she had helped create what would become the nation's foremost institution for ocean science, Wood's Hole Marine Biological Laboratory.



Ellen Swallow Richards

OEKOS Agenda

Prevention

Bristol Bay Oil Leases

"Buy 'em Back"

The future of an annual, billion-dollar fishery and endangered species sanctuary has been sold for \$95.4 million and a few days supply of oil!

Perhaps the world's greatest remaining unspoiled fishery, Bristol Bay is "the single most important region of the U.S. outer continental shelf for the conservation of marine mammals and endangered species and for the protection and management of fish resources," according to the State of Alaska.

An oil spill in Bristol Bay can reduce "the first wholesale value" of the fishery by more than half, or \$563.6 million in one year alone...for 30 to 60 days of "known" oil.

"The U.S. Geological Survey says a single oil platform will have at least one, possibly three, major spills...twenty-five medium spills...two thousand little spills," reports Ann Simon in *Neptune's Revenge*.

The U.S. Department of Interior admits, "...mechanical recovery of oil spilled...becomes ineffective between 'sea states' of three and four." But Bristol Bay sea states of three and greater "occur 68% to 94% of the time," Alaska state documents show.

OEKOS must tell this story to the nation's media. Meanwhile, the U.S. Supreme Court has ruled oil leases can be developed. Only Congress or public opinion can stop economic and ecologic catastrophe about to happen in Bristol Bay.

Fin Fish Mariculture

"Just Say No!"

One acre of salmon pens can produce sewage equal to a town of 10,000 people. Concentrated sewage depletes ocean oxygen. Add chemicals, pathogens, and profits to multi-national corporations and proliferating fin fish farming presents a danger to both wild and hatchery stocks in Alaska, Washington, and British Columbia.

OEKOS commends the many local groups and federations in Washington State for their long and sometimes successful opposition to fin fish mariculture. OEKOS members can help these Washington efforts. For information,

write OEKOS charter members Brigit and Bo Smith, 155 Diamond Shore Lane South, Sequim, WA 98382.

In Alaska, a wise moratorium on fin fish pens is in danger of being lifted. Two bills are pending in the State legislature. One, pushed by Senator Dick Eliason, would continue the moratorium until scientific evidence proves there is no risk to natural and hatchery stocks. Another, which would lift the moratorium, seems favored by key senators and has support in the House also.

OEKOS members are urged to write, phone, or visit Alaska legislators to protest lifting the moratorium and support the Eliason bill. Legislative Information Offices around the state will send your public opinion message to legislators at no charge.

Forest Clear Cuts

"Save the Spawning Streams"

There are many reasons why the Atlantic salmon is nearly extinct--timber harvests that remove trees from spawning streams is one. When trees are removed, stream temperatures are changed and waters are exposed to increased light--not to mention the changes in water composition.

Timber harvests must leave buffer zones of 100 feet or more for successful salmon and trout spawning to continue. In Washington, both public and private lands are given buffer zone protection.

In Alaska, where fishing generates the second largest income to the state (after oil), a bill requested by the governor will exempt timber harvesting on private lands from adequate spawning stream protection.

Your Legislative Information Office has detailed information on this, and will send your public opinion message to your legislators.

OEKOS commends the Salmon Bay Protection Association for its battle to get adequate spawning stream protection in the new Tongass Forest Management bill. But who is there to talk to at English Bay's private joint venture which could devastate critical subsistence, sport, and commercial salmon streams in the area?

Mining

"Hold the Cyanide"

Serious questions are surfacing about new mining operations in Southeast Alaska, specifically in Juneau. In addition to damming (damning?) Sheep Creek for a world-class cyanide tailings pond, daily air emissions of 13,500 lbs. of Nitrogen Oxide and 1,620 lbs. of Sulphur Dioxide--the primary constituents of Acid Rain--and 3,510 lbs. of Carbon Monoxide seriously threaten Southeast Alaska's waters and fisheries. Daily shipments of toxic fuel and tons of cyanide through Gastineau Channel make one wonder if this isn't a new approach to the capital move?

For information contact Alaskan's for Juneau's Future, 310 Irwin Street, Juneau, AK 99801, 907-463-5065.

Exxon Valdez

"Not Where, but When"

The Prince William Sound catastrophe isn't a disaster that happened, it is still happening. Double hulls and bottoms are necessary on all ships transporting oil! Of course, it helps if the vessel is manned, too. Many questions concerning the Valdez oil spill still remain unanswered, such as:

What happened to the \$20 million raised by Valdez for a Spill Response Center? When will local people and governments be given some prevention-response authority? Why wasn't the herring fleet called in with its pumps on the first few days when the weather was calm?

High Seas Intercepts

"Call the Sea Cops"

OEKOS commends the men and women who put Sea Cops on the beat. But we've a long way to go to arrest high-seas interception. Satellite surveillance?

The Ocean Citizen invites members everywhere to write about related problems in your area. Send inquiries or information to:

OEKOS
P.O. Box 3434
Kenai, Alaska 99611

Bristol Bay is "the single most important region of the U.S. outer continental shelf for the conservation of marine mammals and endangered species and for the protection and management of fish resources..."

OEKOS Agenda

Recovery

The Ocean Centennial Conference

OEKOS is planning a conference to commemorate a century of water science and ocean destruction. The Ocean Centennial Conference will be held in Boston, Massachusetts, in October, 1990 (see related article on page 3.)

In addition to commemorating the achievements of 1890, the conference will recognize contemporary efforts to arrest ocean destruction and perpetuate the natural ocean ecology and economy.

The purpose of the Ocean Centennial Conference will be to focus national attention on a problem that threatens the survival of the oceans.

The conference will initiate a realistic assessment of the causes, sources, and costs of ocean destruction and how to arrest and reverse it. A national action plan made up of the activities of local organizations must be formulated.

OEKOS invites the widest possible participation from its members and other interested parties in the planning and implementation of the Ocean Centennial Conference.



The Ocean Network

The first priority on the 1990 OEKOS agenda is to search for and establish a network of every local, regional, and national group concerned with protecting and reviving our natural waters and fisheries.

This search will be made state-by-state, across the nation, in hopes of establishing the largest possible constituency to influence the policies and practices responsible for ocean destruction.

The cumulative resources and support of this network will be available to each local group or association in their efforts to combat their specific water problems.

Oceans, fisheries, and water problems and their solutions are often perceived as localized. In truth, however, they are an interconnected piece of major national and global problems; they affect everyone in the U.S. and all over the world. Limiting the fight to local levels defaults to an eventual piecemeal defeat because of the enormous national and multi-national sources of the problems.

Those who depend on an ocean economy sustained by the health of its ecology, can overcome the corporate and institutional practices causing the destruction of both by affiliating in a common, mutually-supportive crusade.

While many of us protect our respective or collective self-interests by maintaining lobbyists in state capitals and Washington D.C., we still ignore and forego the enormous potentials of an aroused and supportive public opinion.

The Ocean Network will optimize local efforts by bringing this strength of national public opinion to bear on every local ocean water problem.

Membership Expansion Incentives

To facilitate an Ocean Network OEKOS intends, contingent on legal determinations, to establish a Membership Expansion Award of \$5.00 for each new \$20 member enrolled by an OEKOS charter member. (According to our Bylaws, all memberships qualified and paid through October, 1990, will be charter members; thus new memberships brought in by charter members during this period will also qualify.)

The Membership Expansion incentive can be used by OEKOS charter members to provide financial assistance to those nonprofit organizations with which they are involved and which would benefit from OEKOS' success.

For example: A fishing association or an environmental group with 2,000 members can recruit its membership to enroll as OEKOS members. The association would benefit monetarily by as much as \$10,000 to be used to advance that association's specific activities and have the additional benefit of widespread support for its activities through the Ocean Network.

Copies of this inaugural edition of the *Ocean Citizen* will be sent to as many groups and associations known to OEKOS. Hopefully, readers will respond not only from their particular interests, but with additional names of organizations that share our common goals.

All Americans, whether living on coastal waters or inland have a critical interest in safe water and abundant sources of healthy seafood protein.

The *Ocean Citizen* urges all people concerned with the quality of the oceans to join the Ocean Network. Help make our oceans and waters safe and productive.

The cumulative resources and support of this network will be available to each local group or association in their efforts to combat their specific water problems.

All Americans, whether living on coastal waters or inland have a critical interest in safe water and abundant sources of healthy seafood protein.

Summary

Of all the North Pacific's resource industries, fisheries are or can be, the most renewable, the most lasting--if other resource industries and government permits. But historically, energy, timber, and mining industries employ methods that leave fisheries in a foul, even fatal wake.

OEKOS is not opposed to these industries; we enjoy fuel, gold and silver, and wood products as much as anyone. But we believe all who benefit from a natural ocean economy must learn a lesson from those industries which profit by our losses.

Organize and unite to concentrate our influence on poor policies and practices. Who speaks for the oceans? Who speaks for the fish? As a member of OEKOS, you do!

OEKOS Dialogue

Your Comments

The response to OEKOS is encouraging. We have received hundreds of letters, phone calls, and messages in favor of what we are trying to do. We want to thank all of you for your interest.

Although it is impossible to print every comment received, the following is a fair representation. The *Ocean Citizen* will continue to publish as many member comments as space permits.

"It's about time! An organization like OEKOS is long overdue. Let me know what I can do to help."

Robert C. Cahill
Salt Box Publishing
Salem, Massachusetts

OEKOS: Mr. Cahill is a former Massachusetts Legislator, Sheriff, and creator of "The Adventures of Jim Jigger, Frogman," a 1950s radio serial for children on WBUR, Boston.

"Many of our performers (like Madonna and Sting) have taken to saving the rain forests in South America. I don't think people can do enough to help the planet. I'm not sure what I can do to help, but if you'd like to use me...I'd be delighted. Let me have some more pamphlets I can give to friends and see if I can find some more concerned people to help."

Margaret Whiting
New York, N.Y.

OEKOS: Margaret Whiting is one of the great singing stars of records, radio, TV, stage, and supper clubs. She is currently working on a new musical.

"Ketchikan (Alaska) area waters are being fouled up not only by the pulp mill, but also by many of our shore-based processors. All industries need to recognize the importance of clean water."

OEKOS: That's the truth! But we're finding more processors and fishermen who realize quality counts in habitat as well as fish.

"The over-all pollution of Cook Inlet is getting much worse and needs to be monitored more closely..."

Paul E. Jones
Homer, Alaska

OEKOS: We intend to monitor fishery waters in Southeast, Kenai, and other places. We're raising funds in order to accomplish this.

"Enclosed is \$100 in hopes it will help your efforts to expand much faster."

Darral R. Short
Kodiak, Alaska

OEKOS: Thank you, Darral. We're trying.

"We would like to create a local chapter, organization, or group here in south Florida."

Bob Rich, Jr.
Rich Electronics
Miami, Florida

OEKOS: The Bylaws, published on pages 7 and 8, will help answer your questions. If you decide to pursue this, Bob, there are others in Florida with similar interest.

"I hope OEKOS can help put some of our priorities in perspective... I think it's a fantastic idea, and you touched my heart with the poem by Jay Hammond. I have not owned or lived on land in many years, since I have all the oceans of the world to choose from. I find most sparsely populated areas quite healthy. American Samoa is an exception. Fishermen can hang their heads in shame at the blight of Pago Pago. Also, Sitka Harbor, when tons of Halibut Derby trimmings are dumped into the water.

"We fishermen are not lily white when grabbing the almighty dollar. We had better clean up our act instead of trying to reform EXXON. They are hopeless. I'm willing to share the blame for the oil spill. The root of the problem goes deeper than the keel of the Exxon Valdez..."

Harris Smith
Maitland, N.S.W.
Australia

OEKOS: We'll try to publish that poem and yours, Harris, in a future issue.

"OEKOS needs a \$100 Business Membership, and a full-time lobbyist in Washington, D.C."

C.W. Harris, President
Spencer Industries
Seattle, Washington

OEKOS: Thanks to you Charlie, we have the first. With enough of them we can afford the second.

"How serious is pollution from fish farms, (particularly) the effects on wild stocks?"

C.B. Gordon
Vashon Island, Washington

OEKOS: From literature we've seen, fin fish pen sewage, chemicals, and pathogens along with other problems are serious enough to avoid the risk in locations where native and hatchery stocks are healthy (see page 4). For Washington-specific information write OEKOS charter members, Brigit and Bo Smith, 155 Diamond Shore Lane South, Sequim, Washington.

"OEKOS should increase the effectiveness of MARPOL-mandated Recycling Centers in coastal towns..."

Francine Bennis
Anchorage, Alaska

OEKOS: We're looking into it.

RE: On Learning

"I would love to use some material for teaching children about ocean destruction and how they can help prevent it."

Theresa Schneider
Juneau, Alaska

"The only way to really reach people is through education. Could a traveling show (be done for) display at the nation's aquariums?"

Barbara Seaman
Homer, Alaska

OEKOS: Without education, we'll be shoveling pollution of one form or another against the tide until the tide goes out and never returns. OEKOS is seeking funds for educational purposes. Meanwhile, charter member Nancy Ratner, Juneau, Alaska, advises that the Aquatic Education Division of Alaska Fish & Game is currently developing classroom education material.

RE: The Exxon Valdez Oil Spill

"I'm not certain but that beach 'washing' (along Prince William Sound) may have done more harm than good..."

Robert R. Leshner
Pelican, Alaska

"We believe a 3 minute TV spot of a back-hoe digging...and not finding the end of the oil on a supposedly cleaned up beach, would be more effective than anything written..."

Donald C. Bellinger
Juneau, Alaska

"(Exxon) money would be best spent on preventive measures and preparedness equipment...in case it's ever needed, and on self-education to improve their responsibility to all of us in oil transportation and delivery."

Stan Stephens, Captain
Valdez, Alaska

"The Exxon clean up is probably the greatest hoax ever perpetrated on the public..."

Dana Cassidy
Anchorage, Alaska

"I'll donate \$200 for a complete study of the oil industry...Ted Stevens (Alaska Senator) insisted in 1972 a spill could never happen because of double hulls and satellite navigation..."

Larry Calvin
Sitka, Alaska

"Giving Exxon the responsibility to clean up after the oil spill is like trusting a bank robber to bring back the money."

Red Newton
Kenai, Alaska

How OEKOS Began

In late August, 1989, in the aftermath of the Exxon Valdez oil spill, a group of fishermen and consumers met in Kenai, Alaska, to discuss how to combat future destruction of the ecology and economy of the North Pacific.

During the discussions, it was realized these are not problems isolated to the North Pacific. They are concerns of national and global proportion. The decision was made to establish a non-profit corporation dedicated to prevent further ocean destruction and to revive the natural ocean economy in places where destruction has occurred.

Among those attending the discussions were Thom Tomrdle, Frank Newton, Dyer Van Devere, David Bridges, Carl Taurianen, Donald Hallstead Sr., Robert Clarke, Frank Newton, David Watson, Walter Page, Ron Keil, Tom Flynn, Tim Keener, Chris Schelb, Eric Thompson, and Tucker Thompson. These people in turn contacted friends and associates in Cordova, Kodiak, Homer, Seward, Bristol Bay, Seattle, and elsewhere.

OEKOS was incorporated in September, 1989, adopting as its name the ancient Greek word for everyone's house, and the common root for our modern words economy, ecology, and ecosystem.

The OEKOS logo was designed by commercial fisherman Captain Anna Young.

OEKOS Bylaws

Bylaws

Article I. Purpose

Section 1 - OEKOS is a non-profit public benefit corporation and is not organized for the private gain of any person. It is organized under the laws of the state of Alaska.

Section 2 - The purposes of the corporation shall be to inform and educate public awareness of the urgent need to protect and promote the Ocean economy, by arresting the systematic destruction of oceans, tributaries and fisheries.

Article II. Membership

Section 1 - Membership is open to any person concerned with improving and protecting the ocean economy, arresting pollution and improving the conditions of the world's oceans and its tributaries.

Section 2 - There shall be eight classes of membership as follows:

- a. CHARTER MEMBERSHIP shall consist of members who have qualified and joined OEKOS in its first year of existence beginning September 1, 1989 through September 1, 1990 and paid the required membership fee of \$20.00.
- b. PERSONAL MEMBERSHIP shall consist of all persons who have qualified, joined and paid OEKOS the membership fee of \$20.00 after September 30, 1990.
- c. BUSINESS ASSOCIATE MEMBERSHIP shall consist of individual businesses, the operations of which are not directly involved in the ocean economy, but which support OEKOS' goals and purposes, which have qualified, joined and paid the Business Associate Membership fee of \$100.00 - \$250.00. Business Associate members will receive recognition in OEKOS' official publication.
- d. OCEAN AFFILIATE MEMBERSHIP shall consist of regional associations of individuals organized to combat ocean or natural waters destruction or to maintain their fisheries and recreational capacities, which have qualified and paid the membership fee of \$100.00 - \$250.00. Ocean Affiliate members will be recognized in OEKOS' publications.
- e. CONTRIBUTING MEMBERSHIP shall consist of any individual, business, association, institution or trust sympathetic to OEKOS' goals and purposes which has qualified and contributed a minimum of \$500.00 to the Corporation.
- f. CORPORATE MEMBERSHIP shall consist of those Corporations directly or indirectly involved with the Ocean Economy and which benefit economically from the success of OEKOS' projects and objectives, and which have qualified,

joined and paid the Corporate Membership fee of \$1,000.00 - \$2,000.00. Corporate Members will receive recognition in OEKOS' official publication.

- g. SPONSORING MEMBERSHIP shall consist of individuals organizations, foundations and corporations subscribing to the goals and which qualify, join and contribute to the sponsorship of specific OEKOS projects and undertakings and paid the Sponsoring Membership fee of \$2,000.00 or more. Both the Sponsoring Members and their projects will be given prominent recognition in OEKOS' official publication.
- h. HONORARY MEMBERSHIP shall consist of persons, organizations or corporations which share OEKOS' concerns and goals and who have demonstrated extraordinary commitment to these ends by their actions. Honorary Membership must be designated by action of the Board of Directors and no other qualification or membership fee is required.

The Board of Directors may discontinue or combine any class or classes of membership previously established; any member in a discontinued class shall be transferred to another class with equivalent privileges and without an increase in dues until the member's next membership anniversary.

Section 3 - Qualification and Dues. To join OEKOS a member must complete a written application on the form prescribed by the secretary and shall pay the fees as specified by the class of membership sought.

Section 4 - Annual Dues. The membership year is from November 1 to November 1. Annual Dues shall be set by the Board of Directors. Dues are payable annually by members except that payment of membership fees upon joining OEKOS entitles a member to the privilege of membership until the next November 1 at which time the annual dues become payable. Annual dues must be paid by December 1 to maintain membership in good standing.

No member may transfer to another person a membership or any right arising there from. Membership shall terminate upon the death or resignation of the person or persons holding the membership or for non-payment of annual dues after the grace period of 30 days. No membership shall have any property rights by virtue of membership.

Section 5 - Privileges of Membership. Each person, corporation, or organization on the date of record shall be eligible to vote except contributing members, and shall have one vote on any issue presented to the membership as provided in these By Laws. Voting by proxy shall be permitted.

Article III. Membership Meetings

Section 1 - Regular Meetings. Regular meetings of the membership shall be held

The "Late" News

The first issue of *The Ocean Citizen* was scheduled for publication in December, 1989, but was delayed on the advice of counsel until the OEKOS Bylaws were revised and published to accommodate numerous member inquiries and concerns.

The first Annual Membership Meeting will be held as provided in October, 1990. The precise date and agenda will be announced in advance and proxy forms distributed for those members unable to attend in person. A Board of Directors will be elected

at that time. During the interim, OEKOS will be operated by the incorporating officers, Thom Tomrdle, Frank Newton, Robert Clarke, and Joseph Harlan, with the advice and counsel of a National Advisory Board and OEKOS' general membership.

OEKOS members are urged to familiarize themselves with the Bylaws printed on this page.

Members willing to serve on the OEKOS National Advisory Board, in your city or state, are invited to do so by writing to OEKOS.

annually at the time and place specified by the Board of Directors and may be held in conjunction with a meeting of the Board of Directors. Members may vote in person or by mail on ballots provided for that purpose advanced by the Board of Directors in advance of regular meeting. Ballots shall be mailed to qualified voting member no later than 30 days before the annual meeting and must be received by the Secretary prior to the date of the annual meeting.

Section 2 - Special Meetings. Special meetings may be called by the President, Secretary, Board of Directors, or Members having 25% of the votes entitled to be cast at the meeting period.

Section 3 - Notice of Membership Meetings. Notice of Membership Meetings shall be provided by the Secretary in writing at least 30 days prior to the Membership Meeting.

Section 4 - Members shall be in good standing at the date of record, may vote on issues properly brought before the membership as specified by law or properly put before the membership by the Board of Directors. A quorum shall consist of at least one-tenth of the membership votes represented in person or by proxy for the purpose of transacting business at the membership meeting.

Article IV. Board of Directors

Section 1 - Number and Power of Directors. The activities and affairs of OEKOS shall be conducted and all corporate powers shall be exercised by or under the direction of a Board of Directors consisting of seven members in good standing of OEKOS. The majority of the directors then in office but not less than three shall constitute a quorum for the transaction of business by the Board. The Board may delegate management of the activities to any person, persons or committee however composed, provided that the activities and affairs of OEKOS shall be managed and all corporate powers shall be exercised on the ultimate direction of the Board of Directors.

Section 2 - Nomination, Election and Term of Office.

The Board of Directors specified in the Articles of Incorporation shall hold office until the successors are elected and have

qualified at the first annual election of directors. In that election two directors shall be elected to serve one-year terms, three to serve two-year terms and two directors are to serve three-year terms. Directors shall be elected by the membership to serve further term of office and there is no limit on the number of terms an individual may serve on the Board of Directors. The number of the Board of Directors may be increased and decreased by amendment to the By Laws but no decrease shall have the effect of shortening the term of any incumbent director. Only members of OEKOS in good standing are eligible to serve on the Board.

Section 3 - Vacancies. Vacancy occurring on the Board of Directors by reason of an increase in the number of directors or resignation or other termination of an existing director may be filled by an affirmative vote of the majority of the remaining directors. The director elected to fill a vacancy shall be elected for the unexpired term of the predecessor in office. In no case may a vacancy continue for longer than six months.

Section 4 - Quorum. The majority of the directors fixed by these By Laws constitutes a quorum for the transaction of business. The act of the majority of directors present at a meeting at which a quorum is present is the act of the Board.

Section 5 - Board Elections. The Board shall appoint a committee for the purpose of establishing nomination and election procedures for the annual election of the Board of Directors. The first and each subsequent election of the directorship shall be held in December and conducted by mailed ballot. Only members of OEKOS in good standing will be eligible to vote in the election of the Board.

Section 6 - Notice of Meetings of the Board of Directors. The Secretary shall provide notice of the time and place of each Board of Directors meeting by at least ten (10) days prior to the meeting. Notice of any regular meeting may be waived if the time and place of the meeting are set at the previous meeting of the Board.

Notice of any meeting of the Board of Directors may be waived in writing signed by the person or persons entitled to such notice, whether before or after the time of such meeting, shall be equivalent to giving such notice. The attendance of a director at such meeting shall constitute a waiver of notice.

OEKOS Bylaws

thereof, except that a director who attends a meeting for the express purpose of objecting to the transaction of any business because such meeting is not lawfully convened. Neither the business to be transacted at, nor the purpose of any meeting of the Board of Directors need be specified in the notice, or waiver of notice of such meeting, except that the notice of the annual meeting for the purpose of electing the Board of Directors shall specify that it is an annual meeting, at which the Board of Directors election shall take place.

The Board of Directors may hold any lawful meeting by simultaneous telephone communication or teleconference.

All meetings of the Board of Directors or any committee thereof shall be open to the attendance by any member of OEKOS in good standing. But nothing herein shall prevent the Board or any committee thereof from convening a private session of the consideration of any matter, provided however the vote or final action shall be taken in an open session.

Section 7 - Removal. Cause for removal from the Board may be found upon the occurrence of any of the following:

- three (3) unexcused absences within any one year period from any regular or special Board meeting without good cause;
- the breach by any Board member of any confidential information regarding the corporation.
- any dishonest or illegal conduct on the part of the Board member.

Section 8 - Procedures for Removal. A member of the Board may be removed from the Board during his or her term at any meeting of the Board upon a vote of two-thirds of the members of the Board of Directors.

Article V. Officers

The officers of the corporation shall be elected by the Board at the first meeting of the Directors following an annual election. There are four (4) officers of the corporation, there being a President, Vice President, Secretary, and Treasurer. All officers shall be members of the Board of Directors of the corporation. Any two or more offices may be held by the same person except that the offices of President and Secretary shall be held by different individuals. The term of office is one year. Officers may succeed themselves by an additional term or terms. Whenever any vacancy shall occur in any office by death, resignation or increase, the same shall be filled by the Board of Directors, and the officer so elected shall hold office until his or her successor is chosen and qualified.

Section 1 - The President. The President shall preside at the meetings of the Board. The President shall discharge all the duties which evolve upon a presiding officer and perform such other duties as law or By Laws provide or the Board of Directors may prescribe. The president shall have full authority to execute on behalf of the corporation any powers of attorney, deeds, mortgages,

bonds, contracts, checks, or other instruments which the Board of Directors have authorized to be elected.

Section 2 - The Vice-President. The Vice President shall perform all duties incumbent upon the President during the absence or disability of the President, and shall perform such other duties as this code of Bylaws may require or the Board of Directors may prescribe.

Section 3 - The Secretary. The Secretary shall attend all meetings of Directors and shall keep or cause to be kept, in a book provided for that purpose, a true and complete record of the proceedings of such meetings. The Secretary shall attend to the giving and serving of all notices and shall perform such duties as this code of Bylaws may require or the Board of Directors may prescribe.

Section 4 - The Treasurer. The Treasurer shall arrange for the keeping of correct and complete records of account, showing accurately at all times the financial condition of the corporation. The Treasurer shall be the legal custodian of all monies, notes, securities, and other valuables which may, from time to time come into possession of the corporation. The Treasurer shall immediately deposit all funds of the corporation coming into his or her hands in some reliable bank or other depository to be designated by the Board of Directors, and shall keep such bank account in the name of the corporation. The Treasurer shall furnish at each meeting of the Board of Directors, or whenever requested by the Board, a statement of the financial condition of the corporation, and shall perform such other duties as this code of Bylaws may require or the Board of Directors may prescribe. The treasurer may be required to furnish bond in such amount as shall be determined by the Board of Directors.

Section 5 - Delegation of Authority. In the case of the absence of any officer of the corporation, or for any other reason that the Board may deem sufficient, the Board may delegate the powers or duties of such officer to any other officer or to any Director or employee of the corporation, provided a majority of the entire Board concurs therein.

Article VI. OEKOS Chapters

Section 1. Members of OEKOS who reside in the same region may, with the approval of the Board, form a chapter of OEKOS. No chapter shall be approved unless an application has been filed with the Board. The application shall be signed by at least fifty (50) members of OEKOS in good standing who are residents of the designated region. The application shall state the proposed boundaries and name chosen by the applicants for the chapter. A chapter fee as specified by the Board of Directors will be used in addition to the OEKOS' membership fee.

As soon as the formation of a chapter has been approved by the Board, the Secretary of OEKOS shall send a notice to all members of OEKOS who reside in the designated territory announcing the action of the Board and setting the schedule for election of the first Executive Committee of the chapter

and for adoption of Bylaws. The notice shall name three of the members who signed the application as temporary officers.

The bylaws of a chapter shall not contain anything that is at variance with the expressed purposes of OEKOS or with these Bylaws and shall be approved as specified by the Board. The name "OEKOS" shall be included in the chapter's name.

The Board may, by majority vote, suspend or annul a chapter if, in the judgement of the Board, such action is in the best interest of OEKOS. Such action shall not affect the standing of the individual members as members of OEKOS. The Board shall not suspend or annul a chapter until the following conditions are met:

- Written specification of the basis shall have been furnished to the members of the chapter involved;
- A reasonable opportunity shall have been provided for members of the chapter to present evidence in opposition to the proposed action with a full opportunity to be heard thereon; and
- The advice of the Board on the proposed action shall have been received.

Any member of OEKOS who resides within the territorial limits of a chapter shall be considered to be a member of that chapter and shall be entitled to its privileges. No member shall belong to more than one chapter. No dues shall be assessed or collected by a chapter; however, consistent with the policies of the Board, chapters may conduct fund raising and other activities which require members, as well as others, to pay a fee in order to participate. Each chapter shall be entitled to receive from OEKOS a portion of the dues collected from the membership, such amount to be determined in a manner specified by the Board of Directors. Such amounts shall be payable to the treasurers of the chapters quarterly as collected. Nothing in this section shall prevent the Board from allotting additional funds to chapters for specific purposes.

A chapter cannot borrow money or own real estate. The board may, however, place the management of any of OEKOS' property in the hands of the chapter. All members of OEKOS shall have equal privilege on such property. Each chapter is authorized to undertake such activities as are consistent with the purposes of the corporation and are not prohibited by the Board by a general rule applicable alike to all chapters. Chapters shall act on questions of public policy only in pursuance of policies of the Board of Directors or in a manner consistent with them.

Article VII. Special Corporate Acts, Negotiable Instruments, Deeds and Contracts

Section 1. All checks, drafts, notes, bonds, bills of exchange and orders for the payment of money of the corporation; and all deeds, mortgages and other written contracts and agreements to which the corporation shall be a party shall, unless otherwise required

by law, or unless requiring the expenditure of obligation of less than \$500.00, be signed by any two of the officers or Board members. The Board of Directors, may, however, authorize any agent of the corporation who may, in the name of the corporation, sign such instruments.

Article VIII. Fiscal Year.

Section 1. The fiscal year of the corporation shall begin on the 1st day of November and shall end on the 31st day of October.

Article IX. Committees.

Section 1. The Board of Directors may provide for the establishment and appointment of such standing or special advisory committees as it deems necessary and appropriate to advance the purposes of OEKOS. All members of OEKOS shall be eligible for membership upon all committees so established.

Regional committees, made up of delegates from two or more adjacent chapters, may be established by the Board of Directors and shall have such authority to act on matters within their respective regions as is delegated to them by the Board.

AMENDMENT OF BYLAWS

These Bylaws may be amended or changed by the Board of Directors upon two-thirds majority vote of a resolution amending these Bylaws.

There shall be a standing Bylaws committee appointed by the Board on any changes to these Bylaws. Members may initiate, suggest or recommend amendments or changes to these Bylaws to and through the Bylaws committee.

*Please recycle this
newspaper. Thank you.*



ADOPTED AUGUST 1972

CITY of WRANGELL, ALASKA

INCORPORATED JUNE 15, 1903

BOX 531, 99929 (907) 874-2381
FAX: (907) 874-3952

February 21, 1990

Senator Dick Eliason
Alaska State Legislature
Post Office Box V (MS 3100)
Juneau, Alaska 99811

Dear Senator Eliason:

Attached is a copy of City of Wrangell Resolution No. 02-90-341, relating to Senate Bill #397 and House Bill #432, "An Act Prohibiting Finfish Farming."

We ask your support of the above captioned legislation. It is important that we protect the future of our wild fisheries. The State of Alaska and the private sector have expended millions of dollars and untold man hours developing some of the worlds best hatcheries and fisheries enhancement projects to propagate our wild finfish stocks. It would seem ill-advised to sanction an industry that could conceivably jeopardize the future of our wild fisheries.

Sincerely,


Donald J. House
Mayor

DJH/jg

encl.

CITY OF WRANGELL, ALASKA
RESOLUTION NO. 02-90-341

Certified a true and correct
copy of the original filed
in my office.

James K. Henderson
City Clerk *2-14-94*
City of Wrangell *2 page*

A RESOLUTION OF THE COUNCIL OF THE CITY OF
WRANGELL, ALASKA RELATING TO LEGISLATION
PROPOSED IN SENATE BILL #397 AND HOUSE BILL
#432, "AN ACT PROHIBITING FINFISH FARMING;
AND PROVIDING FOR AN EFFECTIVE DATE."

WHEREAS, the State of Alaska and private enterprise have
invested millions of dollars in successful salmon fisheries
enhancement programs; and

WHEREAS, the enhancement programs and careful management of
natural fisheries resources has resulted in Alaska having the
healthiest stocks of wild salmon in the world; and

WHEREAS, the economy, the environment, and the people of
Alaska are highly dependent upon the continued health and
stability of the state's wild salmon resource; and

WHEREAS, commercial salmon farming (pen raising of salmon)
poses serious risks to wild salmon stocks from disease, genetic
mutation, and degradation of water quality at fish farm locations;
and

WHEREAS, the state has a significant investment in marketing
efforts to promote salmon and other Alaskan seafoods as wild and
natural products; and

WHEREAS, preservation of the state's established and
successful wild fisheries resources should take precedence over
development of a speculative and potentially harmful industry
such as salmon farming; and

WHEREAS, Senate Bill No. 397 and House Bill No. 432
introduced to the Sixteenth Legislature of the State of Alaska
propose the prohibition of finfish farming in the State of
Alaska.

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF
WRANGELL, ALASKA:

1. The Council of the City of Wrangell does hereby endorse
Senate Bill No. 397 and House Bill No. 432, "An Act
Prohibiting Finfish Farming."
2. The Council of the City of Wrangell does hereby
respectfully request that the Governor and the Sixteenth
Legislature of the State of Alaska support passage of
Senate Bill No. 397 and House Bill No. 432.

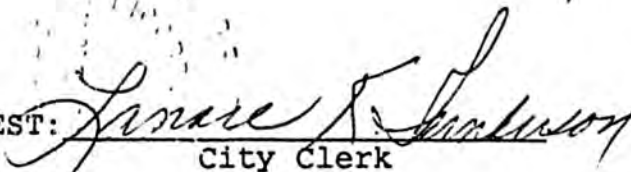
3. The City Clerk is hereby directed to transmit copies of this resolution to:

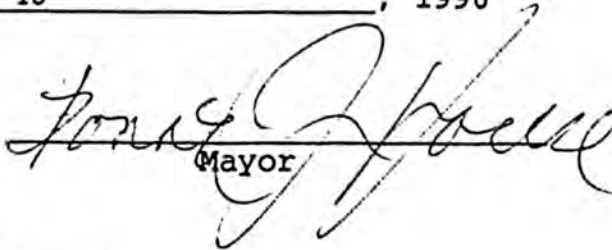
Governor Steve Cowper
Senator Tim Kelly, President of the Senate
Senator Dick Eliason
Senator Lloyd Jones
Senate Finance Committee
Senate Resources Committee
Representative Sam Cotten, Speaker of the House
Representative Ben Grussendorf
House Judiciary Committee
House Resources Committee

4. This resolution shall become effective on approval.

PASSED AND APPROVED: FEBRUARY 13, 1990

ATTEST:


City Clerk


Mayor

Dear Senator Eliason,

Thanks for your strong support of a ban on finfish farming in Alaska. I hope that all mariculture will be given close scrutiny and regulated in a manner which allows for a safe, slow development which respects the rights of all users, soundly protects the environment and existing subsistence, sport, and commercial economies. I do not believe that finfish farming adequately addresses these concerns given the numerous risks involved. I hope that you will continue to show strong support for our wild stocks. It is only through such support that subsistence, sport, and commercial fisheries will continue as an important (if not central) part of SE Alaskan life. Please show strong support for buffer zones on State, Federal, and private lands in the upcoming State Forest Practices Act. Again, thanks for sponsoring the finfish ban. Keep up the good work!

Michael J. Van Note

Box 26,

Haines, Ak. 99827

City of Tenakee Springs

RESOLUTION 90-10

In the Council
February 22, 1990

Introduced by
Robert Pegues

A RESOLUTION FOR THE CITY OF TENAKEE SPRINGS, ALASKA
SUPPORTING SENATE BILL 397

WHEREAS, the legislature has taken a thoughtful and cautious approach to finfish farming; and

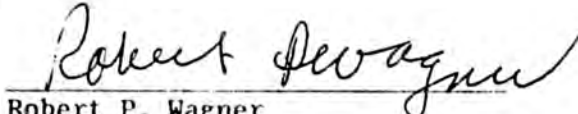
WHEREAS, the legislatively created task force on finfish farming has completed its report; and

WHEREAS, the report notes few benefits countered by numerous serious risks; and

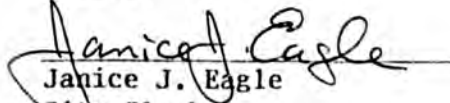
WHEREAS, the "economic development" envisioned by the proponents of finfish farming will be achieved only at great jeopardy to the wild stock fishery, Alaska's largest employer, whose benefits are of vital economic and social value to Alaskans in most every community, great and small; then

THEREFORE BE IT RESOLVED that the common council of the City of Tenakee Springs urges the Alaska State Legislature to adopt Senate Bill 397.

ADOPTED 4 YES, 3 ABSENT THIS 22ND DAY OF FEBRUARY 1990


Robert P. Wagner
City Council President
ex officio MAYOR

ATTEST:


Janice J. Eagle
City Clerk

Senator Bettye Fahrenkamp
Box V
Juneau, AK 99811

Dear Senator Fahrenkamp:

We have been Alaska residents for 18 years. We live here because we love the beautiful pollution free environment. Last summer's oil spill was a devastating experience for us both economically and spiritually.

In light of the fragility of our precious environment, we are asking you to pass a bill (HB432 or SB 397) and prevent fish farming in Alaska.

Aside from the environmental dangers, all of which we are sure you are aware of, fish farming does not make sound economic sense. Already the market is suffering from an oversupply of an inferior salmon. This, consequently, is driving the entire price of salmon down and endangering our existing salmon industry. What we have going for us now is an industry which offers a completely wild stock. Should we go into fish farming, we ruin the one edge we have in marketing. It appears that there is very little to gain if anything at all in fish farming and very much to lose. Why endanger an existing industry by introducing pollutants, disease, and damaging a "good name" with our wild stock.

We applaud Senator Eliason and Representative Grussendorf for the stand they have taken. We ask you to join them and help keep Alaska environmentally sound and economically stable.

Sincerely,

Katy White

John and Katy White
POB 62
Tenakee Springs, AK 99841

c. Senator Eliason
Representative Grussendorf

Thomas E. Thompson

Box 830

SITKA, ALASKA 99835

September 28, 1989

Dear Dick:

Here is some more information on the farmed fish subject, which you may have already received, but in case not, you will find the analysis interesting.

Our association with farmed fish was with Clearwater, who recently got into trouble corporate-wise and had to relinquish all of their western Canada and US holdings to Hillsdown Holdings, Inc., a large food processor holding company in the UK, which had loaned Clearwater 300,000,000 plus dollars and had to take over most of the good assets. Clearwater is still in existence, but only has the plants in the provinces, which are not doing well at all. They had to agree to buy back what they had at a price of 125 million and have five years to pay it off. I would say they are in for a real battle.

Anyway, we are now operating directly under a holding company of Hillsdown Holdings, who we report directly to. We still maintain our autonomously directed company, but I must say the reporting requirements have increased considerably. It is kind of nice to know I am about to get out of this business, as it is a different world than what I have experienced the past forty or so years.

The farmed fish problem was not recognized soon enough in 1988 and resulted in serious problems for the frozen industry. The canners were bailed out by the low volume but high price of canned salmon. This year the farmed problem continues, but we are able to combat this with the existing low prices for fish we must sell in competition (Chums, Silvers, Kings). There is still a lot of farmed fish being produced and even though they are facing tough financial and some quality problems, they will continue to be there. We are dealing with one salmon-trout firm in Sweden that has agreed to just send their product to Japan on a consignment basis, and that makes them a sitting duck for the buyers. The only bright aspect for us, but possibly not for the fishermen, is the high basic cost the farmers have to produce a pound of salmon. It could be in the \$2.00 range - and that is the number we must continue to be aware of. Right now the market for salmon in France for Pacific salmon is absolutely dead. Most of our net and troll silvers moved into Japan, only because of the price competitiveness compared to red salmon. The Japanese, as you probably know, are taking a hard look at farmed fish and are making investments in farms throughout the world. I am sure that they are taking advantage of the twenty-five cents to the dollar price tag on Canadian farms that are in real trouble.

I am glad you are taking the position on farmed salmon that you are.

Tom

(3)

UK Seeks Salmon Reference Price -- The Scottish salmon farming industry plans to launch a joint appeal with Irish salmon producers, urging the EC to introduce a minimum price for salmon, along the same lines as the prices for other fish. A reference price would allow the EC to impose anti-dumping fees on farmed Norwegian salmon if Norwegian fish farmers attempt to flood the EC market with salmon; Norwegian production has increased from 80,000 t in 1988, to 120,000 t in 1989, and could exceed 150,000 t in 1990. Scottish producers claim that the Norwegians are now selling farmed salmon below production costs. (WF: The Scotsman, July 3, 1989). NMFS Note: EC Fisheries Commissioner, Manuel Marin, rejected a similar request last month, stating that EC producers would simply have to meet world competition. (See: Latest Developments in West European and Canadian Fisheries, July 1989)

UK (Scottish) Salmon Production -- A total of 90 companies (operating 197 salmon smolt farms) produced 22 million smolts in 1988, and expect to produce 33 million smolts by 1990. Salmon farmers produced nearly 18,000 t of farmed salmon in 1988 and hope to more than double this production to 43,500 t by 1990. UK exports of farmed salmon exceeded 6,500 t, valued at approximately US\$52 million, in 1988. France, the Netherlands, and the U.S. accounted for most UK exports. During the first six months of 1989, UK exports of farmed salmon were 4,500 t, worth about \$32 million. (WF: U.S. Embassy, London, August 18, 1989).

UK Vacuum-Pack Trout Warning -- A UK health official warns that vacuum-packed, ready-to-eat trout could cause serious health problems. Nearly all trout carry the bacteria *Clostridium botulinum* which causes botulism, a potentially fatal form of food poisoning. Although vacuum-packed trout is usually smoked in temperatures of up to 80° Celsius (enough to kill the bacteria), the absence of oxygen in vacuum-sealed containers provides an ideal breeding conditions for any bacterial spores which were not destroyed by heating. Mr. Brian Thornton, principal environmental health officer at the New Forest District Council said that smoked trout should never be vacuum-packed. (WF: Eurofish Report, August 17, 1989)

II. WESTERN EUROPE (non-EC)

Icelandic Exports to Japan -- The Icelandic Export Council and the Ministry for Foreign Affairs are preparing a trade mission to Japan this winter. The Ministry is also considering opening an Icelandic Embassy in Japan during 1991. Icelandic exports to Japan have been growing steadily and have literally "taken off" since the Flying Tigers airfreight company began service from Europe, via Iceland, to Japan. Exports of fresh Icelandic salmon, flatfish, lobster,

cod milt, and sea urchin roe have reached as much as 18 t per week. Icelandic Freezing Plants Corporation recently opened a new sales office in Tokyo. Icelandic exports to Japan were valued at \$107 million in 1987 (including non-fishery items). (WF: News from Iceland, August 1989)

Icelandic Farmed Salmon -- Icelandic fish farmers expect to harvest 4,000 t of farmed Atlantic salmon in 1989, including 400 t of ocean ranches salmon and another 400 t of trout. Iceland had 16 million salmon smolts and 1 million trout smolts in inventory during January 1989. Of this amount, 5 million smolts will be released for ocean ranching and 5 million will be raised in net pens (the remainder will presumably be exported). The total value of Iceland's aquaculture harvest, in 1988, was estimated at \$17 million. (WF: News from Iceland, August 1989)

Norway Suffers Algae Bloom -- Norwegian fisheries officials report that an algae bloom has appeared in the Ryfylkefjord, along the southern coast near Stavanger. Authorities estimate that 450-600 t of farmed salmon worth \$4 million have been affected by the poisonous algae and 16 fish farms with 2,000 t of farmed salmon are threatened. Farmers are trying to move their fish to safer waters or are trying to dilute the algae by pumping fresh water into the fjords. The Government of Norway has sent 4 research vessels to monitor the algae. Marine biologists believe that the algae stems from an abnormally high concentration of industrial nitrates in brackish waters. These scientists don't expect the bloom to spread along the coast to the Hordaland area where fish farming is more heavily concentrated, but feel it could break out in other fjords where brackish waters are found. (WF: U.S. Embassy, Oslo, August 11, 14, and 16, 1989)

Norwegian Salmon Packaging -- The shelf-life of fresh, farmed salmon can be extended considerably, while lowering the costs of transportation, if salmon are packed in a moist, airtight bag instead of being packed in ice. According to fishery scientists, at the Tromsø research center, carbon dioxide can then be pumped into the bag, forcing out oxygen and inhibiting the growth of bacteria, thus extending the shelf-life of exported salmon from 15 to 20 days. By reducing the amount of ice used in shipping, Norwegian fish farmers will also realize significant savings in transportation costs. (WF: Eurofish Report, August 17, 1989)

Norway Suspends Salmon Licenses -- Norwegian Fisheries Minister Bjarne Eidem has temporarily suspended issuing new licenses for salmon farmers. Eidem noted there is a danger that the industry has expanded too rapidly, because fish farmers are concentrating on quantity, rather than quality. Norwegian farmed salmon production is expected to exceed 120,000 t in 1989 and may approach 150,000

Lord Caithness' report. The license was issued only because of its importance to the salmon industry and to allow time for a new, less toxic medicine to be developed. The approval action has angered many UK fishermen because of Nuva's toxicity. (WF: Eurofish Report, July 6, 1989 and Fishing News, June 30, 1989)

UK (Scottish) Salmon Harvests -- Scottish farmed salmon harvests increased by 71 percent to 17,951 t in 1988 and is expected to reach 53,000 t by 1991. Salmon farming provided 1,335 full-time and 448 part-time jobs and the number of people employed in support services is estimated at about 5,000 individuals. The Scottish Salmon Board and the Shetland Salmon Farmers Association were launched in 1987, with a goal of developing marketing programs in the UK and France. Wholesaling for 125 salmon farmers is done by 53 companies; of these, 10 companies sell 95 percent of Scottish farmed salmon. (WF: Fish Farming International, July 1989)

II. WESTERN EUROPE (non-EC)

Iceland Fish Catch -- Icelandic fishermen caught 1.0 million t of fish during the first 6 months of 1989, slightly less than the amount caught during the same period in 1988. The harvest includes 607,000 t of capelin (same amount as in 1988), 206,000 t of cod (about 5,000 t less than in 1988) and 174,000 t of other demersal fish, slightly more than during the first half of 1988. The U.S. Embassy in Reykjavik reports that the continuing recession in Iceland has caused many bankruptcies. The Embassy predicts that a number of fish farms and several fish plants will declare bankruptcy during the second half of 1989. (WF: U.S. Embassy, Reykjavik, August 2, 1989)

Icelandic Boycott Ends -- Two Greenpeace officials have announced the end of a campaign against Icelandic fishery product. The reason was the Government of Iceland's decision to halt the scientific whaling program. The Greenpeace spokesmen, at their news conference in Reykjavik on August 1, 1989, claimed that the boycott had been a success. News of the end of the boycott came just 2 days after Wendy's restaurant chain announced its decision to stop buying Icelandic fish, an action that could have resulted in the loss of \$4 million in sales. Greenpeace officials indicated that they would contact firms and schools boycotting Icelandic fish and urge them to consider purchasing Icelandic fish. (WF: U.S. Embassy, Reykjavik, August 3, 1989)

Icelandic Whaling -- The 1989 Icelandic whaling season ended with a harvest of 68 fin whales. There has been extensive Icelandic press coverage about the end of the whaling season and speculation about the taking of whales in 1991 or beyond. The

Icelandic Government has decided not to permit any whaling in 1990. Icelandic researchers, however, are taking part in a survey of whale stocks off Iceland as part of a multi-national research effort. (WF: U.S. Embassy, Reykjavik, July 21, 1989)

Norwegian Farmed Salmon Sales -- Norwegian salmon farmers expect to market approximately 120,000 t of Atlantic salmon in 1989, despite declining prices. The Norwegian Fish Farmers' Sales Organization (FOS) claims that if production exceeded 120,000 t in 1989, then some salmon exports would be delayed or extended until early 1990. Odd Berg, the FOS marketing director, reported that Norwegian salmon farmers expect to produce 140,000 t to 150,000 t of Atlantic salmon in 1990 and 1991. Berg also reported that Norway is making an effort to expand into the Japanese market which imported 2,343 t of Norwegian salmon through May 1989. (WF: Fish Farming International, July 1989)

Norwegian Salmon Farm Bankrupt -- Saga Seafood of Bergen has filed for bankruptcy. The company, headed by Norway's pioneer in salmon farming, Thor Mowinkel, is the first major salmon farm to fail in Norway because of the sharp fall in world salmon prices, caused, in part, by the flood of Norwegian farmed salmon entering the market in recent months. According to Thor Mowinkel, Saga Seafood was still in a developmental stage when low prices and other mishaps forced it into bankruptcy. (WF: Fish Farming International, July 1989)

Norwegian Computer Service -- The Norwegian fish farming industry now has its own computer-based information system, "MARINET", which currently has 150 subscribers since it began operating in November 1988. The system gives fish farmers instant access to data on diseases, bad weather, rapid changes of water temperature, and other threatening situations. Marinet also provides news items of interest to fish farmers, reports on short- and long-term changes in market conditions and statistics on production. Each subscriber can also enter and process their own production data, which is carefully guarded against unauthorized entry. (WF: Fish Farming International, July 1989)

Norway-USA Joint Venture -- Aquacare, a Norwegian firm which builds large, intensive culture fish farms is constructing a pump-ashore facility in Westport, Washington. The new farm is expected to become operational in October 1989 and will produce either 1,000 t of steelhead trout and 750 t of Atlantic salmon, or 900 t of a combination of both species. The new farm will be operated by Westport Seafarm which includes Aquacare, a Washington real estate firm, and a local seafood processor are general partners. Aquacare also built a large pump-ashore facility in Spain's Canary Islands which raises seabream and seabass and was responsible for

building "the world's largest indoor growout facility for trout" on Prince Edward Island, Canada (that facility went bankrupt and was purchased by U.S. investors earlier this year). (WF: Fish Farming International, July 1989)

Swedish Catch, 1988 -- Swedish fishermen caught 240,000 t of fish and shellfish in 1988 (versus 205,000 t in 1987) helping to reverse a downward trend in landings during recent years. Herring (61,900 t) and cod (51,300 t) were the most important species caught by Swedish fishermen in terms of quantities landed (slightly less than half the total catch). Most of the catch was taken off the western coast of Sweden (137,000 t, or about 59 percent of the total). (WF: Statistiska meddelanden, 1989)

Swedish Salmon Imports -- Sweden imported approximately 4,300 t of salmon worth \$31 million in 1988. This included 2,150 t of fresh salmon worth \$18 million (mostly from Norway); 1,943 t of frozen Pacific salmon worth \$10 million (including 39 t transshipped through Singapore). Swedish importers also purchased 148 t of smoked salmon valued at \$2 million and 60 t of prepared or preserved salmon worth \$1 million. Norway, Denmark, and the Faroe Islands are all key suppliers of Atlantic salmon to Sweden. Canada, the United States, and Japan also export Pacific species to Sweden. (WF: U.S. Embassy, Stockholm, Sweden, May 30, 1989) NMFS believes that some of the salmon shipped through Singapore may have been taken illegally by Taiwanese or South Korean squid gillnetters operating in the North Pacific.

Swedish Aquaculture -- Swedish fish farmers produced 7,500 t of fish and 860 t of shellfish in 1988. This included 6,800 t of rainbow trout, 360 t of Atlantic salmon, and 230 t of European eel. Production of blue mussels, however, dropped dramatically from 2,560 t in 1987 to only 860 t in 1988. (WF: Statistiska meddelanden, 1989).

III. CANADA

A. General

Aquaculture Drug Approval -- The Canadian Bureau of Veterinary Drugs has issued an import license for the sale of "Tetraplex", an antibacterial product manufactured in the UK which is used for treating bacterial diseases of aquatic species, including salmon and lobster. Canadian authorities test all drugs used in the marine environment to ensure safety to consumers, farmed stocks, and wild stocks of fish and shellfish. (WF: Fish Farming International, July 1989)

Aquaculture Producers Council -- The recently established Canadian Aquaculture Producers Council

(CAPC) is an umbrella organization serving regional and provincial aquaculture organizations in Canada. "Our goals are to promote the Canadian aquaculture industry both here and abroad" said CAPC president Tom May. The CAPC will lobby the Canadian government on matters related to scientific research, habitat, seafood inspection, market development and other areas of interest to the industry. (WF: Fish Farming International, July 1989)

B. Atlantic

DFO Appeals Ruling -- The Canadian Department of Fisheries and Oceans (DFO) has filed an appeal in the decision of a Halifax judge to release a U.S. skipper charged with illegally fishing in Canadian waters and of obstructing a DFO officer. The judge ruled that the U.S. skipper had used reasonable care in determining his position and did not obstruct the DFO officer. The appeal will be based on the grounds that the judge erred in his interpretation of the law. (WF: U.S. Consulate General, Halifax, Nova Scotia, July 19, 1989)

Pursuit of U.S. Vessel -- The Canadian enforcement vessel Cygnus spotted the F/V Bountiful fishing 7 miles inside Canadian waters on July 26, 1989, with scallops in its rakes. The Cygnus ordered the Bountiful to standby for boarding and inspection, but the U.S. vessel, instead, rammed the Cygnus as it attempted to escape. The Bountiful was chased by the Cygnus until U.S. territorial waters were reached. The Canadian Government asked that the U.S. conduct an inspection of the vessel for possible violations of the Lacey Act which prohibits importation of illegally harvested fish or shellfish into the United States. (WF: U.S. Consulate General, Halifax, July 27, 1989)

Dealing with Overcapacity -- Fisheries and Oceans Minister Tom Siddon has assigned DFO officials in the Scotia-Fundy Region to work with fishermen and processors to come up with an action plan to deal with overcapacity in Canada's Atlantic fisheries. Canada has sufficient fish to keep longliners and gillnetters fishing, but not enough to meet the fishing capacity of 400 trawlers. The groundfish fleet (1,000 licensed vessels) already has twice the fishing capacity for the available resource. As groundfish abundance has declined, quotas have been decreased to about 88,000 tons. Public hearings are planned for November 1989. (WF: News Release Communique, NR-HQ-89-025E, July 12, 1989)

Salmon Plant Opens -- Sea Farm Canada, Inc. opened its new C\$1 million processing plant at the Fundy Aquaculture Park at St. George, New Brunswick on July 5, 1989. The plant will be able to process and package more than 10 t of fresh, farmed salmon per day. Sea Farm, also has three hatcheries and three marine farms in New Brunswick. (WF: The Telegraph-Journal, July 6, 1989)

t in 1990. Even so, some Norwegian officials believe that demand for the product is increasing even more rapidly and the market will be able to absorb the large increases. (WF: U.S. Embassy, Oslo, August 14, 1989)

Swedish Faces Herring Quota -- The EC has proposed allowing 20,000 t of Swedish herring to enter the EC from September 15, 1989 to February 14, 1990, without payment of import duties, except for Swedish herring exported to Portugal (where the rate would be 7.5 percent in 1989 and 5.6 percent in 1990). In 1988/89, the EC import quota for Swedish herring (fresh or chilled, whole, headed, or in chunks) was set at 19,78 tons. The annual herring quota was established as part of the EC-Sweden fishing agreement of 1986, which allowed herring to enter the EC market without payment of import duties. EC import quotas decreased from 32,656 (in 1985/86) to 26,563 t (1986/87) to 11,637 t (1987/88) before increasing to 20,000 t during the last two years. (WF: Eurofish Report, July 20, 1989)

III. CANADA

A. General

Stricter Enforcement -- Alex Morrison, director of the Canadian Institute of Strategic Studies and Minister-Counsellor of the Canadian Mission to the United Nations, said that Canada must be able to exercise sovereignty over all its waters, air, and land. He felt that Canada's Navy should be patrolling its waters against those violating Canadian fisheries jurisdiction. The remarks were made after a U.S. scallop vessel rammed a Canadian fisheries vessel while attempting to flee. The vessel was caught allegedly fishing inside Canada's 200-mile limit. (WF: Evening Telegram, St. John's, Newfoundland, July 29, 1989)

New Fishery Officer in Boston -- Daniel Caron, formerly Chief of the Economic Service Division for the Quebec Region of the Canadian Department of Fisheries and Oceans (DFO), has accepted the post of Trade Commissioner at the Consulate General of Canada in Boston. Mr. Caron began work on August 21, 1989, and will follow the evolution of the New England fishing industry and U.S. commercial and political relations in fisheries, and will be active in promoting Canadian fishery trade and interests in the United States. Caron may be reached at the Consulate General of Canada, Three Copley Place, Suite 400, Boston, MA 02116. Tel: 617/262-3760. (WF: Personal communications)

Canadian Exports, 1988 -- Canada exported a record 616,900 t worth an estimated US\$2.3 billion in 1988 according to preliminary, unofficial estimates. This compares with 587,800 t worth US\$2.1 billion in 1987, and 594,500 t worth US\$1.8 billion in 1986. This preliminary data (some export data is still missing) suggests that Canada recovered from the mid-1988 slump in exports, caused by lower cod prices. The United States exported 673,200 t of fishery products valued at US\$2.3 billion in 1988, indicating that the U.S. and Canada are now neck-and-neck in terms of total fishery exports. (WF: Personal communications)

Canada-Thailand Tuna Inspection -- Thailand's canned tuna is eligible for preferred status in Canada, provided it meets Canadian standards. This was part of a Memorandum of Understanding (MOU) signed in Bangkok in June 1988, by the Canadian DFO and Thailand's Department of Fisheries. A Canadian inspection team visited Thailand in late 1988, to review the country's tuna canning industry. A tuna quality workshop is now planned for October 1989, to make sure that the Thai industry is aware of Canadian requirements. The MOU follows the 1986 Morrison Report, commissioned as a result of the difficulties arising from the Star-Kist canned tuna problem. The Morrison Report recommended that DFO inspectors inspect the facilities of all canneries wishing to market canned tuna in Canada. (WF: DFO, Pisces, June 1989)

Star-Kist Tuna -- Star-Kist has resumed selling canned tuna in Canada following a "tainted tuna" story when some canned tuna was recalled because of quality control problems in 1986-87. Star-Kist officials have denied that their tuna product was actually tainted. Following lengthy public examination, the Canadian DFO decided to augment their "taste tests" procedures with additional, more rigorous, scientific procedures. Star-Kist has undergone a major overhaul. The company has been packing private label tuna since August 1988, while building up stocks of "Star Kist" and "Bye The Sea" brand canned tuna. The first symbolic can of Star-Kist tuna was recently placed on the shelf of a grocery store in St. Andrews. (WF: Chronicle Herald, Halifax, Nova Scotia, May 22, 1989 and Atlantic Fisherman, June 16, 1989)

Nylon Bait -- Fishermen in Canada are tightly winding one strand of nylon fishing line to make a "feather". The nylon is heated until it melts and is allowed to cool and harden on a hook. If successful, it could replace costly squid, mackerel, or herring as bait and save fishermen thousands of dollars annually. Tests are now underway to compare the effectiveness of the nylon "feather" versus natural bait. (WF: DFO, Pisces, June 1989)

Aqua Turbot of Trélazec and are expected to reach an average weight of 2 kilograms (kg) apiece after the second year of culture. The company hopes to receive \$15/kg for turbot sold when supplies of fresh fish are traditionally low. (WF: Le Marin, July 14, 1989)

France-Spain Agreement -- French and Spanish fishermen's representatives signed a "Code of Good Conduct" in Paris on July 7, 1989. The agreement follows a growing number of conflicts between Spanish and French fishermen in the Gulf of Biscay. The agreement includes a number of provisions designed to improve communication between fishermen (including common fishing terms in both languages and a special radio channel for communicating). Restrictions on vessels and gear are also carefully defined. The new agreement is designed to reduce conflicts between longline and/or fixed gear fishermen and trawlers. (WF: Le Marin, July 14, 1989)

Irish Salmon Fishery -- Irish salmon fishermen are beginning to fish for Norway lobsters (*Nephrops norvegicus*) because of poor salmon runs in County Cork and Denegal, the low price for salmon, and the tendency of smoking companies to use farmed salmon. Smokers in Ireland can buy farmed salmon throughout the year and do not have to maintain large inventories. Smokers also avoid the hectic fishing season and are better able to plan their annual purchases. (WF: The Irish Skipper, July 1989)

Italy-Cuba Shrimp Farm -- Representatives of the governments of Italy and Cuba have signed a \$1.4 million agreement to raise farmed shrimp in Cuba. The agreement provides for Cuba to raise shrimp for export. Cuba reportedly produced 600 t of farmed shrimp, mostly for export in 1988. Little additional information about the program was published. (WF: France Pêche, July/August 1989)

Spanish Fisheries Trade -- Spanish importers purchased 814,000 t of fishery products valued at \$1.7 billion in 1988, an increase of nearly 39 percent by quantity and 17 percent by value over such imports in 1987. Most of Spain's imports consisted of fresh or chilled fish (45 percent) and crustaceans and mollusks (39 percent). Imports of all commodities, except fishmeal, increased in 1988. On the other hand, Spanish exports of fishery products in 1988, were 346,000 t valued at \$0.6 billion. These exports included 200,000 t of fresh, chilled or frozen fish. Spanish officials are concerned with the rapid increase of fishery imports. They believe that EC fishing zones cannot provide the Spanish fishing fleet with sufficient resources and are looking for access to new fishing grounds around the world. (WF: Le Marin, July 28, 1989)

Spanish Fleet -- Approximately 10 percent of Vigo's freezer trawler fleet (18 vessels) expect to be tied up

by September 1989, if economic conditions do not change soon. Increased imports of frozen fishery products from Third World countries, particularly of squid and hake, is depressing local markets. Many Spanish fishermen reportedly believe that they are not benefiting equitably from international accords negotiated by the EC on behalf of all Community members and complain that a large portion of the fishing fleet could be tied up by 1991, if more steps are not taken to protect national fishery interests. Spanish fishermen are also apprehensive about EC negotiations with the Soviet Union, which would add further pressure on EC stocks if Soviet fishermen are allowed access to these resources. (WF: Le Marin, June 30, 1989)

UK Argentine Experiments -- The first major trials in processing argentinines (*Argentina spp*) for human consumption is taking place in Killybegs where 700 t of this species has been landed. Killybegs Seafoods are filleting and freezing the fish which will be submitted to scientific evaluation as well as consumer testing. Traditionally, UK fishermen land the catch in the Faroe or Shetland Islands, or in Denmark where it is processed into fishmeal. If a local market for argentinines can be developed, then it would pay fishermen to land smaller quantities in the UK, rather than travel to distant ports to sell to reduction plants. (WF: Fishing News, June 2, 1989)

UK (Shetland) Ban on Sand-Eels -- The Scottish Office has announced a ban on sand-eel fishing in the Shetland Islands. This followed reports that young sea-birds were starving to death for the fifth year in succession. The 1989 failure of Arctic terns to breed, has been blamed on the sand-eel fishery. Other birds, including kittiwakes, puffins, Great and Arctic skuas, all feed on sand-eels which are caught to produce fishmeal. The Shetland Fishermen's Association is in favor of the ban to allow stocks to rebuild. (WF: Eurofish Report, July 6, 1989)

UK Landings Down -- Landings of fish and shellfish during the first 4 months of 1989, declined 16 percent (or 30,600 t). Improved fishing in April 1989, however, helped reverse the trend. In previous years, a decline in quantities landed have generally been offset by increased prices. In 1989, however, prices have not increased and the value of landings is down 12 percent, compared to the first 4 months of 1988. (WF: Eurofish Report, July, 1989)

UK Approves Nuvan -- The UK Government recently issued a 12-month license allowing salmon farmers to use Nuvan (also known as Aquaguard Sea Lice Treatment or Dichlorvos) during 1989-90, to control sea lice. The UK Minister of the Environment, Lord Caithness, however, announced that a renewal is unlikely, because Nuvan is on the UK "Red List" of the most dangerous substances that can enter aquatic environments. The chemical is toxic to crabs, lobsters, and plankton, according to

building "the world's largest indoor growout facility for trout" on Prince Edward Island, Canada (that facility went bankrupt and was purchased by U.S. investors earlier this year). (WF: Fish Farming International, July 1989)

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C. Pacific

U.S. Seizes Trollers -- The U.S. Coast Guard cutter Cape Hatteras observed two Canadian salmon trollers, Fonzie and Viscount, fishing inside U.S. waters north of the disputed area near the Dixon Entrance in Alaska on July 5, 1989. Both vessels were observed retrieving salmon. Upon being sighted, the trollers moved south into the disputed zone where they were pursued and boarded by personnel from Cape Hatteras and another Coast Guard cutter, Naushon. The Canadian vessels, and their catch of salmon, were seized and escorted to Ketchikan, Alaska. The captains and crew were released and returned to Canada. (WF: NOAA document)

Canada Asks Release for Trollers -- The Government of Canada has demanded that the United States drop the charges against Fonzie and Viscount, stating that the arrests took place in a disputed area between Canada and the United States. Canada considered the U.S. action to be totally "unjustified", according to Minister of Fisheries and Oceans, Siddon. (WF: News Release, July 14, 1989, NR-HQ-89-026E)

Salmon Fishermen Strike -- Members of the United Fishermen and Allied Workers Union (UFAWU) went out on strike against B.C. fish processors on July 21, 1989. The strike was sparked when B.C. fish processors attempted to extract concessions from the UFAWU fishermen as a move to reduce operating costs. The UFAWU recently rejected a contract offer by the fish processors bargaining association and it now appears that a prolonged strike could result. Approximately 7,000 union members are affected. Another 200 non-union and 400 independent boats have taken advantages of the strike to fish for salmon, beginning on the opening of the annual salmon season July 30th. The strike is costing the industry millions of dollars in lost earnings and revenues. (WF: U.S. Consulate General, Vancouver, B.C., August 1, 1989) NMFS note: The strike ended on August 8, 1989.

Native Brotherhood Supports Strikers -- The Native Brotherhood of British Columbia, a separate union from the UFAWU, which represents about 1,200 native Indian fishermen and 300 shore workers, voted overwhelmingly to accept an offer made by the fish processing industry. The Executive Director of the Native Brotherhood, however, is urging the members to respect the UFAWU strike and refrain from fishing until that strike is settled. (WF: U.S. Consulate General, Vancouver, B.C., August 1, 1989)

Note: This survey of Western Europe and Canada reviews current fishery developments in those regions. The report relies heavily on unconfirmed press reports from the countries involved. The National Marine Fisheries Service does not certify the accuracy of these reports nor does their selection reflect the official view of the U.S. Government.

* * * * *

FOR REGIONAL STATISTICS AND MARKET NEWS OFFICES ONLY - Please publish this summary if there is not enough space for the entire release. Thank you. M. Kravanja.

SUMMARY: "The Branch of Foreign Fisheries Analysis, Office of International Affairs, has prepared a summary highlighting recent developments in West European and Canadian fisheries. U.S. companies can obtain a 6-page report by requesting "The Latest Developments in West European and Canadian Fisheries, August 1989" (IFR-89/78) from this Statistics and Market News Office, enclosing a pre-addressed envelope with \$0.45 postage."

INDEX: EUROPE, WESTERN

Latest Fishery Developments, August 1989

CANADA

Latest Fishery Developments, August 1989

August 25, 1989

RECEIVED
National Marine Fisheries Service

AUG 2 1989

JUN 20 1989



BENSON SEA FARMS

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A GENETIC RESPONSE TO THE FINFISH ISSUE

**BENSON SEA FARMS
WOLF AND DENISE BENSON
P.O. BOX 1541
PETERSBURG, AK 99833**

My wife and I have established a shellfish farm in the Petersburg area. We have both observed the efforts on both sides trying to rationalize our state's potential in the world market for finfish. We observed first hand due to the fact that The Shellfish Growers of Alaska were initially associated with Alaska Mariculture Association. I have a degree in Invertebrate Aquaculture from the University of Washington and my wife has a degree in Speech Communications. We both feel that the introduction of fish farms will only benefit corporations (entities with a lot of money). We are a fishing family putting most of our earnings into our farm which is just taking off. The real investment for a salmon farm is many times greater than our effort. You cannot start small scale with salmon farms. You must move in with support facilities to such a great extent that you must maximize return by producing. In so doing, the environment is not considered and may be violated. This we feel, is not the way Alaskans want their state treated. This is not an industry that residents can put some of their efforts toward, with long term plans for the future. This will not be an industry for Alaskans, but for larger entities than ourselves.

I would like to point out some areas that have come to light lately as well as some questions that I have, and would appreciate a response from the appropriate source.

The Alaska Finfish Farming Task Force seems to lean toward the need for future consideration of some major topics. The commission found that shore based plants are the least likely to pass on disease and create gene mixing between wild and domestic stocks. Where in the world is this method of culture proven to reduce disease transmission and gene mixing? Can this method be used in Alaska economically in competition with the world market? If we are unable to use this method we must consider pen rearing exclusively, with it's probable impacts.

Disease is caused when animals are stressed. Stress will always exist in high density fish farms, as they are treated daily with antibiotics. Excess food is deposited on the bottom or consumed between net and bottom. This opens new pathways for disease transmission to wild stocks and to humans, also creating new virulent types due to hybridization.

On the topic of genetics, I have never run across any publication which used any hypothetical problem solving, using inbreeding and inbreeding depression to explain the potential reduction of heterozygosity in native stocks. Scientists at the Norwegian Government's Directorate for Nature Management in Trondheim claim they have recorded the presence of farm fish in 23 of 54 rivers surveyed (1). This problem of lost heterozygosity has reached a critical stage with the Norwegian farms. Collection of salmon genes for a gene bank is underway.

Through the many years of hatchery research, there has been much work on loss of heterozygosity with hatchery

stocks. A heterozygote organism for a particular gene would contain different genetic information for the same product. In this way the organism has a greater chance for survival due to its diverse make up.

Gene frequencies for population measure the overall abundance of specific genes within that population. The gene frequencies must total one for the population. This number is used to evaluate inbreeding, and may have little effect in changing the overall gene frequencies. It will, however, have important effects in increasing the frequencies of homozygotes. As a rule, therefore, if a recessive gene is rare, inbreeding will cause it to appear in greater homozygous frequency than under random mating (2). This loss is balanced by the introduction of wild stocks to maintain the desired traits within the hatchery stocks. It's my opinion that the application of these equations to the impact of pen reared salmon upon wild stocks needs to be investigated.

Using a single gene to measure stability of the gene frequencies will yield an equilibrium after the first generation. But many times more than a single gene is needed to produce a structure, and one product may disrupt many more pathways. Using multiple alleles takes four to five generations to reach a 90% equilibrium (2).

With a single example I hope to show the complexity and possibilities that exists when dealing with genetics.

Wild stock X Domestic stock

Heterozygote X Homozygote

Aa Bb Cc X aa bb cc

second generation would have 24 various combinations and permutations that could occur.

$2 \times 2 \times 2 \quad \times 3 = 24$

Gene frequencies of wild stocks need to be evaluated. Then using gene frequencies of domestic fish, run some computer simulations of possible scenarios.

The following are equations I have run across that I will reference, as well as a quick description of the factors contributing to the product.

INBREEDING COEFFICIENT, F.

$1/2N$ N=number of alleles in the population.

F for generation 2 is

$F_2 = (1/2N) + [1 - (1/2N)]F_1$

F_1 = inbreeding coefficient of generation 1.

$F_0 = 0$

$F_1 = 1/2N$

$F_2 = 1/2N + (1 - 1/2N)F_1$

$F_3 = 1/2N + (1 - 1/2N)F_2$

$F_N = 1/2N + (1 - 1/2N)F_{N-1}$

The chapter continues into Panmictic Index, a derivative of this above equation, measuring the rate at which homozygosity should be attained (2).

MIGRATION (introduction of new gene frequencies).

q_0 =initial gene frequency.

Q =frequency of same allele in the migrant population.

m =the proportion of newly introduced genes.

q_N =number of generations of migration.

$$q_N - Q = (1-m)^N (q_0 - Q)$$

$$(1-m)^N = (q_N - Q) / (q_0 - Q)$$

This equation comes from reference (2).

INBREEDING COEFFICIENT, F (probability of identity in the t -th generation).

N =number of alleles

$$F_t = 1/2N + (1-1/2N)F_{t-1}$$

$$1-F = (1-1/2N)(1-F_{t-1})$$

$1-F$ is proportional to heterozygosity.

so,

H =heterozygosity

$$H_t = (1-1/2N)H_{t-1}$$

heterozygosity decreases each generation by a fraction equal to $1/2N$, these equations come from reference (3).

INBREEDING (major concern in selective program)

$$F = H_0 - H / H_0 \quad H_0 = \text{original heterozygote}$$

H = hatchery

$$AF = 1/2N_e \quad N_e = \text{effective population, number of individuals contributing to population}$$

N =number of alleles

$$N_e = 4N_m N_f / (N_m + N_f)$$

Assess brood stock and change. Need population of both stocks.

Different number of males and females contributing.

$$AF = 1/8(\# \text{ of females}) + 1/8(\# \text{ of males})$$

Unequal numbers in successive generations

$$1/N_e = 1/t [1/N_1 + 1/N_2 + 1/N_3 + \dots + 1/N_t]$$

t =number of generations

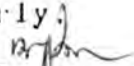
These last few equations come from number five (5) on the reference page.

The task force recommendation for a sanctuary for "wild" stocks is not practical. It has yet to be proven as to how large a reserve you will need. Farms scattered throughout a region is similar to depositing cancerous cells throughout a body. I am an oyster farmer in Southeast Alaska. In one of my shellfish transport permits for mussels, Ted Myers (Fish Health Services Pathologist-FRED) stated that transplantation of mussels of more than twelve miles would need to be sampled for genetic similarity as well as for

pathogens (5), and shellfish can't swim very far as adults. These reservations by people like Ted Myers deserve some consideration, as well as answers to the topics outlined above.

As a shellfish farmer and a responsible environmentalist, I oppose Finfish Culture in the state of Alaska. I strongly support the Finfish Moratorium for another five (5) years until these critical issues are dealt with.

Sincerely,


Wolf Benson
President of Benson Sea Farms
P.O. box 1541
Petersburg Ak. 99833
907-772-4490

References;

- (1) "K.T. Perquet: Fighting Fit; The Tale of the City Fish and the Country Fish." Canadian Aquaculture, Sept./Oct. pp.55-67.
- (2) Monroe W. Strickberger, Genentics (Macmillan Publishing Co. INC., 1976), pp.783-801.
- (3) James F. Crow, Genetics Notes (Burgess Publishing Company, 1976), pp.169-170.
- (4) Hershburger, Bill. "Genetics 444 Population Genetics." University of Washington, 1984.
- (5) Myers, Theodore R. "Shellfish Transport Permit" Department of Fish and Game, Fish Health Services Pathologist-FRED, Juneau Alaska, 12-29-88.

Table II-1 World Farmed Salmon Production, 1980-86							
COUNTRY	1980	1981	1982	1983	1984	1985	1986
Metric Tons (live weight)							
EUROPEAN COMMUNITY:							
France	30	40	40	40	50	60	200
Ireland	21	35	100	257	385	722	1,500
Spain	0	0	0	0	100	150	150
U.K.	598	1,333	2,136	2,536	3,912	6,921	10,338
TOTAL	649	1,408	2,276	2,833	4,447	7,853	12,188
NON-EC EUROPE:							
Faroe Islands	0	0	60	105	116	470	1,370
Finland	0	30	30	30	94	100	100
Iceland	0	20	30	50	107	91	123
Norway	4,143	8,422	10,266	17,000	22,300	28,655	45,675
Sweden	0	0	10	15	20	80	300
TOTAL	4,143	8,472	10,396	17,200	22,637	29,396	47,568
NORTH AMERICA:							
Canada:							
Atlantic	6	35	140	180	200	300	400
Pacific	157	176	273	128	107	120	600
United States	392	873	691	844	1,248	1,320	1,400
TOTAL	555	1,084	1,104	1,152	1,555	2,420	2,400
OTHER:							
Chile	0	1	184	94	109	500	1,144
Japan	1,855	1,150	2,122	1,760	5,049	6,430	8,000
New Zealand	0	2	5	10	10	250	500
TOTAL	1,855	1,153	2,311	1,864	5,168	7,180	9,644
GRAND TOTAL	7,202	12,117	16,087	23,049	33,807	46,669	71,800
Source: U.S. Embassy reports based on various official statistical tables or reports. Some 1986 figures are preliminary estimates. U.S. estimates are based on State and industry sources.							

John Bishop, Statistics & Market News Office

SF-134, Wednesday Issue, 11/9/88 (NOV-PG-18)

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FARMERS MARKET

Salmon prices continue to fall ... Trout market hit by salmon oversupply ... Atlantic mussels fight toxin reappearance ... B.C. oyster growers deliberate on prices.

by Ken Talley

Salmon

As December opened, the instability of wholesale prices perplexed and worried marketers on both coasts. Supplies overwhelmed demand. Prices continued their fall that began two months earlier.

Small fish were the bane of the market in late November and early December. In British Columbia, 2-4 lb. chinook and coho were wholesaling for as little as \$2.80/lb. Some processors were holding fish two to three days because demand was so soft.

Why so many small fish? Two reasons. First, many farmers on both coasts are going through severe cash flow problems. They need money now and \$2.80/lb. is better than nothing. Financial problems have plagued farmers all fall, and those problems are in turn creating market problems.

Another reason for the large number of small fish has to do with husbandry. As winter approaches some farmers found themselves with more fish than they planned. Survival in some cases outpaced predictions. So these farmers are thinning out their crop. The money they make on the small fish, as little as it may be, is still gravy since they hadn't expected to have the fish in the first place.

Demand for 6-9s is steady on both coasts, though prices for Atlantics have continued to fall. Canadian Atlantics are chasing Norwegian Atlantics—and both

are chasing little if any demand. Note that both Norwegian and Canadian Atlantics (6-9s) are about the same price. East coast marketers had been working for this parity for some time, but they were hoping that parity would have been reached closer to \$7/lb.

Also note that B.C. farmed Pacifics are closing in on Canadian Atlantics. B.C. 6-9s have increased in prices as they became scarce while the Atlantics fell as east coast markets weakened.

Some West Coast marketers worry about Chilean farmed fish. Due on the market at any moment the Chilean fish may not go to Japan in the quantities anticipated. In short, the Japanese market seems to have very little taste for frozen fish of any kind, and the Chilean frozen cohos may have a hard time finding a home there. This could prove troublesome to the North American market in February and March.

West Coast marketers are more optimistic over the near term than their East Coast counterparts. The continued flood of Norwegian fish into the U.S. market and the softness of the prices mean that Canadian Atlantics will be hard pressed to reach the same level. However, even West Coast processors worry about the spring of 1989 when the new wild season begins.

Trout

Plummeting salmon prices and the

oversupply of small salmon have had a negative impact on the trout market. Ontario growers were hit especially hard after spending the time and money to grow large rainbows (2-pound fish). With 2-4 lb. salmon wholesaling for \$2.80/lb. (and in some rare cases as low as \$2.60/lb.), customers were not excited about paying \$3.40/lb. for trout. Since October, the price of the large trout has declined until early December when it reached \$2.90. It could go lower, as this price was still a dime more than the salmon. Fortunately, only a few growers focused on the large trout, so the damage was not devastating.

Besides the impact of salmon on the trout market, supplies of trout increased this fall. With product coming from both Quebec and Manitoba, in addition to Ontario, prices moved down. Even the 8-oz. whole trout lost \$.15/lb. from October levels.

B.C. trout farmers haven't experienced quite as much trauma as those in other parts of the country. Even so, B.C. trout lost \$.10/lb. over the last couple of months. B.C. trout had ranged between \$2.60 and \$2.80/lb. Now most quotes are around \$2.70.

Marketers don't expect any good news until mid-January when demand and supply may more closely match each other. As it is now, even those producers who had held back from dropping their

Wholesale Price Trends

All prices in Canadian dollars. Price per pound for the fresh market unless noted otherwise. Delivered FOB major city. Previous month's prices revised.

Species/Product	October '88	December '88	Species/Product	October '88	December '88
Chinook, B.C. farmed, 4-6	\$4.50	\$4.40	Trout, Ont, 2-4	\$3.40	\$2.90
Chinook, B.C. farmed, 6-9	5.20	5.35	Trout, Ont, custom pack	3.05	3.05
Coho, B.C. farmed	4.50	4.40	Trout, Idaho, deboned, frozen	2.35	2.45
Coho, B.C. farmed	5.20	5.35	Trout, Idaho, bone-in, frozen	2.15	2.14
Atlantic, N.B. farmed, 4-6	5.70	5.00	Trout, Idaho, 8 oz., fresh	2.10	2.10
Atlantic, N.B. farmed, 6-9	6.20	5.25	Mussels, Atlantic	0.90	0.90
Atlantic, N.B. farmed, 9-up	6.30	5.40	Oysters, half-shell, beach/doz	3.00 extra sm	3.00
Atlantic, Norway CIF, 4-6	5.40	4.85		3.25 small	3.25
Atlantic, Norway CIF, 6-9	5.95	5.25		3.50 medium	3.50
Atlantic, Norway CIF, 9-up	6.10	5.65		3.75 large	3.75
Trout, Ont, 8 oz.	2.95	2.80	Oysters, half-shell, tray/doz	3.60 extra sm	3.60
Trout, B.C., 8 oz.	2.70	2.60		3.90 small	3.90
			Oysters, shucked, per quart	7.00	7.00

Jan / Feb 1989

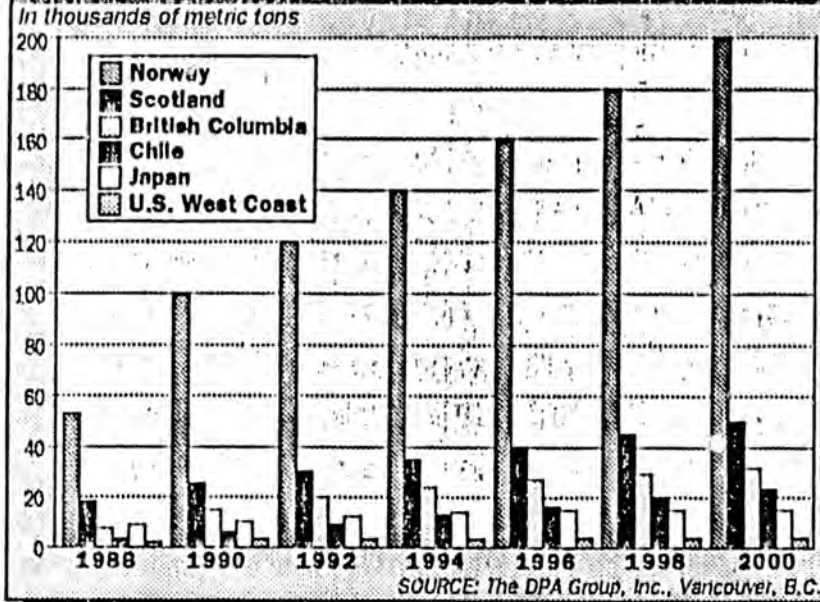
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FARMED SALMON: A FORECAST TO THE YEAR 2000



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no's president, says Atlantic's gen- Group, 31 percent of the world's has

5. M. B. J. Intelligence Agency Feb 13,
1989

IN THE NEWS

Report predicts salmon production to year 2000

A report predicting worldwide farmed salmon production to the year 2000 was recently prepared for the federal Department of Fisheries and Oceans by the DPA Group of Vancouver, B.C. It's an interesting document that shows strong steady growth over the next 12 years. However, in its introduction the consulting firm cautions that the forecasts are "based on future events which may or may not occur." Moreover, notes the report, so far the development of salmon farming has been market-driven, a trend which is expected to continue until 1990 owing to strong economics and no significant increases in the supplies of wild stocks. However, adds DPA, with increasing supplies of farmed salmon, price declines are inevitable. "Levels of production forecasted for the next decade favour those regions which are expected to have greater production efficiencies."

For each supply region the forecasts reflect a *most likely* production scenario. However there are some variables which could effect the forecasts says DPA,

Country	1987		1990		2000	
	Atlantic	Pacific	Atlantic	Pacific	Atlantic	Pacific
Norway	46,000		100,000		200,000	
Scotland	14,000		25,000		50,000	
Iceland	900		2,000		12,000	
Canada East	1,000		3,000*		6,000*	
Canada West		3,000	500	15,000	2,000	31,000
Chile		2,000	500	5,000	8,000	15,000
Japan		8,000		10,000		15,000
New Zealand		1,250		2,500		5,000

* Other estimates put these figures at closer to 5,000 and 10,000 tonnes. (Ed.)

including the vast undeveloped coastlines of British Columbia, Chile, Alaska and the ripe potential for sockeye salmon in Japanese markets if it ever becomes a viable culture species.

The table above does not include estimates from a number of other countries including Sweden, Spain, Finland, Italy, Ireland, the Faroe Islands and the eastern and western United States. When these are taken into account DPA estimates the total farmed salmon production for all countries at 172,000 tonnes in 1990 and a whopping 358,000 tonnes in the year 2000. If the latter figure proves to be correct it could represent well over 50%

of total world production - wild and farmed.

Editors note: Bear in mind that production estimates for the salmon farming industry differ considerably from one source to another. Figures should only be taken as a general indicator of the way in which the industry is going in a particular region.



Sept 1988

P129

CITY OF CORDOVA



February 9, 1990

Senator Dick Eliason
P.O. Box V
Juneau, AK 99811

Dear Senator Eliason:

The Cordova City Council on 2/7/90 passed Resolution 90-18
in support of Senate Bill No. 397.

Sincerely,

D. Lynda Plant
City Clerk

Enclosure

CITY OF CORDOVA, ALASKA

RESOLUTION 90-18

A RESOLUTION SUPPORTING SENATE BILL 397

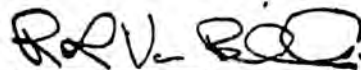
WHEREAS, the City of Cordova, Alaska, is aware of the issues facing the salmon industry in Alaska, and

WHEREAS, Prince William Sound is one of the state's richest fishing grounds, and

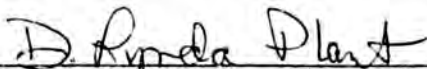
WHEREAS, pen rearing of salmon in salt water has been found to have a detrimental effect on wild stocks in other places.

NOW, THEREFORE, BE IT RESOLVED by the Cordova City Council that it supports Senate Bill 397 which would prohibit pen rearing of salmon in salt water.

PASSED AND APPROVED THIS 7th DAY OF FEBRUARY, 1990.



Mayor Robert Van Brocklin



D. Lynda Plant, City Clerk



The American Fisheries Society, founded in 1870, is the oldest and largest professional society representing fisheries scientists. AFS promotes scientific research and enlightened management of aquatic resources for optimum use and enjoyment by the public. It likewise encourages a comprehensive education for fisheries scientists and continuing on-the-job training.

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Mailed third class from Lancaster, PA.

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FISHERIES

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TABLE OF CONTENTS

EDITORIAL PAGE..... Inside front cover

FEATURE ARTICLES

Transgenic Fish and Public Policy: Anticipating Environmental Impacts of Transgenic Fish	A. R. Kapuscinski and E. M. Hallerman	2
Transgenic Fish and Public Policy: Regulatory Concerns	E. M. Hallerman and A. R. Kapuscinski	12
Transgenic Fish and Public Policy: Patenting of Transgenic Fish	E. M. Hallerman and A. R. Kapuscinski	21
The National Oceanic and Atmospheric Administration Plan for Recruitment Fisheries Oceanography Research	E. S. Fritz, L. B. Crowder, and R. C. Francis	25

AMERICAN FISHERIES SOCIETY NEWS

Parent Society	34
AFS Executive Director Position Announcement	35
President's Corner	38
Divisions, Sections, Chapters	42
What's Happening	43

LETTERS..... 44

CALENDAR..... 46

CURRENT EVENTS AND ANNOUNCEMENTS..... 48

PUBLICATIONS

Reviews	52
New Titles	56
For Your Information	59
Silent Auction No. 3	59
Advertisers Index	62
Guide for Contributors to <i>Fisheries</i>	63

THE COVER: Production of transgenic fish. Using a fine glass needle, DNA for the promoter element from Rous sarcoma virus and the bovine growth hormone gene are microinjected into the animal pole of fertilized walleye eggs. Of fish developing from these eggs, roughly 20% will bear the introduced genetic construct. Photo by E. Hallerman.

Transgenic Fish and Public Policy: Anticipating Environmental Impacts of Transgenic Fish

Anne R. Kapuscinski and Eric M. Hallerman

Better a foot behind than an inch too far ahead

—Lao Tzu

ABSTRACT

Transfer of novel genes into fishes introduces a number of contentious issues into public policy debate among fisheries scientists and regulatory authorities. In the context of the technical status of development of transgenic strains of fishes, we discuss anticipated ecological impacts of releasing such fishes into natural environments. The major determinant of ecological impacts of transgenic fishes will be the phenotypic effect of the inserted genes. Three conceptual classes of phenotypic changes are anticipated, including changes in physiological rates, behavior, or tolerance of physical factors. The complex interactions among organisms and abiotic resources in aquatic communities suggest that it will be very difficult to predict ecosystem impacts of transgenic fishes. Based on current understanding of community-level impacts of stocking non-transgenic piscivorous fish, the release of certain transgenic fishes, particularly those exhibiting substantially altered performance, could destabilize and eventually reorganize ecosystems. The release of sterilized transgenic fishes would reduce but not completely remove long-term environmental risks, because lags in detection of ecosystem alterations resulting from large numbers of such fish are inevitable and could lead to disturbances that are irreversible or expensive to correct. We identify major research needs for formulation of quantitative risk analysis protocols and suggest items to include in a position statement on transgenic fishes for adoption by the American Fisheries Society.

The transfer of novel DNA constructs into fishes introduces a number of contentious issues into public policy debate among fisheries scientists. The development of transgenic fishes with altered performance suggests the likelihood of considerable ecological impact upon their release into natural environments. The objectives of this paper are: (1) to briefly review the status of technical development of transgenic fishes, and (2) to encourage the scientific community to initiate a thorough and rational assessment of the potential ecological impacts of accidental or intentional releases of transgenic fish into aquatic environments.

It is our thesis that ecological impacts of both fertile and sterile transgenic fish will depend more on their overall phenotypic performance than on specific genetic constructs inserted into

their genomes. We therefore outline classes of possible phenotypic changes in transgenic fish. We then introduce questions about environmental impacts from two perspectives: (1) impacts of releasing transgenic fish with altered phenotypes on structure and processes of aquatic communities, and (2) inherent susceptibility of different recipient environments to such perturbations. Additionally, we identify major needs for research and formulation of risk analysis protocols, and suggest position options for debate by the American Fisheries Society.

The scope of this paper is limited to transgenic fish because research to date on gene transfer in aquatic organisms has focused largely on fishes. The possibility of producing other transgenic aquatic animals and plants must be recognized, in which case the discus-

sions below could be broadened appropriately by substitution of "aquatic life" for "fish." The genomes of aquatic invertebrates have been subject to manipulation and a number of researchers are using recombinant DNA methodology to study molecular genetics of various taxa (Al'en 1987; L.L. Ellis, Virginia Institute of Marine Science, unpublished data). Ecological considerations and recommendations regarding introduction of genetically engineered organisms have been addressed in a discussion not restricted to the aquatic environment (Tiedje et al. 1989).

Technical Background

Gene Transfer in Fish

Transgenic fish are defined as fish bearing—within their chromosomal DNA—copies of novel genetic constructs introduced through molecular genetics techniques. Such animals are usually produced by microinjection of DNA into newly fertilized eggs, the DNA becoming integrated into the genome of the injected embryos. With current methods, successful integration usually occurs in less than half of the injected embryos. Transgenic fish

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can also be descendants of individuals so transfected.

Transgenic fish may contain novel genetic constructs composed of genetic elements derived from conspecifics, derived from unrelated species, or derived from a combination of intra- and inter-specific sources. Such novel genetic constructs consist of a structural gene encoding a specific protein flanked by transcription promoter and termination sequences (i.e., regulatory sequences). The regulatory sequences are necessary for successful expression of the structural gene in the host (Kapusinski 1990). Because few piscine structural genes and control sequences have been isolated and characterized, current production of transgenic fish generally relies upon use of constructs containing DNA foreign to the recipient species. Use of DNA derived from conspecifics or from closely related species will become more frequent in the future as molecular biology laboratories successfully clone and characterize piscine genetic elements. Important technical advances will follow characterization and testing of additional promoters or structural genes in new expression vectors.

Production of 13 species of transgenic fish has been reported to date (Table 1). Many gene transfer experiments in fish have followed the design of the classical transgenic mouse work (Palmiter et al. 1982), by introducing copies of a novel growth hormone gene under the control of a regulatory sequence from the mouse metallothionein gene. Successful gene transfer involves demonstrated evidence of several events, including integration of the introduced genetic construct into the genome of the recipient fish, transcription of the structural gene, and translation into the protein product (Kapusinski 1990).

Long-term Development of Transgenic Lines of Fish

The objective of gene transfer is production of favorably altered phenotypes among transgenic individuals. Most transgenic fishes have been produced so recently that performance data are lacking. However, two-fold acceleration of growth rates in transgenic loach, *Misgurnus anguillicaudatus* (MacLean et al. 1987b), and crucian carp, *Carassius auratus* (Z. Zhu, Institute of Hydrobiology, Wuhan, per-

sonal communication), as well as 20% acceleration of growth rate in common carp, *Cyprinus carpio* (Zhang et al. 1990), have been observed.

The immediate utility of first generation transgenic fish produced in gene transfer experiments seems widely misunderstood. These particular individuals are not themselves intended for aquaculture production. Rather, they serve as progenitors of new genetic lines. Stable integration of the introduced genetic construct into the germ line of a novel strain, as evidenced by transmission of the construct to progeny, has been demonstrated in goldfish, *Carassius auratus* (MacLean et al. 1987b), zebra fish, *Brachydanio rerio* (Stuart et al. 1988), common carp (Zhang et al. 1990; Z. Zhu, Institute of Hydro-

biology, Wuhan, personal communication), and rainbow trout, *Oncorhynchus mykiss* (Guyomard et al. 1990).

Not all individuals in which gene transfer has been effected would prove suitable for founding transgenic lines, because not all instances of gene transfer are truly successful. The desired outcome is integration of the (microinjected) construct into a host chromosome before first cell division so that copies would be present in every cell, including germ-line cells of fully developed fish. An alternative outcome is chromosomal integration of the inserted gene copies at some developmental stage after first cell division. This leads to production of mosaic individuals containing integrated copies of the inserted gene in only a subset

Table 1. Gene transfers in fish.

Species	Construct ¹	Status ²	Reference
Atlantic salmon	mMT-bGal	I,E	McEvoy et al. 1988
	mMT-rGH	I	Rokkones et al. 1989
	AFP-AFP	I	Fletcher et al. 1988
Channel catfish	mMT-hGH	I	Dunham et al. 1987
	—	I	Hayat et al. 1990
Common carp	mMT-hGH	I	MacLean et al. 1987b
	mMT-sGH	—	Hayat et al. 1990
	RSV-tGH	I,E,R,G	Zhang et al. 1990
Goldfish	mMT-hGH	I	Zhu et al. 1985
	mMT-hGH	I,G	MacLean et al. 1987b
	RSV-neo	I,T	Yoon et al. 1990
Loach	mMT-hGH	I,R	Zhu et al. 1986
	mMT-hGH	I,R	MacLean et al. 1987b
Medaka	mMT-cCRY	I,E	Ozato et al. 1986
Mud carp	mMT-hGH	I	MacLean et al. 1987b
Northern pike	RSV-bGH	I,E	Schneider et al. 1989
Rainbow trout	SV40-hGH	I	Chourrout et al. 1986
	mMT-rGH	I	MacLean et al. 1987a
	mMT-rGH	—	Guyomard et al. 1990
	mMT-rGH	—	Penman et al. 1990
	mMT-rGH	—	Rokkones et al. 1989
	mMT-hGH	I	MacLean et al. 1987b
Silver crucian	mMT-hGH	I	Brem et al. 1988
Nile tilapia	SV40-CAT	I,E	Indiq and Moav 1988
Wuchang fish	mMT-hGH	I	MacLean et al. 1987b
Zebra fish	SV40-hyg	I	Stuart et al. 1988

¹ The genetic constructs introduced into fish are referred to as fusion genes, comprised of a promoter sequence which regulates expression of the gene, and a structural sequence which encodes the protein product of the gene of interest. Abbreviations for promoter sequences: mMT, mouse metallothionein; AFP, antifreeze protein; RSV, Rous sarcoma virus; SV40, simian virus 40. Abbreviations for structural genes: bGal, beta-galactosidase; AFP, antifreeze protein; hGH, human growth hormone; tGH, rainbow trout growth hormone; sGH, salmon growth hormone; neo, neomycin resistance, CAT, chloramphenicol transacetylase; bGH, bovine growth hormone, cCRY, chicken crystalline; rGH, rat growth hormone, and hyg, hygromycin resistance.

² Status designations: I, genomic integration; T, transcription; E, expression of protein; G, germ line transmission; R, rapid growth.

of their cells. With the production of mosaic individuals, germ-line transmission of the novel construct is not assured because only those individuals containing the construct in at least some gonadal cells will be capable of passing the novel construct to their offspring. An increasing body of data provides evidence of mosaicism among fish developed from microinjected eggs (Stuart et al. 1988; Yoon et al. 1990; Schneider et al. 1989).

Reproduction of the original transgenic individuals and screening of their progeny is needed to identify individuals containing transgenic cells in the germ line (as in zebra fish, Stuart et al. 1988). Genetic lines of fish bearing the introduced gene would then be tested for exhibition of improved performance with regard to specific traits in a given environment. Certain genetic lines will prove superior to others on the basis of higher copy numbers of the novel gene, or higher levels of gene expression due to integration of the novel gene into more favorable positions within the genome.

Only after several generations of inbreeding and testing would transgenic lines have high frequencies of individuals bearing introduced genes in both chromosomal homologues. Ultimately, a primary use of high performance transgenic lines would be in crossbreeding with existing strains of fish that had been improved through classical breeding methods.

Phenotypic Variation Expected in Transgenic Fish

Substantial genotypic and phenotypic variation will be present in the first generation of fish in which gene transfer has been carried out. Major sources of this variation will be the many different integration sites of the novel construct, the varying numbers of gene copies integrated into different individuals, and the occurrence of mosaic individuals. Many individuals will not exhibit desired expression of the introduced gene. Thus, there will be individuals exhibiting no change in performance, reduced performance, or improved performance compared to non-transgenic control fish. A group of transgenics will therefore exhibit a frequency distribution of phenotypes, the shape and/or magnitude of which

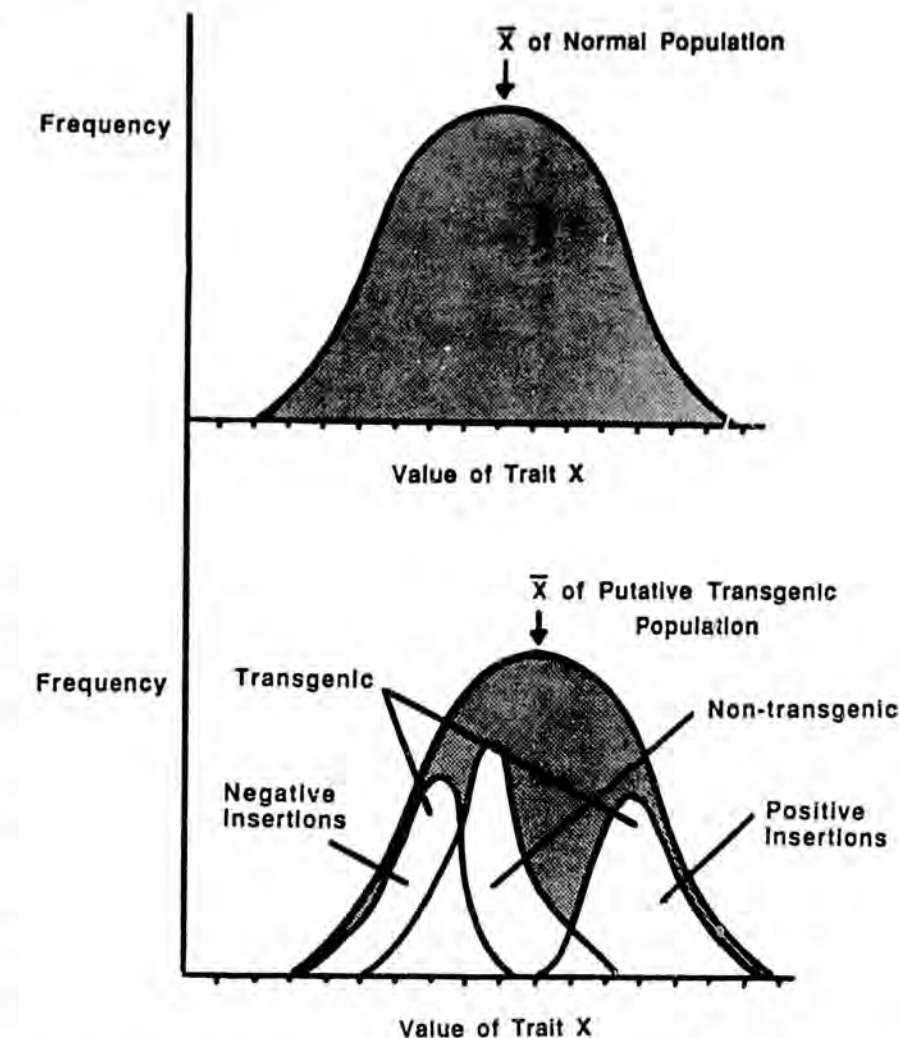


Figure 1. For a given genetic stock of fish and a given quantitative trait, X , theoretical phenotypic frequency distributions in a normal population of non-transgenic fish (upper) compared to a putative transgenic population (lower) consisting of transgenic individuals with either positive or negative insertions of the novel genetic construct, non-expressed transgenic individuals, and non-transgenic individuals. In this example, transfection of some treated individuals has resulted in an increase in the mean value and no change in the variance of the distribution.

has been changed compared to that observed within a group of non-transgenic individuals. In the case of a normally distributed trait, the phenotypic frequency distribution of a group of transgenic individuals might exhibit elongation of the tails of the distribution or changes in the mean value (Figure 1). Preliminary evidence for an altered frequency distribution includes observations of increased variability in individual body weight among loach expressing an introduced human growth hormone gene (MacLean et al. 1987b) and northern pike, *Esox lucius*, expressing a novel bovine growth hormone gene (Schneider et al. 1989).

Besides expected direct effects, broader indirect phenotypic changes

might occur as a consequence of integration or expression of the transferred construct. Integration of the novel gene at a particular genomic site could: (1) artificially create a mutation by insertion into a major gene (Marx 1985), (2) disrupt the normal pattern of genetic correlation between two traits (by affecting one or more genes affecting both traits), or (3) alter pleiotropic relationships (effects of a single gene on more than one trait). Protein encoded by the novel gene could impact other physiological processes in the host and thus create phenotypic changes in other traits. Consequently, phenotypic frequency distributions for particular traits in a group of transgenic fish may differ substantially from those of normal pop-

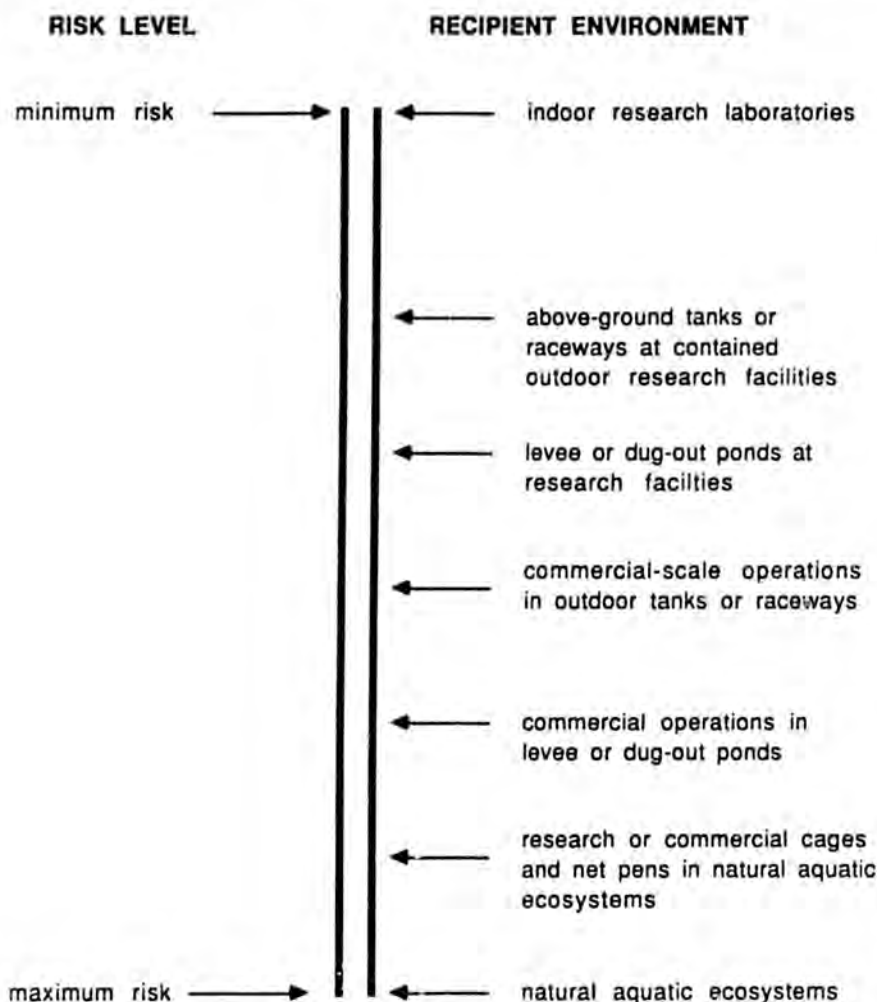


Figure 2. Possible recipient environments for transgenic fish can be conceptualized as lying along a continuum of environments paralleled by a continuum of related degrees of ecological risk. Placement of a particular research or commercial facility along these continuums depends on opportunities for transgenic fish to enter natural waters through accidental escape or vandalism.

ulations. Although performance data for transgenic fish are limited, such predictions are supported by findings in other transgenic animals. When fed a high-protein diet, transgenic pigs containing human or bovine growth hormone genes have exhibited both faster growth and leaner meat. However, females were sterile, and animals of both sexes were lethargic, exhibited muscle weakness, and had a propensity to develop arthritis and gastric ulcers (Marx 1988). In some lines of transgenic mice, insertional mutagenesis has created limb deformities, disruption of sperm formation in males, or lethal mutations (Marx 1988).

Continuums of Environments and Risks

In developing our views and rec-

ommendations regarding transgenic fish, we recognized the existence of a continuum of possible recipient environments paralleled by a continuum of degree of ecological risks. Minimum risk would be associated with indoor research laboratories and maximum risk with natural aquatic ecosystems. Consequently, our discussion is focused on impacts in natural aquatic ecosystems. In order of increasing risk, some possibilities between the ends of the continuum include (Figure 2): above-ground tanks or raceways at contained outdoor research facilities; levee or dug-out ponds at research facilities; commercial-scale operations in outdoor tanks or raceways; commercial operations in levee or dugout ponds; and research or commercial operations in natural bodies of water. Greater risk is associated with commercial operations

compared to research facilities, because the primary commitment of labor and financial resources to profitable production is likely to conflict with special handling of transgenic fish. In contrast, resources at a research facility could be focused on special measures for containment of transgenic fish. The proper placement of a particular research or commercial facility along the continuum of recipient environments will depend on the opportunities for transgenic fish to enter natural waters through accidental escape or vandalism. Germane attributes of a given holding facility would include presence of physical or chemical barriers blocking the escape of fish via influent or effluent water, susceptibility of rearing units to flooding, susceptibility of rearing units to predation, and adequacy of site security measures.

Ecosystem Impacts of Transgenic Fish

Potential impacts of transgenic fish on natural ecosystems might be manifested through a number of pathways. Not all possibilities for such environmental impacts can be expressly considered in a paper of this scope. Our interest here is to stimulate fisheries scientists to begin serious assessments of these potential impacts. Fisheries management agencies and other organizations with jurisdiction over aquacultural activities or natural aquatic environments will inevitably receive increasing numbers of requests to release transgenic fishes into aquacultural or natural settings. To improve the chances that decisions on proposals to use transgenic fishes outside the laboratory are made in an ecologically sound manner, ecological assessments and thorough debate of the issues need to be initiated by fisheries professionals at this time.

All understanding and uncertainties associated with impacts of releasing "normal" hatchery-reared fish (Marnell 1986; Kapuscinski and Jacobson 1987; Pirquet 1988), whether native or introduced species (Kohler 1986; Kohler and Courtenay 1986; Moyle et al. 1986), also apply to the release of transgenic conspecifics. In other words, impacts associated with release of transgenic fish include those associated with

stocking normal hatchery-reared conspecifics, or transplanting wild stocks.

How then do we conceive the environmental impacts unique to transgenic fishes? The major determinant of ecological impacts of transgenic fish is the phenotypic effect of the inserted DNA construct. These impacts will result from altered performance of such fish. To date, little is known about the performance of fish transfected with a particular gene. Relatively few structural genes have been successfully transferred; as researchers identify and clone more structural genes, possible modifications of fish phenotypes through gene transfer will increase dramatically. While current lack of information impedes our ability to forecast the full range of changes in performance traits of transgenic fish, we can draw on knowledge of physiological processes to conceptualize major classes of phenotypic changes. Drawing additionally upon understanding of aquatic ecosystem processes, hypotheses or questions regarding potential impacts attributable to each class of phenotypic change need to be developed.

Classes of Phenotypic Changes

At least three conceptual classes of phenotypic changes for transgenic fish might be anticipated. Classes may overlap, and more than one class of alterations may occur in a given case because of physiological interactions and feedbacks. The common denominator among these classes is that a particular phenotypic change created by the inserted DNA may lead to broader changes in life history patterns.

The first class of phenotypic alteration in transgenic fish includes changes in physiological rates affecting one or more components of the balanced energy budget for individual fish (Brett and Groves 1979). Increased growth rates of fish through transfer of growth hormone genes exemplifies this class of changes. Considering a generalized expression for an energy budget

$$\text{Growth} = \text{Consumption} - (\text{Respiration} + \text{Waste Losses} + \text{Reproduction})$$

an increase in individual growth rate achieved by expression of an introduced growth-promoting gene may result in commensurate changes in

consumption or possibly other rates in the budget. Consumption rates would have to increase in proportion to increases in growth rate in order for other rates to remain unchanged. Increases in consumption rates in fish could be lessened only if respiration or waste losses decreased (resulting in increased food conversion efficiency) or if reproduction rates declined at life stages normally associated with sexual maturation and reproduction. In any case, ontogeny of growth rates and morphometric relationships in such transgenic fish would be expected to differ from that of normal conspecifics. Changes in individual growth rates will probably affect a number of life history traits, for example: age and size at maturity, maximum size, longevity, reproductive effort, and offspring size.

A second class of phenotypic changes among transgenic fish would entail alteration of a species' tolerance of physical factors such as temperature, pH, or salinity. Changes could occur in the upper and lower lethal limits, the range of acclimation values, or the optimum value. The transfer of antifreeze protein genes into Atlantic salmon, *Salmo salar*, is aimed at improving the tolerance of cultured fish to cold seawater (Fletcher et al. 1988). If this research is successful, transgenic fish thus produced would exhibit this class of phenotypic changes.

In the third class, behavioral changes could occur, especially as a result of transferring genes encoding endocrine compounds which often mediate more than one physiological process. The product of a certain inserted gene might alter behaviors such as those involved in seasonal migrations, habitat selection, prey selection, territoriality, or reproduction. Potential changes in reproductive behavior, for example, might include alterations in mate selection or timing of reproduction. Behavioral changes, if manifested in a sufficient number of released transgenic fish to disrupt normal behavior patterns of an entire population, could essentially expand, contract, or shift the Hutchinsonian niche (Herbold and Moyle 1986) of the species.

Eventually, gene transfer could be used to alter other traits that do not fit clearly into these three classes. For example, transgenic lines with increased disease resistance or drug resistance could be developed.

Impacts of Phenotypic Changes

Possible ecosystem impacts of phenotypic changes in transgenic fish are considered below in the context of principles of aquatic ecology, focusing upon possible impacts of transgenic piscivorous fishes. Because lakes are likely candidates for consideration of planned releases of transgenic piscivorous fishes into natural environments, the ecology of such communities (Carpenter 1988) will be highlighted.

Aquatic communities function through complex interactions along pathways connecting organisms and abiotic resources through transfers of energy, organisms, nutrients, or information (Carpenter and Kitchell 1988). The complexity of these interactions includes indirect effects and time lags, which may explain the great sensitivity of community structure to various stresses. It is, therefore, reasonable to expect difficulty in predicting community-level impacts of transgenic fish.

A major factor complicating functional interactions in aquatic communities is the progression of most fishes through several trophic positions during the life cycle, with prey-size selection and gape limitations operating throughout (Stein et al. 1988). The niche shifts of piscivorous fishes influence community structure and dynamics. In the case of growth-enhanced transgenics, how would the possible displacement from the normal temporal progression through trophic positions affect aquatic communities? Could the stocking of such fish lead to temporal or spatial mismatches in sizes of predator and prey, leading to blocks in energy transfer through the food web, and resulting in restructuring or destabilizing of the food web (Stein et al. 1988)? Through simulations with an energetics model, Kitchell and Hewett (1987) forecasted the possibility that sterile, triploid chinook salmon (*Oncorhynchus tshawytscha*) in Lake Michigan will begin to prey on economically important species, including *Coregonus* spp. and smaller salmonids. They proposed that such prey shifts could lead to major alterations in the configuration of current food webs.

Many community structure changes are prevented from triggering large changes in major ecosystem processes, such as primary production, by com-

pensatory dynamics of functionally similar species. However, changes in "singularly important species" can lead to substantial changes in ecosystem parameters (Carpenter and Kitchell 1988). Current evidence suggests that the stocking of piscivorous fishes destabilizes aquatic ecosystems in the short term, with resultant trophic level changes occurring through top-down forces (Mills and Forney 1988). The long-term stability of ecosystems altered by predator introductions has not been determined, although some data suggest that coupling of top-down and bottom-up forces into self-regulating feedback loops may occur, leading to a reorganized ecosystem (Mills and Forney 1988). We must then inquire about the likelihood and intensity of ecosystem destabilization resulting from release of particular transgenic species exhibiting phenotypic changes.

Impacts of Sterile Versus Fertile Transgenic Fish

Release of fertile transgenic fish introduces the possibility that their descendants could adapt to the recipient environment should these transgenic individuals reproduce. Released individuals could mate with each other or with non-transgenic native fish, leading to a diversity of transgenic genotypes with varying adaptive values among their descendants. Alternatively, rapid extinction of transgenic genotypes may occur if their fitness values are very low in the recipient environment.

If some transgenic descendants adapt, the rate and pattern of their evolution would depend on many factors such as life history of the species, fitness value of the altered trait, and interactions of the species with its biotic and abiotic environment. For example, the potential for rapid evolution is greater in species with high fecundities and short generation times than in species with contrasting life histories. Given the wide range of possible transgenic phenotypes acted upon by natural selection, adapted transgenic descendants could ultimately have either minor or major impacts on their environment. We cannot rule out the possibility of major or even irreversible alterations to natural ecosystem processes.

Sterilization obviates the potential

for adaptation of populations of transgenic fish to a recipient environment. It also allows the management option of halting further releases and limiting ecological perturbations if negative impacts are detected. Yet, we know from the history of fisheries management that lags in detection of ecosystem alterations are inevitable. These lags increase the risk of irreversible alterations occurring before a stocking program could be terminated, and, in the case of reversible perturbations, create a need for expensive, perhaps impossible, restoration measures or an allotment of time for natural restorative processes. Another drawback of sterilization is that it can alter performance and behavior, confounding the effects of the transferred genes with those of sterility in the transgenic fish. Such confounding would prevent determination of the true effects of particular transferred genes on fish performance in a given environment.

Transgenic Fishes Considered as Introduced Fishes

Transgenic fishes may be considered a special case of introduced fish. In the terminology established by the AFS Introduced Fish Section (Kohler 1986), an introduced fish is one moved from one place to another by man, thus ending up outside of its native range. The utility of the introduced fish concept for predicting the ecosystem impacts of transgenic fish will depend on the degree of phenotypic alteration. A continuum of analogies can be envisioned between transgenic fish and introduced fish. Starting at the less worrisome extreme, introduction of transgenic fish exhibiting minor phenotypic alterations may be analogous to introduction of a different genotype within a genetic stock. A range of greater phenotypic alterations would be analogous to introduction of a different intraspecific stock. At the worrisome extreme would be major phenotypic alterations analogous to introduction of a non-native species. The greatest phenotypic changes likely to be exhibited by transgenic fish would be anticipated to affect an ecosystem to a degree comparable to the introduction of a closely related, non-native species.

Impacts of introduced fishes on native fishes (Moyle et al. 1986) have

frequently included extirpation of native aquatic species, particularly of native fishes. Other reported impacts on native fish communities included reduced growth and survival rates of native species and changes in community structure. Unfortunately, studies of the impacts of introduced fishes generally have not been initiated until after a problem was perceived, for example, following a decline in the abundance of an important game fish. Clear documentation of impacts caused by introduced fishes is frequently hampered by lack of baseline data on ecosystem processes in the aquatic community prior to introduction.

Mechanisms for domination of native fishes by introduced fishes (Moyle et al. 1986) have included competition via interference or exploitation, predation, inhibition of reproduction, environmental modification, transfer of new parasites and diseases, and hybridization. These classes of mechanisms may provide a useful framework for anticipating impacts of released transgenic fishes on natural aquatic communities. To go beyond mere conjecture, adoption of this approach would require prior collection of appropriate performance data from transgenic fish reared in contained research settings.

It is imperative that harsh lessons learned from plantings of introduced species not be repeated by introductions of transgenic fishes into natural aquatic communities. The history of fish introductions supports two concerns regarding planting of transgenic fishes in natural aquatic ecosystems. First, because transgenic fishes exhibiting substantially altered performance will be the most desirable candidates for stocking, it is likely that they would significantly impact aquatic systems (Courtenay and Taylor 1986; Moyle et al. 1986). Through alterations of ecosystem processes and species assemblages, their introduction could increase the instability of the receiving ecosystem.

Second, it will prove difficult, if not impossible, to assess the impacts of planting transgenic fishes *a priori*. There exist numerous reviews of case histories (e.g., Courtenay and Stauffer 1984; Kohler and Courtenay 1986; Moyle 1986) and attempts to use ecological theory (Li and Moyle 1981; Moyle et al. 1986) to predict ecosystem impacts

of introduced fishes. Yet no unified framework for predicting ecosystem impacts of introduced fishes exists, either for a novel species, or much less for a transgenic variant.

Susceptibility of Recipient Environment

Assessments of environmental risks associated with releases of transgenic fishes should consider varying susceptibilities of different recipient ecosystems to destabilization. One useful approach might be to identify the major environmental factors, for example food resources, that limit the abundance of "singularly important species" in an aquatic community (Carpenter and Kitchell 1988) and then to assess the likelihood that released transgenic individuals would compete for or alter these factors. The utility of this approach will depend on the degree of understanding about major processes controlling long-term dynamics of an aquatic community. In many cases, such understanding is very limited in scope or nonexistent.

Another approach to the problem would be to assume that relatively simple or small aquatic ecosystems would be more vulnerable to destabilization by transgenic fishes than relatively complex or large ecosystems. Based on the theory of island biogeography, Magnuson (1976) suggested this concept as a framework for anticipating impacts of stocking introduced species into aquatic environments. Thus, larger deeper lakes are more stable communities than smaller, shallower lakes that are more subject to frequent environmental disturbances (Tonn and Magnuson 1982). Also, because interactions between top-down and bottom-up effects change with the trophic status of lakes (McQueen et al. 1986), impacts of stocking transgenic predators could be expected to cascade farther down the food chain in oligotrophic compared to eutrophic lakes. Impacts of transgenic fish, therefore, could be very different in different types of lakes. Finally, since introduced fishes have tended to succeed more often in environments highly perturbed by human activities than in pristine ecosystems (Moyle et al. 1986), a similar trend might be anticipated for released transgenic fishes.

Special precautions regarding releases of transgenic fishes are needed for environments with severely depleted or endangered species, including those with ongoing restoration programs, and for designated natural preserves (Mellon 1988) such as national parks, refuges, and wilderness areas. All efforts should be made to prevent uses of transgenic fishes in proximity to such environments, to avoid accidental introductions and consequential environmental risks.

Suggested Research Needs

As development of transgenic fishes continues to advance, it is imperative that fisheries scientists with different types of expertise undertake research in a number of related areas. Timely progress of understanding and technology in the areas described below would represent a major advance towards environmentally sound uses of transgenic fishes.

Characterization of Transgenic Stocks

The degree of phenotypic variability within stocks of transgenic fish produced by gene transfer experiments and within genetic lines ultimately derived from such founders needs to be characterized and compared to that in non-transgenic stocks of conspecifics. Alteration of a given trait through novel gene expression is likely to affect other traits. Estimation of phenotypic variability and changes in important correlated genetic parameters is necessary for assessment of environmental impacts of transgenic fishes.

Performance Evaluations

Thorough performance evaluations need to be carried out for transgenic lines of fish consequent to transfer of genetic constructs which alter expression of a varied range of traits (e.g., growth rate, disease resistance). Such evaluations should be carried out in a step-by-step approach, first in closed laboratory systems, then in experimental mesocosms, and then in more extensive controlled systems that simulate natural systems, with the results of each step being reflected in the design of the next experiment.

Improvement in Sterilization Techniques

Improvements will have to be made in sterilization techniques and in screening methods to confirm the sterility of each individual. Performance evaluations using sterile fish should consider the impacts of sterilization on the expression of other traits, especially those affected by gonadal hormones.

Risk Assessment Modeling

Data collected from performance evaluations and in ecological studies should be used for development of risk assessment models (e.g., Levin et al. 1987) based upon synthesis of existing models of fish bioenergetics, ecosystems, and population dynamics. Experts with different technical backgrounds, including empirical and theoretical areas, should be called upon to develop and critically evaluate strengths and weaknesses of such models, and should participate in using them as decision-making tools in reviewing applications for release of transgenic fishes. The parallel continuums of potential recipient environments and ecological risks should be recognized in the development and application of these models.

Suggested Society Positions for Uses of Transgenic Fishes

The American Fisheries Society recently initiated the development of a position statement on transgenic fishes. A number of Sections of the Society and the Environmental Concerns Committee are involved, with the Fish Genetics Section spearheading the effort to develop a draft statement. After the statement is reviewed and passed through the various steps required by protocol for developing policy statements, the final version of the policy will be voted on at an AFS business meeting. We propose serious consideration of the following recommendations for inclusion in the position statement.

Encourage Performance Evaluation Research

Well-planned "releases" of transgenic fish into safeguarded research facilities will prove the only source of

meaningful performance data for scientific assessment of ecological risks associated with transgenic fish. Because environmental factors have such a great influence on fish performance, it is imperative that these data are collected in rearing facilities that allow influences of natural environmental factors, such as water chemistry fluctuations and photoperiod cycles. Efforts of the U.S. Department of Agriculture (USDA) to develop mechanisms for review and approval of proposals for such releases should be supported. The Agriculture Biotechnology Research Advisory Committee (ABRAC) of USDA should be encouraged to approve studies in appropriate and secure research facilities.

Support Restrictions on Using Transgenic Fishes in Aquaculture

Pending completion of (1) a thorough program of risk assessment, and (2) demonstration of minimal environmental risk, no introductions of transgenic fishes into production-scale aquaculture facilities, whether public or private, should be permitted. Development and demonstration of a means of guaranteeing sterility of every transgenic fish bound for such facilities may be required, depending upon the results of risk assessments. A federal-level review board of technical experts of various backgrounds should: (1)

evaluate research results, (2) recommend decisions on permit applications for use of transgenic fishes in aquaculture facilities, and (3) periodically review and modify the regulatory regime as considered appropriate in light of new knowledge and experience.

Encourage Development of Criteria for Containing Transgenic Broodstocks

To reach reproductive condition, transgenic broodstocks of many fish species will have to be held outdoors. Criteria ultimately will have to be developed to adequately contain fertile broodfish used for production of sterile transgenic progeny.

Oppose Stocking Transgenic Fishes into Natural Waters

Intentional releases of transgenic fishes with greatly altered performance characteristics are likely to have considerable impacts upon aquatic ecosystems. Risks of ecological damage may be greater for intentional releases compared to accidental releases because stocking programs would involve much greater numbers of released individuals. Only if a body of research strongly indicates the safety of stocking a certain type of transgenic fish should proposals for such a program be seriously examined. The burden of proof should be placed upon

those advocating stocking fertile or even sterile transgenic fish into natural systems because, once released, such fish are essentially irretrievable. 

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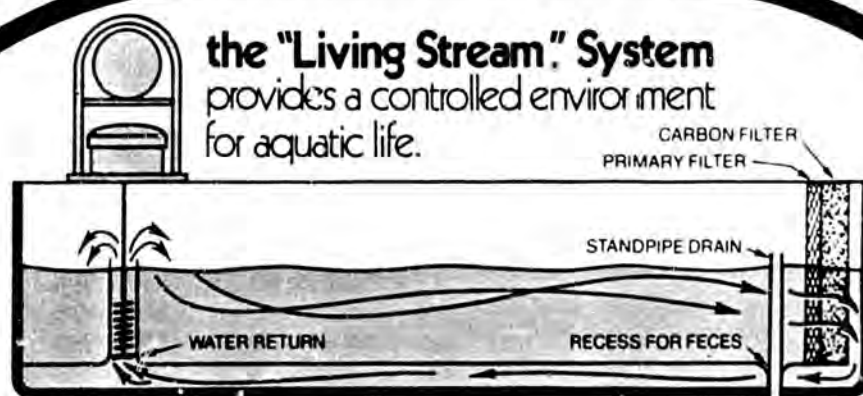
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Transgenic Fish and Public Policy: Regulatory Concerns

Eric M. Hallerman and Anne R. Kapuscinski

ABSTRACT

The present status of public policies regarding laboratory production, field testing, and distribution and final use of transgenic animals is reviewed from the perspective of fisheries professionals. Unsettled policy issues center upon distribution and final use of transgenic fishes. Policy positions regarding regulation of the various stages of production of transgenic fishes are recommended for adoption by fisheries professionals.

Development of techniques for the introduction of novel genes into animals foreshadows the production of genetically altered animals for agricultural production. Development of public policies aimed at regulation of production, field testing, and distribution and final use of novel life forms is incomplete. Institutional frameworks for implementation of the developing biotechnology-related policies are developing within existing government agencies. The production of fish bearing novel genes introduces these policy concerns into the community of fisheries professionals.

In this paper, we attempt to relate public policy questions pertaining to gene transfer technology to the interests of the fisheries community. We approach this by identifying the contentious issues regarding the various stages in the development of lines of transgenic fishes. We also suggest policies which professional fisheries organizations might advocate regarding regulation of transgenic fishes with potential impacts upon fisheries resources.

Gene Transfer in Fishes

Because of their possible value to aquaculture and utility as model systems for vertebrate gene expression, the development of transgenic fishes has attracted a large research effort. At least 22 laboratories, 9 in the U.S. and 13 in other countries, are involved in gene transfer in fish. The effort devoted to research on transgenic fish is large relative to that on transgenic farm animals, and the stage of development of certain transgenic fishes is more advanced than that of transgenic farm animals. Thus, public policies regarding transgenic animals need to address concerns specific to transgenic fish.

Development of transgenic animals can be divided conceptually into three stages: (1) production, (2) development

of transgenic lines and field testing, and (3) distribution and final use. As each stage poses a different level of risk to the environment and is subject to a different set of regulations, each stage is treated separately in the discussion below.

Regulation of Production of Transgenic Animals

The source of financial support for production of transgenic animals determines the relevant guidelines regulating their production.

- Production of transgenic animals in institutions that receive support from the National Institutes of Health (NIH) or from other federal agencies is regulated under the Guidelines for Research Involving Recombinant DNA Molecules (National Institutes of Health 1984, 1986, 1987) under the provisions of the Public Health Service Act. The Guidelines provide the overall framework for conducting biotechnology research and development activities, specifying practices for construction and handling of most recombinant DNA (rDNA) molecules and organisms containing rDNA molecules. Those cases not specified in the Guidelines require review by the Recombinant DNA Advisory Committee (RAC), which includes 25 individuals with expertise in biotechnology, law, public policy, ethics, the environment, and public health (Fanning 1988). The Office of Recombinant DNA Activities (ORDA) of NIH approves local Institutional Biosafety Committees (IBCs) which, together with the experiment's principal investigator, oversee the execution of given rDNA research projects. An IBC, which inspects facilities on-site as needed, consists of at least five members representing disciplines including biological safety and engineering; additionally, not less than 40% of the members of the IBC must be unaffiliated with the institution and represent the public interest and the environment. The jurisdiction of the NIH Guidelines has recently been extended to cover contract arrangements with non-U.S. institutions if NIH funding is at issue (Fox 1988b).

- Among institutions not receiving NIH or other federal funding, under the Coordinated Framework for Regulation of Biotechnology (Office of Science and Technology Policy 1984), voluntary compliance with the NIH Guidelines is expected.

Despite the frustrations imposed by certain regulatory

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conditions and a moratorium on certain forms of rDNA research, compliance with the Guidelines has been impressive (Kingsbury 1988; Fanning 1988). The safety of laboratory research with recombinant organisms has become generally accepted (Kingsbury 1988; Fanning 1988).

Suggested AFS Positions Regarding Production of Transgenic Fish

We propose consideration of the following positions for inclusion in an American Fisheries Society (AFS) position statement on transgenic fishes.

Shortcomings of NIH Guidelines

The NIH Guidelines have been criticized for a number of shortcomings (Fanning 1988). First, the vast majority of rDNA research is carried out using funding from the private sector, for which only voluntary compliance is required. Although compliance has been widespread, there are no mechanisms for enforcement. Future rDNA research involving fish will ultimately be carried out in the private sector, raising this concern within the community of fisheries professionals. Production of transgenic animals in non-federally funded laboratories should be required to follow the NIH Guidelines. State or federal governments should develop legislation that penalizes non-compliance within the private sector.

Second, the monitoring and enforcement provisions of the Guidelines have been criticized as weak (Fanning 1988). As NIH can only limit, suspend, or terminate a grant in response to confirmed violations, researchers, who are heavily relied upon for enforcement, face a strong disincentive against reporting violations.

Finally, although compliance with the Guidelines has been generally good, it has not been complete in all cases. Such cases, when independently substantiated, would tend to indicate laxity on the part of the corresponding IBCs rather than deficiency of the Guidelines.

Adherence to and Appropriate Revisions of the Guidelines

We feel that AFS should support full application of the existing Guidelines regulating production of transgenic animals, and support revision of such Guidelines to address the concerns expressed above. Future revisions of the Guidelines should be made as seems appropriate with the accumulation of technical and regulatory experience.

Regulation of Environmental Release of Transgenic Animals

Both the natural environmental conditions required for attainment of sexual maturity in certain species and the normal culture conditions required for identification of high performance lines dictate the need for outdoor confinement during development of transgenic lines. Transgenic common carp (*Cyprinus carpio*) are approaching reproductive age and the need for natural pond conditions (Conti 1988). Plans have been made to initiate outdoor testing of transgenic carp in Auburn, Alabama (see below), and in China (Z. Zhu, Institute of Hydrobiology, Wuhan, personal communication).

Controlled environmental testing of organisms altered through recombinant DNA technology is often referred to as deliberate release, but a better term might be planned introduction. Deliberate release, which under the NIH Guidelines requires review by the RAC, is the most controversial element of public policy regarding development of recombinant DNA-modified organisms; early outdoor tests of recombinant organisms were the subject of agency debate, lawsuits, and public outcry (Fox 1987; Van Brunt 1987).

During this period, the Cabinet Council Working Group, which included representatives of 18 federal agencies and executive offices, produced the Coordinated Framework for the Regulation of Biotechnology (Office of Science and Technology Policy 1984, 1985, 1986), a regulatory policy document focusing upon environmental release of organisms developed by biotechnological methods. The Coordinated Framework explains the application of existing legislation to the regulation of biotechnology, outlines the jurisdictions of federal agencies, and outlines the approach to interagency coordination.

Under the Coordinated Framework, determination of agency jurisdiction over regulation of commercial biotechnology products relates to their ultimate use. For federally funded research, responsibility lies with the funding agency, with the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA), or with the Environmental Protection Agency (EPA). For non-federally funded research, such responsibility lies with APHIS and EPA as above, with voluntary review by the USDA Science and Education branch under proposed guidelines which parallel the NIH Guidelines.

"Guidelines for Research with Genetically Modified Organisms Outside Contained Facilities" are being developed by the USDA's Agricultural Biotechnology Research Advisory Committee (ABRAC) (Fox 1989a). Under these proposed Guidelines, requests to USDA for approval for outdoor testing are reviewed by ABRAC and outside experts, who evaluate the proposal in terms of environmental safety and agree upon confinement protocols to assure safety. Much of ABRAC's work to date has addressed development of these guidelines and consideration of a manual for conducting field tests of genetically altered organisms developed by staff of the Office of Agricultural Biotechnology (OAB) of USDA (Fox 1988a). The task of developing the Guidelines is complicated by questions of overlapping jurisdiction among existing federal agencies.

No outdoor testing of transgenic animals has yet been expressly approved by the secretary of agriculture. The first such request specifically involved a proposal to USDA for research on transgenic fish, and received provisional approval from ABRAC during spring 1989 (Ezzell 1989). The request was for approval of conditions for release of transgenic carp into outdoor ponds at Auburn University (Conti 1988). These 0.04 hectare ponds included perimeter fencing, double screening of drains, and netting against bird predation. Further confinement conditions were recommended and incorporated into an environmental assessment prepared by OAB. Final approval of the permit awaited completion of the environmental assessment, public comment, and approval by the administrator of the Cooperative State Research Service, the funding agency within USDA.

Subsequent events have complicated the process considerably. Anti-biotechnology activist Jeremy Rifkin (Anonymous 1988) and a number of environmental interest groups asked that USDA deny the field-testing application, noting that the location of the pond on the flood plain of a stream and lack of a gravel trap in the pond drainage system were evidence of insufficient assurance that the carp would not escape. An official go-ahead from USDA had not been issued, but in June 1989, fearing that transgenic broodstock might die if not provided with outdoor habitat, researchers stocked nine adult transgenic carp into outdoor ponds (Fox 1989a). These researchers had obtained approval from the Institutional Biosafety Committee at Auburn University in accordance with the NIH Guidelines for this action under an interpretation that the adult carp were not "released" but confined under conditions appropriate for the carp. Alvin Young, director of the Office of Agricultural Biotechnology of USDA, noted that the researchers were not required to notify USDA of their activities if they were in compliance with NIH Guidelines, and did so voluntarily; and that it was not the stocking of adults, but a proposed experiment involving fry which ABRAC had said must be carried out under restricted condition. (Fox 1989a), since their small size complicated their containment.

The knowledge and experience gained from early releases of recombinant microorganisms (National Academy of Sciences 1987; Office of Technology Assessment 1988; National Research Council 1989) led to the finding that small-scale field tests are unlikely to result in widespread or uncontrollable environmental problems. Experience gained from outdoor tests expected within the next few years should guide the refinement of policies regarding outdoor testing of transgenic animals. Examples of pending or potential environmental applications (Office of Technology Assessment 1988) include fish with novel genes introduced to enhance growth rate, cold tolerance, or disease resistance for use in aquaculture or sport fisheries. The Cooperative State Research Service of USDA has launched the National Biological Impact Assessment Program to serve as a focal point for the exchange of research and monitoring information and to facilitate research designed to predict, assess, and monitor the performance of genetically altered organisms in contained experiments and in ecosystems (Cooperative State Research Service 1989).

The development of regulatory policies within the U.S. should include consideration of policies in other countries, so that U.S. policies do not become an obstacle to development of biotechnology domestically, and do not provide an incentive to carry out less thoroughly safeguarded testing abroad (McCormick 1986). Foreign policies regulating deliberate release of recombinant microorganisms (Miller 1986; McCormick 1987; Newmark 1987) are not generally as developed as in the U.S., and range from very restrictive (e.g., Denmark) to very permissive (e.g., Italy), to non-existent. A recent report aimed at unifying international rDNA regulatory policy in developed countries (Organization for Economic Cooperation and Development 1986, cited in Ager 1988) has begun to influence development of such policies worldwide. Under the suggested OECD Guidelines, the provisional approach to regulating field testing of recombinant animals incorporates independent, case-by-case review of potential risks in a manner not unlike the

current approach in the U.S. Further refinement of the OECD position is being developed. The possibility of developing a European Economic Community framework for regulating biotechnology was addressed in a recent report by the Commission of European Communities (1986, cited in Ager 1988), and draft directives are in preparation (Ager 1988).

Suggested AFS Positions Regarding Field Testing of Transgenic Fish

Review of All Small-Scale Releases

Analysts of the USDA regulatory policy (Fanning 1988) have noted a difference in regulatory policy between divisions of the agency regarding small-scale environmental releases. The Animal and Plant Health Inspection Service favors mandatory review of all releases as an interim step; Science and Education considers such releases as basic research that should be covered under guidelines and ultimately be reviewed by IBCs. Because of its overriding concern for protection of fisheries resources, we suggest that AFS advocate the former policy, at least through the accumulation of experience from early releases. The earlier USDA Recombinant DNA Research Committee has been criticized for its reluctance to take an active role in overseeing execution of reviews for proposed environmental releases (Stern 1986). The AFS should advocate an activist role for the current ABRAC.

Effectiveness of Institutional Biosafety Committees

Upon request of the U.S. House of Representatives Committee on Science, Space and Technology, the General Accounting Office assessed the Institutional Biosafety Committees' (IBCs) implementation of the federal guidelines applicable to the environmental release of genetically-engineered organisms. Three of their findings (General Accounting Office 1987) should cause concern among fisheries professionals:

- IBCs are predominantly composed of members with backgrounds in genetic engineering. Specialists in ecology, containment, and environmental regulation were heavily under-represented relative to recognition of such need by committee chairpersons.
- There was a knowledge gap between what research activities the IBC chairpersons thought were being conducted at their institutions and what activities were actually ongoing.
- Opinions among federal officials involved in regulation of biotechnology differed regarding the intended function of the IBCs in the regulatory process and regarding the present capabilities of the committees to adequately review environmental release proposals.

The respective institutions should address these concerns (1) by naming a broader spectrum of experts to their IBCs, and (2) by institutions and IBC members attaching enough significance to IBC function that the committees succeed in their oversight role.

Monitor Early Releases of Transgenic Fish

In general, the experience of the first outdoor tests of transgenic microbes revealed no major flaws in the corre-

sponding regulatory structure set out in the Coordinated Framework. However, USDA-APHIS has not always followed its own established procedures in approving the use of a genetically engineered product, as evidenced by how it approved the use of a recombinant, live virus pseudorabies vaccine in 1986 (Volkmer 1986, cited in Pimentel et al. 1989). Well-safeguarded outdoor tests of transgenic fishes in confined rearing units would not seem to pose significant levels of environmental risk. We suggest that AFS monitor early environmental releases of transgenic fish as well as the workings of regulatory authority in connection with such tests in order to evaluate the present regulatory regime. This evaluation should guide the further development of AFS policy regarding environmental testing of transgenic fish.

Definition of a "New" Organism

For regulatory purposes, a "new organism" has been defined (Office of Science and Technology Policy 1986) as one containing "an intergeneric combination of genetic material." Specifically "excluded are organisms that have resulted from the addition of intergeneric material that is well characterized and contains only noncoding regulatory regions." Animals that have been transformed with DNA constructs bearing such regulatory regions and *intrageneric* protein-encoding sequences are not considered truly transgenic, and hence might prove more readily certifiable for deliberate release, distribution, or final use. We argue that the key issue is not the source of the protein-encoding sequence, but rather the phenotypic effects of activity of the novel construct within the transgenic animal (Kapuscinski and Hallerman 1990, this issue; Tiedje et al. 1989). Altered gene expression and gross phenotype are indeed the very objectives of gene transfer, and form the bases for the novel performance and environmental impact of the transgenic animal. From the viewpoint of environmental impact and related regulatory policy, then, the distinction between homologous or heterologous protein-encoding genes is largely irrelevant. The exclusion clause in the definition of a "new" organism should be removed. This is particularly important for essentially wild animals, such as transgenic fish, which have a high probability of surviving in natural environments.

Distribution and Final use of Transgenic Fish

The first genetic lines of transgenic fish will likely emerge from field testing and development, becoming available for distribution and final use within the next decade. In the process of developing transgenic fishes, laboratory research and highly regulated field testing would seem to pose relatively low risk of environmental harm. As transgenic fish are ultimately distributed for final use, however, they would enter a wider range of less secure confinements. Some fish might escape from confinement into natural systems, survive, reproduce, disperse to other systems, become widely established, and impact conspecifics and the aquatic community at large. The probability of these occurrences will vary depending on the confinement facility, the natural system, and the fish species involved

(Kapuscinski and Hallerman 1990). The possible mechanisms of environmental impacts of transgenic fish might prove complex (Kapuscinski and Hallerman 1990). Consideration of the environmental impact of transgenic fish at the utilization stage is, therefore, important.

Regulation of Distribution and Final Use

No single piece of federal legislation regulates the distribution and final use of transgenic organisms. Public policy regarding such regulations was developed in response to needs originally associated with the distribution and final use of transgenic microorganisms. The public policy solution to such regulatory problems, outlined in the Coordinated Framework for Regulation of Biotechnology (Office of Science and Technology Policy 1984, 1986), was to apply existing legislation, stretching the coverage of such laws beyond the original legislative intent. For example, regulation of the release and use of recombinant microorganisms, falls within the redefined scope of TSCA (Toxic Substances Control Act) and FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act), and are thus regulated by the Environmental Protection Agency (EPA).

A number of federal and state agencies have interests in regulating various aspects of the distribution and final use of transgenic fish, as described below:

- Coordination of agency interaction, including determination of lead agency responsibility in areas of jurisdictional overlap, is the responsibility of the Biotechnology Science Coordinating Committee (BSCC), an executive branch offshoot of the Working Group which developed the Coordinated Framework. The BSCC is composed of senior officials from the USDA, EPA, FDA, NIH, and NSF (Fanning 1988). Its specific goals are to: (1) serve as a forum for addressing scientific problems, sharing information, and developing consensus; (2) promote consistency in developing review procedures and risk assessments among agencies; (3) facilitate cooperation among agencies on emerging scientific issues; and (4) identify gaps in scientific knowledge. There are arguments as to whether or not the BSCC has achieved its goals (Fanning 1988; Fox 1988c).

- The Animal and Plant Health Inspection Service (APHIS) of the USDA has stated its authority to regulate the importation, interstate movement, and release of genetically altered animals as biological products under regulations promulgated under the Virus-Serum Toxin Act. The Plant Quarantine Act and the Federal Plant Pest Act regulate the interstate movement and importation of plants and known or suspected plant pests. The applicability of these latter two statutes follows from USDA's extension of the definition of a "plant pest" to include all recombinant DNA species (APHIS 1987). However, organisms outside even a broad definition of plant pest are arguably not covered by such legislation.

- The Food and Drug Administration (FDA) is the primary agency responsible for regulation of food products intended for human consumption, and would be required to determine whether, for example, elevated growth hormone levels in transgenic fish affected the safe consumption of the meat. FDA authority as set out in the Food, Drug, and Cosmetics Act and the Public Health Service Act is applicable

to any product, including one which is the result of transgenic expression in animals.

• The Food Safety and Inspection Service (FSIS) of the USDA is charged with assuring meat or meat products intended for use as human food are wholesome, not adulterated and properly labelled. However, neither mandatory nor voluntary inspection of fish and fish products are mandated by the Federal Meat Inspection Act. Conditional inspection provisions of the Act, which are intended for research or experimental animals, might be construed to apply to meat derived from transgenic animals (Jones 1986), including fish. Alternatively, transgenic fish or fish products could be inspected under an expansion of the voluntary inspection provision of the Act. FSIS would be required to ascertain possible food labelling claims, for example, that meat from transgenic animals had less fat or other stated qualities.

Should the transgenic fish be a non-domesticated species or stock intended for stocking into natural systems, the final use criterion set out in the Coordinated Framework for determining the lead regulatory agency is likely to break down. Concerned public agencies might include the Fish and Wildlife Service (FWS), the Forest Service, the National Marine Fisheries Service (NMFS), and the state agencies governing fisheries resources.

Although the FWS has regulatory policies regarding genetic integrity of wild stocks, the maintenance of natural habitat, and protection of biological diversity, it would seem to lack the authority to regulate the use of transgenic animals in most cases. The FWS has authority under the Lacey Act over state regulations concerning the control or impact of migratory species, exotic species, or any fish species that cross state lines. Since fish engineered for increased tolerance to environmental stresses (e.g., temperature) may survive in habitats where they were formerly excluded, some of the precautions taken to assess the risks of exotic species may be applicable (Office of Technology Assessment 1988). Should the introduction of genetically manipulated fish have potential impacts upon endangered species, FWS authority might be invoked under the Endangered Species Act. Any further involvement would require the enactment of new legislation or the "stretching" of laws and regulations intended for other purposes (Office of Technology Assessment 1989).

Under the Coordinated Framework, it is not the Environmental Protection Agency (EPA) that would be required under the National Environmental Protection Act (NEPA) to review the environmental consequences of release of transgenic fish, but instead, the agencies involved in regulating utilization of these animals. The jurisdictional scope of EPA's authority under the Coordinated Framework is limited to transgenic microorganisms and to any organism not specifically covered by other agencies. However, EPA is required to review environmental assessments made by other agencies.

A noteworthy effort to satisfy the lack of legal authority over distribution and final use of transgenic animals was embodied in H. R. 1557 (Kallenmeier 1989), the Transgenic Animal Regulatory Reform Act, a bill introduced jointly to the U.S. House Committees on Science, Space, and Technology and Agriculture, in spring 1989. The major thrust of the bill was to establish a permit requirement for

use of transgenic animals in agricultural activities. Such a permit could only be granted if "the activity . . . authorized . . . does not constitute an unreasonable risk to human health, welfare, or the environment." Permits might thus contain restrictions that the secretary of agriculture deemed necessary, including designation of authorized manner and method of use, requirements for confinement of transgenic animals, monitoring requirements and restrictions on disposal. Provisions for different kinds of permits for experimental, expanded, or commercial use were outlined. A Transgenic Animal Advisory Committee composed of individuals with expertise in risk assessment and risk management methodologies relating to genetic engineering would review permit applications, prescribe data submission requirements, and risk assessment protocols, and recommend actions on specific permits. No congressional action was taken on H. R. 1557, which may be reintroduced.

International regulations regarding environmental impacts of biotechnology are beyond the scope of this paper. They have recently been reviewed (Gibbs et al. 1987).

Suggested AFS Positions Regarding Distribution and Final Use of Transgenic Fish

Regulatory Philosophy

Policies regarding release of triploid and hybrid fishes have been promulgated at the state level, resulting in a patchwork of regulatory regimes. Public policies regarding distribution and release of transgenic fish should be more carefully considered and coordinated than have those of other classes of genetically-manipulated fishes. Agencies in at least 11 states have developed or are expected to develop regulations concerning release of transgenic organisms (Stroick 1987; Fox 1989b). In order to achieve a nationally coordinated approach, however, adoption of such policies at the federal level would be desirable.

The likely environmental impacts of transgenic fishes are unknown. Against this background, initial policies governing distribution and final use of transgenic fishes should be ecologically conservative (Kapusinski and Hallerman 1990). However, as knowledge accumulates about the performances and impacts of transgenic fishes from small-scale releases in experimental settings, policies may be reviewed and relaxed as appropriate.

Regulatory Regime

Results from studies of environmental impacts of transgenic fishes within limited, enclosed test systems should be utilized as a guide for rational decision-making regarding distribution and final use of such fish. We envision a case-by-case system of granting separate permits for distribution and for final use of transgenic fish. Because of different levels of risk posed to the environment, regulations governing the issuance of permits for distribution and final use should distinguish between applications for land-based, enclosed aquaculture systems and for stocking of transgenic fish into more extensive aquaculture settings or into natural waters.

Regarding land-based aquaculture systems, distribution and final use permits should be conditional upon demonstration that the facilities of the broodstock producer or the

growout farmer are secured against the escape of fish and the unauthorized entry or exit of humans. Requiring siting of facilities outside the floodplain of natural waters, double screening of water input and output pipes, passage of discharged water through a gravel trap before release into natural waters, complete perimeter fencing of farm operations, and a prohibition of removal of live fish from growout facilities should be minimum requirements for such purposes.

Regarding transgenic fishes intended for release into natural systems, clarification of lead agency jurisdiction is of great importance. Further, the lead agency should be granted sufficient authority to succeed in this mission. Regarding distribution and final use of transgenic sportfish, we advocate a conservative, multi-step permit process involving review by scientists in aquatic ecology, evolution, fish physiology, and molecular biology. The party requesting the distribution or final use permit should demonstrate that the proposed stocking poses a very low risk of damage to the natural community. Small-scale field tests in enclosed systems are likely to be the only way that potential risks from large-scale stocking of transgenic fish can be evaluated. Through the multistage evaluation process envisioned, each stage of experimentation would refine knowledge and experience. State natural resource agencies that have substantial experience with local ecosystems should be encouraged or required to become involved in the permit process. It is quite conceivable that release of transgenic sportfish might never be allowed, even if sterile (Kapuscinski and Hallerman 1990).

Floating net-pen aquaculture and other systems located in natural waters represent a degree of confinement intermediate between land-based systems and stocking into open natural systems. Because few measures can be taken to secure such facilities, we suggest that stocking of transgenic fish into net-pens and the like be considered no differently in a regulatory sense than stocking into natural systems.

Rational regulation of distribution and final use of transgenic fish should eventually entail a quantitative analysis of the risk posed to the environment within the scope of a decision-making model (e.g., Levin et al. 1987; Regal 1987, cited in Fanning 1988) that is based upon principles of aquatic ecology. The risk analysis protocol, when ultimately developed, should be institutionalized within the procedure for securing a license for distribution or final use of transgenic fish.

Under the current legislatively mandated framework, no provision is made for risk analyses. The broad mandate of USDA is to promote agriculture, and not to protect environmental interests. Analysts have debated the advisability of invoking the National Environmental Policy Act (NEPA) as the basis for regulating proposed releases of transgenic animals (Fanning 1988). NEPA requires the preparation of environmental impact statements for all proposed actions which might significantly affect the quality of the environment. Provisions for environmental assessments, and when appropriate, detailed environmental impact assessments, should be incorporated into the framework regulating distribution and final release of transgenic fish, whether authorized under an extension of the NEPA or by new legislatively mandated policy.

Qualified Support for H. R. 1557

The Kastenmeier bill, H.R. 1557, represents an intelligent approach to the issue of regulating distribution and final use of transgenic animals, and its strictly agricultural provisions should be supported by the Society if it is reintroduced. There are three areas, however, where its provisions might well be modified or strengthened. First, the definition of a "genetically engineered animal," hinging upon possession of intergeneric DNA, is subject to the objections we expressed above in connection with the corresponding OSTP definition in the Coordinated Framework. Second, the provision that "the administrator of the Environmental Protection Agency *may* (italic ours) establish a system for the regulating of the release of genetically-engineered animals into the wild," is too weak. A future version of the bill should *require* establishment of such a system. Third, while the bill would establish a strong system for permitting final use of transgenic animals, it does not address permitting their distribution. Within the aquaculture industry, fingerling production and grow-out facilities are frequently distinct, and each operation poses different levels of risk to the environment. Rather simple modifications of the bill could address these issues.

Authority Over the Private Sector

The release of engineered animals within non-federally funded projects is not presently subject to regulation. Regulation of such animals within commercial facilities should be brought under the auspices of new or existing regulations.

Intrastate Regulatory Authority

Regulatory authority of USDA under the Coordinated Framework covers movement of transgenic animals between states or introduction of such animals from somewhere else. USDA thus has little authority to regulate movement of transgenic animals within a state (Stern 1986; Fanning 1988). This lack of authority should be addressed in revision of the Framework.

The Effect of Heightened Expectations

The agricultural utility of transgenic animals in general and of transgenic fishes in particular is presently unproven. Reports upon transgenic fishes in the popular press (e.g., Thomas 1988), however, have sometimes tended to promote heightened expectations on the part of the general public. Such excessively optimistic and dangerously simplistic reports have sometimes been found in the popular publications of state fish and game agencies.

Gale (1987) eloquently argued that unrealistic expectations of resource miracles ultimately present constituency problems to fisheries resource managers, thus making it increasingly difficult to implement management programs based upon sound biological principles. Against this background, we strongly encourage a policy on the part of state and federal fisheries management agencies of presenting a more balanced discussion of the potential attributes and limitations of transgenic fishes. 

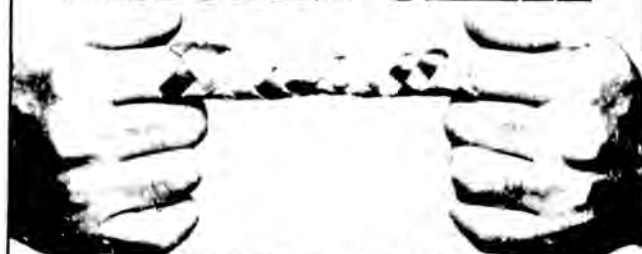
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Transgenic Fish and Public Policy: Patenting of Transgenic Fish

Eric M. Hallerman and Anne R. Kapuscinski

ABSTRACT

Following the granting of the first patent for a transgenic animal, public debate has arisen over a number of contentious patenting issues, including the very patentability of higher life forms. Against the background of the legal history regarding patentability of novel animals and the viewpoints of the various interest groups, we identify key policy questions currently at issue in the U.S. Congress and the U.S. Patent and Trademark Office. Finally, we propose positions that the American Fisheries Society might advocate at this critical moment in the determination of national animal patenting policies which are likely to impact the community of fisheries professionals.

The Legal Basis for Patenting of Novel Animals

A patent (Benson 1986) is a government-sanctioned right to exclude others from using an invention for a specified period of time (17 years in the U.S.). For an invention to qualify for patent protection, its proponent must establish its novelty, practical usefulness, and non-obviousness. The documentation for a patent includes a complete written description of the invention, disclosing the manner and process of making and using the invention, written so as to enable any person skilled in that technology to make and use the patented invention.

The legal precedents establishing the principle of patentability of life forms (Witt 1985) are two statutes concerning plants. The Plant Patent Act of 1930 established the plant patent and enacted special criteria for patent protection for plants reproduced asexually, that is, by cuttings or grafts. The Plant Variety Protection Act of 1970 extended patent-like protection to plants reproduced sexually, that is, by seed.

The legal basis for patenting of non-plant life forms traces back to three key rulings upon particular patent applications. In a landmark decision reached in 1980, the Supreme Court ruled 5-4 in *Diamond vs. Chakrabarty* that manmade microorganisms, in this case, oil-metabolizing bacteria, were patentable. Referring to the earlier, plant-related legislation, Chief Justice Warren Burger (quoted in Witt 1985, page 83) expressed the majority opinion that "Congress thus recognized that the relevant distinction was not between living and inanimate things, but between products of nature, whether living or not, and human-made inventions."

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Utility patent protection was extended by similar legal reasoning to plants in 1985 by the U.S. Patent and Trademark Office (PTO) Board of Patent Appeals and Interferences in *Ex parte Hibberd, Anderson, and Barker*, granting a patent for a tryptophan-overproducing maize plant offering improved nutritional value (Benson 1986). In April 1987, the Board of Patent Appeals, although denying the *Ex parte Allen* patent application for polyploid oysters, ruled that animals were in principle patentable. Following the pivotal Supreme Court and regulatory agency decisions, the PTO on 12 April 1988 awarded the first animal patent (No. 4,736,866) to Harvard University for a mammal carrying an activated cancer-causing gene. A statement of PTO policy on patenting of animals is presented in Office of Technology Assessment (1989).

Public Debate on Patenting of Novel Animals

Following the award of the first patent for a genetically engineered animal, the public debate on patent policy has become intense. Different viewpoints have been brought to the policy debate by several interest groups (reviewed by Dresser 1988).

Religious groups question the morality of genetic engineering *per se* (Rollins 1986; Sitomer 1988), and have seized upon the patenting issue as a means of forcing society to address their concerns. To quote one such religious leader (Crawford 1987, page 480), "The gift of Life from God . . . should not be regarded solely as if it were a chemical product, subject to genetic alteration and patentable for economic benefit. Moral, social, and spiritual issues deserve far more serious consideration before binding decisions are made in the area."

Asserting that animals should not be subject to direct human manipulations of genetic material, animal rights groups oppose animal patenting as part of their opposition to genetic engineering in general. The Humane Society of America worries that animals will physically suffer as a result of genes being transferred into their genetic code (Crawford 1987).

Wildlife groups oppose animal patenting inasmuch as it would provide a strong incentive for development of transgenic animals which could potentially enter and harm natural communities and the environment. Some such groups also object to manipulation of wild organisms or natural systems for human benefit (Schneider 1988).

From the farming sector's point of view, patenting of transgenic animals has both good and bad aspects. Patenting would be an incentive for the rapid development of improved transgenic strains of livestock. However, farmers are apprehensive about the possibilities of having to pay royalties for transgenic animals and their offspring, or furthermore, of having to license rather than own their livestock. Small farmers worry that introduction of yet another high technology would exacerbate the trend toward the large, corporate farms more able to take full advantage of such technical innovations (Van Brunt 1988).

The response of the university community to the issue of animal patenting is split. Researchers as individuals are concerned that patents may restrict their traditionally free access to genetic materials and to information, and that they may ultimately have to pay royalties to gain access to these (Kenney 1988). Scientists find themselves increasingly in conflict, caught between sharing their research results as they are obtained or jealously guarding their data until patent litigation is settled (Broad 1988). The universities themselves, however, regard patent royalties as needed revenue.

The biotechnology industry, of course, strongly advocates patent protection for their products, which represent large financial investments. They argue that innovations in biotechnology are no different in kind than innovations in any other field. Granting of patents on biotechnology products or processes is desirable to maintain economic competitiveness in an industry thus far dominated by the U.S. The industry argues further that granting of a patent is a morally neutral practice, and that ethical issues raised by other interest groups should not be fought in this forum. Industry's position is that animal rights issues have been and will continue to be addressed through specific legislation such as the Animal Welfare Act, that environmental issues should similarly be addressed through specific environmental legislation, and so on.

A variety of groups emphasize that the purpose of patents, as laid out in Article I of the U.S. Constitution, is "to promote the progress of science and useful arts." That patents provide a positive incentive for applied research is abundantly clear. Further, patent lawyers point out that the disclosure requirement of patent law minimizes the restrictiveness of patents. In return for patent protection, by disclosing the basis for the invention, the inventor is in practice furthering the technology at issue by giving potential competitors the basis for improvements upon the invention. The patent is no guarantee that the inventor will receive royalties in the short or long term. Moreover, because of the rapid pace of development in gene transfer technology, the practical lifetime of a particular patent probably will be far less than 17 years. In the absence of patent protection, the inventor would resort to keeping the basis of an invention a trade secret (Kastenmeier 1988).

Even as the public debate over the patentability of animals heats up, over 40 animal patent applications have become backlogged at the Office of Patents and Trademarks (Fox

1989). An applicant for a biotechnology-related patent might expect to wait as long as 4 years for a decision (Crawford 1988a). To reduce the processing time for a patent application, the Office has recently added dozens of patent examiners, and reached an agreement with the Industrial Biotechnology Association for private contribution towards the training of examiners and the provision of current scientific journals (Crawford 1988b). Congress, however, failed in 1988 to appropriate \$2 million earmarked for speeding biotechnology patent application processing to the Patent and Trademarks Office (Fox 1988). Still, the biotechnology sector is clamoring for faster agency action so that they might know the degree to which their inventions will be protected by patents (Crawford 1988a).

International patent protection of novel organisms is regarded as essential by the biotechnology industry. However, the European Patent Office has recently decided that it cannot grant patents on animals (Dickson 1989). For an in-depth review of key issues regarding international aspects of intellectual property rights pertaining to biotechnology, the interested reader is referred to Bent et al. (1987) or to Office of Technology Assessment (1989).

The Call for a Moratorium of Animal Patenting

The legal basis for animal patenting, the *Diamond vs. Chakrabarty* and the Board of Patent Appeals and Interferences decisions, were controversial, split decisions. Because the outcome of these decisions is that animals *could* be patented, the mission of the Patent and Trademarks Office, therefore, is to evaluate each patent case on its merits. Critics of standing patent policy claim that these precedents do not establish whether animals *should* be patentable, which they argue is an issue only the Congress should decide. These critics have pushed for a moratorium on patenting of animals.

Spearheading this drive was Representative Charlie Rose (D-NC), who introduced a bill calling for a 2-year moratorium on the patenting of animals. His intentions (Anonymous 1987, page 865) were "to provide a secure legal basis for . . . consideration of the problems surrounding animal patenting," and to "affirm that animals are not patentable" unless or until Congress specifically approves it. In 1988, animal patent moratorium bills were proposed in both houses of Congress (Fox 1988). An indefinite moratorium died in the Senate Judiciary Committee, and a 2-year moratorium was defeated in the House Judiciary Committee.

In 1987, H.R. 3119, a Bill to Amend Title 35 of the United States Code to Prohibit the Patenting of Genetically Altered or Modified Animals, was introduced into the U.S. House of Representatives. The following year, S. 2111, the Senate equivalent, was introduced. Neither bill progressed through committee to reach full Congressional debate, but similar bills may be introduced in upcoming sessions.

Suggested AFS Policies Regarding Animal Patenting

Given the background presented above, it is clear that public policy regarding patents is at a pivotal point of development. As some debate the broad issue of the patentability of animals, those agreeing upon the principle of such

patenting debate more arcane, but nonetheless contentious issues. Because the scope of AFS interests includes wildlife protection, aquaculture, and fish genetics research, the Society must consider and weigh all relevant points of view in developing a position statement on patenting of animals. We propose consideration of the following positions for inclusion in an AFS position statement on transgenic fishes.

Focus of Public Debate

Certain interest groups are clearly attempting to use the patenting issue as a legal means of restricting all production of transgenic animals (Adler 1988). Use of the animal patenting debate as a forum for advancement of a moral or ethical agenda not related to the specific issue of animal patenting would seem inappropriate or at least misdirected (Merges 1988). The proper vehicle for groups with such concerns would not be to focus their efforts on blocking the execution of current patent policy, but rather to introduce legislation specifically addressing the principal issues that concern them.

It has been suggested (Anonymous 1988) that the economic objections to patenting of animals, unlike the moral ones, really are related to patent policy. Such objections presuppose genetic engineering and focus on whether the enterprise is best governed by existing patent law. To the degree that debate about animal patenting addresses specific patent-related concerns, the debate would seem timely and appropriate. We suggest the AFS refrain from lobbying against animal patenting *per se* and initiate debate within the Society towards the goal of defining comprehensive policies regarding the patent-related issues set out below.

Breadth of Patent Protection

Granting of patents for transgenic fish should be narrowly defined by the Patent Office to avoid stifling subsequent work, and be limited to cases where novel promoters, structural genes, or novel production processes are key innovations.

Strengthening of Research Exemption

To avoid unduly limiting effects of exclusive patents, the Patent Act provides that patents be granted on the condition that the patent holder's proprietary interests are balanced with research interests. However, the Patent Act research exemption was judicially created (Merges 1988; Kastenmeier 1988), lacks explicit boundaries, and is narrowly limited to research having no intended commercial use (Adler 1988). It has been proposed (Walsh 1988, cited in Adler 1988, Merges 1988) that Congress enact an explicit research exemption into the Patent Act similar to that which exists under the Plant Variety Protection Act, where use and reproduction of a patented variety for *bona fide* research purposes is expressly a non-infringing use. This proposition is important in light of the large amount of research carried out in the public sector, especially in the USDA Agricultural Research Service and at state agricultural experiment stations (Merges 1988).

Royalty Obligations

Because transgenic animals are inventions that can reproduce themselves, the issue of user's royalty obligations

is an important one for the aquaculture sector. After having paid royalties for acquisition of transgenic broodstock, would aquaculturists be expected to pay royalties when the transgenic progeny are themselves reproduced or their progeny bought and sold? Current law fails to adequately address the respective rights of patent holders and animal owners over the offspring of patented animals (Merges 1988).

Were only acquisition-related royalties at issue, patent holders might charge large royalties for the original transgenic broodstock, which would effectively limit licensing of transgenic strains to large, corporate farms, while denying it to smaller, family-scale farms. The payment of royalties for propagation for limited on-farm use might seem an intrusion into normal, on-farm husbandry. However, royalty payments might be appropriate when transgenic fishes are propagated and the fingerlings are sold to other aquaculture operations. Congress should consider excluding from patent infringement the reproduction through conventional breeding of transgenic fish for certain uses (Walsh 1988, cited in Adler 1988), an exclusion analogous to that for farmers under the Plant Variety Protection Act (Merges 1988).

We would support a debate towards defining a royalty obligation structure based upon some balance of acquisition, propagation, and transfer charges which would safeguard the interests of all parties in the patenting picture. Although suitable provisions within licensing agreements between patent holders and animal owners could handle the problem to some degree, we feel that the philosophy and structure of royalty obligations regarding use of transgenic farm animals should be established in legislation before such animals enter normal agricultural production.

A bill to establish a Transgenic Animals Patent Reform Act (Kastenmeier 1988) sought an exemption for farmers from payment of royalties for use of patent-protected genetically engineered animals. This bill passed in the House of Representatives in 1988, but died in the Senate Judiciary Committee. Bills of this nature should be examined carefully and considered for support by the Society.

Additional Patent Agency Funding

The prolonged decision period for patent applications is unfair to developers of transgenic animals. Further, this delays the dissemination of useful technical information disclosed in the patent application. Even if a patent was issued quickly, say 2 years after its filing, journal articles describing the same work would have been out for at least 1 year. Congress should expand the budget of the Patent and Trademarks Office to expedite processing of the backlogged patent applications.

Call For a Moratorium

A 2-year moratorium on patenting of animals would provide time for the American Fisheries Society, for Congress and governmental agencies, and for society at large to carry out a thorough debate on certain animal patenting-related issues. It is clear that a range of interest groups are trying to establish a moratorium on animal patenting to try to stop gene transfer experimentation. Thus, the issues debated should be limited to the legal principle of patentability of higher animals, strengthening of the research exemption to patents, and the structure of royalty obligations pertaining

to transgenic farm animals. Debate over the animal patenting controversy should lead Congress and the appropriate federal agencies to adopt regulations and procedures for resolving the new problems and issues that will undoubtedly emerge with further development of gene transfer technology (Dresser 1988).

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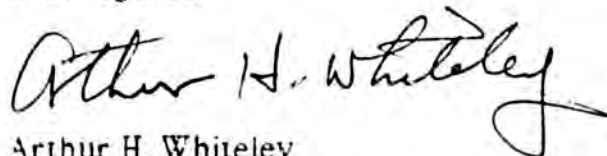
Mr. Guy Thornburgh
Executive Director
Pacific States Marine Fisheries Commission
Metro Center, Suite 170
2000 S.W. First Avenue
Portland, Oregon 97201-5346

Dear Mr. Thornburgh:

I am enclosing a slightly revised version of the presentation Dr. Johnstone and I made at the 42nd Annual meeting in Seattle, inasmuch as you indicated that you may circulate it. Aside from a couple of typos, I have added our addresses, and mainly have redone Table 1. Someone from Oregon at the meeting suggested that it would be good to sort out additives that were used in Washington and the US from those used elsewhere but not here. I had already started to do this the night before the meeting, and agree that it is helpful. In doing this, I have added a reference to Kendra, 1989, which lists registered and disapproved substances in Washington. Of course, there are numerous other chemicals used in net cage culture here or abroad that I have not tried to include in this table.

I have just come upon a report from the ICES, 1988, that makes many of the points we have included in our statement. It continues to surprise me that everyone writing on this subject agrees that there are numerous additives that pose a problem for public health and ecological health, yet things go on unabated. I do hope that federal controls on seafood, definitely including pen raised seafood, will be enacted.

Best regards,



Arthur H. Whiteley
Professor Emeritus
University of Washington